



सत्यमेव जयते

— Training Module —

FACULTY DEVELOPMENT PROGRAMME

ON

DISASTER MANAGEMENT



Resilient India - Disaster Free India

NATIONAL INSTITUTE OF DISASTER MANAGEMENT
(Ministry of Home Affairs, Govt. of India)





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Training Module of Faculty Development Programme on Disaster Management

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Disclaimer

The training module is compiled specifically for the faculties of higher education/universities as a part of their Faculty Development Programme. The details of the module are based on the expertise of the authors in conducting trainings in the area of disaster risk reduction and management. The reading material is collected through various published/unpublished literatures, reports, documents, and other secondary data resources. The report may be freely referred, cited, translated, updated and reproduced in parts or whole for any academic and non-commercial purpose with appropriate citation, permission of authors and publishers of the institute. Authors welcome receiving information and suggestions on its adaptation or use in actual training situations.

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FOREWORD

The increasing frequency and intensity of disasters, driven by climate change and rapid urbanisation, have significantly altered the global risk landscape. Scientific evidence, including reports of the World Meteorological Organization, indicates that climate-related disasters have increased nearly fivefold over the past five decades. India, identified among the most disaster-prone countries by the United Nations Office for Disaster Risk Reduction, faces compounded risks due to its diverse geography, high population exposure, and expanding development pressures. Advancements in early warning systems have reduced mortality, the economic losses and cascading impacts on infrastructure.

In this context, strengthening capacity at all levels, particularly within academic institutions has become essential. Education plays a critical role in shaping risk-informed thinking, enhancing preparedness, and building long-term resilience. Faculty members, as knowledge multipliers, are central to this process, as they influence not only students but also wider community awareness and behavioural change.

The training module on Faculty Development Programme on Disaster Management has been conceptualised to equip academicians with a structured understanding of disaster risk reduction. This module aims to strengthen practical capacities of educators, enabling them to effectively integrate

disaster risk reduction into teaching, research, and outreach. By building a cadre of trained academicians, it contributes to developing informed students, aware communities, and resilient institutions.

I am confident that this training module will serve as a valuable resource for faculty members and stakeholders, and will support India's ongoing efforts towards building a culture of preparedness, reducing risks, and advancing disaster-resilient development.



(Madhup Vyas)

PREFACE

About 76 percent of the Indian population is exposed to high-to-medium hazard risk, of which nearly 30 percent live in cities (with a population of over 0.1 million), including many small and medium-sized towns (Jain, Jigyasu, Gajjar, & Malladi, 2015; Jain & Malladi, 2016). In such scenario, disaster education serve as a functional, operational, and cost-effective tool for risk management. Today, with technological advancement, acquiring knowledge and its application in the realm of action is regarded as the only effective way for preventing disasters or reducing its effects. It is important for the vulnerable communities to learn about their local hazards and their social responsibilities towards reducing vulnerabilities. Behavioural change, awareness and sensitization starts with education and academicians are most important commodities to bring the change. Planning and designing comprehensive educational programmes and capacity building of academicians is necessary for disseminating right information and skills to be shared with larger community effectively.

Faculty development trainings are critical for effective mobilization of imagination, creativity, skills and talents of educators, by enhancing the knowledge and understanding on how to build a society that is disaster resilient and capable for managing any disaster situation effectively and efficiently. The content of this training module is primarily designed to understand the basic concept of the disaster management and implementation of DRR mechanism in their institution, including educating students for mitigating the impact of various hazards. The module compiles all the steps to successfully conduct a faculty development programme, providing guidance for trainers on how to facilitate discussions, along with teaching methodologies and learning units. It consists of a total of 14 sub-modules to be covered in five day training course developed for faculty members in disaster management. The course framework is developed in a way that it will be able to address disaster risk reduction through a multi-hazard and interdisciplinary approach, in line with Sendai Framework (SFDRR) and SDGs goals.

The final outcome of this module is produced after peer review and an extensive investigation of training programmes conducted by NIDM and other stakeholders, national and worldwide, through various literature survey both online and offline, keeping the attention on good practices.

The scope of the training programme will focus on providing training to faculties to strengthen their knowledge in formulating appropriate DRR strategies and developing their skills to conduct training. This training will also help academicians to understand importance of mainstreaming disaster management in all sectors, acknowledge safety of their institutions and provide guidance to develop their own DM Plan.

ACKNOWLEDGEMENT

A Training Module- Faculty Development Programme on Disaster Management has been developed to assist trainers in capacity building endeavours of target group towards disaster risk reduction and disaster risk management. Understanding the need to bring the behavioural change from the very beginning of human life cycle for better community awareness, the training module focuses on faculty development aspect on disaster management so that the academicians can achieve same level of awareness and training required to bring changes in their educational setup, infrastructure and disseminate information to wider masses.

It is indeed a pleasure to express thanks to all who have contributed towards this effort. I sincerely extend my gratitude to Shri Rajendra Ratnoo, Former Executive Director, NIDM for sharing his vision and showing encouragement towards this document. My sincere thanks to Sh. Surendra Thakur, Former Joint Director, NIDM for his constant support. I express my heartfelt appreciation to Prof (Dr.) Chandan Ghosh, Former Head Resilient Infrastructure Division, NIDM who provided guidance in making this document more meaningful.

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Abbreviations

Abbreviation	Description
AI	Artificial Intelligence
CBDM	Community-Based Disaster Management
CRZ	Coastal Regulation Zone
CWDS	Centre for Women's Development Studies
DCWDS	Digital Cyclone Warning Dissemination System
DM	Disaster Management
DRFIP	Disaster Risk Financing and Insurance Program
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DVP	Deccan Volcanic Province
ESMF	Environmental and Social Management Framework
FEMA	Federal Emergency Management Agency
FDP	Faculty Development Programme
FEWS NET	Famine Early Warning Systems Network
GHG	Greenhouse Gas
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HEDRM	Health Emergency and Disaster Risk Management
HFA	Hyogo Framework for Action
HPC	High Powered Committee
HVCA	Hazard Vulnerability Capacity Assessment
IAWN	International Asteroid Warning Network
ICMR	Indian Council of Medical Research
ICT	Information and Communications Technology
INSAT	Indian National Satellite System
IN-MHEWS	International Network for Multi-Hazard Early Warning Systems
IMD	India Meteorological Department
IT	Information Technology
LDC	Least Developing Countries
MAH	Major Accident Hazards

Abbreviation	Description
MIC	Methyl Isocyanate
ML	Machine Learning
MoHFW	Ministry of Health and Family Welfare
MOEFCC	Ministry of Environment, Forest and Climate Change
NICD	National Institute for Communicable Diseases
NBC	National Building Code
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NEC	National Executive Committee
NEOs	Near Earth Objects
NGO	Non-Governmental Organizations
NIDM	National Institute of Disaster Management
OECD	Organisation for Economic Co-Operation and Development
PHEIC	Public Health Emergency of International Concern
RMC	Regional Meteorological Centre
RS	Remote Sensing
SDGs	Sustainable Development Goals
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SFDRR	Sendai Framework for Disaster Risk Reduction
SMPAG	Space Mission Planning Advisory Group
TAD	Transboundary Animal Disease
UNDAC	United Nations Disaster Assessment and Coordination
UNDP	United Nations Development Programme
UNDRO	United Nations Disaster Relief Office
UNDRR	United Nations Office for Disaster Risk Reduction
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
UNOOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-Based Information For Disaster Management and Emergency Response
UT	Union Territory
WHO	World Health Organization
WMO	World Meteorological Organisation

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CONTEXT

The Asia-Pacific region suffers the highest damage, losing an average 1.6% of GDP to disasters annually. India has seen its fair share of disasters over the years resulting in significant loss of lives. While nature's behaviour is not in human hands, reducing its impact certainly is. India itself is prone to almost every type of natural disaster from heavy rain to drought, landslides and earthquakes etc. Extreme weather, refugee crises, COVID-19 pandemics, cyber-attacks is the new normal and there is a requirement of governance models that efficiently mitigate risk and respond to evolving challenges. A gap between the population and resilient infrastructures in India is increasing vulnerabilities day by day. With the growing impact of climate change, there is a need for transformation of disaster risk management strategies towards a more inclusive, sustainable and, ultimately, resilient path. The paradigm shift in approach toward the management of disasters accentuates the need for risk reduction at the community level in India. It focuses on developing the capacity and skills of the community so that they can deal with the disasters as a way of life.

The Prime Minister's 10-point agenda for DRR is a significant step towards enhancing disaster preparedness in India. It is important to highlight the agenda's emphasis on capacity building at the local level, learning from past lessons, leveraging the use of science and technology and develop networking of scientific institutions and educational hubs. To achieve this, the active participation of universities and institutes for higher education can help build efficient and robust technology through knowledge sharing, thereby ensuring a more effective disaster management system. By understanding incorporation of disaster management in day-to-day activities through adopting sustainable practices, preserving natural habitats, investing in resilient infrastructure, improving the emergency preparedness and response for all sector are ways to achieve safe and secure future. Hence, training of trainers especially in education sector is one of the key elements which can engage and enable societies especially the youth in formulating appropriate DRR strategies, adoption of suitable and conscious risk management and reduction of vulnerability.

Global frameworks toward resilience and sustainability have been focusing on the education aspect to achieve the objectives. Universities and colleges are critical actors for effective mobilization of the imagination, creativity, skills

and talents of people by providing the important knowledge and understanding on how to build a disaster resilient society. Universities also have immense role in providing continuum in education during emergency times as well. Thus, education programmes become a mechanism to prepare stakeholders from a perspective of strengthening of humanitarian values, and developing a culture of disaster management.

Prioritizing the necessities of DRR, NIDM works towards the capacity development of stakeholder for effective management of disaster. Understanding the need to bring the behavioural change through education for better community awareness. The training module on disaster management, focuses on faculty development aspect, so that the academicians from different regions can achieve same level of awareness and disaster risk reduction and management skills by the trainers. The faculty development training programmes can become an excellent mechanism to develop a culture of disaster management through education system. The trained faculties can later contribute in these efforts to achieve disaster resilience through providing training and awareness at their level.

About Module

Learning module is a comprehensive tool, acting as a guide to provide course materials in the logical, structured and sequential order. The course content need to be a mixture of theoretical, practical, case studies, and exercises, arranged in an organised manner, to achieve desired goal. In the learning module, whole course is divided into several sub modules and further into learning units with a tentative time allotted to cover the subject. Learning units are organised in a way that all sessions combined must fulfil desired objective of the training programme. Integration of different sessions of learning units each day should be explained to participants through text, pictures, flow chart, discussions, quizzes etc.

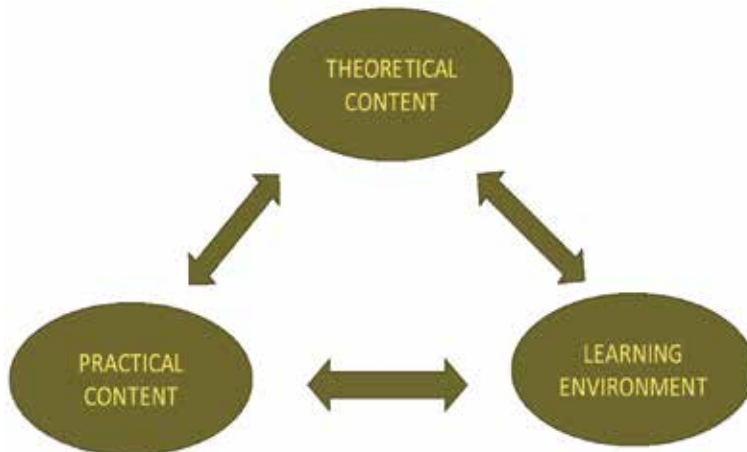


Fig 1. Component of learning module

This Training Module- Faculty Development Programme on Disaster Management has been developed to assist trainers and trainees through capacity building endeavours for comprehensive disaster management. The training module is structured into 14 sub-modules to conduct and deliver the objectives. Further, each sub-module has been given different suggested timings and learning units. Apart from learning units, each sub-module has its own objectives, training need and suggestive reading materials to guide the trainers in more flexible manner. Each sub-module carrying learning units has been supplemented with annexures having a brief descriptions about each learning unit to help trainers gain more insight about the session.

The training manual has been designed to address the following:

- ✓ Disaster Management is a subject of social and behavioural change towards personal safety which need to be incorporated at young stage through education and awareness.
- ✓ To motivate and support the youth through their teachers, in building innovative ideas in the field of disaster management, climate change and sustainable development.
- ✓ To build cadre of master trainers of disaster management which will help initiate the inclusion of disaster management related activities in their curriculum.

The training module is designed in a particular order as shown in Fig 2; yet it is prepared in a way to keep it flexible and allows trainer to use their own capabilities in deciding the trainees' requirement and further update as per need of trainees. The module is made to be learner centric where their involvement will play major role, as they will eventually play a lead role in facilitating such trainings on their own in near future.

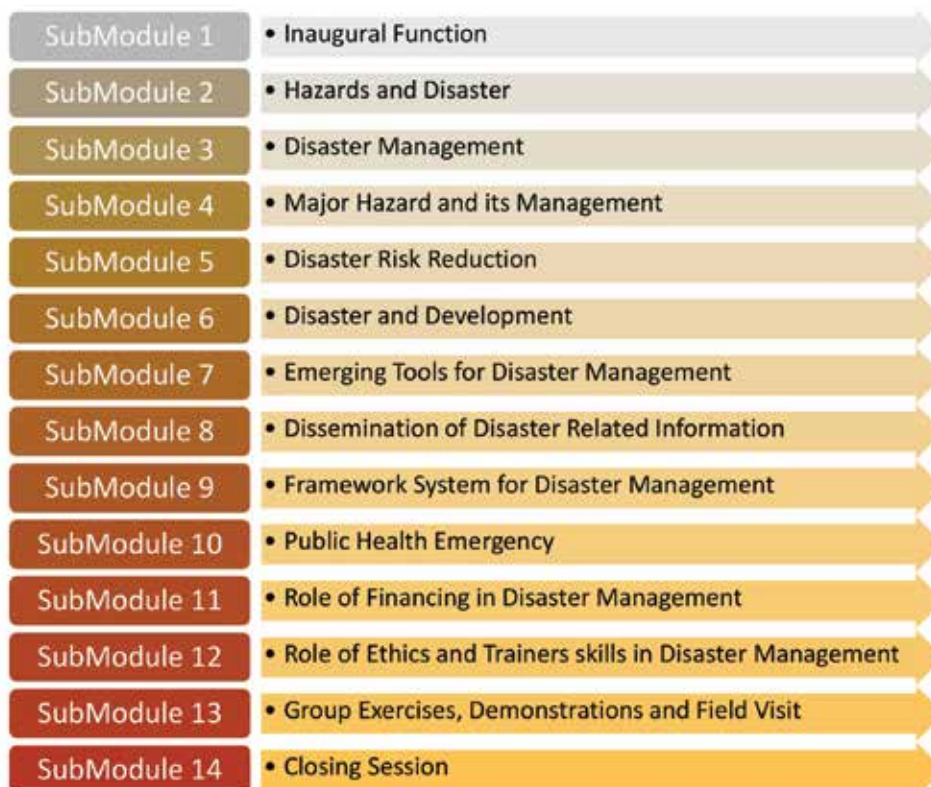


Fig.2 Structure of Module

Apart from the 14 sub modules given in detail for the training module developed for five days' timeframe, additional eight submodules (from 15 to 22) is provided which can be used either as sub-modules or learning units. Through these options, trainer can switch the level of training as per the participants' level of understanding; or, wish to prioritize other session; or, may wish to extend five days training into a week training, then these topics may come into play.



Fig 3. Additional topics of Module

Aim of the training module

The training module- Faculty Development Programme on Disaster Management has been designed to provide a clear, systematic, and replicable training guidelines for trainers and trainees, to impart required basic knowledge and skills to academicians in the field of disaster management. The aim is to sensitize the academicians from the concept of disaster management which they can replicate in their education system and society at large. Through different learning units, exercises, scenarios/case studies, study visits and demonstrations, participants will be able to enhance their expertise and understanding towards disaster management.

Scope

Training module play a vital role in evaluating methods, setting standards, and advancing procedures and guidelines for achieving efficient output. To

make efforts sustainable, there is a requirement for creating trained and skilled manpower which can later disseminate right knowledge and practical experience to next generation. It is necessary for training institutions to guide participants using the comprehensive training module, so they can inculcate complete effective knowledge and become aware about different disaster management related aspects. Hence, to develop a cadre of trained professionals in the area of disaster management, National Institute of Disaster Management (NIDM) has prepared this training module- Faculty Development Programme on Disaster Management.

Objectives

The training module focuses on:

- ✓ Making educational sector imbibe the basic principles of disaster risk management.
- ✓ To enhance appropriate skills and methods of imparting disaster management training.
- ✓ Imparting learning about the relevant Act, Policy, Plan, Frameworks, Guidelines and SOPs on disaster management of the country.
- ✓ Enhancing an in-depth knowledge about the concepts and principles of Disaster Management and mainstreaming Disaster Risk Reduction for resilience building.
- ✓ Contributing to enhance capacities, knowledge and teaching skills of faculties/ professionals and academicians for effective management of disasters.
- ✓ To give one platform to all faculties of different institutes/ universities/schools to work together and discuss the benefits of collaboration and coordination between different educational hubs/ institutes/centres.

Instructions For Using Manual

Facilitator selection

The facilitator should have practical experience in conducting trainings and ideally have a good conceptual understanding of disaster risk reduction and management subject. The facilitator should be well aware of the current issues, advancement and challenges of the disaster risk management and mitigation measures nationally and globally. Facilitators/Trainers can be identified from any national institutes/ universities, consultants with expertise in disaster management and related fields. Facilitator should be confident and possess a quality of a leader capable of monitoring, engaging trainees and evaluation practices. The facilitator should also be well-versed with the medium of training either English, Hindi with/without additional knowledge of regional language.

Target group

This training module is developed for the specific audience comprising faculties/lecturers/scientists and similar teaching position in higher education/colleges/ universities/institutions. The participants are expected to have varied responsibilities, academic backgrounds & experience. The target group shall comprise of the local group of educators and academicians across the nation depending on the scale of the training programme, whether at district/state or national level, keeping in mind that nominated candidates should have similar level of understanding of disaster management field. It is also encouraged to have a good number of women participations in the programme.

Entry Behavior

Nature of group	Homogeneous
Number of Participants	40
Qualifications	Someone with teaching background at higher education level
Age	Minimum 25 yr
Level of Trainees	Trainees are required to be equipped with minimal level of knowledge, skills, information/experience related to disaster
Disaster Experience	Nil to Little familiarity
Experience in working in the area of DM	Nil/Little

Methodology Adopted

- ❖ Nominations through registrations and pre-training assessments
- ❖ Expectations, experience sharing between participants and course coordinators
- ❖ Theory based lectures using videos and presentations
- ❖ Sharing of case studies and good practices
- ❖ Individual and group exercises
- ❖ Assessments/ Questionnaire/ Survey on HRVCA
- ❖ Demonstrations/ hands-on exercise/field visits
- ❖ Recapitulations and discussions each day
- ❖ Presentation by participants or scenario based interventions
- ❖ Panel discussions
- ❖ Evaluation and post training assessments

Training Aids

Following training materials and equipment's will be required for successful completion of the training programme

- ❖ Training kit with background material, pen, writing pad, registration form etc.
- ❖ Computer with LCD Projector
- ❖ White board and flip chart with board markers
- ❖ Loud speakers, mike including collar mike
- ❖ Chart papers- large and multiple colour
- ❖ Wi-Fi connectivity if possible

Venue and Duration

Venue of the training can be kept anywhere, which can cater to all the training needs as mentioned above. The venue ideally should have auditorium or conference hall with facility of logistics and catering. Venue may be selected keeping in mind that it should be easily accessible by target audience. The duration of the training programme is for five days which can be extended to a week programme as per UGC laid FDP norms. The module can be clubbed with a pre and post training meetings/ brainstorming or any group interactions in order to facilitate the preparation and expected outcomes of the training.

Mode of Delivery

English (may be bi-lingual with a use of Hindi). Regional languages can also be used depending on the region and participants background.

Expected Benefits

- ❖ Capacity building of academicians working at higher education level towards the concept of disaster management, disaster risk reduction and disaster resilience.
- ❖ Participants are encouraged to promote the culture of preparedness through their gained understanding on benefits of development of disaster management plans and inclusion of disaster management in their education curriculum.
- ❖ Improved readiness and efficiency of the academicians in taking key roles and responsibilities, while dealing with disasters.
- ❖ Sensitization of faculties towards national and international frameworks, advancement in the field of DRR to learn from good practices and understand the gaps and needs.
- ❖ Participants will engage as trainers and use the module to further disseminate the knowledge gained and impart trainings to other faculties and students.

Evaluation

- ❖ Self-assessment through discussion of each day's key point at the end of each day.
- ❖ Recapitulation at the start of the next training day.
- ❖ Feedback form to be submitted at the end of training course.
- ❖ Survey/Post training assessment to be filled by participants at different time scale, after completion of the training for period of one year.

Day Wise Framework

DAY -1	
Details	Time Required
Sub Module 1: Inaugural Function	
Session 1.1: Registration	30 MIN
Session 1.2: Programme Inauguration	30 MIN
Session 1.3: Pre-Training Assessment of Participants	30 MIN
Sub Module 2: Hazards and Disaster	
Session 2.1: Hazard	20 MIN
Session 2.2: Causes and Impacts of Hazards	20 MIN
Session 2.3: Basic Terminologies related to Disaster Management	40 MIN
Session 2.4: Vulnerability Profile	30 MIN
Session 2.5: Table Top Exercises	30 MIN
Sub Module 3: Disaster Management	
Session 3.1: Concept of Disaster Management	40 MIN
Session 3.2: Progressive Shift in Disaster Management Approach	30 MIN
DAY -2	
Sub Module 4: Major Hazards and its Management	
Session 4.1: Water and Climate Related Hazards	30 MIN
Session 4.2: Geological Hazards	20 MIN
Session 4.3: Chemical, Industrial and Nuclear Hazards	15 MIN
Session 4.4: Accident-Related and other Human induced Hazards	15 MIN
Session 4.5: Biological Hazards	20 MIN
Sub Module 5: Disaster Risk Reduction	60 MIN
Sub Module 6: Disaster and Development	
Session 6.1: Relationship between Disaster and Development	40 MIN
Session 6.2: Need for a New Paradigm	40 MIN
Session 6.3: Blending Indigenous Knowledge with Modern Technology	40 MIN
DAY -3	
Sub Module 7: Use of Technology and Emerging Tools for Disaster Management	
Session 7.1: Geo-Informatics	40 MIN
Session 7.2: Role of Data in Disaster Risk Management and Big Data Analytics	30 MIN

Session 7.3: Use of Advanced Technologies like AI, ML, GPS and Drone Technology for DRR	30 MIN
Sub Module 8: Dissemination of Disaster Related Information	
Session 8.1: Early Warning Systems	40 MIN
Session 8.2: Role of Social Media and Mobile Apps	30 MIN
Sub Module 9: Framework System for Disaster Management	
Session 9.1: Global Milestones	50 MIN
Session 9.2: The Sendai Framework for Disaster Risk Reduction (2015-2030)	40 MIN
Session 9.3: Institutional Mechanism for Disaster Management in India	50 MIN
DAY -4	
Sub Module 10: Public Health Emergency	
Session 10.1: Disaster Epidemiology	30 MIN
Session 10.2: International Health Frameworks	30 MIN
Session 10.3: Health Emergency and Disaster Risk Management (EDRM)	20 MIN
Session 10.4: One Health Approach	20 MIN
Sub Module 11: Role of Financing in Disaster Management	
Session 11.1: Disaster Risk Financing	30 MIN
Session 11.2: Case Study: Programmes for Disaster Risk Financing	20 MIN
Session 11.3: Disaster Management Financing in India	30 MIN
Sub Module 12: Role of Ethics in Disaster Management	40 MIN
Sub Module 13: Demonstrations and Field Visit with Exercise	180 MIN
DAY -5	
Sub Module 13: Group Exercise Presentations	90 MIN
Sub Module 14: Closing Session	
Session 14.1: Feedback, Evaluation & Certification	60 MIN
Session 14.2: Valedictory Function	30 MIN
Session 14.3: Post Training Assessment/Action Plan	30 MIN

Additional Topics

DAY-6 and 7	
Sub Module 15	Mainstreaming Cross-Cutting Issues on DRR <ul style="list-style-type: none"> ➤ Related to Gender, Psycho-social Vulnerabilities ➤ Disability inclusive DRR ➤ Emergency standards and supplies for WASH ➤ Mainstreaming disaster resilient infrastructure for livelihoods ➤ Solid waste management
Sub Module 16	Community Based Disaster Risk Management <ul style="list-style-type: none"> ➤ Addressing Visible and Invisible Needs of Disaster Survivors: Community participation ➤ Stress Management and Handing Responsibilities: Exercises for Self-care
Sub Module 17	Role of Higher Education <ul style="list-style-type: none"> ➤ Role of Faculties for DRR ➤ Disaster Resilient Educational setup ➤ Institution/University DMP
Sub Module 18	Urban Resilience <ul style="list-style-type: none"> ➤ Disaster Safe Housing ➤ Disaster Safe Developmental Planning ➤ Disaster resilience frameworks
Sub Module 19	Fire Safety Management, Basics of Life Safety & First Aid
Sub Module 20	Climate Change Adaptations and Mitigation Measures <ul style="list-style-type: none"> ➤ Lifestyles for Sustainable Development (LiFE) ➤ Nationally Determined Contributions (NDCs) towards climate change ➤ National and State Action Plan on Climate Change ➤ India Climate Change Knowledge Portal
Sub Module 21	Good Practices and Case Studies at National and International Level <ul style="list-style-type: none"> ➤ Scenario based studies ➤ Stimulation exercises
Sub Module 22	Guide to Systematic Approach to Training <ul style="list-style-type: none"> ➤ Group Discussion Method ➤ Lecture Method Participants ➤ Quiz Method ➤ Role Play Method ➤ Feedback Methodology

Way Forward of the training module

1. After organizing number of trainings and achieving the expected outcomes from the use of Training Module- Faculty Development Programme on Disaster Management, the assessment of training output will be done after two years of its implementation.
2. Training need assessment will be done based on the gaps reflected from the trainings done and post training assessment.
3. As per the need, further advancement of skills will be provided in the advanced module on DRR which will be prepared. Thus the Faculty Development Programme on Disaster Management module will serve as basic course and those who are trained through this module and/ or have gone any FDP program related to disaster management can participate in the advanced module.
4. Advance module will be based on honing skills development, use of IoT tools and latest technologies, understanding early warning systems, developing action plans and mitigation strategies.

How to use the module

1. The module can be used by trained trainer/master trainer in disaster management subject at national to local level with suitable modifications. The trainer will develop the program agenda based on the day wise framework of sub modules provided in the module from five to seven days schedule.
2. According to the pre-training assessment and training needs, additional topics covered under submodule 15 to 22, may also come into play and facilitators will invite the resource persons accordingly.
3. Few resource persons should have knowledge and experience related to good practices, case studies or public health, life safety skills, GIS and remote sensing etc. to provide clear and informative sessions.
4. Sub module 13 on exercises, demonstration and field visits should be incorporated appropriately during the training as and when felt necessary in between the sessions.
5. The module can also be used by the trained participants to help them in post training activities and awareness generation among students and other stakeholders.
6. The submodule also have several learning units which should be addressed during the session. Suggested readings provided should be shared with participants each day as their exercise or as pre/post training exercise.
7. Brief information about some of the learning units and sub module is provided in the annexure to help the trainers and trainees understand and know about the learning units if required.
8. Additional topics if added in the training agenda should take help from suggestive reading list given in submodule 15-22, where the mentioned sub topics may be considered as learning units.
9. Submodule 1 and 14 discusses on pre and post training assessment which should not be neglected at any cost.
10. After completing the training, facilitators and trainees both, need to chart out their action plan based on feedback, self-assessment, performance in exercises and gaps identified.
11. The training report should be compiled by the facilitator and key outcomes of the trainings must be highlighted.

Trainers Tips

- ④ Building trust and rapport with participants will help making session interesting and receptive.
- ④ Trainer should be receptive to take guidance from the module and if required modify sessions day, time and learning units as per the given additional topics, requirement and suggestions of the participants.
- ④ Training materials should be kept ready and checked before the training.
- ④ During the inauguration/introduction session, the trainees should be asked to switch off or keep their mobiles/cell phones in silent mode during sessions and advised to attend only the urgent calls that too by going out of the training hall.
- ④ Trainer must break the lengthy lecture sessions into interactive exercises and discussions as much as possible.
- ④ Participants should be given a scope for recapitulation before beginning of day and summary and discussion session at the end of day.
- ④ Having group exercise and simulation exercise with/ without field visit is must. Groups should be made keeping in mind the different themes and background of faculties. Faculties from same institutions and similar experience or qualifications may be kept in different groups.
- ④ The modules and sessions can be used in the order presented, on their own, or in combination with other individual sessions and sub modules given in the additional topics for Day 6 and 7.
- ④ Some sessions should take into account the past lessons and experiences at local level, to address all the hazards and vulnerabilities holistically.
- ④ WhatsApp Group comprise of all participants and organizing team members should be made 15 days before the start of training. This will help in pre training assessment, acknowledge logistical issues; sharing of reading materials, coordination during training; and communication for post training assessment.
- ④ Participants list with names, addresses, contact numbers, emails, etc. should be circulated for verification from the trainees, marking daily attendance, and for necessary corrections.

Inaugural Function

This submodule will provide instruction to the course team on basic requirements to be fulfilled at the beginning of the training, so that all the formalities and necessities of registrations and inaugural sessions may be conducted smoothly.

Time Duration: 90 min

Session 1.1: Registration

1. Filling the registration form by the participants through Google forms, online registration portals and/or directly at the registration desk on the first day.
2. To mark attendance daily (session wise).
3. To provide a help desk for all participants, guests and resource persons.
4. Distribution of training kit/ IEC materials etc.

Session 1.2: Programme Inauguration

The opening session has to be planned and conducted prudently to set the tone of the training programme. Inaugural ceremony should be conducted in the presence of the patrons and chief guests, to hear their expectations and guidance. This session should be able to give participants encouragement and build interest in taking this course efficiently. Inauguration function is also the opportunity to share the purpose and objectives of the training course and set ground rules. It should include:

1. Welcoming remarks by the Moderator of the training programme.
2. Course outline by the Course Coordinators.
3. Introductory speech on the theme by Conveners or Programme Chairperson.
4. Keynote Address by the Guest of Honour.
In case of university- vice chancellor or other prominent person / patron of training programme who is expert of that field. In case of NIDM, Executive Director or Joint Director can be the guest of honour.
5. Any Souvenir/Plants may be presented to chief guests and patrons to honour their presence in the inaugural ceremony before starting the brief of the session.

Session 1.3: Pre-Training Assessment of Participants

Pre-training assessment of the candidates are necessary to understand the background knowledge, skills and local/personal issues related to disaster, to chart the training need assessment. The Pre training assessment shall be taken by the training expert/ facilitator who will be present throughout the training programme.

Pre-training assessment can be taken via following options:

- a) One on one participant introduction, where they should tell about their name, designation, affiliation, any prior experience of disaster faced, any work done related to disaster risk management, expectations from training and raising general discussion on local vulnerability and hazards.
- b) Quiz or survey can also be made to get the information of participants prior to training for knowing their expectation from the course and their level of understanding.
- c) Ice breaking activity by requesting trainees to interact with their nearby participants and asking trainee to introduce their partner/ buddy with whom they interacted with their expectations from the training to the entire group.

The results or answers given by candidates on pre-training assessment, help analyse the needed modification of the module, so that trainer may modify the learning units based on the required specific area wise topic.

Time Required	90 MIN
Session Outcome	<ol style="list-style-type: none"> 1. Data bank of all participants will be created. 2. Formal welcome of dignitaries and start of the event to brief the training framework. Clear understanding of training programme framework 3. Interaction of participants with each other and the trainers.
Mode of delivery	Discussion and welcoming of dignitaries, guests and participants; Online and offline registrations.
Requirement	Training poster, folders with inaugural schedule and programme details for all dignitaries, dice arrangements, souvenirs /plants

Trainer's tip:

Inaugural Function should not take more than 60mins in any case. Choose any one way for Pre Training exercise which can be completed in 30 minutes, if facilitated properly.

Hazards and Disaster

This is an introductory training sub-module for building familiarity with the disaster and disaster risk management related terminologies, to grasp better understanding of the whole course. It will highlight the key concepts about the disasters and hazards and how hazards can transform into a disaster event. It also focuses on the cause of disasters and the impact it can bring in our day-to-day life. The submodule will further delve into the vulnerability profiles at global to local level and its assessment. The sessions will be carried through presentations, lectures, case studies, examples of past incidents, using videos etc.

Following five sessions are delineated under this sub module:

Session 2.1: Hazard

Session 2.2: Causes and Impact of hazards

Session 2.3: Basic terminologies related to disaster and its management

Session 2.4: Vulnerability Profile

Sessions 2.5 : Table top exercises on different aspect of disaster management

Time Duration: 140 mins

Trainer's tip:

- ✓ Trainer may ask participants if they have prior understanding of the disaster management terminologies and may fast forward as per their answers.
- ✓ While defining each terminology trainer must cite an example, case study to link the general concepts with the perspective of local area.
- ✓ While addressing the cause and impact of the hazards, trainer must acknowledge the future risk scenario of climate change and give importance to hydro-meteorological hazards, and earthquake.
- ✓ It is crucial that the learners coming from different backgrounds and with varied level of experience are brought to a level-playing field of a similar level of clarity of concepts, as these will enable having enriching learning and discussions under subsequent technical

sessions.

- ✓ Trainer must discuss the vulnerability profile of the campus where training is taking place and connecting it with the vulnerability profile of the city/place/district.
- ✓ While discussing the session, trainer may like to introduce exercises of session 2.5 in between to address the topics with examples.

Session 2.1: Hazard

Hazards are activities which may cause loss of life, injury or other health impacts, property damage along with other effect on societies. India's varied geo-climatic conditions and topographic profile, along with unsustainable development is a major cause of changing hazards into disaster. The cause of various hazards and its intensity of destruction varies widely from natural to manmade causes and integration of both. Hence, understanding about the hazard can help reduce their impact on vulnerable communities.

