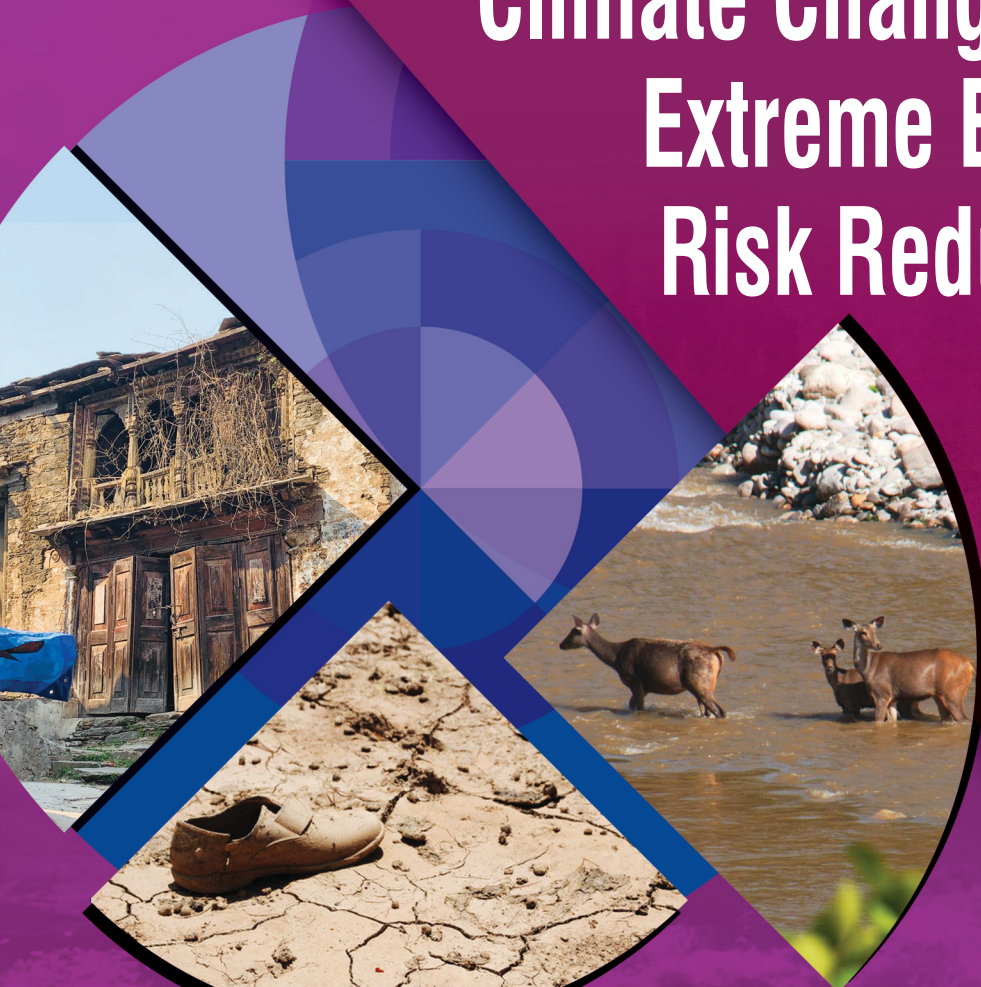




Training Manual on Climate Change and Extreme Events Risk Reduction





Training Manual on Climate Change and Extreme Events Risk Reduction



National Institute of Disaster Management (NIDM)
(Ministry of Home Affairs, Government of India)

Plot No. 15, Pocket 3, Block B, Sector 29, Rohini, Delhi 110042
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Training Manual on Climate Change and Extreme Events Risk Reduction

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Authors

Ms. Thinles Chandol

Prof. Anil K. Gupta

Ms. Fatima Amin

Maj. Gen. Manoj Kumar Bindal, VSM

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Dr. Akhilesh Gupta
Senior Advisor (DST) & Head
Strategic Programmes, Large Initiatives and
Coordinated Action Enabler (SPLICE) &
Climate Change Programme

Department of Science and Technology (DST)
Government of India
Technology Bhavan, New Mehrauli Road,
New Delhi - 110016

Message

As the world has warmed, it has triggered many other changes to the Earth's climate. Changes in extreme weather and climate events, such as heat waves and droughts, are the primary way that most people experience climate change. Human-induced climate change has already increased the number and strength of some of these extreme events. Increase in prolonged periods of excessively high temperatures, heavy downpours, and in some regions, severe floods and droughts. Heat-trapping gases already in the atmosphere have committed us to a hotter future with more climate-related impacts over the next few decades. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases that human activities emit globally, now and in the future.



This training manual on Climate Change and Extreme Events Risk Reduction developed by the National Institute of Disaster Management, New Delhi, is an important attempt towards the capacity building of relevant stakeholders. This training manual consists of five modules and has been designed for a five days course with interesting learning activities, case studies and tools to support the overall framework of the manual. The five modules are 1. Understanding climate change trends and extreme events 2. Factors of risk and vulnerability 3. Tools and methods for Assessment 4. Risk Mitigation and management 5. Mainstreaming DRR.

I would like to compliment Prof. Anil K Gupta and his team for this document. This training manual provides a distinctive platform. The manual is developed looking to the performance gaps and training needs of the following target participants: Senior to middle level officials from the state and district level officials from various departments or executives/ professionals from other government agencies/boards, programmes/schemes, including public sector, members/representatives research scholars, academicians, researchers, and students at graduate/post-graduate level. This manual will help in capacity building to mitigate adverse impacts of climate change for cross domain professionals dealing with climate change and extreme events risk reduction.

(Dr. Akhilesh Gupta)



Foreword

Extreme weather and climate events and their impacts can occur in complex combinations, an interaction shaped by physical drivers and societal forces. In these situations, governance, markets and other decision-making structures together with population exposure and vulnerability create nonphysical interconnections among events by linking their impacts, to positive or negative effect. Various anthropogenic actions can also directly affect the severity of events, further complicating these feedback loops. Such relationships are rarely characterized or considered in physical-sciences-based research contexts. Disasters are occurring all over the globe at varied degree of severity, intensity and frequency hampering our daily life activities. Climate related risks are created by a range of hazards. Some are slow in their onset, while others happen more suddenly.

The connection between climate extremes can be conceived of as complex time- and space-varying physical and societal mechanisms that relate one event to another, ultimately causing major impacts. Extreme events such as Floods, heat waves, cold waves, cloudburst, flashfloods, squall, hailstorms, etc., are increasing and it is a matter of concern worldwide because of its potential impact and damage on physical, social and environmental systems posing a great threat to the development pace in the country.

Therefore, it has become the need of the time to have a sound understanding and knowledge of climate change and extreme weather events in order to enhance the capacity to withstand any of the extreme events as consequences of climatic change. This training manual will help in training activities on concepts and understanding about the climate and weather related extreme events and holistic knowledge of extreme events and hydro-meteorological and to equip the participants with knowledge and skills for risk mitigation of extreme events, response and recovery interventions.


(Taj Hassan)

आपदा प्रबंधन महाविचार: पूरा भारत भागीदार



Prof. Anil K Gupta
Project