Learning Units:

- a) What is hazard?
- b) Types of hazards
- c) What is disaster?
- d) Difference between hazard and disaster. Case studies about local hazards and disasters of the past.
- e) How do hazards transform into disaster?
- f) Local emergency incident versus disaster: Level of incidents

Time Required	20 Min
Learning Outcome	1. Participants will be able to understand about hazards and disasters and their difference. 2. Participants will be able to learn the characteristics and associated risks of different disaster events.
Enabling units	Hazard, Disaster, Emergency
Mode of delivery	Presentations, real life incidents/precedents, case studies

Suggested readings	<ol style="list-style-type: none"> 1. UNDRR Hazard Understanding Disaster Risk https://www.preventionweb.net/files/1633_ch3.pdf?startDownload=true 2. HPC Report hp2 https://www.preventionweb.net/files/1633_ch3.pdf?startDownload=true 3. Hazards, disasters and your community a primer for parliamentarians https://ndmindia.mha.gov.in/images/public-awareness/Primer%20for%20Parliamentarians.pdf
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Session 2.2: Causes and Impact of Hazards

For understanding the mitigation, prevention and preparedness activities, it is necessary to know about the origin and cause of hazard along with its impact on communities in the pre, during and post-disaster phases.

Learning Units:

- a) Causes of Natural hazards
- b) Causes of Man-made hazards
- c) Its impact on communities

Time Required	20 Min
Learning Outcome	Clear understanding on types of natural and man-made hazards with their cause and impacts in case of disaster.
Enabling units	Natural Hazard, Manmade hazard, Community
Mode of delivery	Video Show and/or Presentation
Suggested readings	<ol style="list-style-type: none"> 1. What is a Natural Disaster? https://leverageedu.com/blog/what-is-a-natural-disaster/ 2. Natural Disasters: Causes, Effects & Solutions https://environmental-conscience.com/causes-effects-solutions-for-natural-disasters/ 3. Human-Caused Hazards https://www.rpvca.gov/ArchiveCenter/ViewFile/Item/2912

Session 2.3: Basic Terminologies related to Disaster and its Management

With the increasing focus on disaster management and evolution of the approach with time, many terms were coined for establishing better

understanding, implementation, and execution. It is imperative to learn all the terminologies associated with disaster management to better understand the fundamental concept of disaster management cycle.

Learning Units:

- a) Hazard
- b) Exposure
- c) Vulnerability
- d) Capacity
- e) Risk
- f) Disaster Mitigation
- g) Disaster Prevention
- h) Disaster Preparedness
- i) Disaster Response
- j) Disaster Recovery
- k) Rehabilitation
- l) Reconstruction
- m) Retrofitting
- n) Build Back Better
- o) Contingency Planning
- p) Critical Facilities
- q) Risk Retention
- r) Risk Transfer
- s) Resilience
- t) Sustainable Development

Session 2.4: Vulnerability Profile

Natural hazards are outcome of natural processes occurring since the formation of the Earth. However, these hazards when interact with humans hampers the normal activities and impacts the living organisms including the humans in some way or other. But in the race of modernization, new man-made hazards have emerged as equally dangerous and rather frequent due to the unregularised development issues. These factors along with the varied geo-climatic conditions make the communities highly vulnerable to certain hazards. For a proactive approach towards disaster risk reduction, it is necessary to map the vulnerability profile of any area from regional to local

level along with associated hazards.

Learning Units:

- a) Global vulnerability profile
- b) Vulnerability profile of India
 - i. Climate change vulnerability
 - ii. Physical vulnerability
 - iii. Socio-economic vulnerability
 - iv. Environmental Vulnerability
- c) Discussion: Vulnerability profile of India/local/state/city
- d) Vulnerability assessment

Time Required	30 Min
Learning Outcomes	Participants will know about the disaster profile of country and are able to understand and assess their local vulnerabilities from the associated hazards of that area. To become familiar with the disaster risks of particular area.
Key words	Climate change vulnerability, Physical vulnerability, Socio-economic vulnerability
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Country Profile India.pdf (nidm.gov.in) 2. CEEW (2021) Mapping India's Climate Vulnerability, A District Level Assessment India's Climate Change Vulnerability Index District-Wise Study (ceew.in) 3. Lavell AM et al. (2012) Climate Change: New Dimensions in Disaster Risk, Exposure, Vulnerability, and Resilience 1 - Climate Change: New Dimensions in Disaster Risk, Exposure, Vulnerability, and Resilience (ipcc.ch) 4. USAID (2007) Adapting to climate variability and change a guidance manual for development planning https://pdf.usaid.gov/pdf_docs/PNADJ990.pdf

Session 2.5: Table Top Exercises on Different Aspect of Disaster Management

A table top exercise involves key personnel discussing simulated scenarios in an informal setting. These exercises can be used to assess plans, policies, and procedures. For disaster management, table top exercises are designed to provide comprehensive training in disaster management. Practical activities, case studies, and interactive discussions are often integral components of these training sessions. Specific details and methodologies may vary based on the training program and the expertise of the instructors.

Learning Units:

1. Exercise I : Frequency vs Impact of Disasters
2. Exercise II : Cause and Impact of Disasters
3. Exercise III : Grading/Ranking of Hazards/Disasters
4. Exercise IV : Hazard and Resource Mapping
5. Exercise V : Seasonality of Disasters

Time Duration: 30 mins

Activities can include various ways to perform these exercises as given in Annexure 2.5. These can include: analysis of the severity, probability of each disaster, considering casualties, socio-economic losses, and other impacts; Risk assessment based on the frequency and impact; Develop strategies for mitigation, response, overall risk reduction and management based on the understanding of causes and impacts; Create hazard risk matrices to rank different types of hazards; Identify evacuation routes and emergency facilities; Analyse historical data to identify seasonal variations in disaster occurrence; Incorporate season-specific considerations into risk management strategies.

Disaster Management

This sub-module on disaster management will highlight the key concepts and different phases of the disaster management. It also focus on the evolution of the disaster management from conventional to holistic approach. The sessions will be carried through presentations, lectures, examples for each phases, discussions etc.

Following two sessions are delineated under this sub module:

Session 3.1: Concept of disaster management

Session 3.2: Progressive shift in disaster management approach

Time Duration: 70 mins

Trainer's tip:

- ✓ Trainer need to make participants understand the importance of proactive approach in the disaster management cycle to build resilience.
- ✓ Trainer must cite an example, case study to link the general concepts of disaster management and how it is tackled at national and local level.
- ✓ Addressing the progressive shift in management approach should highlight the need of aware community and grassroots level approach in current situation.

Session 3.1: Concept of Disaster Management

Disaster management is aggregation of measures, devised to manage/mitigate/prevent the negative impact of disaster on communities through different phases also known as disaster life cycle. It is also necessary to know about the goals and necessities of its implementation to bring sincerity, standardization and efficiency in the implementation of the various steps of disaster management amongst the participants.

Learning Units:

- a) Necessities
- b) Goals
- c) Phases/Stages

Time Required	40 Min
Learning Outcome	Participants are aware of all stages of disaster management cycle and understand the importance of pre-disaster stages. To become familiar with the life cycle of disaster management.
Keynotes	Mitigation, prevention, preparedness,
Mode of delivery	Presentation, real life incidents/precedents, case studies.
Suggested readings	<ol style="list-style-type: none"> 1. Carter, W. N. (2008). Disaster management: A disaster manager's handbook. https://www.adb.org/sites/default/files/publication/27890/disaster-management-handbook.pdf 2. What Is Disaster Management? Understanding Emergencies From Prevention to Mitigation https://publichealth.tulane.edu/blog/what-is-disaster-management/

Session 3.2: Progressive Shift in Disaster Management Approach

With the increase in frequency of hazardous events or the rapid increase in the population, disasters lead to increase in loss of lives and properties. Considering the grim situation, with evolution of disaster related studies and research, it became necessary to shift from conventional approach of providing post disaster relief and response to vulnerability driven approach and ultimately to holistic, multi-disciplinary, integrated disaster risk reduction approach.

Learning Units

- a) Conventional approach
 1. Transitional approach
 2. Vulnerability-driven approach
 3. Disaster risk management (DRM) approach
- b) Non-Conventional approach
 1. Systems approach for risk management
 2. Community based disaster management approach
 3. Disaster Risk Reduction (DRR)

Time Required	30 Min
Learning Outcome	Participants must familiarize with evolution of disaster management approaches both conventional and non-conventional.
Keynotes	DRM, DRR, Vulnerability
Mode of delivery	Presentation, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Nojavan M. et al (2018) Conceptual change of disaster management models: A thematic analysis - PMC (nih.gov) 2. GFDRR (2017) A Decade of Progress in Disaster Risk Management on Approach https://www.gfdr.org/sites/default/files/10%20Years%20DRM%20Development%20DRAFT.pdf 3. USAID (2011) Introduction to disaster risk reduction, https://www.preventionweb.net/files/26081_kp1concepdisasterrisk1.pdf 4. Case study for Community based disaster management https://www.orfonline.org/expert-speak/following-the-odisha-example-for-developing-community-based-disaster-management-in-india/

Major Hazards and its Management

Once a basic understanding of participants is developed about the disaster management cycle, this submodule will now briefly discuss the management of each hazard while discussing their preventive and mitigation measures. Discussion on COVID-19 and the local challenges faced by the participants will be taken up to understand the impact and the need in the current situation.

Following five sessions are delineated under this sub module:

Session 4.1: Water and climate related hazards

Session 4.2: Geological hazards

Session 4.3: Chemical, industrial and nuclear hazards

Session 4.4: Accident-related and other human induced hazards

Session 4.5: Biological hazards.

Time Duration: 120 mins

Trainers tip:

- ✓ Trainer during discussion about the water and climate related hazards must emphasise on the climate change impact and how it is faster and different from the past and influencing the disaster related phenomena.
- ✓ Trainer must cite examples, case study while suggesting the preventive methods for each hazard.
- ✓ Trainer may have a round of discussion with participants or can evolve a group exercise where all participants may be grouped according to different types of hazards and may come up with scenarios where an area was impacted by such hazard and what are the mitigation measures taken to lower the impact.

Session 4.1: Water and Climate Related Hazards

Observing the ongoing change in atmospheric circulation causing erratic weather pattern has drastically led to frequent and sudden meteorological hazardous events. This category is seen to be far more challenging to predict

with the impact of climate change which ultimately led to higher impact on the people from this type of hazard in form of flood, cyclone etc. This session will provide a conceptual understanding about their characteristics, vulnerability profile and prepare a management plan for the events originating from hydro-meteorological event.

Learning Units

Climatological: relating to the climate

Meteorological: relating to weather conditions

Hydrological: caused by the occurrence, movement and distribution of water on Earth's surface

1. Floods
2. Cyclones
3. Tornadoes
4. Hailstorm
5. Cloud Burst
6. Heat Wave and Cold Wave
7. Snow Avalanches
8. Droughts
9. Sea Erosion
10. Thunder and Lightning

Time Required	30 Min
Learning Outcome	Participants understand the different types of hydro-meteorological hazards and get familiar with their occurrence and distribution. Participants will also understand the increasing climate related disasters in the rise of climate change impact.
Key words	Global warming, weather pattern
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Discussion: WMO (2021) https://public.wmo.int/en/media/press-release/water-related-hazards-dominate-disasters-past-50-years 2. Dual, H. B. (2017). Making cities resilient to climate change: Identifying “win-win” interventions. <i>Local Environment</i>, 22(1), 106-125 3. High Powered Committee on Disaster Management hp2 (preventionweb.net) 4. Discussion: UN water and Disasters: https://www.unwater.org/water-facts/water-and-disasters

Session 4.2: Geological Hazards

Geological hazards are associated with the plate movements of the solid Earth. These category of hazards comprise of the most killing disasters like earthquake to most frequent issues of any mountainous region such as landslide. Mudflows to lava upwelling from volcanoes are also associated with geological hazards. Understanding their nature of origin, characteristics, helps identify the vulnerability of the local area from geological hazards. Studying the past events which affected the local area and the lessons learnt will eventually help prepare the management plan for the different events that may originate due to geological event.

Learning Units

1. Landslides
2. Earthquakes and Tsunami
3. Volcanic activities

Time Required	20 Min
Learning Outcome	Participants are informed about different geological hazards, causes and associated risks, their characteristics and impact on human lives and environment.
Key words	Tectonic plates, Earthquake, Landslide
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Geological Disasters Disaster_geo.pdf (nidm.gov.in) 2. Geologic Hazards http://www.oas.org/dsd/publications/unit/oea66e/ch11.htm 3. Geological hazards: Causes, Consequences and methods of Containment https://www.researchgate.net/publication/260025889_Types_causes_and_strategies_for_mitigation_of_geological_hazards

Session 4.3: Chemical, Industrial and Nuclear Hazards

With the onset of industrialisation, several industries sprang up to fulfil the demand of humans befitting their comfort lifestyle. Many such industries which are mainly involved in production, required several chemicals and equipment's along with human resources and land. Similarly, several nuclear facilities established to produce energy mainly required to supply electricity to both people and production facilities. These facilities having large demand

and supply became source of several manmade hazard due to sheer human greed and manual mistakes if not handled, monitored and maintained properly. In this session, trainee will briefly address the different chemical, industrial and nuclear hazards which are prevailing in the country and at local level. The impact of these hazards and their mitigation measures should be discussed sharing example from the local case studies.

Learning Units

1. Chemical Disasters
2. Industrial Disasters
3. Nuclear Disasters

Time Required	15 Min
Learning Outcome	Participants get the knowledge of terms and concepts related to chemical, industrial & nuclear hazards. They will also get familiar with their occurrence, associated risks, and impact on human lives and environment.
Key words	Industrial, Nuclear disaster
Mode of delivery	Presentations, Videos
Suggested readings	<ol style="list-style-type: none"> 1. Chemical incidents (who.int) 2. Resilience: A New Paradigm of Nuclear Safety (2017) https://link.springer.com/book/10.1007/978-3-319-58768-4 3. Nuclear Disaster Home West Bengal Disaster Management & Civil Defence Department (wbmd.gov.in) 4. NIDM (2012) Trainer’s Module -Chemical (Industrial) Disaster Management https://nidm.gov.in/pdf/modules/chemical.pdf 5. Discussion from Chemical & Nuclear hazard section: Emilia, W., Chadia, W., & Morenikeji, G. (2018). Words into Action Guidelines: Practical considerations for Addressing Man-made and Technological Hazards in Disaster Risk Reduction.

Session 4.4: Accident-Related and Other human induced Hazards

The era of technology and machines also brought the use of hazardous chemicals, gases, and explosives in our day to day life, putting the human lives and property at risk. Reasons for such hazards varies from intentional

use or ignorance to mechanical fault. Since the day to day lives of humans are very much dependent on various equipment and machineries, their potential to affect human lives and property is ever increasing.

Learning Units

1. Defining accident related hazards
2. Causes and impact of different types of accident related hazards
3. Preventive and Mitigation measures of accident related hazards

Time Required	15 Min
Learning Outcome	Participants will understand on common man made hazards such as accident-related hazards and discuss on their mitigation and preparedness.
Key words	Accident, Explosive
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Accidents, incidents, first aid and emergency preparedness https://www.worksafe.act.gov.au/health-and-safety-portal/managing-safety/accidents,-incidents,-first-aid-and-emergency-preparedness 2. Safety, Risk And Disaster Management https://environmentclearance.nic.in/writereaddata/online/RiskAssessment/070920177YH10QMZRiskAssessment.pdf 3. Discussion: Transportation related Hazard: Cova, T.J., and Conger, S. (2004) Transportation hazards, in Handbook of Transportation Engineering, M. Kutz (ed.), McGraw Hill, New York, pp. 17.1-17.24. https://www.ugpti.org/smartse/research/citations/downloads/Cova-Transportation_Hazards_Chapter_17-2004.pdf

Session 4.5: Biological Hazards

Millions of humans and animals are exposed to zoonotic infections each year. With the increase in human population, human settlements are expanding haphazardly. The marginalised sections often living in most unhygienic and inhospitable environment. It is mostly due to poor sanitation facilities and the absence of adequate sewage treatment and disposal systems.. Many times,

the encroachment has led to the interaction of human and wildlife which has given birth to many epidemics in the past. Along with this use of biological substances for different purposes such as human cure, biological warfare, etc. may lead to the spread, which can threaten human lives.

Learning Units

1. What are biological hazards?
2. Impact on human lives and related health issues
3. Preventive and mitigation measures of biological hazards
4. Management system for biological hazards in India
5. Discussion on COVID-19 local challenges, impact and current situation.

Time Required	20 Min
Learning Outcome	Awareness about biological hazards and become familiar with the mitigation and management system for biological hazards.
Key words	Epidemics, biological warfare, COVID-19
Mode of delivery	Presentations, real life incidents/precedents, case studies, Discussion
Suggested readings	<ol style="list-style-type: none"> 1. Human-Caused Disasters Central Washington University (cwu.edu) 2. Biological Hazards Risk Assessment https://www.preventionweb.net/files/52828_05biological_hazardsriskassessment.pdf 3. Discussion: Djalante, R., Shaw, R., & DeWit, A. (2020). Building resilience against biological hazards and pandemics: COVID-19 and its implications for the Sendai Framework. Progress in disaster science, 6, 100080. https://doi.org/10.1016/j.pdisas.2020.100080.

GROUP EXERCISE (20 mins)

All participants may be grouped according to different types of hazards and may come up with scenarios where an area was impacted by such hazard. They also need to work on the challenges and the impact hazard can make and what are the mitigation measures taken to lower their impact.

Disaster Risk Reduction (DRR)

With the impact of climate change and population growth it has become a necessity to integrate all measures and stakeholders to prevent new, reduce existing and manage residual risk. The Disaster Risk Reduction (DRR) approach suggests a holistic, multi-disciplinary solution which contribute to strengthening resilience from disasters and therefore aims towards to the achievement of sustainable development under changing climate.

Time Duration: 60 mins

Trainers tip:

- ✓ Trainer must highlight the evolution of framework which now focuses on DRR.
- ✓ Discussion can be generated on mainstreaming DRR in various practices.

Learning Units

1. Introduction to Disaster Risk Reduction
2. Importance of incorporating DRR
3. Activities associated to DRR in the country and at local level.
4. Measures for DRR.
5. Prime Minister's Ten Point Agenda on DRR

Time Required	60 Min
Learning Outcome	Participants acknowledge the importance of DRR measures and the work done at international, national and local level. Participants will also become familiar with the measures integrated in this approach.
Key words	Sustainable, Holistic, Multi-hazard, DRR
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. H1. ADPC (2020) Disaster Risk Reduction in India Status Report https://www.undrr.org/media/48528/download?startDownload=true 2. Gupta, A. K., et al. (2016). Prime Minister's Agenda 10: India's disaster risk management roadmap to climate resilient and sustainable development. https://www.preventionweb.net/files/51313_51304pmagenda10paper.pdf 3. Disaster risk reduction UNDRR 4. Discussion: UNISDR Local Governments and Disaster Risk Reduction: Good Practices and Lessons Learned https://www.preventionweb.net/files/10748_FlyerLocalGoverments.pdf

Disaster and Development

While focusing on the application part of DRR in various sectors, development sector emerges as the most sensitive and affected to the impact of disasters. Not only the disasters can destroy all the developmental gains achieved over the past but affects the overall growth and socio-economic development of the country. The pattern of infrastructural growth under the pressure of high population showcases the poor quality haphazard growth which increases our vulnerabilities towards disaster. Understanding of the complex interaction of development and disaster may help participants understand the importance of building resilience in our developmental practices.

Following three sessions are delineated under this sub module:

Session 6.1: Relationship between Disaster and Development

Session 6.2: Need for a new paradigm

Session 6.3: Blending indigenous knowledge with modern technology

Time Duration: 120 mins

Trainers tip:

- ✓ Trainers may take help from videos and case studies to make participants understand the different types of developmental practices and disaster safe indigenous construction practices.
- ✓ Trainer must cite examples as and when suitable especially for resilient infrastructures showcasing the importance of resilient critical infrastructures in the time of disaster.
- ✓ Trainer must highlight the safe, sustainable and eco-friendly ways of developmental practices.
- ✓ Trainer may have a discussion in groups of learners on which DRR strategies can be helpful for creating resilient and sustainable future, what measures need to be taken, how to incorporate these DRR strategies.

Session 6.1: Relationship between Disaster and Development

Many industrialised and emerging nations have made disaster management and economic development two of their top public agendas. Policymakers and

public managers must develop various development policies and programmes to look for opportunities for business formation and industry development. While concentrating on development objectives, the leaders of these nations must modify their policy priorities and reallocate valuable resources to address the occurrences and difficulties of a variety of natural, man-made, and technological disasters that are either directly or indirectly related to economic development.

Learning Units

1. Interconnection between disaster and development
2. Deficiencies in development planning in this regard;
3. Discussion on vision for the future.

Time Required	40 Min
Learning Outcome	Participants will be able to understand the correlation of disaster and development to chart out the way forward for resilient and sustainable development.
Key words	Development, UNDP
Mode of delivery	Presentations and case studies
Suggested readings	<ol style="list-style-type: none"> 1. Disaster and Development Unit-16 (egyankosh.ac.in) 2. Case Studies: Disaster & development: Examining global issues and cases https://www.researchgate.net/publication/262105896_Disaster_development_Examining_global_issues_and_cases 3. Reducing Disaster Risk, A Challenge for Development https://www.undp.org/publications/reducing-disaster-risk-challenge-development.

Session 6.2: Need for a New Paradigm

To emerge as resilient nation, modification in policy priorities and reallocating of valuable resources through various measures is required, such as updation of national building code, development of disaster management plans at local level, incorporating technological advancement towards resilient infrastructure etc. to address the occurrences and difficulties due to variety of natural, man-made, and technological disasters that are either directly or indirectly related to economic development.

Learning Units

1. Why the change in development practices are necessary?
2. National Building Code of India (NBC)
3. Resilient Infrastructure
4. Principles for resilient infrastructure

Time Required	40 Min
Learning Outcome	<ol style="list-style-type: none"> 1. To understand the importance of sustainable and resilient development of infrastructure. 2. To become familiar with approaches to manage them.
Key words	Sustainable development, resilient infrastructure
Mode of delivery	Presentation, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Discussion: Archana Patankar ADB (2019) Impacts of Natural Disasters on Households and Small Businesses in India. 2. National Building Code National Building Code - Bureau of Indian Standards (bis.gov.in) 3. Principles for resilient infrastructure Principles for resilient infrastructure UNDRR 4. Addressing climate change impacts on infrastructure https://www.climatelinks.org/sites/default/files/asset/document/Infrastructure_Overview.pdf 5. UNDP (2015) Reducing disaster risk: a challenge for development https://www.undp.org/sites/g/files/zskgke326/files/publications/Reducing%20Disaster%20risk%20a%20Challenge%20for%20development.pdf

Session 6.3: Blending Indigenous Knowledge with Modern Technology

Numerous local communities throughout the world have used traditional techniques passed down from one generation to the next to prepare for, operate, act, and respond to natural disasters. Presence of modern technology such as early warning systems is also helping in DRR, however may find difficulty in last mile connectivity. It is important for everyone to recognise indigenous knowledge as a significant source of information and a major factor in lowering risk in many different parts of the world. Through

application of various approaches like blending of modern technologies and indigenous traditional knowledge can help in developing better preparedness, response and mitigation strategies which will be cost effective, participatory and long term sustainable.

Learning Units

1. What is indigenous knowledge?
2. Role of indigenous knowledge in disaster management
3. Indigenous knowledge used in DRR
 - Mountain ecosystem, Coastal zones, Housing & Water resource management
4. Expanding benefits by traditional knowledge and modern technology
5. Discussion on local traditional good practices related to disaster management

Time Required	40 Min
Learning Outcome	Participant learns different indigenous knowledge of disaster safe approaches and familiarize with different disaster safe construction practices.
Key words	Indigenous people, vernacular housing
Mode of delivery	Presentation, case studies and discussions
Suggested readings	<ol style="list-style-type: none"> 1. Maferetlhane_OI. Vaidya H. et al. (2023) pdf (nwu.ac.za) 2. Vaidya H. et al. (2023) The role of indigenous knowledge in disaster risk reduction: a critical analysis https://shorturl.at/BDPS3 3. Indigenous Knowledge Disaster Risk Reduction 148964_IK-textpage.indd (unisdr.org) 4. Shaw R et al. (2009) Indigenous Knowledge and Disaster Risk Reduction ISBN 9781607415749, 1607415747 5. DISCUSSION: Indigenous Knowledge for Disaster Risk Reduction (Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region) Cover Good-practices-indigenous.indd (unisdr.org)

Use of Technology and Emerging Tools for Disaster Management

To bring the resilience in our day-to-day practices, innovative technologies have made substantial contributions to improving disaster impact assessments, reliefs, and recoveries. Embracing technological advancements and innovative approaches can enhance international cooperation efforts, such as the use of remote sensing, artificial intelligence, and data analytics. Across continents, remarkable initiatives have been launched to combat disasters. The recent innovations have helped in the welfare of mankind, specifically in times of crisis and natural calamities. There is a growing significance of technology for disaster risk reduction, monitoring, and mitigation, etc. which can set forth the future agenda of sustainable development. In this submodule, two most frequently used tools Geographical Information System (GIS) and Remote Sensing (RS) will be dealt along with the importance of data collection, sharing and its usability.

Following three sessions are delineated under this sub module:

Session 7.1: Geo-informatics

Session 7.2: Role of data in disaster risk management and Big Data Analytics

Session 7.3: Use of advanced technology like Artificial Intelligence (AI), Machine Learning (ML), Global Positioning System (GPS), Drone technology for DRR

Time Duration: 100 mins

Trainers tip:

- ✓ Trainer must highlight the use of RS and GIS in different phases of disaster management cycle and its application in digital DM Plans by various stakeholder.
- ✓ Trainer should aim for active participation of learners in promoting research and scientific work for application of various innovative tools, advanced technologies, data and knowledge networking in the field of disaster management.
- ✓ The explanation should be strengthened with several cases, examples, evidence, group activities and visual aids if possible. It is recommended that while explaining and using case studies, examples on the same, trainers should strive to link, the use of common tools for local hazards and vulnerabilities.
- ✓ Future ahead what measures need to be taken, and how to incorporate those DRR strategies.

Session 7.1: Geo-Informatics

Hazards in a specific location influencing a region depend on various controlling and triggering factors, which may be natural or human-induced. Therefore, comprehensive regional information is essential for mapping and monitoring in order to assess the risk factors for better disaster preparedness and mitigation. Remote sensing facilitates continuous and efficient monitoring of key disaster parameters, including the location, transformation, and regression. With the use of advanced technologies, Remote Sensing (RS) and Geographical Information System (GIS) tools provide aid in all phases of disaster management, from prevention to response and recovery. Such information further helps to formulate effective action plans for post-disaster situations of response activities.

Learning Units

1. Understanding GIS
2. Role of GIS in disaster management in different phases
3. Application of Remote Sensing in disaster management
4. **Discussion:** Current research and scientific work using RS and GIS at national level

Time Required	40 Min
Learning Outcome	Participants learn the importance of GIS and RS in different phases of disaster management. Participants will also discuss the current research practices and the way forward.
Key words	Spatial data, Remote Sensing, GIS
Mode of delivery	Presentation, Discussion on research /scientific studies
Suggested readings	<ol style="list-style-type: none"> 1. SGL (2022) Role of GIS in Disaster Management Use of GIS Technology in Disaster Management GIS for Disaster Management (sgligis.com) 2. NIDM (2014) Role of Geo-Informatics in Disasters https://nidm.gov.in/easindia2014/err/pdf/themes_issue/technology/role_of_geo.pdf 3. Eguchi, R. T et al. (2008). The application of remote sensing technologies for disaster management. https://www.iitk.ac.in/nicee/wcee/article/14_K004.pdf 4. Discussion on current research practices: Example: Rao, P. J., Rao, K. N., & Kubo, S. (Eds.). (2018). Proceedings of International Conference on Remote Sensing for Disaster Management: Issues and Challenges in Disaster Management.

Session 7.2: Role of Data in Disaster Management and Big Data Analytics

The diversity of disaster types, impacts, and disaster management activities make the data associated with disaster risk reduction have a much broader scope. Moreover, disaster management decisions involve life-threatening situations and lack of data or compromising with poor quality data may cost in terms of lives and huge monetary losses. Data availability and its processing is important to make a usable format of data through which efficient and appropriate decision can be taken. Big Data analytics revolutionizes disaster management by processing complex real-time data from diverse sources to predict disasters, enabling timely alerts and evacuations. Big Data analytics in disaster management enhances situational awareness, improves decision-making, and aids in more effective and efficient responses before, during, and after disasters.

Learning Units

1. Role of data in disaster management
 - a. Crisis mapping
 - b. Connecting missing people with their families
 - c. Social media mining
 - d. Event Simulations
2. Application of Big Data

Time Required	40 Min
Learning Outcome	Understanding of importance of data and information for various disaster management activities. Participants acknowledge application of Big Data to retrieve information and other uses in disaster management.
Key words	Computational intelligence, Big Data
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. World Bank (2021) World Development Report 2021: DATA FOR BETTER LIVES https://www.worldbank.org/en/publication/wdr2021 2. Song, X.et al.(2020). Big data and emergency management: concepts, methodologies, and applications. https://par.nsf.gov/servlets/purl/10188343

	<p>3. UNDRR (2019) The role of data interoperability in disaster risk reduction: barriers, challenges and regional initiatives 66781_fmigliorini.pdf (preventionweb.net)</p> <p>4. Homberg M.V.D. (2016) Data for Disaster Management: Mind the Gap Middle East Institute (mei.edu)</p>
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Session 7.3: Use Of Advanced Technology like Artificial Intelligence (AI), Machine Learning (ML), GPS and Drone Technology for DRR

By leveraging the usefulness of advanced technologies like AI, ML, GPS, and drone technologies for disaster management efforts provide proactive, efficient, and effective results in various applications from early warning systems and risk assessment to response, recovery, and future planning. Drones equipped with multispectral sensors are essential in search and rescue missions. GPS has ability to provide accurate and real-time location information while AI can help to analyse satellite images and assess disaster damage. These informations has improvised the not only the coordination and response strategies but the preparedness and mitigation for effective disaster risk management as well.

Learning Units

1. Application of Drones and GPS in disaster management
2. Application of AI and ML for disaster risk reduction and management

Time Required	20 Min
Learning Outcome	Participants analyzed the different applications of AI and ML. Built understanding of role of drones and GPS in various disaster management activities.
Key words	AI, ML, GPS, Drone
Mode of delivery	Ppts, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. WMO (2022) Artificial Intelligence for Disaster Risk Reduction: Opportunities, challenges, and prospects https://shorturl.at/ehoBE 2. Linardos V. et al (2022) Machine Learning in Disaster Management: Recent Developments in Methods and Applications https://www.mdpi.com/2504-4990/4/2/20 3. Kafi KM & Gibril BM. (2016) GPS Application in Disaster Management: A Review regional initiatives https://shorturl.at/dilA4

Dissemination of Disaster Related Information

With the growth in using innovation and technology for disaster risk reduction and management, monitoring, and mitigation, the role of dissemination of data through various communication system came into play. In this submodule two most important and widely accepted tools for communication and dissemination of information are dealt with i.e. early warning system and use of mobile apps and social media. They are used in preparedness measure to response scenario and requires community to be a major part in the process and its success.

Following two sessions are delineated under this sub module:

Session 8.1: Early Warning System

Session 8.2: Role of social media and Mobile Apps

Time Duration: 70 mins

Trainers tip:

- ✓ Trainer must showcase the use of various social media platforms like Twitter, Facebook, SOS system by community during the time of disaster.
- ✓ Trainer should discuss the mobile-based alert and early warning systems and outline the key stakeholders and nodal agencies responsible for different hazards.
- ✓ Trainer shall discuss about how different hazards have different timeline for early warning.
- ✓ The explanation should be strengthened with as many cases, examples, evidence, group activities and visual aids as possible.

Session 8.1: Early Warning Systems

Most of the hazardous events which are capable to convert into disaster usually have certain characteristics which can be tapped as some signs of alert. So, in order to save lives and developmental gains of the country, many alert systems are have been implemented to reduce disaster risk in the “window of opportunity” arising before an anticipated event materializes. A set of information, thus, can be disseminated timely to stakeholders as an early

warning system. It is necessary to integrate different information gathered by various stakeholders, with continuous monitoring of hazards in order to make informed decisions and take actions through relevant and timely information present in a systematic way.

Learning Units

1. Understanding early warning system
2. Importance and role of early warning system in disaster management.
3. Types of early warning systems for different hazards

Time Required	40 Min
Learning Outcome	Participants are aware of different early warning system currently in use for different hazards. They will also learn about various mobile apps to receive information related to disasters.
Key words	Radar, Pubic Warning, GNSS
Mode of delivery	Presentation, case studies
Suggested readings	<ol style="list-style-type: none"> 1. ILO (2022) The importance of early warning systems in disaster risk reduction https://www.ilo.org/global/topics/employment-promotion/recovery-and-reconstruction/WCMS_858123/lang--en/index.htm 2. NIDM (2014) Early Warning https://nidm.gov.in/easindia2014/err/pdf/themes_issue/technology/early_warnings.pdf 3. UNISDR (2006) Developing Early Warning Systems: A Checklist https://www.unisdr.org/files/608_10340.pdf

Session 8.2: Role of Social Media and Mobile Apps

Public and social communication along with media relations have become key elements in efficient emergency management. The emergence of these channels and applications give a chance to expand emergency notifications to various population segments and provides redundancy in communication during emergency situations. In many of the cases during disaster event, where false information spreads, government accounts and other major accounts turn to social media to supply the public with updated information. The high usage of mobile phone technologies makes it an important tool for communication. It assists in disaster risk reduction, as a means of enhancing inclusivity and local relevance of knowledge production and resilience building.

Learning Units

1. **Group Discussion:** Use of Mobile Applications for different hazards and early warnings in India with their limitations.
2. Role of social media in disaster management

Time Required	30 Min
Learning Outcome	Participants learn the uses and misuses of social media and its role in enhancing situational awareness. Discussions on various Mobile Apps help disseminate information about usage of the Apps and chart out the limitations to build familiarity.
Key words	Internet, Social Media, Apps
Mode of delivery	Discussion on real life incidents/ case studies, Presentations, Videos
Suggested readings	<ol style="list-style-type: none"> 1. Navarro de Corcuera, L., Barbero-Barrera, M. D. M., Campos Hidalgo, A., & Recio Martínez, J. (2022). Assessment of the adequacy of mobile applications for disaster reduction. <i>Environment, development and sustainability</i>, 24(5), 6197-6223. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8419831/ 2. Down To Earth (2015) How people turn to social media during natural disasters https://www.downtoearth.org.in/blog/how-people-turn-to-social-media-during-natural-disasters-49587 3. Wendling, C., J. et al. (2013), “The Use of Social Media in Risk and Crisis Communication”, OECD 5k3v01fskp9s-en.pdf (oecd-ilibrary.org) 4. Ahmed A (2011) Use of social media in disaster management https://researchbank.swinburne.edu.au/file/9f73753e-9fbc-432f-931f-a870f71ba268/1/PDF%20%28Published%20version%29.pdf <p>Discussion: National Disaster Alert Portal- SACHET For more details, please visit: https://sachet.ndma.gov.in/</p>

Framework System for Disaster Management

In this submodule global milestones of disaster management which came out as frameworks are briefly described. This will provide learners, a broad view of how the frameworks and strategies at the global and national level have evolved and the influence these frameworks have made at the sub-national level. The current ongoing Sendai Framework for Disaster Risk Reduction (SFDRR 2015-2030) framework will be discussed in detail for participants to orient their actions for achieving/addressing the global targets as well. Later, the institutional mechanism from national level context will be introduced so that learners grab the knowledge of policies and framework which can help them providing guidelines, action frameworks and ultimately achieve better output.

Following three sessions are delineated under this sub module:

Session 9.1: Global Milestones

Session 9.2: The Sendai Framework for Disaster Risk Reduction (2015-2030)

Session 9.3: Institutional Mechanism for Disaster Management in India

Time Duration: 140 mins.

Trainers tip:

- ✓ Trainer may discuss the framework and policies at state level and whether they are aligned with the global frameworks/guidelines.
- ✓ The trainer should aim for developing an understanding of each frameworks covered through active participation of learners through discussions and question & answer sessions.
- ✓ Trainer may discuss on different Disaster Management Plans and/ or give an exercise to the participants to find out the steps taken by the Indian government towards achieving Sustainable Development Goals (SDGs) and SFDRR targets.

Session 9.1 Global Milestones

To achieve efficient disaster management worldwide and further help the low income and developing nations to go beyond rescue and relief in disaster phase,

United Nations and other several international agencies led to establishment of several frameworks. These frameworks and agendas got updated from time to time, incorporating more and more countries in agreement with the frameworks through bringing change in approaches and targets to achieve resilience at grassroot level. This session will highlight the evolution of major international frameworks and their objectives to achieve the disaster risk reduction globally.

Learning Units

1. Evolution of disaster management framework.
2. International organisations and major agreements:
 - Yokohama Strategy and Plan of Action
 - Hyogo Framework for Action (HFA)
 - Sendai Framework for Disaster Risk Reduction
 - Paris Agreement and COP for climate change
 - 2030 Agenda for Sustainable Development

Time Required	50 Min
Learning Outcome	<p>Participants are sensitized about the evolutionary framework on international and national level for disaster management.</p> <p>Participants will be familiarized with a several actions to support DRR and SDG.</p>
Key words	Hyogo, Sendai, Yokohama, COP21
Mode of delivery	Presentations, discussions
Suggested readings	<ol style="list-style-type: none"> 1. DRR and UNDRR’s history History UNDRR 2. Global Frameworks for DRR https://ndmindia.mha.gov.in/global-frameworks-for-drr 3. UN Climate Action https://www.un.org/en/climatechange/paris-agreement 4. The Sustainable Development Goals Report 2023 https://unstats.un.org/sdgs/report/2023/ 5. UN Take Action for the Sustainable Development Goals https://www.un.org/sustainabledevelopment/sustainable-development-goals/

Session 9.2: The Sendai Framework for Disaster Risk Reduction (2015-2030)

The currently ongoing international framework called Sendai Framework for Disaster Risk Reduction (SFDRR 2015-2030) was endorsed by United Nation post 2015. It replaces the 10 year plan of Hyogo framework, focusing on reducing disaster risk and losses in lives, livelihood and health, aiming to minimise the impact of disaster to protect lives and infrastructure from impending disaster. To manage disasters efficiently one must converge or substantiate their objectives and goals with the SFDRR targets and priority actions. Hence, understanding guiding principles of SFDRR is taken up in this session.

Learning Units

1. What is the Sendai Framework for Disaster Risk Reduction 2015-2030.
 - Global targets
 - Priorities for action
 - Guiding principles
2. Group Discussion on achieving targets of SFDRR in India and achievement so far.

Time Required	40 Min
Learning Outcome	Participants are aware of the Sendai framework and its targets, priorities and guiding principles. Built understanding of different approaches to actively participate in disaster management activities.
Key words	SFDRR, Risk Reduction
Mode of delivery	Presentation and discussion
Suggested readings	<ol style="list-style-type: none"> 1. What is the Sendai Framework? UNDRR 2. Sendai Framework UNECE 3. NDMA (2022) Mid Term Review SFDRR https://shorturl.at/DR125 4. Discussion: Mihir Bhatt (2018) India and the Middle East: Common Areas of Action on the Sendai Framework https://www.mei.edu/publications/india-and-middle-east-common-areas-action-sendai-framework

Session 9.3: Institutional Mechanism for Disaster Management in India

Government of India enacted the Disaster Management Act, 2005 to establish a well-structured organisation to manage and reduce the impact of disaster in country. This institutionalized structure evolved the disaster related activities from single faculty domain and relief based approach to multi-dimensional approach. The DM Act, 2005, institutionalized and developed techno-legal framework, policy perspective for effective disaster management at national, state, district and local levels. This Act establishes a number of organisations and institutions for effectively managing disasters at the national, state, and local levels and promoted preparation of DM Plans.

Learning Units

1. Earlier approach before DM Act 2005
2. Disaster Management Act, 2005
3. Establishments for disaster management framework at national, state and district level
4. Discussions: Responsibilities of different stakeholders as per NDMP 2019

Time Required	50 Min
Learning Outcome	Participants become familiar with institutional framework in India for disaster management at various level, raised awareness of DM Act 2005 and DM Plans of India.
Key words	NEC, NDMA, SDMA, NIDM
Mode of delivery	Presentations and discussions
Suggested readings	<ol style="list-style-type: none"> 1. DM Act 2005 NDMA, Gol 2. Institutional Framework of Disaster Management in India Geography https://shorturl.at/uyB11 3. Disaster management in India https://nidm.gov.in/PDF/pubs/DM%20in%20India.pdf 4. The Asia Foundation (2022) India's Disaster Risk Reduction Journey - Opportunities for Strengthening Partnerships in the Indo-Pacific. https://asiafoundation.org/wp-content/uploads/2022/10/Indias-Disaster-Risk-Reduction-Journey_TRIDEP_EN.pdf 5. NDMA (2019) NDMP 2019 https://ndma.gov.in/sites/default/files/PDF/ndmp-2019.pdf

Public Health Emergency

This submodule provides learners with a broad overview of the impact of disaster events on public health, including the associated public health emergencies and related concerns. It will help learners to gain knowledge by studying various health frameworks, health management systems and relevant approaches. It will also focus on improving the overall health status of communities by reducing the impact of disasters on public health.

Following four sessions are delineated under this sub module:

Session 10.1: Disaster epidemiology

Session 10.2: International health frameworks

Session 10.3: Health Emergency and Disaster Risk Management (Health EDRM)

Session 10.4: One Health approach

Time Duration: 100 mins.

Trainer's tip:

- ✓ Trainer may discuss the public health related framework and policies at state/UT level and whether they are aligned with the global frameworks/guidelines.
- ✓ The trainer should aim for active participation of learners through discussion and question and answer sessions about public health.
- ✓ Trainer may give an exercise to the participants to prepare a framework at local /departmental level towards health emergency and disaster risk management.
- ✓ Trainer, on completing the sessions of Public Health may introduce First Aid and Mass Casualty Management, as per the interest of participants through panel discussion followed by demonstration on first aid.

Session 10.1: Disaster Epidemiology

Every country is responsible for maintaining the health, safety, and welfare of its citizens, as well as the health system's resilience and self-reliance. It is crucial for reducing health hazards, vulnerabilities and providing effective

response and recovery in emergencies and disasters. The most apprehensive effect of disaster is on people's lives and their livelihood. This shows the requirement in the improvement of resilience of people and communities. Disaster epidemiology works in the same direction to improve the health status of people, so disaster impact on their health can be as low as possible.

Learning Units

1. Emergency medical response
2. Health emergencies
 - Immediate health concerns
 - Secondary effects
 - Triage

Time Required	30 Min
Learning Outcome	Participants will understand the terminologies and concepts related to public health as consequence of disaster.
Key words	Epidemiology, PHEIC
Mode of delivery	Presentations, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. Overview of Disaster Epidemiology https://www.cdc.gov/nceh/hsb/elearning/DisEpiOverview.html 2. K Park,(2015) Preventive and Social Medicine https://milonm28.files.wordpress.com/2017/08/parks-preventive-social-medicine-23rd-ed.pdf 3. Giorgadze T, et al. (2011) Disasters and their consequences for public health. https://pubmed.ncbi.nlm.nih.gov/21685525/ 4. Natural Disasters: Protecting the Public's Health https://iris.paho.org/bitstream/handle/10665.2/748/9275115753.pdf?sequence=2

Session 10.2: International Health Frameworks

To achieve the improved health status worldwide for those who are affected and at risk from disaster related impact, multilateral agreements were signed for health improvement as framework.

Learning Units

1. Alma-Ata Declaration
2. UNICEF's GOBI – FFF Programmes

Time Required	30 Min
Learning Outcome	Participants are acquainted with major frameworks regarding health and able to correlate with disaster management.
Key words	Epidemiology, PHEIC etc.
Mode of delivery	Ppts, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. UNICEF's GOBI – FFF Programs https://rehydrate.org/facts/gobi-fff.htm 2. Noji, E. K. (1996). Disaster epidemiology. Emergency Medicine Clinics, 14(2), DoI 289-300. 10.1016/s0733-8627(05)70252-2 3. WHO, Europe (1978). Declaration of ALMA-ATA https://apps.who.int/iris/bitstream/handle/10665/347879/WHO-EURO-1978-3938-43697-61471-eng.pdf?sequence=1&isAllowed=y

Session 10.3: Health Emergency and Disaster Risk Management (Health EDRM)

Health Emergency and Disaster Risk Management (Health EDRM) framework of WHO 2019. It highlights the importance of prevention, readiness, and preparedness, together with response and recovery, in order to save lives and safeguard health. It demonstrates the integration of all health initiatives and the entire health system. It is derived from the good practices and achievements in many related fields such as humanitarian action, multi-sectoral disaster risk management, and all-hazards emergency preparedness and response, including for epidemics, health systems strengthening and community-centred primary health care.

Learning Units

- a) Vision, principles and outcomes of Health EDRM
- b) Components and functions of Health EDRM

Time Required	20 Min
Learning Outcome	Participants learning from good practices such as Health EDRM and get familiar with the contemporary approaches.
Key words	Health infrastructures and programmes
Mode of delivery	PPTs, real life incidents/precedents, case studies
Suggested readings	Health Emergency and Disaster Risk Management Framework 9789241516181-eng.pdf (who.int)

Session 10.4: One Health Approach

With the increase in human population, human settlements are expanded into exposed areas and sometimes coming in contact with wildlife. As a result of these interactions, humans and animals increasingly share food, land, and water resources, leading to widespread exposure to zoonotic infections annually. For example, recent epidemic Covid-19 which engulfed whole world came from wild animal interaction. Hence this approach helps analyse the whole system on Earth in an integrated manner.

Learning Units

1. Introduction to One Health approach.
2. Its role in disaster health management.

Time Required	20 Min
Learning Outcome	Awareness on One Health approach and become familiar with its necessities, and management.
Key words	One Health
Mode of delivery	Presentation, demonstration, discussion, case studies
Suggested readings	One Health Basics https://www.cdc.gov/onehealth/basics/index.html

Practical Demonstration and discussion on First Aid and Mass causality Management

1. ASDMA (2013) Mass Casualty Management <https://www.asdma.gov.in/download/modules/Mass%20Casualty%20Management%20Peripheral%20Level.pdf>
2. Disaster Safety Education :Procedures and Tools for First Aid https://www.preventionweb.net/files/8082_DSEQKitFirstAidManual.pdf

Role of Financing in Disaster Management

The negative financial effects of disasters, needs mechanism to be developed in a way to protect people and their assets from future risk. This submodule will brief the learners about the proactive planning to strengthen the financial resilience through different strategies evolved globally. A case study on disaster risk financing and insurance programme will be discussed to promote the culture of insurance in the learners. Further the mechanism of financial support provided for disaster management in India will be discussed in detail.

Following three sessions are delineated under this sub module:

Session 11.1: Disaster risk financing

Session 11.2: Case Study: Programmes for disaster risk financing

Session 11.3: Disaster management financing in India

Time Duration: 80 mins.

Trainers tip:

- ✓ Trainer should use comparative analysis of all financial programmes to discuss the benefits and good practices of each programmes with the learners.
- ✓ The trainer must quote examples and case studies for easy understanding.
- ✓ Trainer may discuss with the participants on what proactive steps can be taken in their organizations/department to reduce the financial pressure during any emergency and disaster related event.

Session 11.1: Disaster Risk Financing

Disaster when occur not only make the country's economic and social condition vulnerable but also lead to the collapse of essential services at the time of crisis. So, it is necessary to reduce the volatility of financial risk so the country can manage economic and fiscal shock. This ultimately ensures proper mitigation along with efficient response and recovery. Achieving financial resilience is thus a critical component of effective Disaster Risk Management.

Learning Units

Types of Disaster Risk Financing

- a) Sovereign Disaster Risk Financing
- b) Property Catastrophe Risk Insurance
- c) Agricultural Insurance
- d) Disaster-linked Social Protection

Time Required	30 Min
Learning Outcome	Participants will understand importance of disaster risk financing and become familiar with its approach to mitigate future disaster risk.
Key words	Finance, Insurance
Mode of delivery	PPTs, real life incidents/precedents, case studies
Suggested readings	<ol style="list-style-type: none"> 1. What is Disaster Risk Finance (DRF)? Financial Protection Forum 2. Disaster Risk Financing: A global survey of practices and challenges (oecd.org) 3. OECD Recommendation on Disaster Risk Financing Strategies 4. DRFI https://www.worldbank.org/en/programs/disaster-risk-financing-and-insurance-program

Session 11.2: Case Study: Programmes for Disaster Risk Financing

In line with disaster risk financing, several programmes were initiated. These programmes broadly aim to reduce the volatility of economic status of both as a country and an individual. Financial risk transfer using insurance and risk-hedging is applicable in all three phases of disaster to keep the approach proactive. This case study session will briefly highlight the Disaster Risk Financing and Insurance Program (DRFIP) of World Bank which was established in 2010 to improve the financial resilience of governments, businesses, and households against natural disasters.

Learning Units

Disaster Risk Financing and Insurance Program (DRFIP)

Time Required	20 Min
Learning Outcome	Participants learn about DRFIP global programme for disaster risk financing as good practice case study.
Key words	Risk transfer, hedging
Mode of delivery	PPTs, real life incidents/precedents, case studies
Suggested readings	1. World Bank Disaster Risk Financing and Insurance (DRFI) Program (worldbank.org) 2. GFDRR- Disaster Risk Financing and Insurance Program https://www.gfdr.org/sites/default/files/publication/thematic-note-diaster-risk-financing-and-insurance-program.pdf

Session 11.3: Disaster Management Financing in India

With the change in atmospheric concentration and haphazard development, the disaster risk has increased both in terms of incidence and economic impacts. In order to mitigate the financial and economic consequences of disasters, financial management tools and available physical risk reduction approaches must be implemented. The midterm evaluation of SFDRR (2022) for India highlighted the need to invest in climate and disaster resilient development.

Learning Units

1. Structure of Disaster Management Financing
 - At National Level
 - At State Level
2. Allocation of Funds in Management Segment
3. Challenges and Gaps in Disaster risk financing for India

Time Required	30 Min
Learning Outcome	Better understanding about the need and importance of investment for disaster risk reduction. Participant shall promote risk transfer and insurance mechanism.
Key words	Finance commission ,different types of fund
Mode of delivery	Presentations, experience sharing, case studies

Suggested readings	<ol style="list-style-type: none">1. Ray S et al (2021) Financing India's Disaster Risk Resilience Strategy ES Financing India_Disaster_Risk_Resilience_Strategy.pdf2. 15th Finance Commission - A Game Changer in Disaster Finances of India - Knowdisaster3. NIDM (2021) Working Group Report Disaster Risk Financing, Insurance and Risk Transfer https://nidm.gov.in/PDF/pubs/WGR_NIDMandIII_2021.pdf4. Sharma S (2021) Exploring Disaster Mitigation in India: A Financial Viewpoint https://doi.org/10.1177/23949015211057915
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Role of Ethics in Disaster Management

Ethics/moral philosophy decide the decision (good or bad) or conduct of human being on the basis of principles, norms. In the field of disaster management it helps all the managers to take appropriate decision, to utilise resources properly without guilt (moral crisis) and do their work responsibly. Ethical decisions made during disaster management have long-term impacts on communities, including their resilience-building, social cohesion, and in recovery processes. This submodule is very important from the perspective of faculty development programmes where educators are our learners. Understanding and applying ethical principles in disaster management not only ensures an effective decision making, but also contribute significantly to building resilient and cohesive communities in the aftermath of disasters.

Time Duration: 80 mins.

Trainer's tip:

- ✓ Trainer must focus on the disaster ethics which need to be spread through the educators among all young minds and society for better future.
- ✓ The trainer must showcase videos and examples of good practices and differences inculcating ethics can bring in long term.
- ✓ Trainer may discuss with the participants on how they can take part in disseminating the information and awareness regarding disaster ethics in their community.

Learning Units

Role of Ethics in Disaster Management

1. Concerns

Table Top Exercise on Moral Questions such as:

- a) When to call for evacuation?
- b) How limited resources & personnel should be expanded?
- c) How much time to be devoted to search and rescue?

- d) How much time and resources to be devoted to restoration of life line facilities?
- e) Which geographical areas should receive priority? etc.

Group Discussion to enhance the importance of role of disaster ethics for:

- a) Development of society
- b) Fast development of transport
- c) Development of information and communication technology (ICT)
- d) Globalisation
- e) Societal disparities

2. Approaches

Different Ethical approaches to address this issues.

1. Consequential approach
2. Capabilities approach of Amartya Sen
3. Virtue ethics
4. Enlightenment & Romanticism philosophy
5. Immanuel Kant's categorical imperative
6. Bertrand Russell's Social Reconstruction
7. Gandhian philosophy

Time Required	40 minutes
Learning Outcome	Building correlation of different ethical approaches and its necessities in disaster stages. Discussion on the social aspect of disaster and how education sector help in building ethics.
Key words	Lifeboat ethics, ethical dilemma, moral judgement, ethical approaches
Mode of delivery	Presentations, experience sharing, discussions, excercises
Suggested readings	<ol style="list-style-type: none"> 1. Saban, L. I. (2016). International disaster management ethics. https://www.perlego.com/book/2674759/international-disaster-management-ethics-pdf 2. Ethical Disaster or Natural Disaster? Importance of Ethical Issue in Disaster Management M0602079093.pdf (iosrjournals.org)M0602079093.pdf (iosrjournals.org) 3. Lifeboat ethics - Wikipedia 4. The ethics of disaster management Emerald Insight 5. Ethical Dilemmas in Disaster Medicine - PMC (nih.gov)

Demonstrations and Field Visit with Exercise

This session introduces the practical orientation of the theoretical sessions by introducing a field visit followed by group exercise/presentations of the participants and open panel discussion. A field visit is very helpful for supplementing the theoretical knowledge gained during the training programme. It aids to interlink the facts with the practical field and teaches its significance.

Another important learning skills is through demonstration and mock drills. This submodule will guide on few areas where faculties may benefit from demonstration and performing drills.

Time Duration: 180 min for field visit and 90 min for group discussions

1. **Field Visit:** Steps to be followed:

- Introduction of the field coordinators by the course coordinator (including him/her).
 - Introduction to field visit, task to perform and grouping of participants.
 - Share instruction related to exercises, presentations as follow up of field survey.
 - Distribution of materials to perform tasks.
 - Mark group leaders for each group nominated by group members, and give them responsibility of coordinating and distributing work amongst all team members.
 - Group leader will also share exercise updates, their locations, name of group members and queries in WhatsApp group for field investigator and others to check in real time.
- **Field visit can consist of:**
- Identification of Hazard, Vulnerability and Capacity (HVCA) of local area
 - Structural, non-structural mitigation measures of infrastructures
 - Preparation of framework of Disaster Management Plan for local area/ building etc.

2. Demonstrations/Mock Drill

In case of field visit is comprised of demonstrations or mock drill, a trainee must learn to operate the equipment used during emergency such as:

- Fire safety measure and use of fire extinguishers
- First Aid and other Life safety Skills
- Demonstration of using social media, early warning, Ham radio, and satellite phones during rescue and relief etc.
- Fire and earthquake safety mock drill and establish evacuation plan.

Trainers Tips:

- ✓ Trainer should be capable of knowing:-
 - Importance of knowing exercise needs
 - Methods of assessing needs and outcomes
 - Ways to incorporate findings into the exercises and presentations.
- ✓ While performing demonstration and mock drill, facilitator must ensure it is conducted under the supervision of trained and skilled personnel.
- ✓ The performance of drill should be checked by third party as well to give opinions and list out gaps and issues while conducting drill.

Time Required	270 Minutes
Learning Outcome	<ul style="list-style-type: none"> ➤ Participants will benefit working on practical issues and perform in stimulation exercises through mock drills. ➤ Discussion with the participants on the coordination, awareness, contextual issues and specific challenges identified through exercise.
Key words	Field survey
Mode of delivery	Demonstration, field survey, group discussion, presentations
Suggested readings	Flip charts, Markers, Pen Pencils, Colours, Exercise Materials, Camera/Phone etc.

Closing Session

The closing of your training session is the time for participants and contributors to reflect, synthesize, and consolidate what they have learned and taught respectively. This will also be the certification ceremony for the learners on successfully completing their Faculty Development Training Programme. The submodule will also guide learners on their roles and responsibilities after the training and what all requirements they need to follow for post training assessment.

Time Duration: 120 minutes

Session 14.1: Feedback, Evaluation & Certification

1. Summarising the key points of training by organisers.
2. Review of the objectives and achieved outcomes.
3. Discussion and feedback on field visit/mock drill/demonstration with observed results.
4. Short discussion on the effectiveness and processes of training.
5. Discuss Future Action Plan and way forward.
6. Provide instructions for filling out the feedback form.
7. Collect the form or ask participants and trainers to email them to you about the training as feedback.

Session 14.2: Valedictory Function

1. Recognize contributions.
2. Acknowledge efforts and achievements.
3. Formal Vote of Thanks for participants and trainers.
4. Take feedbacks of participants on how to improve the training in future.

Trainers Note:

- ✓ The valedictory function should have patrons, chief guests and organisers.
- ✓ The valedictory note shall be given by chief guest after discussing the summary of programme, convenor and coordinators shall present, moderate and honour the guests for valedictory session.

Session 14.3: Post Training Assessment/ Action Plan

It gives valuable insight into your programme's effectiveness. The best course evaluation tool to validate this, is a post-training evaluation questionnaire. It gives an idea of the learner's experience about the course, along with effective working of training session.

Post Training Assessment can be sent in form of questionnaire or assignments at different time scales to follow the learner's long term engagement and activities.

- 1) Immediate response: At the end of the programme with immediate follow up activities that they would like to organise and get involved into.
- 2) Cognitive Assessment (within 30 days) after one month it should check the changes adopted by the participant itself and the activities he has taken up as mentioned in the immediate response
- 3) Behavioural Change (within 90 days) should investigate the sustainability of the adopted changes, challenges observed and its influence to their colleagues.
- 4) Community Change (within 120 days) should investigate on the status of long-term goal of the participant and inspect on major activities included as part of their organisation.
- 5) Impact assessment (within 1 year) consist of detailed assessment of the work done and the impact observed in one year.

Trainers Note:

- ✓ The Post Training Assessment can be taken up through questionnaire form developed using Google forms and shared on the email IDs and whatsapp group of the training programme.
- ✓ The Questionnaire must be developed by the coordinators so that they know the issues raised during the training programme by participants.
- ✓ Questionnaire developed will be based on the responses given by participants in earlier assessment, such as immediate response should be based on feedback and suggestions received during training programme; Cognitive Assessment based on immediate response and so on.
- ✓ Training related project assignments can be allotted to participants in small teams or individually. Submission with presentations within three months after training may be kept.

Additional Topics

The sessions of these submodules covered as the additional topics are some of the important subjects that may not be directly related to basic of disaster management but are equally important to improve practical skills and understand the thematic areas where community can be a part of change towards resilience. Facilitator, on the basis of experience and requirement of target group can take learning units in brief or at length with help of suggested readings. The topics discussed in following submodule thus provide flexibility to facilitators to effectively build a faculty development programmes where educators get maximum benefit from such trainings.

Time Duration: 40 mins each

Trainers Note:

- ✓ Facilitator should perform training need analysis for selecting topic.
- ✓ Using sub-module 22, the participants need to learn the trainers skills and different approach to training individually while developing their future action plan.

Sub Module 15	Mainstreaming Cross-Cutting Issues on DRR
Learning Units <ol style="list-style-type: none">1. Related to Gender, Psycho-social Vulnerabilities2. Disability inclusive DRR3. Emergency standards and supplies for WASH4. Mainstreaming disaster resilient infrastructure for livelihoods5. Solid waste management	Suggested Readings <ul style="list-style-type: none">• ADB (2022) Disaster-Resilient Infrastructure: Unlocking Opportunities for Asia and the Pacific https://www.adb.org/publications/disaster-resilient-infrastructure-opportunities-asia-pacific.• UN Women (2021) Gender equality and women's empowerment in disaster recovery, https://wrd.unwomen.org/practice/resources/gender-equality-and-womens-empowerment-disaster-recovery• UN Women (2020) Review of gender-responsiveness and disability-inclusion in disaster risk reduction in Asia and the Pacific https://wrd.unwomen.org/practice/resources/review-gender-responsiveness-and-disability-inclusion-disaster-risk-reduction• GWC https://www.washcluster.net/resources

	<ul style="list-style-type: none"> • UNEP/OCHA (2013) Disaster Waste Management Guideline https://wedocs.unep.org/bitstream/handle/20.500.11822/27291/DisaterWM_guidelines.pdf
Sub Module 16	Community Based Disaster Risk Management
Learning Units 1. Addressing Visible and Invisible Needs of Disaster Survivors: Community participation 2. Stress Management and Handling Responsibilities: Exercises for Self-care	Suggested Readings <ul style="list-style-type: none"> • Sutton J (2020) 16 Effective Stress-Management Activities and Worksheets https://positivepsychology.com/stress-management-activities-worksheets/ • Chap-8 Participation, Disaster risk reduction: mitigation and preparedness https://www.preventionweb.net/files/8450_gprch810.pdf • NIDM (2009) Psychosocial Care in Disaster Management https://nidm.gov.in/PDF/modules/psychosocial.pdf • Self-Care Strategies to Handle Stress After Disaster https://www.cigna.com/knowledge-center/stress-after-disaster • Dr. Cyalene P. Bryce (2001). Stress Management in Disasters https://www.preventionweb.net/files/2001_VL206610.pdf • Accelerating Change: Engaging Local Communities in Disaster Risk Reduction in the Indian Himalayan Region https://gbpihed.gov.in/PDF/Policy%20Briefs/Policy_Brief_Local_DRR_in_IHR.pdf
Sub Module 17	Role of Higher Education
Learning Units 1. Role of Faculties for DRR 2. Disaster Resilient Educational setup 3. Institution/ University DMP	Suggested Readings <ul style="list-style-type: none"> • Nalla V et al. (2022) Considering curriculum, content, and delivery for adaptive pathways: higher education and disaster resilient infrastructure in the Indian urban context https://shorturl.at/dEM28 • UNDRR (2015) Strategic mobilisation of higher education institutions in disaster risk reduction capacity building https://www.preventionweb.net/publication/strategic-mobilisation-higher-education-institutions-disaster-risk-reduction-capacity

	<ul style="list-style-type: none"> • Thayaparan M et al (2014) Disaster Management Education through Higher Education - Industry Collaboration in the Built Environment https://www.researchgate.net/publication/275541198/Disaster_Management_Education_through_Higher_Education_-_Industry_Collaboration_in_the_Built_Environment • HPSDMA DM Plan of Department of Higher Education • https://hpsdma.nic.in/WriteReadData/LINKS/DMP%20-%20Dept%20of%20Higher%20Education%20-%2020187d7c48e3-c04c-4c39-9144-299bf858efb5.pdf
<p>Sub Module 18</p>	<p>Urban Resilience</p>
<p>Learning Units</p> <ol style="list-style-type: none"> 1. Disaster Safe Housing 2. Disaster Safe Developmental Planning 3. Disaster Resilience Framework 	<ul style="list-style-type: none"> • Suggested Readings • National Disaster Housing Strategy, FEMA (2009) • https://www.fema.gov/pdf/emergency/disasterhousing/NDHS-core.pdf • UNDRR (2022) Policy Brief Urban Disaster Resilience • https://www.undrr.org/publication/policy-brief-urban-disaster-resilience • WB (2016) From Urban risk to resilience- Building safer citites • https://www.worldbank.org/en/news/feature/2016/04/06/from-urban-risk-to-resilience--building-safer-cities • Almeida et al. (2024) Urban planning for DRR: A systematic review of essential requirements • http://dx.doi.org/10.21203/rs.3.rs-5328043/v1

Sub Module 19	Fire Safety Management, Basics of Life Safety and First Aid Hands on Session <i>(To be conducted under the supervision of master trainer and skilled personnel in these areas such as Fire Department, NDRF, SDRF, Red Cross etc.)</i>
Sub Module 20	Climate Change Adaptations and Mitigation Measures
Learning Units <ol style="list-style-type: none"> 1. Lifestyles for Sustainable Development (LiFE) 2. Nationally Determined Contributions (NDCs) towards climate change 3. National and State Action Plan on Climate Change 4. India Climate Change Knowledge Portal 	Suggested Readings <ul style="list-style-type: none"> • Niti Ayog (2023) 75 ideas to promote LiFE. https://www.niti.gov.in/sites/default/files/2023-06/Thinking-For-Our-Planet-75-Ideas-to-Promote-LiFE.pdf • IEA (2022) LiFE lessons from India The benefits of advancing the Lifestyle for Environment (LiFE) initiative through the G20 • World Bank https://climateknowledgeportal.worldbank.org/country/india/extremes • Oxford Policy Management (2017) India's State Action Plans on Climate Change: towards meaningful action https://www.opml.co.uk/files/Publications/corporate-publications/briefing-notes/id-state-action-plan-climate-india.pdf?noredirect=1 • NICRA-ICAR National Action Plan on Climate Change http://www.nicra-icar.in/nicrarevised/images/Mission%20Documents/National-Action-Plan-on-Climate-Change.pdf
Sub Module 21	Good Practices and Case Studies at National Aand International Level

<p>Learning Units</p> <ol style="list-style-type: none"> 1. Scenario based studies 2. Stimulation exercises 	<p>Suggested Readings</p> <ul style="list-style-type: none"> • Singh D. et al. (2018). Climate resilient disaster risk management: Best practices compendium. https://www.researchgate.net/publication/331074060/CLIMATE_RESILIENT_DISASTER_RISK_MANAGEMENT_Best_Practices_Case_Studies_Compendium • IFRC (2018) Case Studies: Red Cross Red Crescent Disaster Risk Reduction in Action - What Works at Local Level, https://shorturl.at/jpPTV • Gol-UNDP (2009), Good Practices in Community Based DRM https://www.undp.org/sites/g/files/zskgke326/files/migration/in/gd_practices_in_cbdrm.pdf • Singh D., Chopde S. K., Raghuvanshi S. S., Gupta A. K., Guleria S. (2018). Climate resilient disaster risk management: Best practices compendium. • Murray, V., et al. (2012): Case studies. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap9_FINAL-1.pdf
<p>Sub Module 22</p>	<p>Guide to Systematic Approach to Training</p>
<p>Learning Units</p> <ol style="list-style-type: none"> 1. Group Discussion Method 2. Lecture Method Participants 3. Quiz Method 4. Role Play Method 5. Feedback Methodology 6. Training Need 	<p>Suggested Readings</p> <ul style="list-style-type: none"> • Campbell C (2021) Most effective training techniques https://ccleisureolutions.com/the-most-effective-training-techniques • UNODC, Systematic Approach To Training-DLM https://www.unodc.org/pdf/india/publications/guide_for_Trainers/03_systematicapproachtotraining.pdf • NTG (2015) Training Need Analysis https://ocpe.nt.gov.au/_data/assets/pdf_file/0004/281911/tools-training-needs-analysis-tna.pdf • US DOE Training Program Handbook (2014): A Systematic Approach To Training https://www.standards.doe.gov/standards-documents/1000/1078-bhdbk-1994-reaff-2013/@images/file

Sub Module - 2 Hazards and Disaster

Session 2.1 - Hazard

HAZARD: As per UNDRRR, hazard is “A process, phenomenon or human activity that may have potential to cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation”. It can be an atmospheric, hydrological, geophysical and man-made event which has the probability to impact the normal functioning of the society.

In August 1999, Government of India formed the High-Powered Committee (HPC) under the chairmanship of J.C. Pant, suggested a comprehensive model plan for disaster management at the central, state, and local levels. This was the first attempt in India to take a systematic, comprehensive and holistic approach to disasters. HPC had identified 30 hazards, grouped into five categories based on general considerations (National Centre for Disaster Management, 2002).

Water and Climate related	Geologically related	Chemical, Industrial and Nuclear related	Accident related	Biologically related
Floods and drainage management	Landslides and mudflows	Chemical and industrial disasters	Forest fires	Biological disasters and epidemics
Cyclones	Earthquakes	Nuclear disasters	Urban fires	Pest attacks
Tornadoes and hurricanes	Dam failures / dam bursts		Mine flooding	Cattle epidemics
Hailstorm	Mine fires		Oil spill	Food poisoning
Cloud burst			Major building collapse	
Snow avalanches			Serial bomb blasts	
Droughts			Festival related accidents	
Sea erosion			Electrical disasters and fires	
Thunder and lightning			Air, road and rail accidents	
			Boat capsizing	
			Village fire	

Fig 4: Classification of different types of hazards

Source: Repul Kanji (2019): *Understanding Disaster Risk Management: An easy-to-use training module*

DISASTER: The Disaster Management Act, 2005 defines a disaster as “A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of the environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area”.

Hazard and disaster are related incidents, but they are not the same. A hazard may cause a situation having the potential to damage lives, infrastructure, and property. In contrast, disaster is an actual event caused by a hazard which leads to loss of lives, damages to infrastructure and property because of the interaction between vulnerability-associated risk and exposure of people and/or infrastructure to the hazards.

LEVELS OF INCIDENTS

Emergency

According to Federal Emergency Management Agency emergencies are small-scale localised incidents resolved quickly using local resources. Although sometimes, small-scale emergencies can quickly turn into disasters due to a lack of planning and inappropriate use of resources.

Disaster

According to Federal Emergency Management Agency (FEMA), disasters are large-scale, cross-geographic, political, and academic boundary incidents which require a level of response and recovery beyond the local community’s capacity.

Disasters are broadly classified differently on the basis of origin; such as natural disasters and manmade disasters. While based on severity and impact, it can be also classified as minor or major, or based on scale such as small scale or large scale disaster.

Disaster can also be classified as a slow onset disaster for those that emerges gradually overtime, and a sudden onset disaster that emerges quickly or unexpectedly.

Session 2.2-Causes and Impact of hazards

The cause of various types of hazards are varied as their types. Natural hazards are caused by natural phenomena like crustal movement, ocean wave propagation, volcanic eruption, extreme weather events etc. At the same time, manmade hazards are caused due to human negligence, intent or error involving a failure of a manmade system.

CAUSES OF NATURAL HAZARDS

Natural hazards occur as the regular activity of the Earth. This natural hazard has occurred as a natural phenomenon on the Earth's surface since its formation. Natural phenomena are occurring on the earth's surface and below has the potential to cause catastrophe and change to natural disaster.

On the Earth's surface, meteorological events such as rainfall, storms, cyclones, thunderstorm etc., occur due to differences between temperature, air pressure and moisture from one place to another.

Seismic activity is the leading cause of the earthquake. Earth's surface is broken into several tectonic plates. Continents sit on these giant tectonic plates that move from time to time, and as these plates move, subsurface stress increases, eventually stress breaks through releasing energy in form of seismic waves causing earthquakes. Sometimes human activities such as drilling, bombing, mining and construction also alter stress within the earth's crust, leading to induced seismicity causing earthquakes.

Deep within the Earth, high temperatures and the enormous pressure above crustal layers melt rock slowly and become viscous magma. The pressure cause the magma move towards the surface producing surface waves. Gas and magma can explode or erupt and release large amounts of volcanic ash and pyroclastic materials into the atmosphere. Accumulation of lava and pyroclastic material eventually led to mountains shape volcanoes after solidification.

Extra-terrestrial activities, such as the moon's activity, solar events etc., also impact the earth's natural activity; for example, the moon's relative position and the sun's determine the tides of ocean waves. In the full moon period, the tides become very high and dangerous.

Air pollution, noise pollution, and water pollution may cause imbalances in our natural environment, for example, global warming, extreme weather patterns, ecosystem damage etc. These imbalances, either alone or in cumulative form, have increased the frequency and vulnerability of natural

hazards. Natural hazards like earthquakes and flood incidents have been occurring in the past when humans were far from modern life. However, rapid modernization, haphazard developmental growth and increasing exposed areas are increasing the vulnerability and severity of natural events. Areas disturbed by human interaction for different need, such as mining, logging, and development, are highly vulnerable to natural disasters like flooding, landslide, earthquakes etc.

Wind systems such as cyclones, storms etc., are often caused due to the interaction of high-pressure and low-pressure air systems, which are extremely dangerous and devastating for human settlement. In India, it majorly affects the coastal settlements.

Natural disasters threaten (directly or indirectly) people's health and well-being, affecting human life for a considerable period of time.

The primary cause of natural hazards includes -

- Climate extremes/Climate change
- Tectonic movements
- Volcanic activity
- Soil erosion/ Slope Modification
- Atmospheric disturbances
- Deforestation/ environmental degradation
- Mining
- Oceanic processes/ Sea Erosion
- Natural combustion like lightening for forest fires

CAUSES OF MANMADE HAZARDS

Manmade hazards are mainly caused due to human negligence, intent or error with the failure of a manmade system.

- Intentional and deliberate activity
- Technological malfunctioning
- Industrial activities
- Poor maintenance
- Human negligence/ Accidents

- Transportation failure
- Pollution and waste management
- Overexploitation of resources
- Unplanned urbanization/development

IMPACT OF DISASTER

The disaster led to damage to infrastructure, public health issues and diseases.

- Fatalities
- Injuries
- Food and water scarcity
- Environmental issues
- Economic impact
- Health impact
- Social and educational impact
- Governance Impact
- Developmental Impact

Factors defining impact on communities

The impacts of disasters vary in time and severity depending on the catastrophic nature of disaster. In many ways, wealth and development assists in the way people recover from disasters. A more economically developed country can prepare for and predict hazards more effectively. They have many resources to support a faster recovery. However there is also a need for resilience, which means, in many developing countries people with experience of hardship can often recover more quickly from hazards. Many factors can play a role in defining the impact from disasters:

- ❖ **Natural factors** - things like rock type in an earthquake, the shape of a coastline in a tsunami, the height of the land hit by a tsunami can impact the effects. For example, a gently sloping coastline will often suffer more damage than a steep coastline in a hurricane storm surge.
- ❖ **Population density** - the greater the number of people in an area the greater the potential for disaster.

- ❖ **Magnitude** - the size of the event massively affects the impact.
- ❖ **Frequency** - how often the hazard occurs. The more often a hazard occurs generally the higher the perception of risk and more prepared people are.
- ❖ **Level of development** - Showcases the level of resilient infrastructures, better financial and insurance mechanisms thus creating better response, coping and adaptation capabilities.
- ❖ **Time** - the amount of time since the last hazardous event can influence the impact, if a long time goes by people can be unprepared. Also, if the disaster occurs when lots of people are asleep they can also be unprepared.
- ❖ **Preparations** - if a place is well prepared regardless of its level of development, this can limit the impact of a hazardous event. In India, traditional wooden houses have been designed to be earthquake proof, thus limiting the impact of these hazards.
- ❖ **Accessibility** - if an area is remote and/or affected by bad weather conditions and/or experiencing aftershocks, may prevent from timely safe search and rescue efforts, due to which the impacts can be greatly increased.

Session 2.3 Basic terminologies related to disaster and its management

- ❖ **HAZARD:** As per UNDRR, hazard is “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”.
- ❖ **EXPOSURE:** As Per UNDRR, exposure is “the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas”.
- ❖ **VULNERABILITY:** As Per UNDRR, vulnerability is “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:** As Per UNDRR, capacity refers to “all the strengths, attributes and resources available within a community, organization or society to manage and reduce disaster risk and strengthen resilience”. **RISK:** AS PER UNDRR, risk is “the probability of an outcome harming people, systems or assets”.

Risk is a function of the combined effects of hazards, and exposure, i.e., the assets or people exposed to the hazard and the vulnerability of those elements. $\text{Risk} = \text{Hazard} \times \text{Vulnerability} \times \text{Exposure} / \text{Capacity}$

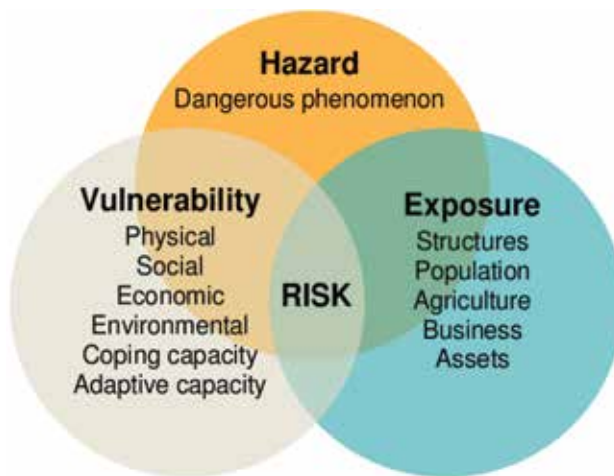


Fig 5: Conceptual framework for disaster risk management

Source: De Brito, M. M., Evers, M., & Höllermann, B. (2017) DOI: 10.1016/j.ijdr.2017.05.027

- ❖ **DISASTER MITIGATION:** It includes all such actions aimed at reducing the impact of disasters on communities.
- ❖ **DISASTER PREVENTION:** It includes all such measures which are aimed at preventing the occurrence of catastrophic events which may have a detrimental impact on the community. For example, the formulation and implementation of long-term policies and programmes to prevent or eliminate the risk or occurrence of disasters.
- ❖ **DISASTER PREPAREDNESS:** It enables individuals, communities, organisations and governments through workable disaster plans, resource maintenance, and personnel training to effectively anticipate, respond to and recover from impacts of a disaster situations. It is supported through eminent legislation and financial capacities.
- ❖ **DISASTER RESPONSE:** Actions taken to save lives, protect property and address the immediate damage before, during and immediately after a disaster. It is predominantly focused on immediate and short term needs of affected people by providing “relief”.
- ❖ **DISASTER RECOVERY:** Process and activity for returning of the disaster affected community to normal living situation.
- ❖ **REHABILITATION:** The restoration of basic services and facilities for the functioning of a community or a society affected by a disaster.
- ❖ **RECONSTRUCTION:** The medium and long-term rebuilding and sustainable restoration of critical infrastructures, services, housing, facilities and livelihoods required for the full functioning of a community affected by a disaster.
- ❖ **RETROFITTING:** Measures used to improve the quality and strength of existing structure against damaging effects of hazards through upgradation and reinforcement.
- ❖ **BUILD BACK BETTER:** A post-disaster recovery approach that aims to reduce future vulnerabilities and enhance community resilience by integrating disaster risk reduction measures into reconstruction efforts.
- ❖ **CONTINGENCY PLANNING:** It is a management process in which advanced arrangements enable organisations and society to respond appropriately, timely and effectively after analysing potential threats to a specific society, environment etc.

- ❖ **CRITICAL FACILITIES:** Socially, economically or operationally essential facilities such as physical structures and technical facilities that are required for routine circumstances and also in extreme circumstances of an emergency eg. hospitals.
- ❖ **RISK RETENTION:** An approach to risk management that involves retaining responsibility for the risk and any costs associated with the materialisation of that risk.
- ❖ **RISK TRANSFER:** Method of managing risks by shifting the economic burden of bearing those risks and the costs of dealing to another party (e.g., through a financial instrument such as a property insurance contract).
- ❖ **RESILIENCE:** The ability of a community or system to withstand and bounce back from a disaster.
- ❖ **SUSTAINABLE DEVELOPMENT:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Session 2.4- Vulnerability Profile

The essence of vulnerability is the “likelihood that a community, structure, service, or geographic area would be harmed or disturbed by the impact of a particular hazard,” due to the nature, construction, and proximity to hazardous terrain or a disaster-prone area.

The vulnerability to disasters is influenced by regional geography, socio-economic condition, governance and exposure levels. Commonly vulnerability are categorized into physical, social, economic and environmental vulnerability.

Vulnerability, thus, is a measure of risk exposure, together with an evaluation of the degree to which social and economic systems can absorb and recover from the associated disruption or loss. Each hazard will have a different level of susceptibility and vulnerability due to its unique qualities. For eg. over 10,000 people were killed, and over 200,000 homes and other buildings were destroyed in the Latur earthquake (M 6.4) in India in 1993. Similarly over 55 people were killed in the 1971 Los Angeles earthquake (M 6.6), in the United States.

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Thus the concept of “differential vulnerability” is also important, which states that various populations are exposed to differing degrees of danger. Therefore, strategies that try to address risk and vulnerability must also consider catastrophes’ varying consequences and outcomes. The vulnerability stems from a wide variety of causes, but population size, location, development level and socioeconomic differences are particularly significant contributors.

Earthquakes, hurricanes, floods, and droughts, together with the gradual increase of sea levels, affects millions of people in many parts of the world. Long-term, climate change has increased the frequency and severity of many of these events. However, the severity of disasters caused by extreme natural events depends on factors other than the phenomena themselves.

GLOBAL VULNERABILITY PROFILE

Earthquakes, hurricanes/cyclones, floods, and droughts, together with the gradual increase of sea levels, affects millions of people in many parts of the world. Long-term, climate change has increased the frequency and severity of many of these extreme weather events. However, the severity of disasters caused by natural events depends on several factors other than the phenomena themselves.

As per the Global natural disaster assessment report (2022), regionally, Asia has seen the highest frequency of natural disaster in year 2021, making it deadliest region as well, followed by North America. North America had seen the highest economic loss due to disasters, followed by Europe. Compared to the developed countries, developing countries were more severely affected by natural disasters, mostly floods, storms and extreme temperatures. Regions like South Asia, Sub-Saharan Africa, Southeast Asia and Small Island Developing States are particularly vulnerable.



Fig 6: World Risk Index for year 2021

Source: World risk index report 2021 https://www.researchgate.net/figure/World-Map-WorldRiskIndex-2021_fig2_354601635

As per the Global natural disaster assessment report (2022), 10,492 lives were lost and 104.1676 million people were impacted worldwide in 2021. As per WMO (2021), number of weather related disaster increased five folds over 50 years period (1970-2019) driven by climate change. However, mortality decreased by three folds due to improved early warnings.

Vulnerability Profile of India

India lies in the top three countries that suffers from natural disasters. Nearly 70% of India's land area is prone to one or more types of hazards. More than 75% of districts are multi-hazard prone.

Around 58% of India is prone to earthquakes. India has 7,500 km long coastline, with 9 coastal states highly vulnerable to cyclone. Nearly 12% area of 4 crore hectares is at risk of flooding; 68% of the net planted area is at risk of drought; hilly areas, around 11% of total land, mainly in Himalayan sector and the Western Ghats are at risk of landslides. Climate change is amplifying risks, especially in hilly, coastal and arid regions.

Brief vulnerabilities to specific natural hazards in India:

i. **Climate Change Vulnerability:** As global warming reaches a tipping

point, India's growth is linked intricately with climate risks. Such risks have a disproportionate impact on vulnerable communities with low adaptive capacities and pose a critical threat to India's sustainable development. Investments in infrastructure such as housing, transport, and industries will be threatened, especially along the coasts. Further, with mounting weather-related insurance losses, climate change could trigger the next financial crisis.

A) Floods

The four monsoon months account for 75% of annual precipitation (June to September). In other words, most rivers see their highest runoff levels in spring. Flash Flood events due to cloudbursts are getting frequent due to increase in extreme weather events. The danger of tidal flooding on coastal plains is exacerbated by sediment build-up, plugged drains, and issues synchronising river floods. The river basins of the Brahmaputra and the Ganges are the most prone to flooding. Central India and the Deccan region are also at risk due to substantial east-flowing rivers like the Mahanadi, Krishna, and Cauvery. At the same time, the northwest is prone to flooding due to rivers like the Narmada and Tapti, which flow west. The rapid glacial melting due to global warming may exacerbate the situation further.

B) Droughts

India's irrigation system is highly reliant on monsoons. Because of the erratic nature of rainfall, 68% of the land mass is at risk of experiencing periodic droughts. This is especially true in the low (less than 750 mm) and intermediate (750-1125 mm) ground. An examination of the last century reveals that drier-than-average conditions prevail in arid, semi-arid, and sub-humid regions 54-57% of the time. Every eight or nine years, arid and semi-arid regions suffer from devastating droughts. Approximately half of the semi-arid and arid climate zones, or around 76% of the territory, are experiencing severe drought. The impact of climate change has been projected to cause unusual rise in temperatures and increase in drought like situation.

C) Cyclones

India's coastline is very extensive. Pre-monsoon (May-June) and post-monsoon (October-November) are the two cyclone seasons. The maximum damaging extent of these cyclones is only 100

kilometres inland from the coast; therefore, they mainly affect coastal communities—everything from the eye of the cyclone to the furthest fringes of the storm’s path. Coastal flooding due to storm surges, and heavy rains is the leading cause of death from natural disasters. Both Bay of Bengal and Arabian Sea are active cyclone zones where states like Odisha, Andhra Pradesh, Tamil Nadu, and West Bengal are frequently affected by cyclones.



Fig 7. Climate Risk Map of India

Source: Wikimedia Commons (2007) https://commons.wikimedia.org/wiki/File:India_climatic_disaster_risk_map_en.svg

ii. Physical Vulnerability

Where people are, how close they are to the unsafe infrastructures, and what precautions are taken to protect them, all contribute to their physical susceptibility. For instance, people are only at risk from flooding if they reside in a region prone to such events. The ability of buildings and other structures to withstand the forces exerted by a hazard also contributes to their physical vulnerability. Thus, physical vulnerability refers to the susceptibility of buildings, infrastructure, and the physical

environment to damage or collapse during a disaster. Geographically, the Himalayas, the Plains, and the Coastal Areas of the Indian Subcontinent are the most vulnerable parts of the country. Different regions are vulnerable to various calamities due to differences in topography and climate.

A. Earthquakes

The Himalayas are the world's young fold and active mountains, which is constantly shifting, causing stress buildup and release. Four earthquakes of magnitude eight or higher have struck this region. The magnitude 6.4 earthquake that struck Latur, Maharashtra, on September 30, 1993, caused around 8000 loss of life and complete destruction of several villages, severe damage to infrastructure, even though the area was thought to be the least seismically active. In the Indian context, this is a major concern due to the combination of high seismic risk zones, weak or unregulated construction practices and poor enforcement of building codes.

B. Landslides and Avalanches

The Himalayas, the Northeast hills, and the Western Ghats has been experiencing frequent landslide activity of different intensities. Landslides are triggered commonly due to heavy rains, river toe cutting causing instability of slopes and seismically induced landslide. The Himalayan peaks pose another significant risk due to the presence of snow avalanches. The hilly regions of Jammu and Kashmir, Ladakh, Himachal Pradesh, and Uttarakhand are prone to large avalanches. Factors influencing physical vulnerability are unsafe construction practices in hilly regions, lack of slope management system with hill roads, deforestation and high exposure.

Multiple risks to India's landmass are depicted on the Fig 8 map.

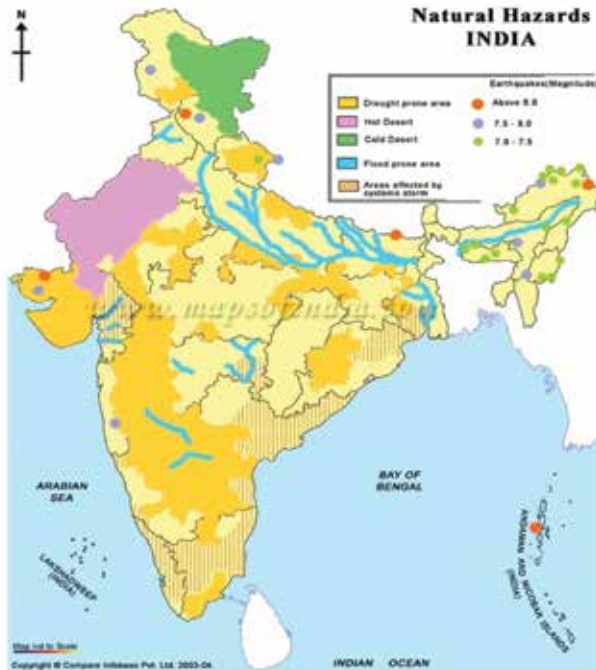


Fig 8. Natural Hazard Map of India

Source: Maps of India. <https://www.mapsofindia.com/maps/india/natural-hazard.htm>.

The rise in disaster losses directly results from unwise and haphazard building practices in high-risk areas, such as earthquake and flood zones. Most urban and rural poor live in informal settlements, which are more vulnerable to physical stress during earthquakes and floods and account for many deaths due to natural disasters. When infrastructure fails, a seemingly isolated incident can snowball into a complex chain reaction, making it more difficult to contain and respond to hazards like fires and electrical shocks.

iii. Socioeconomic Vulnerability

The degree to which a disaster impacts a population is tied not only to its physical susceptibility but also to the pre-existing social and economic conditions and the context associated with the influence on human activities within a given society. People's vulnerabilities and losses can be understood in terms of their capacities, which vary depending on the nature of the disaster. Socioeconomic vulnerability is the term used to explain this in the disaster literature. The severity and extent of poverty

in a society or region directly affect the damage wrought by natural disasters. This is because impoverished people tend to congregate in economically depressed and environmentally vulnerable zones (e.g., unstable slopes, flood plains), where there is little to no infrastructure and few resources to cope with their needs. Research conducted in earthquake-prone regions has consistently identified single mothers, women, the disabled, youngsters, and the elderly as particularly vulnerable populations.

The rise in disaster losses directly results from unwise and haphazard building practices in high-risk areas, such as earthquake and flood zones. Every year, in addition to enormous human and societal costs, one million Indian homes are destroyed or severely damaged. The fact of our time is the concentration of scarce resources in major cities, while the rural sector suffers from a lack of access. The risk of natural disasters, particularly earthquakes, is made much worse. Most urban and rural poor live in informal settlements, which are more vulnerable to physical stress during earthquakes and floods and account for many deaths due to natural disasters. When infrastructure fails, a seemingly isolated incident can snowball into a complex chain reaction, making it more difficult to contain and respond to hazards like fires and electrical shocks.

iv. Environmental Vulnerability

Environmental vulnerability refers to the susceptibility of ecosystems, natural resources, and environmental conditions to be damaged or degraded by hazards, either natural or human-induced e.g. poor environmental management, overconsumption of natural resources, decline of risk regulating ecosystem services, global warming etc.

In India, Himalaya and Western Ghats are ecologically sensitive zones. Unregulated infrastructure development, unabated tourism, and rapid deforestation make these regions prone to landslides, flash floods, and glacial lake outburst floods (GLOFs). Similarly in coastal regions natural protections like mangroves and wetlands are declining due to urbanization and pollution.

Vulnerability Assessment

Physical, social, economic, and environmental aspects or processes make people, places, and things more susceptible to the negative consequences of risks. Reducing exposure and vulnerabilities with increase in the coping capacity, is the principal method of lowering disaster risk. Poor economic

and urban development decisions and practices, environmental degradation, poverty and inequality, and climate change are only some of the risks that need to be identified and mitigated to bring these the risk down to an acceptable level.

Crucial steps for the assessment of vulnerability and preparedness in high-risk zones are the followings:

- Identification of various hazard-prone areas
- Vulnerability and risk assessment of critical structures
- Preparation of detailed vulnerability profiles, for example- mapping food insecurity, landslide hazards etc.
- Developing disaster damage scenarios
- Developing technical guidelines for hazard-resistant constructions
- Crafting a techno-legal regime to be adopted for infrastructure development.
- Strengthening existing housing/ infrastructure by retrofitting to make disaster resilient.

Session 2.5 Table Top Exercises on Different Aspect of Disaster Management

Exercises are designed to provide comprehensive training in disaster management, covering various aspects from risk assessment to response planning. Practical activities, case studies, and interactive discussions are often integral components of these training sessions. Specific details and methodologies may vary based on the training program and the expertise of the instructors.

Exercise I: Frequency vs. Impact of Disasters

The exercise will assess the relationship between the frequency and impact of different types of disasters.

Activities can include:

- • Data collection on historical occurrences of disasters
- Analysis of the severity of each disaster, considering casualties, economic losses, and other impacts

- Visualization of data to identify patterns and trends
- Risk assessment based on the frequency and impact

Exercise II: Cause and Impact of Disasters

This exercise likely involves understanding the causes and impacts of various types of disasters. Participants may study the root causes of disasters such as natural hazards (e.g., earthquakes, floods, hurricanes) or human-made disasters (e.g., industrial accidents, technological failures). Analyzing the causes helps in developing strategies to mitigate and respond to disasters effectively. Understanding the impacts is crucial for preparedness and response planning.

Activities can include:

- Study the causes of natural and human-made disasters
- Analyze the physical, social, economic, and environmental impacts of disasters
- Explore case studies to understand the dynamics of specific events
- Develop strategies for mitigation and response based on the understanding of causes and impacts

Exercise III: Grading/Ranking of Hazards/Disasters

Grading or ranking hazards and disasters involves assessing their severity, likelihood, and potential consequences. This exercise may include creating a hazard risk matrix to prioritize different types of hazards or disasters based on their impact and probability. This ranking is valuable for resource allocation and planning, ensuring that efforts are focused on addressing the most significant risks.

Activities can include:

- Create hazard risk matrices to rank different types of hazards.
- Assess the probability and impact of each hazard.
- Prioritize resources and planning efforts based on the ranking.
- Develop strategies for risk reduction and management.

Exercise IV: Hazard and Resource Mapping

Hazard and resource mapping involves creating visual representations of hazards and available resources in a given area. GIS (Geographic Information

System) tools are commonly used for this purpose. By mapping hazards, participants can identify vulnerable areas and plan evacuation routes. Resource mapping helps ensure that response teams have access to necessary equipment, facilities, and personnel during and after a disaster.

Activities can include:

- Use GIS tools to map hazards, vulnerable areas, and resources
- Identify evacuation routes and emergency facilities
- Develop list of resource availability for effective disaster response
- Strategies enhance coordination and communication for resource mobilization

Exercise V: Seasonality of Disasters

Seasonality of disasters refers to the patterns in which certain types of disasters are more likely to occur during specific times of the year. For example, hurricanes are more prevalent during the Atlantic hurricane season. This exercise may involve studying the seasonal variations in different types of disasters, understanding the reasons behind these patterns, and adapting preparedness and response plans accordingly.

Activities can include:

- Analyze historical data to identify seasonal variations in disaster occurrence.
- Explore the reasons behind seasonality (e.g., weather patterns, climate influences).
- Adapt preparedness and response plans based on seasonal trends.
- Incorporate season-specific considerations into risk management strategies.

Sub Module - 3 Disaster Management

Session 3.1 Concept of disaster management

According to the Disaster Management Act of 2005, “disaster management” is defined as “a continuous and integrated process of planning, organising, coordinating, and implementing measures which are necessary or expedient for: (i) Preventing danger or threat of any disaster (ii) Mitigating or reducing the risk of any disaster or its severity or consequences (iii) Building capacity, (iv) Being prepared to deal with any disaster, (v) Responding promptly (vi) recovering from any threatening disaster.

Disaster management is the systematic process of planning for, responding to, and recovering from natural or manmade disasters to limit their impact. Every prevention, precaution, must be taken to ensure that a potential threat does not become a catastrophe. Natural disasters are mostly inevitable, but they need not be catastrophic. With proper preparation and planning, lives can be saved, and property can be protected. Human-caused disasters, rather than natural ones, have become one of the more significant threat.

Consequently, disaster management can forestall risks from becoming catastrophic. It focuses on implementing preventive and mitigation measures, preparedness in case of any event, assure prompt and appropriate assistance to victims of disaster, achieve rapid and effective recovery and build back better to decrease the overall impact of disasters. Disaster management simple terms, is not just about emergency response, but about risk reduction, preparedness, and building a safer society for current and future generations.

The Disaster Management Cycle depicts the continuous process of its management through which governments, corporations, and civil society plan, prepare for and lessen the impact of disasters, respond during and in the immediate aftermath of a disaster, and plan for effective recovery. Taking the proper steps at the correct times throughout the cycle increases readiness, improves alerts, lessens susceptibility, reduces exposure and prevents disasters in subsequent iterations. Creating public policies, guidelines and plans to lessen the impact of a disaster on individuals, communities, and

infrastructure is an integral part of the entire disaster management cycle.

Disaster management progresses through phases of prevention, mitigation and preparedness in the lead-up to an actual disaster. Understanding developmental factors are essential while planning for preparedness and mitigation strategies. However, the phases of disaster management are not always present and often do not even occur in this specific order. The length of each stage of the cycle varies substantially depending on the severity of the disaster, and these phases often overlap.

Goals of Disaster Management:

- (1) Reduce the risk and avoid losses and damages from hazards
- (2) Immediate assistance to victims
- (3) Rapid and effective recovery

To better plan for and respond to a disaster, disaster managers use a 5-stage process, namely, prevention, mitigation, preparedness, response and recovery. Complete disaster management approach is often called a “disaster management cycle.”

PREVENTION: A pre-emptive approach is the most effective strategy to deal with an emergency. To do so, one must first recognise the existence of potential threats (both primary and cascading) to develop measures for neutralizing them. While certain disaster risks cannot be eliminated, prevention aims at reducing vulnerability and exposure in such contexts where, as a result, the risk of disaster is removed.

Examples include:

- Land use regulations for eg coastal zone regulations in India
- Planning and design to eliminate flood risk. For example, structures like embankments, dams, and channels to prevent flooding in populated regions to reroute water flow.

MITIGATION: During this stage, efforts are made to lessen the scale or severity of disasters’ root causes, effects, and repercussions by various strategies and actions. Mitigation measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness.

Examples include:

- Slope stabilization measures for landslides

- Construction of cyclone shelters
- Levees and other permanent barriers can be built to reduce flood damage.
- Watershed management for drought
- Buying insurance policies

PREPAREDNESS: Activities such as planning, training, and capacity building are carried out during this stage for building readiness to manage catastrophic events.

Examples include:

- Preparing contingency plans/ SoPs, outlining clear roles, activities and responsibilities for disaster management
- Capacity building through mock drills, tabletop exercises, scenario building and full-scale exercises
- Making a list of disaster-relief supplies and other resources. For eg. IDRN portal for resource inventory at district level
- Planned evacuation and public information

RESPONSE: Actions taken during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. The degree of readiness relies on disaster preparedness. It determines the likelihood of survival and the efficiency with which help can be provided.

Examples of response activities include:

- Search and Rescue operations
- Emergency relief

RECOVERY: The restoring or improving of livelihoods and health, as well as economic, physical, social, cultural and environmental assets and systems, of a disaster-affected community. During recovery, efforts to return to normal coexist with clean-up and repair tasks. The time required to bounce back from a disaster can vary from short term to long term recovery and can include rehabilitation and reconstruction phases.

Examples of recovery activities include:

- Medical/ Psychosocial care to disaster affected community

- Temporary housing/ relief shelters;
- Insurance/ financial aids
- Reconstruction/Retrofitting of damaged buildings

Session 3.2 Progressive shift in management approach

Over the last two decades, the process and understanding of disaster management has undergone significant change, notably shifting from relief and response centric to risk management and currently towards Disaster Risk Reduction (DRR), Community-Based Disaster Management (CBDM), and enhancing community resilience to natural disasters (UN ISDR 2004). The paradigm shift in disaster management is a change of practices from the erstwhile relief centric response to pro-active prevention, preparedness, mitigation as well as recovery and rehabilitation driven approaches so as to conserve the development gains and also minimize losses to life, livelihood and property.

a) CONVENTIONAL APPROACH

Historically disaster management has been a reactive process which was relief and rehabilitation centric. Actions were taken after the disasters occur, such as providing relief such as food, clothes, clean drinking water, etc., along with rehabilitation work such as building homes and other public amenities, so the affected people can cope with the stress after a disaster. Disasters were viewed as one-off events and only responded to by governments and relief agencies without considering the social and economic implications and causes of these events.

Conventional disaster risk management takes into account three factors: (i) the hazard, or the likelihood of an adverse event occurring; (ii) exposure, or the proximity of people, property, infrastructure, and industry to the hazard; and (iii) vulnerability, or the degree to which these elements are susceptible to damage from the hazard.

1. **Transitional Approach:** This approach focuses on managing the transition from relief to recovery and development after a disaster. It emphasizes the importance of linking short-term emergency response efforts with long-term development goals.
2. **Vulnerability-Driven Approach:** This approach involves identifying and addressing the underlying vulnerabilities that make a community susceptible to disasters. It aims to reduce vulnerability by addressing social, economic, and environmental factors.

3. **Disaster Risk Management (DRM) Approach:** Disaster risk management focuses on the reduction of risk from hazards. The goal of disaster risk management (DRM) is to improve people's ability to withstand, adapt to, and recover from a wide variety of threats to their safety and well-being.

The ability of a community's physical, social, and economic sectors to continue operating after a disaster, is increased by implementing adaptation measures that make them more resilient to the effects of the hazard. As quickly as possible, the system's performance can be restored to its pre-disaster state with these adaptation strategies, which aid individual components in surviving and recovering from the effects of potential hazards. You can classify available adaptations into four broad classes:

- i. Robustness, defined as the strength or the ability of the system to resist hazards-induced stresses like flood protection measures e.g., flood protection measures
- ii. Resourcefulness is using resources (including money, technology, information, and people) to set, prioritise, and complete objectives. For example-raising, money for disaster relief.
- iii. Rapidity-speed, or the ability to restore normal operations to where they were before the hazard. Since resilience is a preventative approach to disaster management, it is more appealing for widespread adoption.
- iv. Redundancy, which is the capacity of a system to continue normal operations in the face of an interruption. For e.g., in case of disaster, mobile communications are affected, emergency responders use satellite phones, radios to disseminate informations.

b) **NON-CONVENTIONAL APPROACH**

Non-conventional approaches might involve innovative or unconventional strategies for addressing disaster challenges.

1. **Systems approach for risk management:** A systems approach would look at the holistic picture instead of just the parts by emphasizes cross-level coordination and networked governance systems aligning local, national, and global actors. Promotes integrated strategies that address the root drivers of risk through multi-sectoral collaboration.

2. **Community Based Disaster Management approach:** Community-based disaster management (CBDM) is an approach that emphasises bolstering local communities' abilities to conduct risk assessments for both natural and manmade disasters, as well as to create plans and gather the resources needed to both prevent and mitigate the effects of those dangers, and to respond to, quickly recover from the aftermath of those disasters. Global climate change, increasing exposure to disasters and the growing awareness of the need for stronger ties between centralised government and grassroots responses have contributed to the increasing significance of CBDM policies. Instead of waiting for already overburdened governments and NGOs, CBDM allows communities to take the initiative in disaster management. To lessen risk and susceptibility, communities shifted from responding to catastrophes in a reactive, top-down manner to adopting a proactive CBDM approach based on local resources and capacities.
3. **Disaster Risk Reduction (DRR):** Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. Since DRR is an element of sustainable development, it requires participation from all levels of government, NGOs, the business community, and the general public. Therefore, a people-centric and cross-sectoral approach is promoted to create a culture of prevention and resilience in the face of many cascading and interrelated dangers.

Efforts made to lessen potential danger can be categorised as:

- Structural, for example, land use planning and building codes implementation
- Non-structural, for example, raising awareness, legislation and policy-making.

Disaster risk reduction is the policy objective of disaster risk management, mainly aimed at preventing the creation of disaster risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience. Effective DRR is achieved by increasing the ability of a community, society, or organisation by strengthening its strengths, qualities, and resources. The decrease in fatalities and property damage is particularly noticeable in poorer countries due to these adjustments.

Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. Disaster risk is an indicator of poor development, so reducing disaster risk requires integrating DRR policy and DRM practice into sustainable development goals.

Sub Module - 4

Major Hazards and its Management

Session 4.1 Water and Climate related hazards

Floods, droughts, cyclones, tornadoes, hurricanes, hailstorms, cloudbursts, snow avalanches, heat & cold waves, sea erosion, thunder, and lightning are all examples of hydro-meteorological dangers. The risks span a broad range of spatial and temporal scales, from localised extreme events to regional impact. For example: Storm surges causing torrential rains with high wind speed may cause coastal flooding, heavy snowfall/blizzard conditions can cause avalanches at local level, while severe hot or cold temperatures can affect vast areas for days. To manage the risk, disaster mitigation for hydro-meteorological hazards are aided tremendously by applying meteorological, climatological, and hydrological information in risk assessment, land-use planning, and the design of structures. Weather forecasting and early warning systems in alerting communities of approaching disasters like storms, heat waves, droughts, and floods has been extremely helpful in saving lives through timely displacement. The response phase also benefits from up-to-date alerts, forecasts, advisory from emergency and relief agencies.

Many hazards also lead to cascading hazards, for eg. floods and cyclone, extremely high temperatures and droughts, can trigger or intensify the impact of other. Wildfires, insect and pest infestations, poisonous gas releases, oil spills, and nuclear mishaps are all things that could happen as a cascading impact. So, offering precise and timely meteorological guidance as forecasts can significantly help to deal with various non-hydrometeorological dangers.

1. FLOODS

Floods can have long, short, or no notice. Commonly, the southwest monsoon season (June-September) is when most floods occur in India. However, floods in other seasons have been observed in the past. Riverine flooding is caused by excessive rainfall over multiple days in the upper catchment of a river basin. Still, the situation can become complex by several hydrological factors. Heavy rains can cause local floods due to water accumulation in low-lying areas with inadequate drainage systems. Erosion and silting of the riverbeds exacerbate the river channel's inadequate carrying capacity.

The Central Water Commission (CWC) operates Flood Forecasting Network under Ministry Jal Shakti and maintains 338 flood forecasting stations spread across 25 state/UT. 200 Level Forecast Stations and 138 Inflow Forecast Station (PIB, 2023) across country are present. Short range (upto 24 hrs) forecast using gauge to gauge correlation and medium range (upto 7 days) advisory flood forecast based n models are provided to concerned stakeholders.

There are two main approaches to the flood management problem: structural (focusing on flood mitigation infrastructures) and non- structural. Non-structural measures includes behavioral, institutional, and planning interventions to reduce flood risk by integrating people and policies in mitigating flood damage. The implementation of watershed management and major flood control works, including the construction of flood control structures, the regulation of land use, the installation of emergency equipment, the improvement of forecasting, monitoring, and warning systems, and the education of the general public are all long-term measures. Measures like anti-erosion works, and bank protection are medium term measures. Cleaning, de-silting of flood protection structures, flood plain zoning, flood mapping, include assessing the susceptibility of flood control structures are short term. Before the monsoons arrive, it is imperative that all village Panchayats, local bodies and district authority, monitor and maintain the drainage system, excavated their ponds and that any encroachments on tanks or natural drainage systems be removed.

Suggestions for Removal of Gaps/Constraints in the Present System

- Increase in observational sites, forecasting stations, and flood forecasting services/centres.
- A reservoir's regulation policy should be consistent with the downstream area's risk management.
- In places prone to flash floods or critical systems, cutting-edge sensors and telemetry equipment that can automatically record and transmit data can be tested.
- Combine early warning and preventive measures.
- Development of real time floodplain inundation maps for locations at risk of frequent flooding.
- Ensure that all significant floods are correctly documented.
- All construction in flood plains must be designed to withstand the expected level of flooding.

Future Requirements in Flood Disaster Mitigation

- Presently, the country does not make the most of its satellite-based

remote sensing facilities for managing floods and preventing disasters.

- Better means of transportation and communication for flood-stricken communities.
- Raising public awareness on the major anthropogenic impacts and educating about using the alert apps and early warning system.
- Training officials at all levels of flood-prone areas.
- It is imperative that flood prevention strategies based on scientific management practices are backed up with traditional knowledge and wisdom.
- The importance of the involvement of non-governmental organisations (NGOs) and the general public cannot be overstated.
- Having local media help in last mile connectivity.

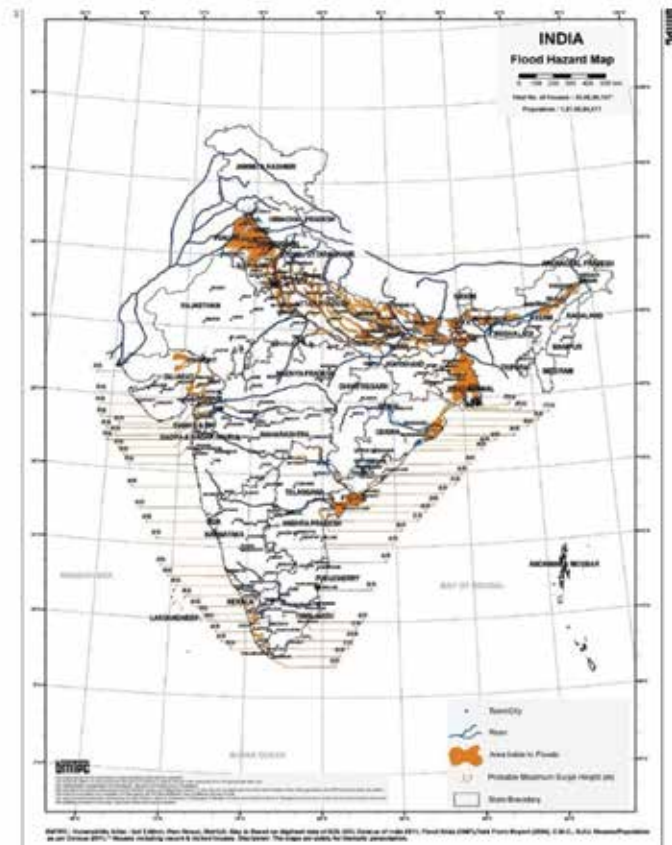


Fig 9. Flood Hazard Map of India

(Source: BMTPC Vulnerability Atlas 3rd Edition, 2018) <https://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/floodmap/flood.jpg/Flood-INDIA.jpg>

2. CYCLONES

Tropical cyclones affecting India, develop in the warm waters of the tropics when the sea surface temperature is consistently above 26.5 degrees Celsius. Where there is a wide-open sea, they may remain active for two weeks or more. Their typical lifespan of cyclones in India, including the Bay of Bengal and the Arabian Sea, is between four and five days. On average, tropical cyclones have occurred in the northern Indian Ocean (the Bay of Bengal and the Arabian Sea) every 5.6 years. Cyclones usually occur in India during pre-monsoon and post-monsoon seasons. The Bay of Bengal sees stronger and almost four times as many as the Arabian Sea. By far, the worst aspect of a cyclone is its storm surges. Flooding, erosion of beaches and embankments, destruction of flora, and depletion of soil fertility result from storm surge, which occurs when the sea rises above low-lying coastal zones. Extremely high gusts of wind can cause problems for buildings, power lines, telephone lines, trees, and other environmental objects, perhaps leading to injuries and property loss.

India Meteorological Department (IMD) is main nodal agency for forecasting and monitoring of cyclones. It runs a reliable system of meteorological observatories that can forecast the formation, progress, intensity and landfall of cyclones. The system for tracking and predicting tropical cyclones at IMD is well- established and reliable. It also acts as Regional Specialised Meteorological Centre (RSMC) and Tropical Cyclone Advisory Centre, New Delhi Satellites in polar orbit and those in geostationary orbit provide additional observational data to supplement the traditional observations. During cyclone situations, INSAT satellite imageries are obtained at hourly intervals. It has a 3-tier network with Cyclone Warning Division at Delhi, 3 Area Cyclone Warning Centres at Mumbai, Chennai & Kolkata and 4 Cyclone Warning Centres at Bhubaneswar, Visakhapatnam, Ahmedabad & Tiruvananthapuram.

INCOIS is the nodal agency to provide the Storm surge advisories to Indian coast along with IMD. These advisories are useful to foresee the threat, mitigate and save precious the lives along the Indian Coast. INCOIS has set-up the storm surge early (SSEWS) warning system for the Indian coasts using ADCIRC model.

Regarding tropical cyclone disaster management, having access to warning information at the right moments is paramount. Most coastal states have emergency plans in place in case of a cyclone. In the coastal areas, shelters have been built. Cyclone-prone regions and fishermen have access to cyclone warnings.

The main problem areas are the following:

Meteorological services: The observational network is inadequate on the high seas and along the coastline. Current methods of analysis and forecasting could benefit from the use of satellite systems with multi-channel, higher-resolution imaging capability. More accurate analysis and forecast of cyclones would be possible with the help of Doppler radar, which could be deployed and networked. There has to be less friction in IMD's communication with users at crucial periods. A better, more accurate, and widely distributed network of tide gauges is needed to record storm tides. It is recommended that a system of inter-agency coordination be established between the various government agencies at the federal and state levels and between state governments and the general public.

Management system: All coastal areas at risk need to have a reliable road system built so people can get out and supplies can be brought in quickly. Putting institutions of higher learning and medical care along the superhighway is one strategy to lessen the impact of a typhoon.

Government employees in cyclone-prone areas should receive training in disaster preparedness and response. Fishermen need more help when they venture out during cyclones in the hopes of catching a large harvest of fish to sell and feed their families. Severe Storms in the area Severe local storms are atmospheric disturbances on a smaller scale that develop from mature cumulonimbus clouds due to intense convective motions in a humid and unstable environment.

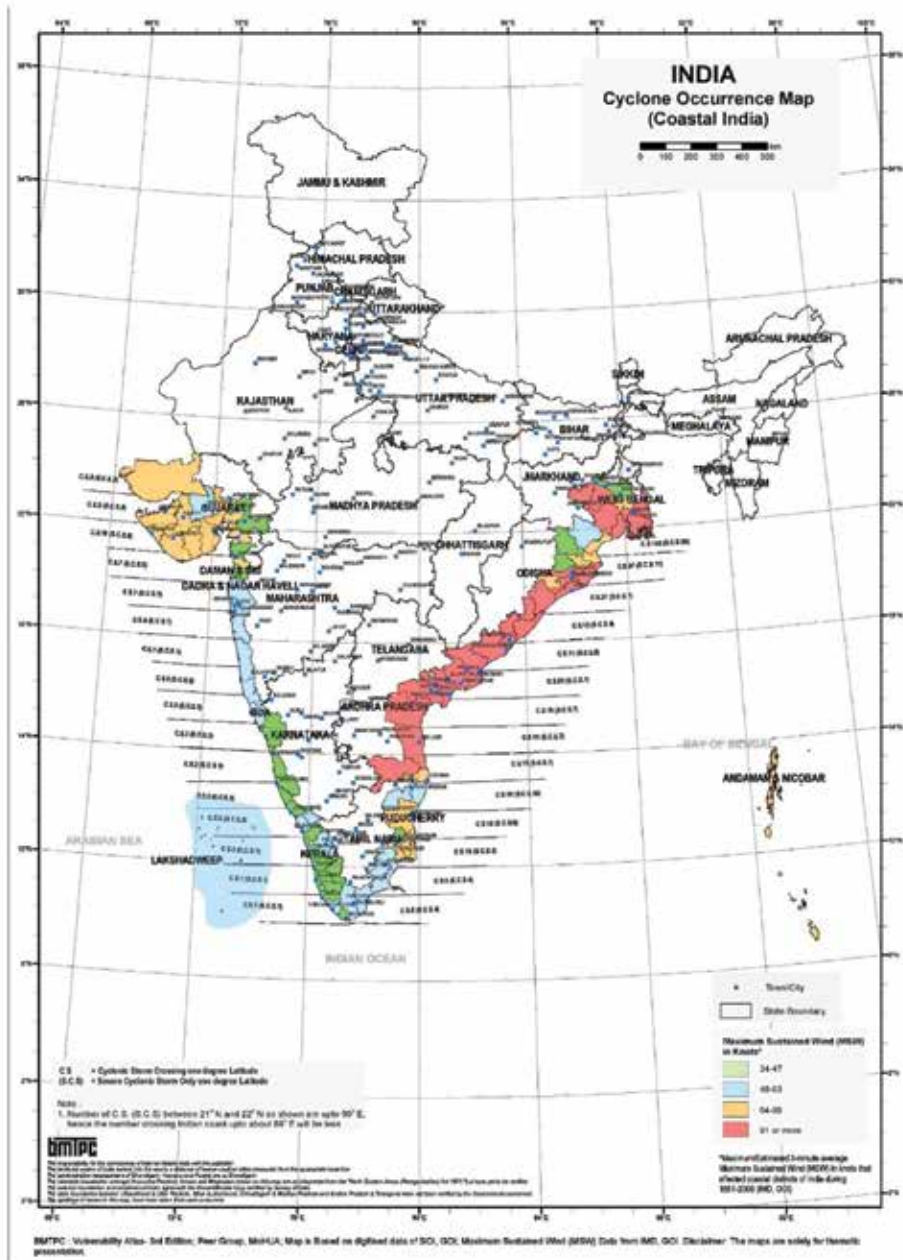


Fig 10. Cyclone Occurrence Map of India

(Source: BMTPC Vulnerability Atlas 3rd Edition, 2018) https://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/cymap/06_INDIA_CYCLONE_OCCURRENCE_DEC_2018.jpg

Cyclone Mitigation Measures: The mitigation measures recommended by the UN-HABITAT are given below:

- **Hazard Mapping** implies that vulnerable locations can be predicted by mapping the pattern from historical cyclone data such as wind speed, impacted areas, frequency of flooding, etc.
- **Land use planning** - Planning for land usage must be carried out efficiently. Thus, the most susceptible places can be spared from the principal activity and settlements. For instance, a community built east coast is in more danger than the west coast area. Therefore, authorities need to make preparations in advance to forestall the frequent occurrence of such hazards.
- **Engineered Structures** - These buildings are effective in reducing damage caused by wind and are therefore recommended. Cyclone hazard mapping should be factored into the planning and development the country's public infrastructure.
- **Retrofitting of Non-Engineered Structures** - People living in homes that weren't built to withstand cyclone-force winds or other forms of severe weather need to take precautions. A few retrofitting recommendations for the non-engineered structures by UN-HABITAT are:
 - ✓ Building with a steep sloping roof minimises the possibility of being blown off.
 - ✓ Planting sturdy uprights firmly in the ground and anchoring them.
 - ✓ Tree groves placed safely from the house can act as a windbreak.
 - ✓ Premature repairs to the shelters.
- **Cyclone Sheltering** - The construction of cyclone shelters should be prioritised at the national, state, and regional levels to protect vulnerable communities from cyclones. The population, transportation, communication, distance from previously affected areas, and topography should all be considered when constructing the shelters.
- **Flood Management** - Heavy rain from cyclones can cause flooding in many different areas, so flood prevention and control are crucially important. The drainage systems must be well-planned to reduce the likelihood of flooding. This requires input from both the government and the local community. (For more information about floods, see the associated article.)
- **Vegetation Cover Improvement** - Growing more plants is crucial to make

the land more permeable to rainwater. Taking preventative measures like planting rows of trees, establishing coastal shelterbelt plantations, establishing mangrove shelterbelt plantations, etc., can reduce the destructive power of the wind and the resulting damage.

- **Mangrove Plantation** - The ecologically-efficient mangroves, which are beneficial to the environment, should be planted. There are 3% of the world's mangroves in India. When a tsunami or other natural disaster strikes, the root systems of mangrove trees can help stabilise the soil and prevent further erosion.
- **Levees** - They give protection from the wind and a place of refuge in the event of flooding.
- **Artificial Hills** - These serve as safe places in the event of flooding and should be established in appropriate locations.
- **Saline Embankment** - Saltwater dikes safeguard the shore's homes, farms, and infrastructure.
- **Awareness of the public** - The community's participation is directly related to public awareness initiatives. With more public awareness campaigns, more people will get involved. Programmes raising public awareness of natural disasters and encouraging greater participation from local communities in the mitigation effort should be launched by governments at all levels.

India's Cyclone Disaster Management Initiatives:

- India has taken the initiative to take both structural and non-structural measures to reduce the impact of cyclones through the National Cyclone Risk Mitigation Project. This product is made for the Indian states and UTs near the coast. A centrally sponsored, National Cyclone Risk Mitigation Project (NCRMP), supported by World Bank supported programme, implemented by NDMA in two Phases, Phase-1 (2011-2018) for Odisha and Andhra Pradesh and next Phase II (2015-2023) to other states such as Goa, Gujarat, Karnataka, Kerala, Maharashtra, West Bengal (MHA). As major output, facilities for early warning dissemination systems (EWDS) and cyclone risk mitigation infrastructures like multipurpose cyclone shelters, embankments were constructed etc.
- The Ministry of Environment, Forest, and Climate Change released a draught of the Environmental and Social Management Framework (ESMF) for integrated coastal management in August 2019. (MoEFCC). Its ultimate goal is to implement a systematic strategy for controlling coastal areas.

- New reforms in the Coastal Regulation Zone (CRZ) Notification for 2018 and 2019 align with the sustainable development of coastal areas.
- The Indian Meteorological Organization (IMD) issues cyclone weather warnings to state government in four stages issued in 72 hrs, 48 hrs, 24hrs, 12 hrs in advance of expected time of landfall. It is also issued in different colour codes. These colour codes are used to prepare the public for impending natural disasters.

3. TORNADES

Tornadoes are the most dangerous and potentially catastrophic mesoscale convective phenomena that develop during thunderstorms. Intense and enormous Cumulonimbus clouds or cyclonic storms often lead to tornadoes and highly severe vortices of very small diameters. The visible symptom of a tornado is a funnel-shaped cloud tapering from the base of a thunderstorm. At times, it makes contact with the ground, causing catastrophic destruction in its wake. It can live for anything between several minutes and a few hours. Due to these factors, meteorological characteristics related to tornadoes have not been measurable.

Tornadoes are rare in India because the energy needed for storms to form is several times lower than that observed in the tornado alley. However, eastern parts of India, particularly West Bengal and Orissa, are vulnerable to tornadoes during pre-monsoon season (March-May). Assam and the surrounding states, West Bengal, Orissa and the Gangetic plains, Punjab and Haryana are the most likely regions of tornado occurrence in India. Intense local storms require only a few hours from their inception to their eventual dissipation.

In addition to standard weather forecasts, specialised observational tools and detection methods are required. Tornado prediction and its early warning is a challenging endeavour. As a tool for tracking and warning of tornadoes, radar is invaluable. Tornado warnings have a limited window of opportunity during which they may be transmitted to the general public, making it impossible for people to take the necessary precautions to avoid being caught in their path unless the warning is widely distributed. Small in size and short in duration, intense storms are often missed by the current network of observatories and the frequency of observations used to create synoptic weather charts.

4. HAILSTORMS

Hailstorm is the term used to describe thunderstorms that produce hail and

falls to the ground. Hailstorms can produce stones from a few millimetres to a few centimetres in diameter. Solid rain, or hail, consists of ice balls, lumps, and falls from the sky. They usually don't last longer than 15 minutes but can still harm people and destroy property and crops. Hail storms are dangerous because they can knock out power, topple trees, and lead to flash floods and mudslides in mountainous regions. Occasionally, other forms of extreme weather, including cyclones and tornadoes, will occur in tandem with a hailstorm. Massive hailstones have sometimes been reported to inflict fatal head injuries and concussions on rare occasions.

5. CLOUDBURST

During the monsoon season, the cloudburst can be seen across large swaths of the Himalayas. In meteorology, a cloudburst is defined as heavy rain that falls in a short amount of time over a small area. Rainfall rates of over 100 millimetres per hour across a few square kilometres are commonly used as definitions. Regions of the Uttarakhand Himalaya above 1200 metres in elevation are particularly vulnerable to cloudburst-induced landslides during the monsoon.

Cloudbursts and their accompanying dangers strike multiple areas of the Uttarakhand Himalaya every year. Recent cloudburst incidents in the Uttarakhand Himalaya have been linked to flash floods and landslides in places like Ukhimath (Rudraprayag) and Malpa (Pithoragarh) in August 1998, Phata (Rudraprayag) in August 2001, Burakedar (Tehri) in August 2002, Asi Ganga (Uttarkashi) in August 2012, Ukhimath (Rudraprayag) in September 2012.

Large-scale mass movements and flash floods have been triggered by recent catastrophic rainfall events, as cloudbursts are prevalent in the Himalayan region. And in the Himalayas, especially in the Garhwal and Kumaon regions of Uttarakhand, cloudbursts are a common and natural occurrence. Each year, thousands of people are impacted by cloudbursts and the disasters that accompany them, suffering losses in terms of life, property, livelihood, infrastructure, and the environment.

Debris flows have been found to obliterate the upper reaches of first and second-order drainages (seasonal streams). During this phenomenon, slope failures and bank erosion are prevalent, leading to sedimentation and, in extreme cases, blocking the river stream and transforming the river into a large lake with devastating flood conditions.

Mitigation Measures

People in the Himalayan region of Uttarakhand are advised to avoid living in low-lying areas like valleys and along abandoned drain channels and instead settle on the hard rock or firm ground of hills. In areas where ground fissures have formed and subsidence has occurred, it is necessary to take precautions against rainwater and surface water intrusion. Residents in the area are advised to keep a close eye on the slopes during the monsoon season and report any noticeable changes to the authorities as soon as possible. According to local interviews, cloudbursts frequently bring gusty winds and flashes of lightning. Without genuine meteorological data from the vicinity of slope failure occurrences, it is difficult to accept or refute local claims that the phenomenon is a cloudburst. Areas prone to landslides are particularly in need of a prohibition on haphazard and unscientific building practices.

Meanwhile, proper attention must be paid to the secure disposal of rainwater. Therefore, developing and implementing drainage solutions for the ground and the water underneath is essential. It would be possible to install drain pipes on the debris slope for this purpose. Heavy rainstorms can be handled by a well-designed drainage system with multiple levels and large enough channels to accommodate the water. The vulnerability of valley settlements and hilly terrains to landslides is growing steadily due to increased anthropogenic activity, intrepid exploration of dangerous places due to limited land availability, and heavy localised precipitation. If careless and uninformed building practices were not controlled, then any and all remediation efforts would be for nought. Successful application of bioengineering technology requires using site-specific, regional vegetation in conjunction with engineering methods to mitigate issues like soil erosion and instability. Although it is challenging to predict cloudburst incidents, a dense network of rain gauges is necessary to better understand this phenomenon, especially in areas classified as sensitive to cloudburst. A cloudburst forecasting model would be helpful in collecting precise data on such occurrences and conducting studies on various geology, geomorphology, and climatology aspects. Effective landslide risk reduction could also arise from such research. In addition, locals must be aware of the dangers of heavy rain and flooding.

6. HEAT AND COLD WAVE

According to WHO, Heat wave is defined as an extended period of extremely high temperatures, with 40 degrees Celsius being the threshold for the Plains and 30 degrees being the threshold for the Hilly regions.

Based on Departure from Normal

Heat Wave: Departure from normal is 4.50°C to 6.40°C

Severe Heat Wave: Departure from normal is $>6.40^{\circ}\text{C}$

Based on Actual Maximum Temperature

Heat Wave: When actual maximum temperature $\geq 45^{\circ}\text{C}$

Severe Heat Wave: When actual maximum temperature $\geq 47^{\circ}\text{C}$

If the above criteria are met at least in 2 stations in a Meteorological sub-division for at least two consecutive days, it is declared on the second day.

According to IMD, a cold wave is a period in which the ambient air temperature drops to a level that is fatal to human life. Statistically, it is characterised by the threshold temperature over a region, either in terms of the actual temperature or its departure from normal.

Criteria of cold wave:-

When the minimum temperature of a station is $\leq 10^{\circ}\text{C}$ for plains and for $\leq 0^{\circ}\text{C}$ for hilly regions.

Based on departure

Cold wave: Minimum temperature departure from normal -4.5°C to -6.4°C

Severe cold wave: Minimum temperature departure from normal $\geq -6.5^{\circ}\text{C}$

Based on actual minimum temperature (for plains only)

Cold wave: when minimum temperature is $\leq 4.0^{\circ}\text{C}$

Severe cold wave: when minimum temperature is $\leq 2.0^{\circ}\text{C}$

For coastal stations

When Minimum temperature departure is $\leq -4.5^{\circ}\text{C}$ or actual minimum temperature is $\leq 15^{\circ}\text{C}$

The human body has adapted to a specific range of environmental conditions, including humidity and temperature. Extreme temperatures can cause severe thermal strain and even death if left untreated for an extended period. This requires keeping an eye on the daily minimum and maximum temperatures throughout the year. In most of India, the average high temperature rises

to the mid-40s during March and July. The stakes are quite high for any unexpected growth. Two or three extremely hot periods with temperatures well above average are possible in every season.

Similarly, two or three frosty periods are possible between November and March, the heart of winter. Hot and cool waves appear to move from place to place. However, their progression is random. Heat waves and cold waves are terms used to describe extreme weather events, even though they have nothing to do with actual wave motion. About 10 per cent of India's territory is typically affected by widespread heat waves. Typically, they originate in the regions of northwest India and north Pakistan and move in an eastern and southern direction.

7. DROUGHTS

Drought describes as a period of low precipitation that fails to replenish groundwater supplies or meet the demands of humans, cattle, and industry. Drought can classify as meteorological, hydrological, or agricultural drought. The regions with high risk are typically well-known, droughts can last for long periods, and ample warning time is generally provided.

Droughts arise because of a lack of rain or other forms of precipitation. The southwest monsoon, which occurs from June to September, is responsible for the majority of yearly precipitation in most of the country (except Tamil Nadu). In Tamil Nadu, the rainiest months are typically October through December. There is a strong correlation between the amount of snowfall that falls during the winter in the hills of Jammu and Kashmir, Himachal Pradesh, and western Uttar Pradesh and the amount of water that flows through those regions the following summer.

The National Department of Agriculture and Cooperation compiles crop production projections based on data from individual states' agriculture departments regarding precipitation and crop condition. The State irrigation departments and Central Water Commission check all the big and medium reservoir levels daily. Employment creation, water and power conservation, crop preservation, and public distribution of needed commodities are specific goals of drought management. Large-scale policy decisions and the responsibility for their implementation typically fall at the feet of national governments when addressing drought issues on a long-term basis. The Indian initiative is unique since it includes sub-district-level drought monitoring. Watershed-based soil and moisture conservation programmes have been working to maintain or restore ecological equilibrium for nearly two decades.

Further, the country's drought was significantly alleviated by building big and medium-sized dams to supply agricultural and drinking water.

The three pillars of a proactive strategy to improve drought resilience are as follows:

- Early warning and drought monitoring systems
- Evaluation of exposure to danger
- Preventative methods for drought

To help people take preventative measures against droughts and to get ready for effective reactions, Early Warning Systems (EWS) give accurate and timely information. Effective early warning systems thoroughly evaluate present and projected drought and water supply circumstances with water information such as stream flow, snowpack, groundwater levels, reservoir and lake levels, and soil moisture.

With an emphasis on natural infrastructure enhancement and integrated land and water resource management, United Nations Convention to Combat Desertification (UNCCD) supported strategies are at the heart of these actions and policies.

These are some examples of significant preventative actions:

- Utilising groundwater reserves, water rationing/allocation systems, water harvesting, preserving water sources from contamination, developing water sources (such as micro dams, ponds, and wells), and water conservation are all viable options.
- Repairing pastures and redistributing water and land
- Soil water retention can be restored by planting trees (including fruit trees) and protecting riverbanks and wetlands.
- The Integrated Water Resources Management (IWRM) approach is put into practice by coordinating among water users, communities, and sectors and reducing tensions between upstream and downstream users.
- Strengthening Irrigation Systems
- Social security, cash-transfer programmes, or improvements in access to markets and rural services can assist in diversifying rural livelihoods, reducing their vulnerability to natural disasters like droughts.

8. THUNDERSTORM AND LIGHTNING

Moisture, coupled with swiftly rising warm air and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain breeze, creates a thunderstorm. Extreme weather can be caused by a single thunderstorm that stays over a certain area for a while. Thunderstorms can occur everywhere in India at any time of year, but they are most common during the hot weather period (also known as the Pre-monsoon period) from March to May.

Thunderstorms can occur in some sections of the country between June and September due to the monsoons. Storms accompanying cyclones and depressions are common across peninsular India in the months following the monsoon (October and November). Often spanning hundreds of kilometres, a squall line is a line of thunderstorms. Thus, the squall lines are more severe convective occurrences than a single thunderstorm. Extreme convective phenomena also include the summer dust/sandstorms that form over Northwest India. When the strong downdraft of a Cumulonimbus cloud stirs up loose dust or sand from the ground, visibility can drop to virtually nothing during dry thunderstorms.

Tornadoes, hail, lightning, and high winds are some weather hazards that might accompany a thunderstorm. Stay inside a safe structure and listen to a battery-powered radio for updates on the storm if one approaches. When a storm rolls through, lightning poses a severe risk. Every year, lightning strikes and kills several individuals in India.

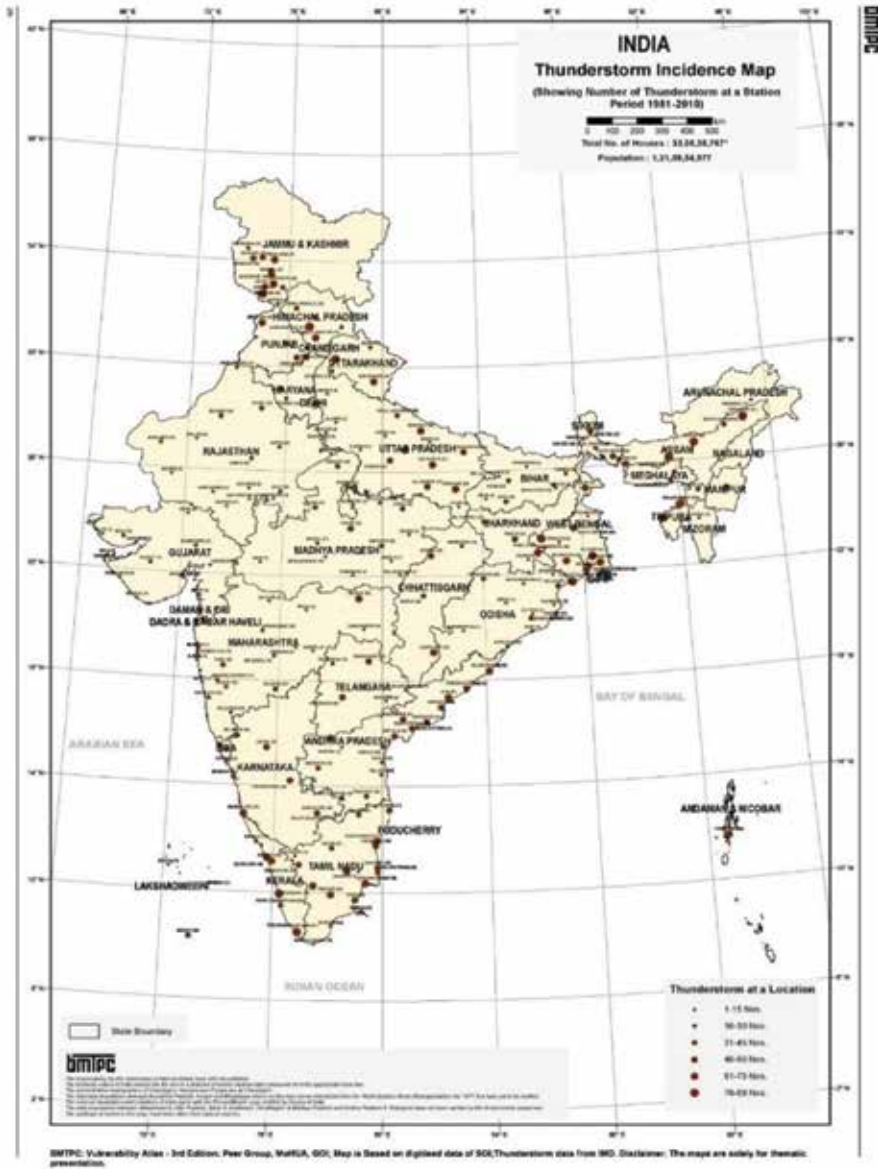


Fig 11. Thunderstorm Incidence Map of India

(Source: BMPTC Vulnerability Atlas, 3rd edition 2019 <https://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/thmap/th.jpg>)

During thunderstorms, lightning often occurs. Bolts of lightning can occur alone, in clusters, or rows. Thunderstorms produce lightning, an electrical discharge caused by the accumulation of positive and negative charges. As the pressure rises, a “bolt” of lightning will appear, either from within the clouds or from the interface between the clouds and the ground. A lightning bolt may heat up to over 50,000 degrees Fahrenheit in one instant. Thunder is produced when air is rapidly heated and cooled in the vicinity of lightning. Every year, lightning strikes and kills several individuals in India.

About 1,800 thunderstorms are active at any given time somewhere over the planet. Lightning’s electrical charge and high heat can electrocute on contact, break trees, start fires, and short out electrical systems. In the Indian plains, lightning is the leading cause of death. Since most forest fires begin during the dry season when lightning strikes are common, it’s possible to see certain thunderstorms coming while others appear out of nowhere. Being aware of and prepared for potential threats requires education and practice.

Natural lightning may strike tall, isolated trees in an open area or on top of a hill and metal objects like wire fences, golf clubs, and metal tools, all of which should be avoided if you find yourself outdoors. The adage that lightning never returns to the same spot is nonsense. It’s true that lightning can strike the same spot multiple times during a single discharge.

Severe Thunderstorm Warnings

When conditions are favourable for the development of severe thunderstorms, the National Weather Service will issue a severe thunderstorm warning. Severe thunderstorms produce damaging winds of 58 miles per hour or more or hail three-fourths of an inch in diameter or larger. In such condition, one must find a secure location inside the house and advise your loved ones to be alert by monitoring the sky and the radio or television for updates.

Thunderstorms can also cause both tornadoes and flash flooding. In the event of a severe thunderstorm warning, reviewing procedures for responding to a tornado or flash flood becomes essential.

The Damini Lightning Alert app provides users with location-specific lightning alerts. The user can view lightning strikes within the last five, ten, or fifteen minutes.



Fig 12: Lightning Alert APP - Damini

(Source: Damini Mobile APP)

Session 4.2 Geological hazards

Earthquakes, mudflows, coastal erosion, dam breaks are all natural disasters with geological components. More than half of the country is located in high to moderate seismic zones, where earthquakes of devastating severity are possible, while all the hilly regions mainly the Himalayas severely impacted by landslides having a widespread impact. It is necessary to study their characteristics, understand the vulnerability of the local area from geological hazards, talk about the past events which affected the local area and prepare the management plan for the different events that may originate due to geological event.

1. LANDSLIDES

A large amount of rock, rubble, or earth sliding down a hill is called a landslide. Mass wasting, which includes landslides, is the movement of soil and rock downslope under the influence of gravity alone. The phrase “landslide” can refer to the following five types of slope movement: a fall, a toppling, a slide, a spreading, or a flowing. Further categorisation is done according to the specific geological constituents (bedrock, debris, or earth). Frequent landslide types include debris flows (mudflows or mudslides) and rock falls.

Multiple factors usually contribute to a landslide’s occurrence. When the force of gravity and other downward-acting forces on a slope becomes more significant than the strength of the earth’s materials making up the slope, movement of the slope occurs. In India, landslides are typically brought on by torrential rain from cloud bursts and flash floods. Structures, geomorphic features, and the relationship of slope to the primary fabric of rock mass are all contributors to landslides in mountainous regions like the Himalayas. Factors that amplify the impact of downslope forces and those that contribute to low or diminished strength are all potential causes are: rainfall, snowmelt, changes in water level, stream erosion, changes in groundwater, earthquakes, volcanic activity, disturbance by human activities, or any combination of these can trigger landslides on slopes that are on the verge of movement.

Fast mass movements, such as rock falls, are perilous since they frequently occur without any prior warning or indication of difficulty. But as landslides, ground subsidence, and creep are gradual processes, preventive measures can be adopted in time to lessen the extent of the damage. Multiple scientific organisations continue to conduct landslide research in a rather disjointed approach. Predicting and minimising the damage from landslides and other mass movements requires careful and systematic research and implementing corrective actions.

Landslides and Mudflow Mitigation and Response Plans

Avoidance, surface drainage, subsurface drainage, external supports, excavation, river structural work, vegetation, blasting, and hardening are all methods for controlling landslides. Zonation and risk assessment is crucial when pinpointing actual or future landslides location using various detection methods. Specific plans are needed for each type of mass movements. However, activities like geotechnical surveys, Landslide Hazard Zonation maps, public participation, fundamental understanding, and education are important steps for reducing the impact of landslides and other mass movements. Prediction of landslides, better mapping, landslide process models, land use pattern design, landslide control methods, and robust risk assessment frameworks are top R&D priorities in this area.

2. EARTHQUAKES AND TSUNAMI

In an earthquake, the ground shakes violently and suddenly due to the movement of rocks deep below the surface or volcanic or magmatic activity. Seismic belts are regions of the earth where quakes are common but not uniform in frequency, depth, or intensity. These seismic belts are thought to be located on the periphery of the contacts between the earth's large tectonic plates, as is the case with the current scientific consensus. Though the number of disasters resulting from earthquakes contributed only eight percent of disasters globally, geophysical disasters - primarily earthquakes - killed more people than any other type of disaster. In the past 20 years, with the cumulative toll of 747,000 fatalities exacerbated by the vulnerability of poor and badly prepared populations exposed to two major events: the 2004 Indian Ocean tsunami and the Haiti earthquake of 2010.

Earthquakes can happen at any time and hit without warning. An earthquake's exact time and location are unknown, but seismic zones have been well-mapped out, and precautions can be taken to lessen its impact through thoughtful design and construction. It's impossible to anticipate when or if an earthquake will happen because they only happen rarely. Where, how much destructive power it has, and how far underground it is focused are all factors determining its size and scope. Fires, embankment failure, poisonous gas discharge, nuclear radiation leaks, liquefaction, and other secondary impacts in the event of an earthquake can significantly damage structures and infrastructure more than the earthquakes themselves. Any disaster mitigation strategy should include

the primary and secondary consequences of earthquakes. Population growth, economic development, and rapid urbanization place more people in harm way more than ever before in earthquake zones.

Tsunamis are caused by a variety of geological processes, such as earthquakes, subaerial and submarine landslides, volcanic eruptions, or very rarely from meteorite impacts. However, it takes a large event (e.g., typically an earthquake of magnitude greater than 7.0) to generate a damaging tsunami. A tsunami is a series of waves generated by an impulsive disturbance in a body of water such as a lake or ocean. The disturbance is typically a fault displacement. Therefore, determining the likelihood of future tsunamis for coastal communities requires an understanding of the likelihood of reoccurrence of such geological processes, the likely magnitude of such events, and the location of the sources.

Earthquake Disaster Mitigation

The time before an earthquake strikes is crucial for disaster preparedness and the reduction of casualties. Simply experiencing an earthquake is not catastrophic. The breakdown of human-made infrastructure and a general lack of readiness and knowledge is the leading causes of the disaster. Disaster relief efforts in the face of earthquakes have thus far been largely reactive. Avoiding, mitigating, and being ready for disasters is preferable to reacting to them. The first thing to do to prepare for a disaster is to evaluate the risks. First, a hazard analysis must be conducted, then a vulnerability study, and finally, earthquake risk maps and statistics must be produced.

In India, the Earthquake Monitoring Network includes the India Meteorological Department, the Survey of India, the National Geophysical Research Institute, Department of Earthquake Engineering, IIT Roorkee, and various other institutions. The country's Vulnerability Atlas details potential risks to buildings and other infrastructure in each state and district. The community's susceptibility can significantly exacerbate the effects of the earthquake. Buildings, infrastructure, utilities, the economy, and the populace will all be evaluated for their susceptibility to harm. Engineering and other physical protective measures, appropriate non-structural measures for decreasing damage and distress, and legislative measures managing land use and urban planning all contribute to a comprehensive strategy for prevention. The primary measures of prevention are as follows: scenario planning for harm,

disaster mitigation cells in priority metropolitan areas, and strengthening existing infrastructure.

Earthquake Response/Recovery

After an earthquake response may include emergency procedures, including evacuation, search and rescue, and relief. In the aftermath of an earthquake, various stakeholders may be involved in a variety of response and recovery operations. Immediately following an earthquake, rescue and relief efforts should be prioritised as per the disaster management plan. The trigger mechanism for setting of an incident command system is an essential component of any disaster response. It is designed to energise and activate the mechanism of response and mitigation upon receiving a warning of an imminent disaster. Other concerns include reconstruction, documenting losses and damages, and responding to emergencies.



Fig 13. Seismic zonation Map of India

(Source: MoES, 2023) https://en.wikipedia.org/wiki/Earthquake_zones_of_India#/media/File:Seismic-Map-of-India.png

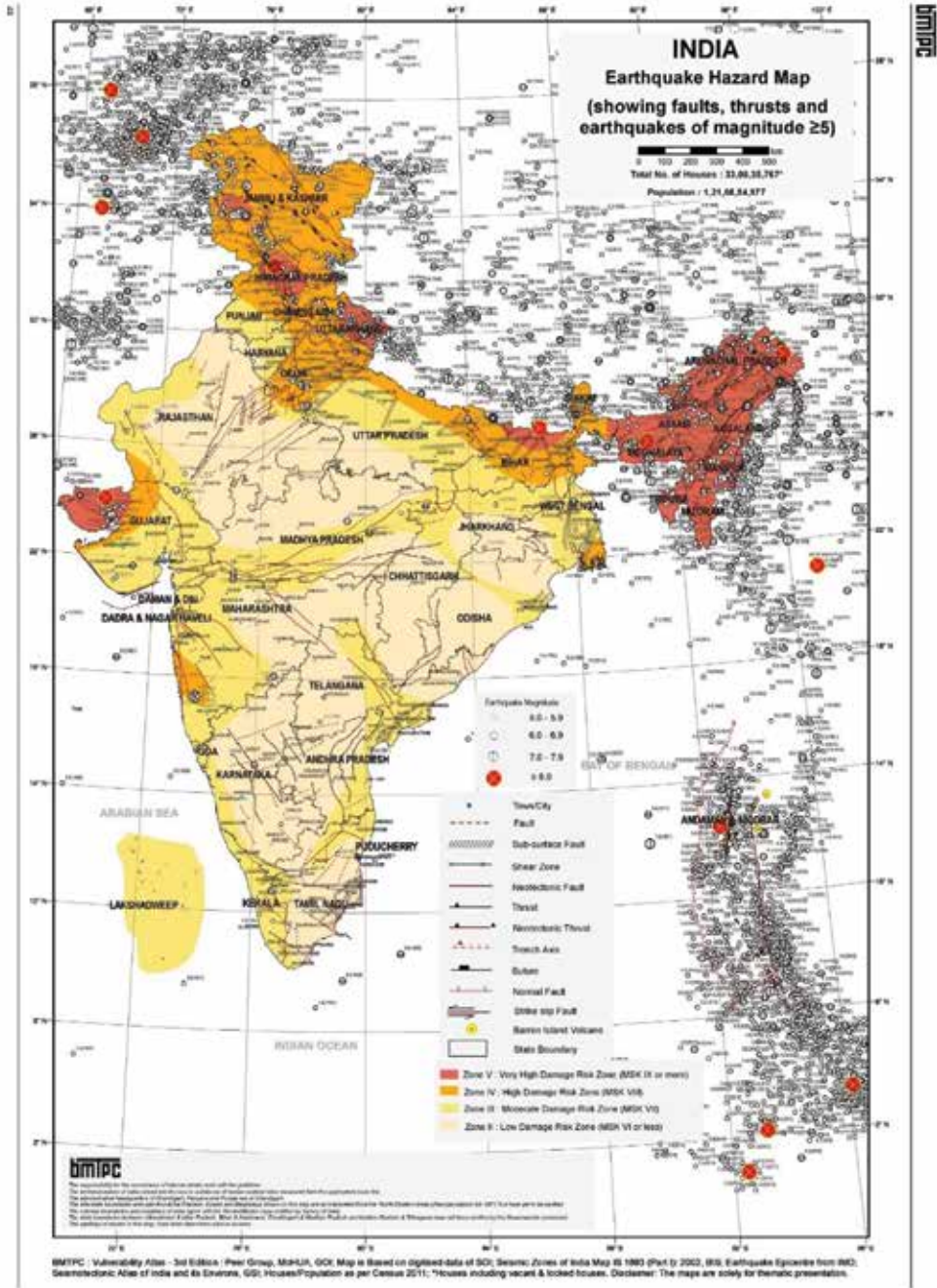


Fig 14. Earthquake Hazard Map of India

(Source: BMPTC 2019) https://bmtpc.org/DataFiles/CMS/file/VAI2019/MAP/eqmap/EQ_JPG/EQ_INDIA.jpg

3. VOLCANIC ACTIVITIES

A volcano is an opening or rupture in the earth's surface that allows magma (hot liquid and semi-liquid rock), volcanic ash and gases to escape. They are generally found where tectonic plates come together or separate but they can also occur in the middle of plates due to volcanic hotspots. The risk that can be associated with a volcanic hazard depends on the proximity and vulnerability of an asset or a population of people near to where a volcanic event might occur. In India, volcanic hazard is classified as low, however, the potential for future damaging eruptions cannot be ruled out. The Andaman Islands is the most active source of volcanic activity in India. The remote island of Barren Island is located east of India in the Andaman Island and its most recent activity as seen in 2022. The Deccan volcanic province (DVP) formed during India's northward migration as it passed over the Reunion hotspot (which is today the Reunion Island). This hotspot is still active today and last erupted on April 7, 2007. The DVP is one of the largest volcanic eruptions in Earth history and today covers an area of 500,000 km².

Volcanic eruptions can also cause secondary events, such as floods, landslides and mudslides, if there are accompanying rain, snow or melting ice. Hot ashes can also start wildfires. Earthquakes can occur due to volcanic activity. These earthquakes could produce topographical deformation and/or destruction of buildings, homes, cars, etc. Two different types of these earthquakes can occur: volcano tectonic earthquakes and long period earthquakes.

Session 4.3 Chemical, Industrial and Nuclear hazards

1. CHEMICAL HAZARDS

A chemical mishap occurs when hazardous chemicals are released into the environment without proper precautions. For example, fires, explosions, leaks, or the release of toxic or hazardous materials can all result in severe disease or permanent disability for those exposed.

Chemical disasters may arise in several ways, such as:-

- Process and safety systems failures
 - ✓ Human errors
 - ✓ Technical errors
 - ✓ Management errors
- Induced effect of natural calamities
- Accidents during the transportation

- Hazardous waste processing/ disposal
- Terrorist attack/ unrest leading to sabotage

In 1984, India witnessed the “Bhopal Gas Tragedy,” the most significant chemical (industrial) disaster in history. Thousands of people lost their lives in the worst chemical catastrophe in history, Bhopal, when the poisonous gas methyl isocyanate was released by accident (MIC). Injuries, agony, suffering, deaths, property destruction, and environmental degradation are only some devastating outcomes of such incidents. Although Bhopal had shown India’s susceptibility, the country continued to see a string of chemical mishaps. Around 1861 Major Accident Hazard (MAH) units are dispersed among 301 districts, 25 states, and 3 Union Territories. Thousands of registered and hazardous factories (below MAH requirements) and unorganised industries dealing with a wide variety of hazardous materials pose significant and nuanced disaster risks.

2. INDUSTRIAL HAZARDS

The term “industrial hazard” was coined to describe an event that “occurs suddenly or over a short period of time and is limited to fires or explosions in industrial settings or to chemical or radioactive releases from industrial point sources and causes widespread destruction or distress and usually causes injury or death to man.”

There are a variety of causes of industrial accidents, some of which include:

- uncontrolled release of untreated chemicals, reaction products, or energy from a chemical reaction;
- the improper storage of flammable, toxic, or explosive chemicals, including radioactive materials;
- The presence of people near enough to the chemical or energy release to be exposed and/or injured.
- Other disaster events such as fire, structural collapse etc.

Preventive measures:

- Safety initiatives at the National level to address industrial risk through law, policies, guidelines etc.
- Safety initiatives at the organisational level to manage industrial risk
- Safety measures through training
- Monitoring unsafe observations etc.

3. NUCLEAR/ RADIOLOGICAL HAZARD

A nuclear/radiological emergency can occur if a radiation incident exposes

or threatens to expose personnel or the public to radiation levels above their thresholds for safety. Human mistakes, system failure, sabotage, earthquakes, cyclones, floods, and other natural disasters are all uncontrollable externalities that might cause nuclear accidents. Such breakdowns could cause a local or regional emergency despite the minimal likelihood.

When a nuclear or radiological emergency occurs in a nuclear facility, it can either cause a plant/site or offsite emergency, depending on how far its effects spread. It can also happen in hospitals, factories, farms, and universities because of mishandling and misplacing of radiation sources. Accidents involving vehicles transporting radioactive or nuclear material, orphan sources (i.e., sources not subject to regulatory oversight), and the malicious use of radiation or radioactive materials are three other potential causes of a nuclear or radiological emergency in the public sphere.

Mitigation measures:

- Identification of Signal/Warning Mechanism
- Identification of Authorities/Team Members and their Response Time
- Fixing Roles and Responsibilities of the authorities
- Developing Incident-Specific Emergency Procedures
- Plan Preparation, Training, Testing and Updation

It is crucial that first responders have training in technical matters and crisis management for nuclear/radiological emergency. Those responsible for contingency planning and preparation should participate in regular drills to ensure the plan is effective. The plan is revised after considering the results of the tests.

Session 4.4 Accident-related and other human caused hazards

An accident is a negative, unintended consequence of carelessness or ignorance.

It is a potential threat that could result in a major incident, such as multiple fatalities and/or extensive damage to infrastructure and/or the natural environment. Safe operations rely on careful management of potential causes of major accidents. There is an emphasis on the importance of conducting vulnerability assessments for each potential accident scenario. The victims' chances of survival are highest during the response action phase. District Administration under District Collector is primarily accountable for initiating emergency measures such as search-and-rescue operations, providing aid to those in need, evacuating those in danger, and beginning the rehabilitation and reconstruction of damaged buildings.

At the organisational level, the following steps should be taken immediately:

- The authorities from the State Police must aid in the rescue of those involved in the accident or affected by it.
- The police must immediately set up a perimeter around the accident site, including the debris path, and ensure the safety of everyone there, as well as any property damaged or lost in the accident.
- Press officials must remember only to release accurate information to the media. Information that could cause panic, speculation, or even distortion should not be shared.
- Set up information hubs in strategic areas to provide accident details, field questions, etc. The phone numbers of all such resources should be widely disseminated through electronic media. Information gathered at these hubs should include the total number of people involved, their names, the types of injuries they sustained, where they are at the moment, how many people are likely to be still trapped inside, the total number of crew members, any hazardous cargo, and so on.
- The appropriate law enforcement agencies will arrange for a medical and post-mortem examination.

The strategy for making the workplace safe need to be developed and implemented with engineering principles in mind. As an example, interlock switching can be installed to restrict access to moving parts of machinery, an engineering strategy that can eliminate the human element of uncertainty by ensuring that only specific actions or conditions are met. A well-designed work environment can facilitate the right decisions and actions. All accidents should be looked into to determine what caused them, and the results of those investigations should be made public as soon as possible. In addition, all of the recommendations made in such reports accepted by the central and state governments must be implemented within that same time frame. In the event of a disaster, a plan should be in place, and a team of people should be assigned to oversee operations and ensure the plan is kept up to date. Reference materials should spell out role-players' responsibilities and obligations in detail. There needs to be a well-defined procedure for setting up and staffing incident /emergency control rooms.

Session 4.5 Biological Hazards

The term “biological hazards,” also spelt “biohazards,” is used to describe potentially dangerous biological substances. An example is a sample of a

microorganism, virus, or toxin (from a biological source) that can have an adverse effect on human health. Biological disasters include pandemics, pest infestations, bovine disease outbreaks, and food poisoning.

Our ability to respond to diseases highly depends on the necessary resources, knowledge, and technology to keep them at bay. When dealing with exotic pathogens, it's important to have the proper facilities, including biosafe high containment laboratories, staffed by professionals who are fully invested in their work, have received extensive training, and have access to diagnostic reagents on an ongoing basis. Transboundary Animal Diseases (TADs) not only harm livestock production in the form of constant losses but also discourage investment in livestock with greater productive potential and production systems. As of right now, India is adhering to the render pest eradication programme.

Management System

- The National Programme for Surveillance of Communicable Diseases conduct surveillance and implement mechanisms to control the outbreak of endemic diseases in India.
- The Ministry of Health and Family Welfare (MoHFW) in India is the country's central agency in charge of preventing and responding to medical crises, including making policy decisions and serving as an advisory body.
- According to the Constitution, health care is a matter of state jurisdiction.
- When an epidemic strikes a country, the National Institute of Communicable Diseases (NICD) is the first place people look for answers.
- The National Institute of Communicable Diseases (NICD) of India, in collaboration with the Indian Council of Medical Research (ICMR), provides academic instruction, scientific investigation, and laboratory facilities.

Along with this, the Epidemic Act of 1987, equips India's state and central governments with a wide range of tools for managing biological disasters.

Sub Module - 5

Disaster Risk Reduction (DRR)

Since the 1970s, there has been an increase in both the breadth and depth of our understanding of the causes of disasters, as well as the development of more comprehensive strategies for mitigating their effects through both pre-emptive measures (disaster risk reduction) and reactive responses (disaster impact management). Numerous governmental and non-governmental organisations, as well as international agencies and disaster planners, have been working on this front exclusively to improve overall disaster resilience.

The concept of disaster risk reduction (DRR) is generally understood to mean the widespread implementation of policies, strategies, and practises designed to lessen societal vulnerability to, and exposure to, disasters. Since DRR is an aspect of sustainable development, it requires participation from all levels of government, NGOs, the business community, and the general public. Therefore, it is necessary to take a people-centred, cross-sectoral approach to create a culture of prevention and resilience in the face of multiple, interrelated, and potentially catastrophic hazards.

Consequently, activities for reducing risk can be described as

- Structural, for example, implementation of building codes, land use planning etc.
- Non-structural, for example, policy-making, legislation and capacity building etc.

Effective disaster risk reduction (DRR) is achieved by increasing the capacity of a community, society, or organisation by strengthening its manpower, attributes, and resources. Increase in the likelihood of disasters results in loss of human life, economic resources, social capital, cultural heritage, and environmental resources for individuals, communities, and nations. Reducing the likelihood of future disasters and mitigating risk through coordinated and all-encompassing efforts will help improve economic, structural, legal, social, health, cultural, educational, environmental, technological, political, and institutional safeguards. DRR further lessen exposure to and vulnerability to disasters, and to better equip communities to respond to and recover from such events. Developing countries, face specific challenges, needing to have

their implementation capacity and capability bolstered to achieve DRR goal. This can be done through international cooperation and the mobilisation of support to provide means of implementation under their national priorities.

Measures used for the Disaster Risk Reduction

Risk identification

The first steps toward mitigating the negative effects of natural hazards and climate change are to recognise, assess, and understand the risk posed by these events. The public and policymakers alike can benefit from having access to comprehensive disaster risk information by better anticipating the effects of natural hazards through careful planning and investment. Risk identification is a crucial first step in facilitating evidence-based decision-making, leading to greater and more precisely targeted investments in risk mitigation, preparedness, financial security, and resilient recovery. When organisations across sectors have access to risk data, they can take preventative measures against disasters by creating new land-use planning guidelines, designing financial protection measures, equipping and training emergency responders, retrofitting buildings etc.

Capacity-building

Capacity-building is developing and strengthening the skills, abilities, processes, instincts and resources for organisations and communities which they need for survival, adaptation, and thriving in a dynamic and unpredictable environment. Capacity building relies heavily on personal growth and development that is sustained over time; this kind of change goes beyond completing tasks and can affect one's perspective.

Regarding achieving sustainability, SDG 17: Revitalising the Global Partnership for Sustainable Development, the United Nations is serious about making changes from the inside out. Increased technology and innovation in LDCs, as well as better data collection and monitoring, are all part of the capacity-building goals included in Goal 17. Particularly data collection, research, innovation, and analysis can serve capacity-building.

Prime Minister's Ten Point Agenda on DRR

The Indian Prime Minister at the Asian Ministerial Conference, outlined a 10-point agenda for efforts towards disaster risk reduction.

1. Disaster risk management principles should be incorporated into the development process.
2. Everyone, from low-income families to medium- and large-sized businesses to governments, must be protected from potential loss.
3. Disaster risk management must prioritise the leadership and increased participation of women.
4. Global risk mapping investments can increase awareness of potential natural and man-made disasters and help save lives.
5. Make the most of modern tools to increase the effectiveness of disaster risk management.
6. Create a consortium of educational institutions to address disaster-related concerns
7. Make the most of the tools made available by mobile and social media technologies to reduce disaster risks.
8. Improve disaster preparedness by relying on local resources and initiative.
9. Take advantage of every available opportunity to learn from disasters; to this end, studies on the lessons learned after every disaster are essential.
10. Tend toward a more unified international response to natural disasters.

Sub Module - 6

Disaster and Development

Session 6.1 Relationship between Disaster and Development

Due to urbanisation and population growth, natural disasters and economic losses have been on the rise in recent years. It is evident that a one-dimensional view of development with only growth perspective left sustainability behind causing natural disasters to have a much significant effect on society. As the adage goes, “an ounce of prevention is worth a pound of cure.” Harmful effects can be prevented only when mitigation measures are incorporated into the development planning process. Natural disasters, such as floods, cyclones, droughts, earthquakes, fires, and many others, negatively affect progress. Human lives are lost, along with property and resources, whenever a natural disaster strikes. As a result, development processes are intrinsically linked to natural disaster risk.

The United Nations estimates that natural disasters with moderate to the high impact caused at least 25,000 deaths and economic losses of around US \$ 36 billion worldwide in 2001. Seventy-five per cent of the world’s population is located in areas hit by a natural disaster like an earthquake, typhoon, flood, or drought between 1980 and 2000.

The term “disaster” refers to “any significant disruption in the functioning of the society, caused by a hazard having wide spread human, material, environmental, and other losses that exceed the ability of the affected society to cope using its own resources.”

“Development,” on the other hand, refers to an all-encompassing social, economic, and political process that seeks to perpetually enhance the well-being of the populace and all individuals.

In terms of long-term sustainability, the issue is not development per se but rather the nature of development, specifically whether or not it is motivated by concern for the common good or merely by profit. The devastation wrought on numerous Asian countries by the tsunami of 2004 provides a useful analogy. Overdevelopment in the Maldives, Sri Lanka, and Thailand’s coastal areas was not ecologically sustainable, which contributed to the disaster. However, in India, Sumatra, and North East Sri Lanka, the death toll was much higher

because affected areas were inaccessible due to a lack of infrastructure and resources. Construction must proceed, but only if the environment is protected. Some examples of how science and technology can be used productively to manage disasters include the creation of alternative energy sources like biofuel that reduce reliance on less sustainable options like dams and nuclear energy and the safe and environmentally responsible disposal of nuclear and radioactive waste. Research and development in science and technology create these options and should be vigorously promoted as a means of economic growth. There is a current push to use scientific and technological advancements, especially in information and communication, to increase our capacity to learn from and respond to disasters.

The United Nations Development Programme (UNDP) asserts that governments around the world should devote proactive resources to studying the root causes of natural disasters and the nature of the correlation (whether positive or negative) between these causes and development, which has been significantly pushed forward over the past few decades by globalisation. White, Phillip et al. (2004) cite estimates from the World Bank and the US Geological Survey suggest that investing US\$40 billion in mitigation and preparedness could have reduced economic losses worldwide from natural disasters in the 1990s by US\$280 billion. A cost-benefit analysis of mitigation and preparedness in Darbhanga district, North Bihar, suggests a return on investment of 3.76 Indian rupees for every rupee spent (Twigg (2002), the World Bank (2004), and Tearfund International (2005)). Some of the correlations listed by the UNDP include rapid urbanisation, leading to an increase in the prevalence of poor populations in high-risk areas such as ravines, steep slopes, flood plains, exposed coasts, and areas near hazardous industrial installations; degradation of the environment as a result of hazardous agricultural and industrial practises; climate change resulting in rising seas, coral reef damage, and economic trends that are increasingly vulnerable to natural disasters.

Distinguishing economic and social aspects of development helps clarify the interplay between catastrophes and progress. These societal and economic changes either reduce or increase the likelihood of disasters. There are 'four' aspects to the connection between disasters and development:

- (1) **Disasters can halt progress:** Disasters can reverse decades of social and economic progress that has been made. The constant drain on resources caused by frequent disasters limits the development potential of millions of people worldwide.
- (2) **Disasters can create opportunities for progress:** Restructuring the

economic base as a result of resource transfer from other areas, infrastructure development as contingent requirements, and so on are all examples. Long-term development aims could be served by increased investments in modernising administrative capacity and training the relevant personnel. One way disasters can impart “direction” to development is by drawing attention to areas of underdevelopment where losses are disproportionate to the overall impact of the disaster. Important clues for future development are revealed during the Recovery phase. Improved air quality, better flora and fauna, health and longevity for people, etc., are all side effects of reforestation programmes implemented in the wake of landslides and flash floods. These in turn improve the outcomes of “mainstream” development programmes by providing the poor with more means of subsistence, increasing employment opportunities, fostering better animal husbandry, and increasing the quality of forest produce for those who live in the surrounding areas. Consequently, progress is a factor in both the input and output stages of the disaster management cycle. It plays a pivotal role in crisis management.



Fig 15. Disaster and Development

(Source: ILO crisis Response Trainer’s Guide)

https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_ent/@ifp_crisis/documents/presentation/wcms_116752.pdf

- (3) **Development can increase vulnerability:** Communities may become more susceptible to disasters due to their own social and economic development. Informal settlements and inner-city slums, typically populated by migrants, tend to sprout up in precarious locations, such as low-lying areas, steep slopes, flood plains, or in close proximity to potentially hazardous industrial sites.
- (4) **Development can decrease vulnerability:** Competing forces must be considered in development planning if we want economic growth to occur without a corresponding increase in disaster risk. First, the creation of wealth, which can improve the baseline for human development, and second, the redistribution of wealth, which can help the most disadvantaged people in a society overcome their precarious living conditions. It is essential to achieve economic development without creating new risks by incorporating disaster risk assessment into existing development instruments. One way to do this is to make newly constructed structures more resilient to natural disasters (White & Phillip, 2004).

The connection between disasters and development depends on the development choices made by the individuals, communities, and nations that implement the development programmes (Stephenson et al., 2002).

Session 6.2 Need for a new paradigm

Given the prevalence of natural catastrophes in some regions, disaster risk management needs to be at the top of the agenda for development policymakers. We need to take steps to better coordinate local disaster preparedness with broader strategic planning. The potential for development projects and programmes to either lessen or increase risk exposure must be assessed.

For the fields of disaster mitigation and development to work together, three things must occur (Khan et al., 2007) :

1. Gathering and disseminating best practices in development planning and policy that lower disaster risk;
2. Energising political will to re-orient both the development and disaster management sectors;
3. Collecting and developing basic data on disaster risk and planning tools to track the relationship between development policy and disaster risk

The foundation of a future ‘blueprint’ for disaster management in India is the belief that while hazards are unavoidable in today’s society, the disasters that follow may be mitigated to an extent by prepared society to cope effectively whenever they occur. It is crucial to initiate development efforts aimed at risk reduction and mitigation and to map out a comprehensive strategy for preventing, preparing for, responding to, and recovering from disasters.

To achieve “sustainable development,” balance between economic growth and social progress should be in line with risk associated from disaster. As emphasised in the tenth plan, the government’s role will be that of a catalyst and promoter. At the same time, service providers will be the responsibility of non-government organisations and businesses. Public spending is needed for infrastructure provision, especially in rural areas. The 73rd and 74th amendments to India’s constitution established decentralised governance. Local democratic institutions would be involved in development planning, enlisting people’s participation in interest articulation, and implementing the plan. This decentralised arrangement, transforms people from passive beneficiaries into active participants in administration, bolstering local administration leading to quicker response to disaster calls, improved warning and information dissemination, and a deeper understanding of vulnerabilities.

NATIONAL BUILDING CODE OF INDIA (NBC)

Large-scale shifts in the building construction industry have resulted from factors like the increasing popularity of high-rise and mixed-occupancy buildings, the growing reliance on and complexity of building services, the advent of cutting-edge technologies and building materials, the awareness that the environment must be preserved, and the need to manage construction projects strategically. With the built environment and the structures already in place, the current building construction scenario reflects a paradigm shift. Considering these concerns, the National Building Code Sectional Committee, CED 46 of BIS, along with its 22 expert Panels, and a total of approximately 1000 experts, undertook a Project to completely revise the Code.

The National Building Code (NBC), 2016 of India is a state-wide framework for regulating building construction all over the country. Public works departments, other government construction agencies, municipal governments, and private construction firms are encouraged to adopt this document as a model for future projects. The Code covers a wide range of topics, including administrative regulations, development control rules, and general building requirements; fire safety requirements; materials, structural

design, and construction (including safety) stipulations; plumbing services; an approach to sustainability; asset and facility management; and more.

RESILIENT INFRASTRUCTURE

Infrastructure resilience refers to the ability of critical elements of a nation's infrastructure to withstand and recover from past, present, and future threats and adapt and change to meet new demands. Collaborative risk and uncertainty management, multi-hazard assessments are all essential to implementing resilience across all phases of disruption.

The interconnectedness of infrastructure and services, the complexity of risks, and the domino effect of a disaster on the entire infrastructure system are not fully taken into account by the current approach to infrastructure planning, financing, design, development, operations, and decommissioning. These problems could be solved by adopting a more holistic approach to analysing risks and interconnections, which should be flexible enough to account for unique national threats to resilience, and reduces the potential downsides of infrastructure investments and modifications by using the Principles for Resilient Infrastructure.

Modern economies rely heavily on national infrastructure making critical infrastructure resilient is a prerequisite for long-term economic success. More people than ever rely on the services provided by critical infrastructure systems like those responsible for supplying and transporting energy and delivering and treating water, sewage, trash, and electronic communications. Health care, social services, education, law enforcement, corrections, and fire and rescue rely on critical services. Maintaining the flow of essential services while mitigating the effects of catastrophic events is the responsibility of critical infrastructure. Delivery of public services, improvement of living standards, and stimulation of economic growth rely heavily on the reliable operation of critical infrastructure systems. Protecting, maintaining, and ensuring the continuity of essential services and infrastructure is a top priority on a global scale.

The figure below details a set of six interrelated Principles for Resilient Infrastructure. That is:

- Adaptively transforming
- Continuously learning
- Socially engaged
- Proactively protecting

- Environmentally integrated
- Sharing responsibility



Fig 16. Principle for Resilient Infrastructure

Source: UNDRR 2022 Report on Principles for resilient infrastructure

<https://www.undrr.org/publication/principles-resilient-infrastructure>

Session 6.3 Blending indigenous knowledge with modern technology

Across the globe, indigenous knowledge is ingrained in countless communities with unique environmental, social, cultural, economic, and political conditions. Although such information is inherently bound to these local conditions, there is room for the transfer of certain principles and practices between communities to aid in disaster reduction. The Sendai Framework on DRR (SFDRR 2015), recognizes culture as an important dimension of DRR and the need to protect and draw on heritage as an asset for resilience. Traditional technologies and construction practices often reflect adaptations to the surrounding environment. These technologies of managing local hazards - evolved through trial and error - are often very resilient because they employ local materials and are embedded with site-specific knowledge. There are many examples of traditional buildings surviving earthquakes, floods, cyclones and other hazards. Continuous processes of innovation and adaptation enable this knowledge to blend with modern science and

technology. Blending the traditional and the modern creates a fertile ground for innovation and enhances local ownership and acceptance of new risk-reduction initiatives. Partnering with disaster managers, local communities and heritage or other technical specialists in institutions like universities and NGOs can be instrumental in drawing out critical knowledge for reducing risk (ICCRROM Blog 2023).

Indigenous knowledge used in different settlements:

Mountain Ecosystem

Numerous hazards (such as earthquakes, forest fires, flash floods, landslides, and avalanches), inaccessibility, and steep terrain are just a few distinguishing features of mountain ecosystems. Several categories of indigenous knowledge provide domains in which knowledge themes are more closely related due to shared contextual details. These indigenous knowledge principles can be applied to all communities residing in that context discussing about weak ecosystems, outdated infrastructure, and limited economic opportunities. Also, mountain regions' vulnerability has grown due to modern developments like out-migration, children leaving villages for better education, and the negative environmental impacts of ad-hoc development projects. For new methods of development to be successful, indigenous knowledge can serve as crucial guidelines. For example the Assam type of houses for flood protection and earthquake resistance, Kath Kunni traditional house type seen in Himachal Pradesh, which are safe from earthquake point of view. Mountain communities often employ glacier grafting to increase water predictability, vertical transhumance to increase crop diversity, and slope farming to decrease erosion. In perilous conditions, mountain communities can pursue livelihoods thanks to these practices, which have evolved over generations of habitation and experience with the local environment.

Coastal Zones

Several potential disasters—cyclones, storm surges, sea erosion, flooding, sea level rise, and tsunamis—are most likely to strike coastal areas. The severity of many of these events is predicted to increase due to global warming. Pollution, improper development, and mismanaged resources all have devastating effects on coastal communities. A decline in fish yield is an economic risk associated with the mismanagement of coastal areas, as many who live there rely on fishing for their livelihood. Destroying coral reefs and mangroves, which provide additional protection from potential hazards, is just one example of how coastal ecosystems are negatively impacted by

pollution, development in seaports, and climate change. For centuries, people living in coastal areas have been finding ways to adapt to and survive extreme weather. They have a wealth of indigenous knowledge about the coastal environment and how to coexist with it, which is reflected in their subsistence and economic activity methods. The indigenous people who live along the coast have a wealth of knowledge about the ocean and how it behaves, as well as wind and weather patterns. The knowledge of coastal communities often reflects that they are typically smaller and more tightly knit than inland communities. This is frequently seen in effective methods of disseminating knowledge, such as the transmission of lore from one generation to the next within families. Coastal indigenous knowledge also includes the use of local materials, such as sand and thatch, in the building. Last but not least, most of the information is directly applicable to the fishing and farming that provide a living for the people along the coast. Incorporating such knowledge principles in the right context can provide significant support for current initiatives to strengthen coastal communities' resilience.

Housing

It is well known that traditional or vernacular housing in many parts of the world is often more resistant to natural disasters like earthquakes than modern buildings. This is often the case because, especially in the developing world, new buildings are often erected using materials and techniques that are foreign to and inappropriate for the region. Locally sourced materials and any skilled labour that may be available are used in the construction of a home's traditional design and construction. Because of its gradual evolution, testing by local phenomena, and shaping by factors like culture and climate, this technology has proven to be effective. Poor housing construction is becoming an increasingly pressing issue due to increase in the impact of disasters and climate change. Over the years, the decline in respect for and practice of vernacular arts and crafts has led to their eventual extinction. Over time, the environment and the way people live in their homes are being reshaped by the combined effects of several major forces, including modernity, climate change, and development. However, conventional dwellings are effective at preventing harm and ensuring financial stability. Every major earthquake is accompanied by countless anecdotes about how ancient, traditional structures like temples, mosques, and forts survived the quake while more modern structures were destroyed. Local materials, construction technologies, and building management systems are just some of the aspects of housing that need to be analysed and incorporated into nuanced disaster reduction and response policies. There should be more investments in traditional housing-

related R&D, training, and education. Incorporating indigenous and modern technologies into housing is a great way to bridge the gap between the knowledge and practices of traditional cultures and those of modern societies.

Water Resource Management

In many disaster risk management efforts, water has played a critical theme. Communities dealing with water's abundance or scarcity can gain the resilience they need through proper management, which is the leading cause of disasters worldwide. Water resource management is becoming increasingly precarious due to environmental changes such as the rise in frequency and severity of extreme water-related events and the widening gap between water demand and available water supplies. Indigenous knowledge has much to offer regarding water resource management's technological and process challenges. Traditional weather prediction methods, water storage through tank systems, water transfer through gravity, and other applications of indigenous technology have broad applicability.

Further insight into the efficient protection and distribution of water resources can be gleaned from indigenous knowledge, which includes management elements like community rule, community-based decision-making, and collaboration with local government. Indigenous wisdom also imparts uncommon techniques for disseminating water-related information, using oral traditions like proverbs, songs, poems, and festivals. Indigenous wisdom has much to offer the ever-growing water management problem. Many regions will see their water supply shift as a result of climate change, with either an increase or decrease from the norm depending on the area. Therefore, water management provides a unique opportunity for transferring indigenous knowledge between communities, which must be further explored.

Expanding Benefits by Traditional Knowledge and Modern Technology

Current and future researches could focus on integrating AI with local traditional knowledge to adapt and grow sustainably in face of climate change. Many such ways can be developed to mainstream with advanced scientific knowledge and technology such as:

- Documentation of indigenous disaster safe practices and their implementation through national programs and schemes.
- Developing policy programs through engagement of local bodies and communities for its inclusion.
- Dissemination of information to international research societies

for advanced research on blending in construction and cultural practices.

- Setting up knowledge network on traditional knowledge and modern technology.
- Engage in technologies to help reduce greenhouse gas emissions by providing social and economic benefits.

Sub Module - 7

Use of Technology and Emerging Tools for Disaster Management

Session 7.1 Geo-informatics

A GIS is a computer programme that can create, maintain, analyse, and display data in the form of maps. Geographic information systems link information with maps by combining location information with other descriptive data. This lays the groundwork for mapping and analysis, fundamental procedures in virtually every field of study and business. The geographic context, relationships, and patterns are easier to grasp with the help of a GIS. One of the advantages is the enhanced ability to coordinate and make decisions. It provides users with maps, satellite images, and other spatial data.



Fig 17. GIS System

(Source: GIS-GEOGRAPHY (2023) <https://gisgeography.com/what-is-gis/>)

Disasters have a spatial component because they occur in discrete areas. As a result, geospatial data is indispensable in crisis management. Together, GIS and remote sensing form a foundational framework that is useful throughout the disaster risk management process, from prevention to response to clean-up and rebuilding. Web-based GIS applications and cutting-edge wireless

networking are revolutionising how governments and other organisations manage disasters, allowing for better response coordination and more thorough preparation for disaster risk reduction. Many countries have turned to GIS decision support systems for disaster management because they have proven useful. Key characteristics of disaster events, such as the location of impact (epicentre, landfall, etc.), physical characteristics (magnitude, central pressure, etc.), local conditions (such as land use and type and height of structures), and so on, are necessary for assessing disaster risks.

In order to model the intensity and severity of the hazard, understand the impact on buildings, infrastructure, and the population, and respond to the disaster for evacuation and rehabilitation, knowledge of the geography of the affected area is necessary. These jobs can be carried out more efficiently and effectively with GIS and remote sensing (Johari, 2018). For emergency management purposes, GIS has the potential to consolidate data from numerous sources into a unified database that a wide range of users can easily access. In times of crisis, it allows for the prompt dissemination of vital information. In addition, this information can be visualised to aid in analysis and decision-making.

Preparedness, mitigation, response, and recovery are the four pillars of disaster management, and all have benefited from GIS implementation in developed nations. Since all of these steps depend on one another, setting the solid groundwork for GIS is crucial.

Primary Duties of Disaster Administration where GIS can be made useful-

- It's important to be aware of the potential dangers in your area.
 - ✓ Determining which parts of a country are most likely to experience a natural disaster. Based on historical data, managers can use GIS to pinpoint exactly where they can expect a disaster to strike.
 - ✓ Taking precautions through planning is the main focus: In addition to preventing further damage, disaster managers must educate the public on staying safe in potentially dangerous situations. With the aid of maps and other GIS tools, the disaster management department plans the following safety measures:
 - ✓ Since one can now make their unique maps, one can use any GIS software to make specific maps for various regions, depending on the type of disaster that has struck.
 - ✓ Things like the number of construction sites and safety precautions

- can be planned by looking at maps and researching areas where disaster is most likely to strike based on historical records.
- ✓ Locating nearby medical facilities; allows for the location of hospitals to treat victims.
 - Organising methods for evacuation and rescue.
 - ✓ Rescue and escape routes operations for those trapped by a disaster are planned through disaster management. Geographic information systems (GIS) are useful for determining the safest route for rescue and evacuation, whether by land, sea, or air.
 - ✓ Finding nearby locations where shelters and camps can be set up is made simple with a map, which can be accessed with the help of a geographic information system.
 - Disaster and rehabilitation planning
 - ✓ Following a disaster, the sector responsible for disaster management preparations to restore the affected area and its inhabitants.
 - ✓ Geographic information systems (GIS) can pinpoint safe areas where victims can be treated and where rehabilitation zones have been established close by. As part of our disaster risk reduction efforts, one will use GIS to create a comprehensive map of the affected area.

So, GIS aids in the detection of disaster-prone regions, allowing for more precise planning of rescue and evacuation operations. Managing the aftermath of the disaster and restoring the affected areas. After that, they implement preventative measures to ensure the safety of the most vulnerable residents of the affected areas. Use of GIS has improved efficiency in managing disasters, and has become one of the most effective tools in Geo-informatics.

Application of Remote Sensing in disaster management: Data through remote sensing is required for several aspects such as monitoring and early warning for example tracking of winds, monitoring of formation of cyclones, tracking the monsoon pattern, tracking of forest fires and flood management etc. Remote sensors can also help in predictions and preparedness such as in case of landslide and earthquakes. Further when many of the times after a disaster event the affected areas become inaccessible physically, remote sensing helps in monitoring from sky and in disaster assessment for rescue and relief operations. Apart from the direct application for disaster management, remote sensing have a huge applications in the field of research and

development studies. It provides researchers and scientists with the required information and data concerning the hazards and the affected area for their decision making.

Session 7.2 - Role of data in disaster risk management and Big Data Analytics

Disasters are complicated events, and to respond successfully, military and humanitarian responders require accurate, dependable, and timely data. This information should address requirements for the operational environment and crisis impact (baseline, damage and needs, and catastrophe situation data) (coordination, capacity, service locations, security, and access) (van den Homberg, 2016). The big data and analytics era opens up new possibilities for disaster management. Due to its ability to visualise, analyse and predict disasters, big data is changing humanitarian operations and crisis management dramatically. Big data is characterized by data having at least four dimensions that are “data volume”, “data velocity”, “data variety” and “data veracity” in addition to these “data value” is important to measures the usefulness of data. Big data paradigm consists of data management tools and techniques for storage, processing and security of data. The main objective of big data management is to enhance data value and accessibility for decision-making. (Roxin, A. M. et al. 2005).

When deciding on response activities, a good fit between information demands and the facts at hand promotes situational awareness and sense-making and allows for adequate decision-making. Given the intrinsically chaotic and disordered environment, where decision-makers must deal with squeezed deadlines and high degrees of uncertainty, this information management process is difficult. Obtaining crucial, precise, and complete data is, in fact, an extremely iterative process rather than a linear one, especially in the moments following a disaster event.

Data can be used in several stages such as:

- Crisis mapping
- Connecting missing people with their families
- Social media mining
- Event simulations

Employing massive amounts of data gathered from remote sensing and other sources to run sophisticated monitoring and forecasting programmes are

providing meaningful information for efficient disaster management. For example, many features of a flood, such as its likely inundation, duration, and river discharge, can be detected early with the help of data integration of diverse data formats from multiple sources. Predicting and analysing the effects of floods can benefit greatly from both remote sensing data and data from social media. Providing a more rapid comprehension of the flood's location, timing, and impact, data from disaster response organisations, remote sensing derived data from the Global Flood Detection System (GFDS), and social media data from flood-related twitter activities.

Data is further useful in providing information to better respond to emergencies. It is crucial to prioritise evacuation and rescue efforts during times of emergency. Three ways in which Big Data might improve emergency response: figuring out where the damage is, analysing the issue in real-time, and figuring out the best course of action based on past examples. The proliferation of cell phones, social networking sites, and mobile applications has increased the volume and variety of data that may be collected in the wake of a catastrophe. Using visualisation and geographic information system (GIS) mapping, disaster management can be enhanced by the massive data stream from various sources. Using big data, we can pinpoint the areas most need assistance and direct our limited resources. The public can be given a map of the safest routes out of a dangerous region courtesy of modern GPS technology (Rahman, 2017). Data modelling may give user useful, tangible information that is both organised and easy to understand.

Damage assessment, information archiving from a lesson learned, and research efforts to build resilience are all examples of what fall under the umbrella of “disaster recovery,” which is the period of activity that occurs after a disaster. Many scholars regarded the accident as a chance to better prepare for such events in the future by collecting and analysing new data. Disaster-related structural damage data, for instance, can be used to update building codes. Damage and loss estimation data from past accidents may be useful for preparing for future catastrophes.

Communities in need can benefit from the use of data and analytics to aid in relief and response efforts. Data analytics is being adopted as a crucial tool to boost early warning systems and aid relief operations following a terrible event, from satellite photos and crowd-sourced mapping tools to predict and help prepare for catastrophes to on-the-ground reports from drone footage. Emergencies are being handled in innovative ways by doing real-time analysis of data collected from the community.

Session 7.3 Use of advanced technology like Artificial Intelligence (AI), Machine Learning (ML) GPS, Drone technology for DRR.

Advanced technologies like Artificial Intelligence (AI), Machine Learning (ML), GPS, and drone technology play pivotal roles in various facets of disaster management:

Early Warning Systems: AI and ML algorithms process diverse data sources, including satellite imagery and sensor data, to detect patterns and anomalies. This facilitates the development of more accurate early warning systems, enabling timely alerts for disasters like floods, storms, or earthquakes.

Risk Assessment and Preparedness: AI and ML analyze historical data alongside real-time information to assess vulnerabilities in specific regions. This aids in creating risk maps, improving preparedness strategies, and optimizing resource allocation for infrastructure reinforcement and evacuation planning.

Response and Resource Allocation: GPS technology tracks and coordinates responders, resources, and supplies in real-time during a disaster. Integrating AI with GPS data assists in optimizing routes, resource distribution, and logistical support, ensuring an efficient response.

Drone Technology for Situational Awareness: Drones equipped with sensors and cameras provide high-resolution imagery of affected areas. AI and ML algorithms analyze this data swiftly to assess damage, identify hazards, and prioritize areas needing immediate attention, enhancing situational awareness.

Predictive Analytics for Future Preparedness: AI and ML models analyze historical disaster data to predict potential future events and their impacts. This enables proactive planning, resource allocation, and the development of response strategies to mitigate the effects of future disasters.

Post-Disaster Recovery: These technologies aid in damage assessment by analyzing data collected from drones and other sources. They help in planning reconstruction efforts, prioritizing areas for rebuilding, and optimizing resource allocation during the recovery phase.

Decision Support Systems: Integrating AI, ML, GPS, and drone technologies creates comprehensive decision support systems. These systems provide real-time information, predictive insights, and aid decision-making for authorities throughout the disaster management cycle.

Sub Module - 8

Dissemination of Disaster Related Information

Session 8.1 - Early warning systems

As per UNDRR, An early warning system is an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events. Over the past few years better understanding of the natural hazards that trigger disasters, along with the deployment of improved sensors and means of communication to transmit the data to national observatories, has led to an improvement in early warning systems and an expansion of the list of hazards under surveillance. Four levels of the early warning system is shown in Fig 14.



Fig 18. The four elements of effective early warning systems

(Source: Luther J (2017) adapted from UNISDR 2006b IEWP <http://www.unisdr.org/2006/ppew/inforesources/docs/IEWP.pdf> DOI: 10.1007/978-3-319-59469-9_9)

Experts at the 2nd International Early Warning Conference in 2003 introduced the current concept of efficient or people-centred early warning systems based on these four tenets:

- Information about the potential for disaster, inferred from disaster risk assessments and data collected systematically
- Risk assessment through identification, observation, evaluation, and projection
- Authoritative, timely, accurate, and actionable warnings and associated information on likelihood and impact disseminated and communicated by an official source.
- A systemic readiness to act on warnings at all levels

SFDRR (2015-2030) Priority 4 (Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation, and reconstruction) and Target G (Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030) recognises the importance of early warning systems in preventing and mitigating disasters. The implementation of early warning systems is mandated in the Paris Climate Agreement as well. In addition, since the 1990s, the United Nations has spearheaded efforts to facilitate international cooperation and the development of early warning systems worldwide. Nationally, early warning systems for hazards like floods, extreme rainfall, cyclones, lightning etc. are in place and looked after by various departments like IMD, Flood and Irrigation Department, NRSC etc.

The idea of early warning systems for multiple hazards has been widely disseminated in recent years. These systems consider the potential for interconnected effects as they deal with multiple hazards and/or impacts of the same or different types in settings where hazardous events may occur singly, in a cascade, or over time. The UN-SPIDER project helps with an early warning by spreading information about how various space technologies can be used in tandem with on-the-ground data to enhance current early warning systems. Moreover, it is a part of the Global Network for Integrated Early Warning Systems (IN-MHEWS). Satellite communications, Earth observation, and the implementation of Global Navigation Satellite Systems (GNSS) are examples of how space technologies contribute to early warning systems. Moreover, the space community has started working on setting up early warning systems for space weather and Near Earth Objects (NEOs).

Types of early warning systems

Early warning systems can be categorised in many different ways.

- **By type of hazard**
 - i) tsunamis, earthquakes, volcanic activity, landslides, geological hazards
 - ii) floods, droughts, hurricanes, typhoons and cyclones, tornados, cold and heat waves, and for other Hydro-meteorological hazards
 - iii) Forest fires etc.
- **By the level at which it is operated**
 1. Community- or individuals early warning systems run by a city or county government on a smaller scale. Standardised methods of this type typically deal with flooding.
 2. A National government agency, such as a meteorological office, a geological observatory or institute, or a health or agriculture ministry, operates a national early warning system.



Fig 19. Weather monitoring instruments (Doppler radar) on the roof of the Indian Meteorological Department building in New Delhi (Source: IMD)

3. The regional system functioned primarily on a regional basis. Among these are the European MeteoAlarm and the United States-operated Famine Early Warning System Network (FEWSNET) in various parts of the world.

4. International systems are managed by agencies such as the World Health Organization and the Food and Agriculture Organization of the United Nations.

- **As a single or multi-hazard system**

1. Single-hazard
2. Multi-hazard

SPACE TECHNOLOGIES FOR EARLY WARNING

Satellite communications, Earth observation, and global navigation satellite systems (GNSS) are the three main categories of space technologies. However, at the moment, early warning systems are most frequently employing satellite communications and Earth observation.

One can use satellite communications for:

- To send information gathered by sensors in far-flung locations to observatories for analysis and use in developing disaster-prediction models
- To communicate warnings from one area to another, especially in the event of tsunamis.

Several types of early warning systems rely on data gathered from Earth observation. Several usages include:

1. To monitor the progress of tropical cyclones, typhoons, and hurricanes at sea before they arrive at land.
2. To evaluate the severity of droughts in light of past droughts.
3. To locate potential hotspots on active volcanoes.
4. To track the development of floods in basins.
5. Predict how much a volcano's cone might grow or change shape just before an eruption.
6. Tracking active mass movements, such as landslides.

Applications developed by space agencies combine satellite imagery to create useful products for use in early warning systems all over the globe.

Early warning of outer space hazards

Multiple space agencies are cooperating with astronomical observatories to keep an eye out for potential threats from beyond Earth's atmosphere, such as near-Earth objects and space weather. With funding from UNOOSA, the Space Mission Planning Advisory Group (SMPAG) and an International Asteroid Warning Network (IAWN) was established as part of a coordinated international effort to manage NEOs like meteorites. With the help of the World Meteorological Organization (WMO), space agencies and astronomical observatories are working together to watch for space weather, such as solar or geomagnetic storms.

Session 8.2- Role of Social Media and Mobile Apps

“Social media” refers to various online platforms where users can interact with one another and share ideas, content, and other materials. The proliferation of these new forms of communication offers a chance to reach more people with urgent safety information during times of crisis. These innovations have the potential to strengthen the dissemination of warning messages by reducing reliance on a single platform, but they also present new challenges for policymakers.

There are two ways to categorise how social media is used to deal with disasters and other emergencies at the organisational level. Firstly, social media can be used relatively hands-off to disseminate information and collect user feedback in the form of inbound messages, wall posts, and polls. Secondly, social media can be used methodically to help manage crises. One example of systematic use is the use of social media to receive requests for help from victims, monitor user activities and postings to gain situational awareness, use uploaded images to create damage estimates, and so on (Bruce R. Lindsay, 2011).

Emergency communications and issue warnings: When it comes to handling emergencies and potential threats, the various forms of social media can work together to provide a more effective response. Volunteers and emergency personnel can better coordinate their efforts using social media platforms. When dealing with a crisis or risk situation, the various stakeholders may benefit from opening lines of communication through collaborative knowledge-sharing media.

A dedicated team can develop key indicators about current situations, volunteer social media scanners, or a technological application that can recognise trends and early warning signals. Pre-messaging, a well-organised crisis communication team, and a risk-awareness social media campaign that helps to head off disasters are all essential. Finally, institutions must establish themselves as reliable resources in the online community and learn to recognise and interact with other credible sources.

Social media can function as a resource by disseminating facts and guidelines alongside timely warnings and updates. Another way for emergency services to get the word out is through social media. That’s the case when a natural disaster occurs, like a storm or a tornado. The advice can be disseminated via social media platforms like blogs, where pertinent data like emergency phone numbers, locations of hospitals in need of blood donations, evacuation routes, etc., can be posted.

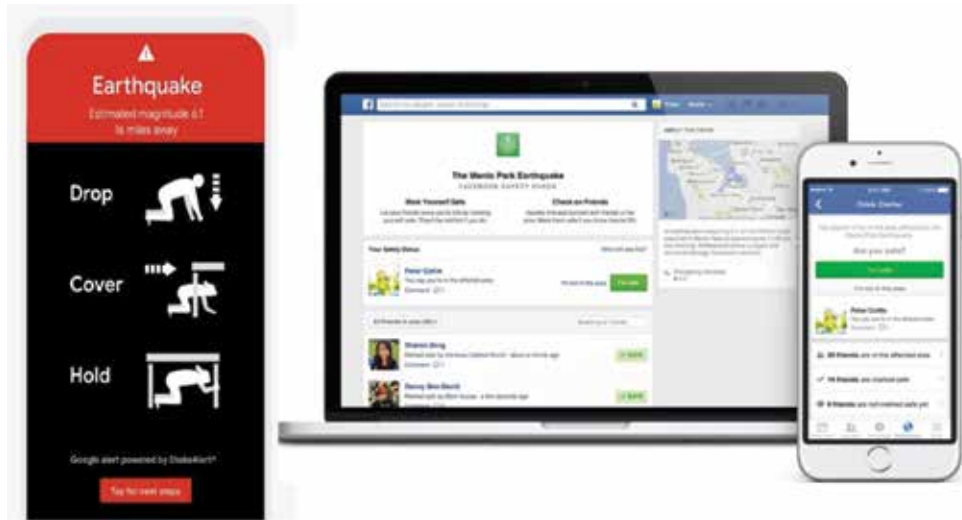


Fig 20. (a) Google Alert and (b) Facebook Safety Check System

(Source: (a) India Express 2023 <https://indianexpress.com/article/technology/tech-news-technology/google-android-earthquake-alerts-india-how-to-8958385/>

(b) Facebook from Newsweek 2014 <https://www.newsweek.com/facebook-launches-safety-check-feature-natural-disasters-277935>)

Requests for assistance: Volunteers can now be connected outside of formal and established communication channels thanks to the proliferation of the internet and mobile phones. Volunteers could be encouraged to report unusual situations via social media, allowing decision-makers to use this participatory sensing to take the necessary actions. The social media platforms or modules synthesise different social media content to aid emergency managers and volunteers in their efforts.

Social media can be utilised to enlist help from the public both before and after an emergency. A person's willingness to assist in an emergency can also be communicated via social media. Furthermore, it can enhance disaster response by enlisting online volunteers located far from the epicentre of the crisis to relay information provided by emergency services.

Establish situational awareness: Through content-sharing platforms, it is possible to gain a real-time understanding of a crisis's progression by identifying images and videos of the situation as they unfold. Tools for blogging or microblogging, such as Twitter, can be used not only for the instantaneous dissemination of news but also for the rapid dissemination

of advice and safety notices. Societal resilience can be bolstered through risk and crisis communication during the pre-crisis, crisis, and post-crisis phases. Organisations can build the capability to monitor and gain situational awareness via social media filtering in the pre-crisis phase. In times of crisis, organisations must make objective information readily available to the public so that people aren't left in the dark or forced to rely on unreliable third parties. They must also mobilise IT volunteers through an online technology community to enhance crisis mappings and situational awareness. Social media can be used to track down both victims and those who managed to escape harm. When used in conjunction with mobile phones, social media platforms allow users to quickly and accurately report accidents and send out urgent calls for help to friends and family members.

Create damage estimates: Social media can function as a resource by disseminating facts and estimates alongside timely warnings and updates. Social media can disseminate updates on relief efforts, rebuilding efforts, etc. Recovery of infrastructure (bridges, routes, water supply) can be communicated via social media, and areas most need recovery can be pinpointed. After the crisis, social media can be a valuable resource for determining which areas most need stress management during recovery and providing access to resources through dynamic mediums.

If a major disaster occurs, people can be encouraged to donate money through social media, and the supply of aid can be facilitated through the same channels. People who want to help disaster victims by, say, providing blankets or a place to stay often don't know where to start. The role of social media in disaster risk management extends far beyond simply increasing public awareness of risks and crises and encouraging better preparation. However, open data plans must be maintained and implemented by the



Fig 21. Donation Campaign on Facebook
(Source: Facebook)

government to curb the spread of false information, measure the influence of social media, and provide the nation's infrastructure with the long-term storage capacity necessary to gradually learn from past crises. The content on social media platforms is user-generated, user-managed, and user-influenced.

The use of social media has the potential to facilitate two-way communication and interaction between businesses, their customers, and the general public. Officials in the government need to lead by example and include this new paradigm shift in their risk and communication strategy. Although Facebook and Twitter are two of the most well-known examples of social media, many other webs- and mobile-based technologies fall under the umbrella of "social media," too.

The table (below) outlines the different kinds of social media and gives examples of the most common ones.

Social Media Type	Examples
Podcasting	Audible
Video Sharing	Flickr, YouTube, Snapchat
Social Networking	Facebook, Instagram, Be Real
Video/Text Chatting	Skype, WhatsApp, telegram
Micro-blogs	Twitter, Tumblr

Sub Module - 9

Framework System for Disaster Management

Session 9.1 - Global Milestones

Disaster risk reduction has evolved from a specialised field of study to a worldwide social movement committed to long-term sustainable progress on all fronts. The UN General Assembly has made great strides in reducing the likelihood of catastrophic events occurring over the past half-century, and those steps are highlighted on the timeline with other major agreements for DRR are:

1971 - United Nations Disaster Relief Office (UNDRO)

- ✓ To promote the study, prevention and prediction of natural disasters,
- ✓ To assist governments in pre-disaster planning,
- ✓ To improve national warning systems for disaster.

1990-1999 - The International Decade for Natural Disaster Reduction (IDNDR) : The UN General Assembly proclaimed the International Decade for Natural Disaster Reduction from 1990 to 1999. Activities addressed hazards and hazard reduction, resilience was also a focus in discussions of disaster reduction and sustainable development.

1994 - Yokohama Strategy and Action Plan, World Conference on Disaster Reduction, Yokohama, Japan: From May 23rd to the 27th, 1994, delegates from all over the globe gathered in Yokohama, Japan, for the World Conference and approves the World Conference's Yokohama Strategy and Action Plan. Proactive prevention approach, was promoted in the Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation (United Nations 1994). In this strategy, the close links between risk, disaster reduction, sustainable development, environmental protection, and poverty alleviation became apparent.

1999 - International strategy for Disaster Reduction (ISDR) : As the successor to IDNDR in 2000, the International Strategy for Disaster Reduction (ISDR) was designed to foster this need by proceeding from the previous emphasis of protection against hazards to a process involving awareness, assessment and management of risk.

2002 - The Johannesburg Plan of Action: When the World Summit on Sustainable Development was held in Johannesburg, South Africa, in August and September 2002, it included a specific Strategy for Disaster Reduction within the International Agenda for Sustainable Development.

2005-2015 Hyogo Framework for Action (HFA): During the second World Conference on Disaster Reduction in 2005, 168 states adopted the first global framework for DRR. The Hyogo Framework is a global document; as such, it addresses DRR issues in all types of environments and settings. The UNISDR was tasked with the implementation of the Hyogo Framework for Action (HFA), agreed to by the 168 member states of the United Nations in 2005.

2011 - Istanbul Programme of Action (IPoA): charts out the international community's vision and strategy for the sustainable development of LDCs with a focus on developing their productive capacities during the decade 2011-2020.

2012 - Rio+20 The Future We Want: Rio+20 the short name for the United Nations Conference on Sustainable Development held in Rio de Janeiro, Brazil, in June 2012 resulted in a focused political outcome document which contains clear and practical measures for implementing sustainable development.

2015-2030 - Sendai Framework for Disaster Risk Reduction: The Sendai Framework for Disaster Risk Reduction aims to achieve, over the next 15 years, a substantial reduction of disaster risks and loss of lives, livelihoods, and health and the economic, physical, social, cultural, and environmental assets of people, businesses, communities, and countries by preventing new disaster risks and reducing existing ones through the implementation of integrated and inclusive measures that strengthen resilience (SFDRR 2015).

Paris Agreement, 2015 - The Agreement is a legally binding international treaty. It entered into force on 4 November 2016. 194 Parties (193 States plus the European Union) have joined the Paris Agreement. The Agreement includes commitments from all countries to reduce their emissions and work together to adapt to the impacts of climate change, and calls on countries to strengthen their commitments over time.

2030 Agenda for Sustainable Development - was launched by a UN Summit in New York on 25-27 September 2015 and is aimed at ending poverty in all its forms. It is grounded in the Universal Declaration on Human Rights and international human rights treaties and emphasises the responsibilities of all states to respect, protect and promote human rights.

Session 9.2 - The Sendai Framework for Disaster Risk Reduction (2015-2030)

In Sendai, Japan, on March 18th, 2015, the third United Nations World Conference endorsed the Sendai Framework for Disaster Risk Reduction, 2015-2030. Consultations with stakeholders began in March 2012 and intergovernmental negotiations that took place from July 2014 to March 2015, with the support of the United Nations Office for Disaster Risk Reduction per a request from the United Nations General Assembly.

Compared to its predecessor, the Hyogo Framework for Action, the Sendai Framework is an improvement since it expands coverage to include technical dangers and natural ones. In addition to radioactive, nuclear, biological, and other types of threats, technology poses chemical and industrial risks. The framework acknowledges the importance of having the full support of political leaders in each country. Disaster risk reduction is a collective effort that includes not just state actors but also local governments, businesses, and non-governmental organisations.

Seven global targets have been agreed upon to aid in the assessment of worldwide progress toward the end and purpose of the present framework. The aim and goal of the current framework is assisted by using national targets and indicators.

The seven global targets are:

- (a) Reduce the average global disaster mortality rate (per 100,000 death due to disaster) by 2030 compared to the period 2005-2015;
- (b) Reduce the average number of people affected (per 100,000) globally by 2030 compared to the period 2005-2015
- (c) Reduce the economic loss (direct) due to disaster in relation to the global gross domestic product (GDP) by 2030;
- (d) By developing resilience in critical infrastructure to reduce the damage to critical infrastructure and disruption of basic services like health and educational facilities by 2030;
- (e) Countries with disaster risk reduction strategies at the national and local levels must be increased by 2020;
- (f) For the implementation of the present framework, international cooperation must be enhanced to complement the national actions of developing countries through adequate and sustainable support.

- (g) Availability and access to multi-hazard early warning systems, information about disaster risk and assessments to people must be increased by 2030.

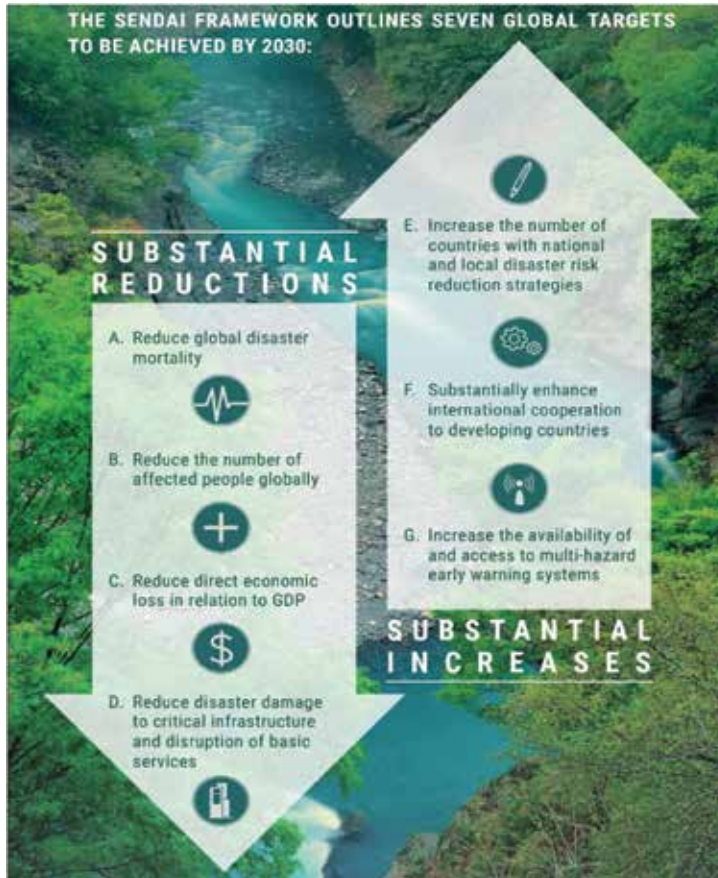


Fig 22. Outlines of Sendai Framework

(Source: UNDRR <https://www.undrr.org/implementing-sendai-framework/what-sendai-framework>)

To prevent and lessen the impact of disasters, the Sendai Framework for Disaster Risk Reduction 2015-2030 sets forth four distinct areas of focus:

Priority 1. Understanding disaster risk

Disaster risk management must be grounded in thoroughly comprehending disaster risk across its many dimensions, including susceptibility, capability, exposure of people and property, hazard characteristics, and the surrounding environment. This information can be used in various contexts, including risk analysis, prevention, mitigation, preparation, and response.

Priority 2. Strengthening disaster risk governance to manage disaster risk

Effective national, regional, and global disaster risk governance considerably aid prevention, mitigation, readiness, response, recovery, and rehabilitation. Collaboration and friendship are fostered.

Priority 3. Investing in disaster risk reduction for resilience

Economic, social, health, and cultural resilience, as well as environmental resilience, can all be bolstered by public and private sector investment in disaster risk mitigation and reduction through structural and non-structural methods.

Priority 4. Building back better through relief efforts and catastrophe recovery, rehabilitation, and reconstruction.

Disasters have demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of a disaster, is a critical opportunity to “Build Back Better”, including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters.

Guiding principles:

The following principles will serve as the basis for the framework, which will be implemented in a manner that is consistent with domestic law and international duties and commitments and takes into account any relevant national circumstances.

- (a) The primary duty for preventing and reducing disaster risk rests with each State, including working together across international, regional, sub-regional, transboundary, and bilateral boundaries. Disaster risk reduction is a priority for all countries, and sustained international cooperation can help developing nations improve their disaster preparedness policies and practices in light of their unique conditions and resources.
- (b) Responsibility for disaster risk reduction must be shared between national governments and the necessary national authorities, sectors, and stakeholders, according to each country's unique context and system of governance.
- (c) Promoting and safeguarding all human rights, especially the right to development, while mitigating the effects of potential calamities is the ultimate goal of disaster risk reduction.

- (d) All facets of society must work together to reduce disaster risks. It also calls for people to be given a voice and for disaster relief efforts to be open to all community members regardless of socioeconomic status. Women and young people should be encouraged to take leadership roles, and all policies and practices should account for the experiences of people of all ages, abilities, and cultures. Improving citizens' organised volunteer efforts is particularly important in this regard.
- (e) Clear circulation of responsibilities and coordination across sectors and with relevant stakeholders at different levels along with state institutions (executive & legislative) at the local and national levels decides the disaster risk reduction and management.
- (f) While national and federal state governments play an essential role in enabling, guiding, and coordinating efforts to reduce disaster risk, local authorities and communities must be given the tools they need, including funding, incentives, and decision-making authority where appropriate.
- (g) Exchange and dissemination of disaggregated data (including sex, age, disability etc.) and multi-hazard approach is essential for Disaster risk reduction.
- (h) Coherence between sustainable development and growth, food security, health and safety, climate change and variability, environmental management, and disaster risk reduction agendas should be a goal of developing, strengthening, and implementing relevant policies, plans, practises, and mechanisms. In order to reach the goal of sustainable development, disaster risk reduction is crucial.
- (i) Although the causes of disaster risk may have a regional, national, or even global reach, disaster risks have regional and local features that must be understood in order to determine how to mitigate disaster risk.
- (j) Public and private investments that take catastrophe risk into account are more efficient than relying solely on post-disaster response and recovery and are better for sustainable development.
- (k) Building back better and raising public awareness of disaster risk are both important in the post-disaster recovery, rehabilitation, and reconstruction period.
- (l) Effective catastrophe risk management requires strong global collaboration and increased international cooperation, including the fulfilment of official development assistance promises by rich nations.

- (m) Finance, technology transfer, and capacity building from developed countries and partners must be sufficient, reliable, and timely for developing countries, particularly the least developed countries, small island developing states, landlocked developing countries, and African countries, as well as middle-income and other countries facing specific disaster risk challenges.

Increased catastrophe risk calls for greater disaster response preparedness, proactive measures before disaster strikes, and adequate resources for effective post-disaster rebuilding. The time spent on clean-up, repair, and rebuilding is a crucial window for improvements, such as incorporating disaster risk reduction strategies into development efforts.

Till year 2030, it is intended to significantly reduce disaster risk and losses in human lives, livelihoods, health, and economic, physical, social, cultural, and environmental assets.

Session 9.3 Institutional Mechanism for Disaster Management in India

In earlier days, disaster is managed through:

- Famine Codes
- Relief Manuals of State

With time government put the management of disaster within the Ministry of Agriculture. The obvious reasons, the government and other authorities considered only the flood and drought as a concerned disaster. But with strikes of major disasters (such as Latur earthquake 1993; Orrisa Supercyclone 1999 Gujarat earthquake 2001) in different parts of India, government set up a High Powered Committee (HPC) for the review of the scenario and submitted its report in 2001. The Tsunami of 2004 became the precipitating factor for enacting the Disaster Management Act 2005.

The Disaster Management bill, after being passed by both houses and after the consent from the president of India on December 2005, Disaster Management (DM) Act 2005 came to be in effect.

The DM Act defines disaster management as “a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for:

- i) Prevention of danger or threat of any danger
- ii) Mitigation or reduction of risk of any disaster or its severity or consequences
- iii) Capacity building
- iv) Preparedness to deal with any disaster
- v) Prompt response to any threatening disaster situation or disaster
- vi) Assessing the severity or magnitude of effects of any disaster
- vii) Evacuation, rescue and relief
- viii) Rehabilitation and reconstruction”

The Act, therefore, attempts to define and deal with disasters in a holistic way, linking causes, both natural and man-made, impacts, including life, property and environment, and developing a disaster management plan that includes not only the post disaster aspects of response, relief and reconstruction, but also the pre-disaster aspects of prevention, mitigation and preparedness at national state and district level.

For this, the Disaster Management Act, 2005 (DM Act, 2005) lays down institutional and coordination mechanisms for effective disaster management (DM) at the national, state, and district levels. As mandated by this Act, the Government of India (GoI), created a multi-tiered institutional system at each level.

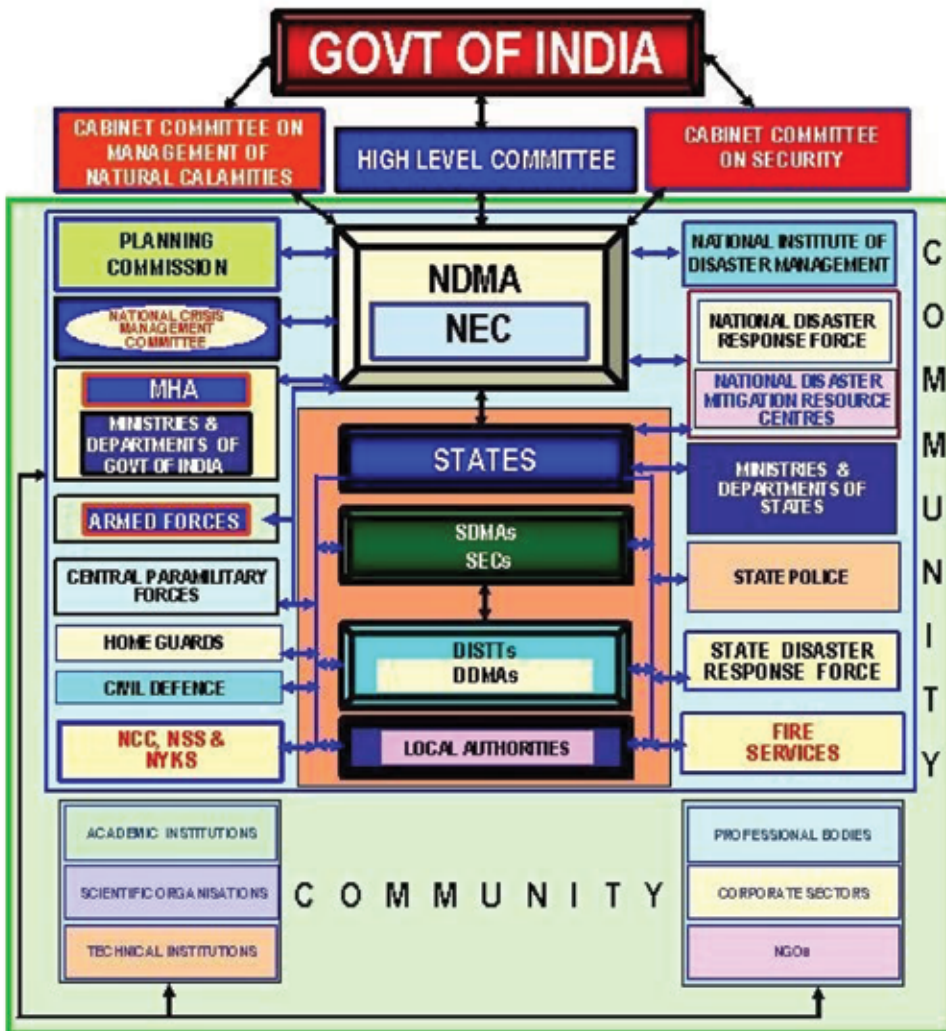


Fig 23:-Institutional setup for disaster management in India

(Source: Gupta, P. S. (2014) <https://shorturl.at/afEM8>)

At National Level

National Disaster Management Authority (NDMA): At the national level, the Ministry of Home Affairs is the nodal Ministry for all matters concerning disaster management. The Institutional structure consists of a chairperson and members not exceeding nine. The Prime Minister of India act as an ex officio chairman of NDMA and nominates a vice chairperson from its members. It lays down Policies, Plans, and Guidelines for ministries, departments and state authorities. National Disaster Management Authority has the power to constitute an advisory committee and a National Executive Committee (NEC) to assist it. It can also provide relief in loan repayment in case of a disaster of severe magnitude. It supports other countries in an emergency on behalf of central government determination.

National Executive Committee (NEC) under the chairmanship of the Home Secretary to assist the Authority, it as a coordinating, implementing, and monitoring body for the implementation of the national policy. It prepares a National Plan with help of state government and other experts and to be approved by NDMA. It ensures the compliance of directions given to ministries, departments and other authorities.

National Institute of Disaster Management (NIDM): Its broad functions are capacity building and training in all areas of disaster management. It has been actively involved in developing training modules, conducting research and documentation, assisting in policy formation, and human resource development. Nevertheless, it assists in training members of Central and State governments in previewing disaster management and risk reduction. NIDM is also required to network with various research and training institutions for sharing of knowledge and resources.

National Disaster Response Force (NDRF): Constituted by upgradation/ conversion of 8 standard battalions of the Central Para-military Forces as specialist force which is activated in case of disaster situations for rescue and response. Units of this force will work under the general superintendence, direction and control of the NDMA. Each battalion will provide 18 self-contained specialist search and rescue teams of 45 personnel each including engineers, technicians, electricians, dog squads and medical/paramedics.

At State Level

State Disaster Management Authority (SDMA): State Disaster Management Authority is established and functions at the state level. The state-level authority also consists of a chairperson and members not exceeding nine.

Chief Minister of a state is the ex-official chairman of SDMA. A state executive committee at the centre is established for the essential support to SDMA and enforce guidelines, estate executive committee is established at the state level. SDMA lays down and approves the policies and plans based on guidelines for national disaster management plans. It also has the power to review the mitigation and capacity building programme integration with the development programme from time to time.

State Executive Committee (SEC): On a similar pattern to the national executive committee in the estate, there shall be a constitution of the state executive committee for the support of a state disaster management authority. The executive committee also constitute some sub-committees for the efficient discharge of function. The State executive committee of any state coordinates and monitor the implementation of state plan and policies along with national plan and policies. Along with the examination of the vulnerability of the State, it also lays down guidelines and monitors them in the functioning of departments.

State Disaster Response Force (SDRF): The states have been advised to set up their own Specialist Response Forces for disaster response. The existing resources of the state armed police, fire and rescue services, Home Guards, Civil Defence, etc., would be the sources from which the SDRFs may be constituted to generate specialist response. They will also include women members for looking after the needs of women and children. NDRF battalions also assist the states/UTs in this effort.

At District Level

District Disaster Management Authority (DDMA) is constituted for the implementation at the district level. It consists of a chairperson and seven-member. District magistrate or collector or deputy commissioner act as ex Officio chairperson, and can elect local authority representatives to act as co-chairperson. District disaster management authority prepares the response plan for the district and coordinates and monitors the national plan, policy, and guidelines along with state plan Policies and guidelines. It also ensures the order of disaster mitigation and preparedness programmes along with response and relief measures.

Discussion: Disaster Management Plans

The **National Disaster Management Plan (NDMP)** of India, overseen by the National Disaster Management Authority (NDMA), serves as a comprehensive framework for disaster management. NEC prepares the National Plan for

Disaster Management based on the National Policy on Disaster Management. NEC will monitor the implementation of guidelines issued by NDMA (NPDM 2009). The plan was first drafted in 2016 which is updated later in 2019. NDMP vision is to make India disaster resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets - economic, physical, social, cultural, and environmental - by maximizing the ability to cope with disasters at all levels of administration as well as among communities. It encompasses policies and strategies for multi-hazard disaster management, emphasizing prevention, mitigation, preparedness, response, and recovery. It delineates the roles of key institutions, outlines measures for risk reduction, early warning systems, preparedness, and capacity building. The NDMP emphasizes community involvement and international cooperation. It addresses recovery and reconstruction post-disaster and highlights the importance of continuous monitoring and updating to ensure effectiveness.

State Disaster Management Plan (SDMP) are the disaster management plans documented and prepared by each state and UTs of the country as per the guidelines given by the NDMA in lines with NDMP. States/UTs have to accord highest priority to building up their own DM capabilities. Plans at all levels will be made in consonance with the guidelines and provisions in the DM Act, 2005. State Plan in accordance with the guidelines laid down by the NDMA, coordinate the implementation of the State Plan, recommend provision of funds for mitigation and preparedness measures and review the developmental plans of the different departments of the State to ensure integration of prevention, preparedness and mitigation measures. (NPDM 2009). Preparation of SDMP is mandatory to established legal framework, preparedness, mitigation and response and DRR strategies as required in the state. SDMPs address specific regional risks and vulnerabilities.

District Disaster Management Plan (DDMP): DDMA are responsible to prepare the District DM plan for the district and monitor the implementation of the National Policy, the State Policy, the National Plan, the State Plan and the District Plan. DDMA also ensure that the guidelines for prevention, mitigation, preparedness and response measures laid down by the NDMA and the SDMA are followed by all Departments of the State Government at the District level and the local authorities in the district (NPDM 2009).

Sub Module - 10

Public Health Emergency

Session 10.1 Disaster epidemiology

Health emergencies and natural catastrophes pose various threats to people everywhere. Regularly, people are exposed to hazards, some of which have little effect on their health. In contrast, others have the potential to escalate into catastrophes or disasters with far-reaching effects on the population's health, quality of life, and prospects for improvement. Acutely and in the longer term, these events can have disastrous effects on health, the economy, politics, and society. The incidence, severity, and implications of many different forms of emergencies are on the rise due to climate change, unplanned urbanisation, population increase, migration, and state instability. Protecting people's health in the face of emergencies and catastrophes, building the resilience of communities, governments, and health systems all depend on the effective management of these risks.

Epidemiology of disasters is the study of the effects of disasters on human populations, with an emphasis on forecasting future disasters' consequences by collecting and analysing data. Experts can swiftly identify needs, develop suitable responses, assemble essential resources, and guide recovery activities if they have a thorough understanding of how a disaster might affect the health and function of communities (Noji, 1996).

There are two main methods used in the epidemiological study of disasters. A primary focus should be on learning more about what went wrong to bring about the catastrophe. In this case, the emphasis may be on the occurrence itself or the mortality and morbidity rates resulting from it.

Understanding the root causes of disasters is crucial for future population-based preventative efforts. Methods of epidemiology can also be used to study post-disaster relief efforts. Direct applications of epidemiology in this context include setting up surveillance systems to detect injuries and the emergence of communicable and mental health diseases, utilising rapid needs assessment to determine and prioritise solutions to existing problems, and conducting analytical studies of risk factors and the natural history of health events. Managing risks and mitigating the effects of routine and emergency events caused by all hazards falls squarely within the purview of health systems at all levels.

Session 10.2 International health frameworks

Alma-Ata Declaration

The Declaration of Alma-Ata was adopted at the International Conference on Primary Healthcare in September 1978 in Alma-Ata, Kazakhstan. It calls for immediate action from all governments, all health and development workers, and the international community to protect and promote the health of all people. In the history of international declarations, this one was the first to highlight the significance of PHC. Primary health care was recognised as the key to achieving the Health for All goal in the Alma-Ata Declaration of 1978, widely regarded as a major public health achievement of the 20th century. Since then, the primary healthcare strategy has been recognised by WHO member countries as essential at least initially in developing countries. Five years later, this rule was implemented in every other nation.

UNICEF's GOBI – FFF Programmes

James P. Grant of UNICEF devised a method in 1983 called GOBI, an acronym for the four low-cost, high-impact, knowledge-mediated approaches essential to halving child mortality.

The measures defined under the programme were:

- **Growth Monitoring:** Tracking infant height and weight gains over time to deduce the nutritional requirements. Which may aid mothers in preventing malnutrition in their children.
- **Oral Rehydration:** This can save the loss of life of more than 4 million young children annually due to diarrhoeal dehydration. Intravenous feeding of a saline solution was previously the only effective treatment for dehydration, but this is out of reach for most needy people. A mother can rehydrate her infant at home by giving her child a solution of salts, sugar, and water. Oral rehydration therapy (ORT) could save the lives of most of these kids. It's one of the simplest, most game-changing discoveries ever made.
- **Breast-Feeding:** This guarantees that children receive the finest nutrition and have a high level of immunity against common infections for the first six months of their lives. Breast milk is more nourishing and hygienic and offers some infection immunity to infants.
- **Immunisation:** This can protect a child from illnesses including polio, diphtheria, whooping cough, tetanus, and measles. These illnesses

cause the deaths of an estimated 5 million young children each year, leave another 5 million disabled, and play a significant role in child malnutrition.

Public health emergency of international concern (PHEIC)

Public health emergencies of international concern (PHEICs) are situations that are "serious, sudden, unusual, or unexpected" and which "have implications for public health beyond the affluent" when declared by the World Health Organization (WHO). The International Health Regulations (IHR) of 2005 mandate a rapid response from governments in case of a PHEIC.

Session 10.3 Health Emergency and Disaster Risk Management (EDRM)

An important step in meeting the problem of "universal health coverage, for health security, and health for all" is this Health Emergency and Disaster Risk Management (EDRM) Framework. It stresses the need for prevention, preparedness, readiness, reaction, and rehabilitation to save lives and maintain health. It emphasises the importance of collaboration since EDRM is never the sole responsibility of a single industry or government body. It demonstrates how the entirety of the healthcare system can and should play a crucial role in these initiatives. Current and future threats to public health necessitate a consolidation of modern concepts and practise through the conceptual framework or paradigm of "health emergency and catastrophe risk management," which aims to better coordinate, utilise, and manage available resources (World Health Organization, 2019). Regarding health and other sectors, it is crucial to design and implement national, regional, and global policies, but doing so requires careful risk management.

Health EDRM focuses on preventing and mitigating possible emergencies and disasters, rather than just responding to existing emergencies and crises, and on strengthening the resilience of communities and nations. Comprehensive Health EDRM employs a wide variety of risk management measures to address a wide variety of natural, biological, technological, and sociological hazards through the widespread engagement of the health system and different sectors, with a strong focus on the community (e.g., primary prevention and recovery in addition to emergency preparedness and response) (WHO, 2019).

Health EDRM connects the broader EDRM community with those working in the health sector. Its goal is to give people working for better health outcomes and well-being for communities at risk of catastrophes and disasters a common language and an adaptive methodology they can use.

The SDGs (particularly target 3d), the Sendai Framework, and the Paris Agreement are all strengthened by this project, as is the execution of the IHR (2005), a foundational document for the growth of national Health EDRM capacities. These pacts are most useful when used collectively, rather than singly, because of how they reinforce one another. It also acknowledges the importance of primary health care and the provision of secondary and tertiary services in mitigating health risks and minimising health-related effects during times of emergency or disaster.

To ensure that "no one is left behind," Health EDRM represents a major advancement in the transformation of an existing policy, practise, and culture to advance health, safeguard the global community, and meet the needs of those who are marginalised.

Session 10.4 One Health approach

In order to achieve the best possible health outcomes, it is necessary to use a collaborative, multi-sectoral, and trans-disciplinary strategy known as "One Health," which works at the local, regional, national, and international levels. It acknowledges that animal and environmental health are inextricably intertwined with human health. The concept of "One Health" is not novel, but its significance has increased in recent years. This is due to the many variables that have altered human, animal, and plant interactions.

The One Health approach can:

- Take measures to halt the spread of zoonotic diseases from animals to humans.
- Boost the reliability of our food supply.
- Decrease the prevalence of illnesses resistant to antibiotic treatment, and boost the health of both humans and animals.
- Maintain worldwide health safety.
- Useful in addressing complex problems such as chronic illness, mental health, injury, occupational health, and NCDs.



Fig 24. One Health Concept

(Source: WHO 2021 <https://www.who.int/news/item/01-12-2021-tripartite-and-unep-support-ohhlep-s-definition-of-one-health>)

Zoonotic diseases, antibiotic resistance, food safety and food security, vector-borne diseases, environmental contamination, and other concerns affecting the health of humans, animals, and the planet are all manifestations of the One Health approach. The human population is increasing and spreading to new locations. Because of this, more individuals now share their homes with various species of animals. Animals provide vital purposes in human society, whether we use them for sustenance, clothing, transportation, income, leisure, learning, or friendship. Because of the increased potential for disease transmission from such close contact, it is important to minimise such interaction between animals and humans.

Deforestation and other forms of intensive farming have altered the planet's climate and landscape. Changes in weather and habitat create new entry points for infectious pathogens to infect animals. International travel and trade have increased the flow of people, animals, and products worldwide. Thus, diseases can easily cross international boundaries and spread worldwide.

There has been an increase in historically prevalent (endemic) and newly emerging zoonotic diseases due to these shifts. Millions of humans and animals are exposed to zoonotic infections each year. Diseases that can be transmitted from animals to humans include:

COVID-19, Ebola, Rabies, Anthrax, Brucellosis, Lyme disease, Ringworm, Salmonella infection, West Nile virus infection, West Nile virus infection, etc.

According to CDC, some diseases and environmental risks can affect animals in the same way they can humans. This makes them potentially useful as early indicators of sickness in humans. For instance, the West Nile virus kills many birds before it ever infects a human being in the same location.

Collaboration between human, animal and environmental health organisations is essential for effective public health initiatives. Communicating, collaborating, and coordinating activities among professionals in human health (doctors, nurses, public health practitioners, epidemiologists), animal health (veterinarians, paraprofessionals, agricultural workers), environmental health (ecologists, wildlife experts), and other fields is essential. Pet owners and law enforcement officials might also play important roles in a One Health framework, along with lawmakers, farmers, and members of communities. The best health outcomes for humans, animals, and plants living together in the same space can be attained through a One Health strategy by encouraging collaboration across all sectors.

Sub Module - 11

Role of Financing in Disaster Management

Session 11.1 Disaster risk financing

Disaster risk financing and insurance is a growing idea developed to protect countries from the financial repercussions of natural disasters such as earthquake, flood, cyclones etc. Developing countries are highly exposed to the economic and fiscal shocks caused by major disaster. A comprehensive plan can provide quick, low-cost cash to support recovery efforts once a disaster has occurred. In most cases, governments will employ tactics tailored to each recipient to increase their financial resilience.

Sovereign Disaster Risk Financing

- Provides incentives for investment in risk reduction.
- Clarifies the government's potential responsibility for damaged public property, private businesses, and state-owned enterprises, as well as for the impoverished, in the aftermath of natural catastrophes.
- Enhances the ability to respond financially and to rebuild after disasters;
 - ✓ Insurance of public assets;
 - ✓ Resource allocation, mobilisation and execution;
 - ✓ Social safety net financing.
- As a result of a decrease in the yearly fluctuations in the cost of disasters, government spending is more stable.

Property Catastrophe Risk Insurance

- Access to financial support for direct and indirect losses due to property damage.
- Helps people realise their exposure to financial risk in a natural disaster.
- Spreads the responsibility for recovery and the associated risks among the public and private sectors.
- Has the potential to motivate spending on risk mitigation.

Agricultural Insurance

- It ensures that those who suffer losses in production or see their productive assets damaged can file a claim and receive compensation.
- Spreads the responsibility for recovery and the associated risks among the public and private sectors.
- It helps people realise their monetary exposure to agricultural risks and better understand those risks.
- Has the potential to motivate spending on risk mitigation.
- It paves the way for the use of riskier, higher-yielding farming techniques.
- It Benefits Low-Income Families by Providing More Opportunities to Use Financial Services and Markets (insurance, banking, savings).

Disaster-linked Social Protection

- This raises people's sensitivity to their susceptibility to natural calamities and helps them learn how to protect themselves better.
- Protects against calamity by compensating victims of unforeseen events who have suffered a loss of income or property.
- Protects those People at risk of falling into poverty.
- Has the potential to motivate spending on risk mitigation.

Session 11.2 Case Study: Programmes for disaster risk financing

Disaster Risk Financing and Insurance Programme (DRFIP) is a joint initiative of the World Bank Group's Finance, Competitiveness, and Innovation Global Practice and the Global Facility for Disaster Reduction and Recovery (GFDRR), established in 2010 to improve the financial resilience of governments, businesses, and households against natural disasters.

When creating and implementing comprehensive financial protection policies, DRFIP is a key partner of developing countries. By combining sovereign disaster risk finance, crop insurance, property catastrophe risk insurance, and scalable social protection programmes, this project helps governments adopt comprehensive financial protection measures. DRFIP also provides aid to nations in need of disaster preparedness. Governments can often use this to better collaborate with the private sector, resulting in more productive public-private partnerships.

The DRIP focuses on four primary areas to improve national and local government, homes, companies, agricultural producers, and low-income residents' ability to respond rapidly and resiliently to disasters:

1. **Sovereign Disaster Risk Finance:** The government's potential responsibility for damaged public property, private businesses, and state-owned enterprises, as well as for the impoverished, in the aftermath of natural catastrophes. It enhances the ability to respond financially and to rebuild after disasters. Provides incentives for investment in risk reduction. As a result of a decrease in the yearly fluctuations in the cost of disasters, government spending is more stable.
2. **Market Development:** Increases a country's financial resilience in the face of natural disasters by empowering governments to take action and create a favourable climate for private market growth.
3. **Analytics:** Improves the government's ability to make financially responsible judgments on disaster risk financing.
4. **Knowledge Management & Global Partnerships:** Provides information that stakeholders can use to take steps toward establishing financial stability.

Session 11.3 Disaster management financing in India

In India the aspect of disaster risk finance and insurance is almost negligible for pre-disaster context state and is still centred on post disaster relief and recovery. The Finance Catastrophe insurance is an underdeveloped sector whose importance has not been realised yet. Further, the reinsurance market for catastrophic losses is also underdeveloped in India. Reducing or controlling catastrophe exposure is yet to be a significant driver in reinsurance buying decisions for Indian insurance companies. However, budgeting on a national and state scale; developing a fresh way of estimating the Disaster Response and Mitigation fund and the financial support for preventative and emergency measures are now allocated by the government and distributed to Centre and different states. The present scenario in India is that in the event of a disaster, relief expenditure is met from State Disaster Relief Fund (SDRF). In case of severe calamities, the National Disaster Relief Fund (NDRF) supplements the funding available from SDRF.

Allocation of Funds in Management Segment

Currently, twenty percent of the national and state corpus for disaster management funds was set aside for prevention and education, while eighty percent went for relief efforts. The response fund is further divided into three categories: response and relief, recovery and reconstruction, and capacity building, with each category receiving 50%, 37.5%, and 12.5% of the total.

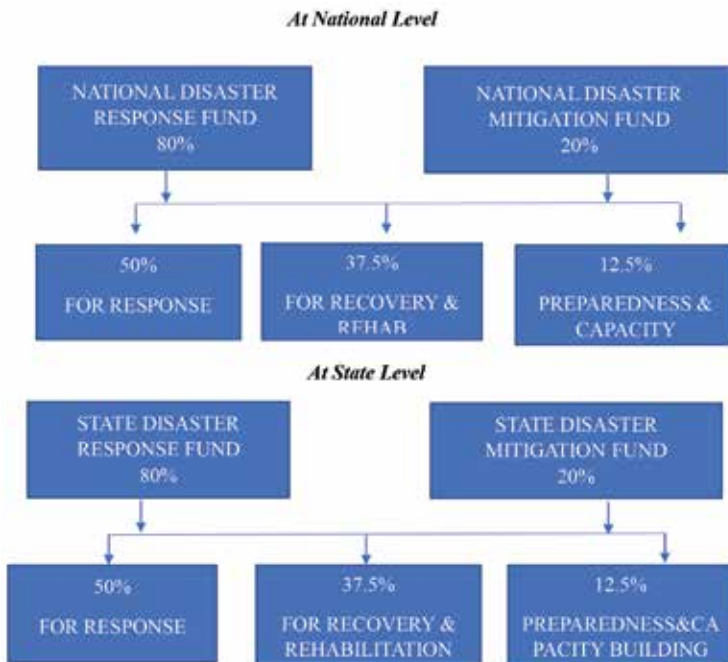


Fig 25. Financial Resource Allocation Outline (Source: NDMA)

Sub Module - 12

Role of Ethics in Disaster Management

What is beneficial for people and society is the subject of ethics, often known as moral philosophy. Essential help, such as transportation, emergency food and water, and medical supplies, must be delivered to the right place immediately following a disaster. A concerted interdisciplinary response can only accomplish this. Responders to natural disasters may face unusual scenarios where the standards of conduct that govern normal medical and emergency circumstances no longer hold. Ethical dilemmas can arise when one has to choose between two unacceptable courses of action or two moral rules that seem to conflict with one another (Jenson, 1997, p. 8).

The morality of decisions made during a disaster depends on the fundamental truths of what is right and wrong, on the assessment of how these universal rights and wrongs might be applied to disaster conditions, and ultimately on the ethics of the decisions themselves. Ethical dilemmas have sparked controversy and passionate debate for decades. A tale by Garrett Hardin (2001), titled "Lifeboat Ethics," describes some of the challenges of making ethical decisions when needs exceed available resources. Decisions on who stays in the lifeboat, who gets to leave, and who is denied entry can all be understood through the lens of many ethical systems. The bigger mystery is who gets to choose who stays on shore and who goes with the current. Difficult choices must be made when food and medicine are few, like in a famine or a natural disaster. Two main frameworks can be used to make ethical decisions: the end-justifying-the-means principle and utilitarianism.

If there is extensive destruction, death, and injury, the local community may not be able to handle it alone. Responders (doctors, nurses, aid workers, or military personnel) often express moral disappointment and frustration with the ethical decisions they are forced to make during crises. In a world where disruption is constant, ethical standards help keep businesses steady. (Ahayalimudin, et al, 2017).

Triage should be used when a large number of individuals are affected by the disaster and limited access to life-saving resources such as water, medicine, and antiseptic equipment.

When several patients require treatment at once, a healthcare situation arises that calls for applying certain principles. When demand exceeds available resources, decisions must be made about who gets care first. "Triage," derived from the French verb *trier*, which means "to sort, sift, or select," describes this procedure. This procedure aids in making sure that nobody gets left behind and everyone receives the care they require.

Moral judgement is required during a triage situation. Triage identifies patients in urgent need of care and prioritises their treatment. Some characteristics, such as age, gender, and socioeconomic status, are ignored in the triage process. The treatment-related survival rate is the sole metric. In order to defend triage from an ethical standpoint, it is helpful to have a broad context, such as the Ethics of Consequences. The ethical principle of justice as fairness is revealed by the fact that survival is the sole criterion that should be considered to decide who is treated. The ultimate goal of triage is to save lives that are in danger. When medical personnel and supplies are just inadequate to treat everyone in a mass casualty occurrence, how should they be handled ethically? (Repine et al., 2005).

Medical professionals in disaster management go above and beyond bioethical concepts to use standards of ethical conduct as a framework for individual, organisational, and societal decision-making.

Different Ethical approaches to address this issue:

- Consequential approach
- Capabilities approach of Amartya Sen
- Virtue ethics
- Enlightenment & Romanticism philosophy
- Immanuel Kant's categorical imperative
- Bertrand Russell's Social Reconstruction
- Gandhian philosophy

Classical philosophers like Aristotle (1869), Kant (1990), Mill (1867), and Rawls (2001) all agree that ethical concerns play a significant role in determining the path an organisation chooses to fulfil its stated goals. In today's ever-evolving and complex business environment, ethics can be a foundation upon which an organisation can rely.

Sub Module - 13

Demonstrations & Field Visit with Exercise

Mock drills, demonstrations, and field visits play a crucial role in disaster management trainings. This submodule engages the trainees in group activities through practical experience and knowledge gained and to plan and facilitate training workshops in participatory and practical manner towards co-management of disasters. This session introduces future trainers to the necessity of adapting training materials to their trainees' needs.

A field visit is a journey by a group of people to a place away from their normal environment. A field visit is very helpful for supplementing the theoretical knowledge. It aids to interlink the facts with the practical field and teaches its significance. It builds interest of the trainers to get more about the places and the world around us and increase their awareness.

In training workshop a trainee must have to learn to operate the equipment, skill development techniques used during emergency such as:

- Ham radio
- Fire extinguisher working
- Lifesaving skills such as first aid and CPR
- Early warning system demonstration, and
- Other essential system

Main Objective of performing demonstrations, mock drills and field visits with exercises is to let participants assess the preparedness in any situation. The hands on experience gives practical opportunities to enhance their skills, become familiar with the resources and equipment and work on their coordination skills which will build confidence in them.

Demonstrations and field visits also contribute to public awareness and education. When communities actively participate in or observe these activities, they gain a better understanding of the importance of preparedness and response measures.

The feedback obtained from mock drills and field visits facilitates a process of continuous improvement. Lessons learned from each exercise can inform updates to plans, policies, and training programs.

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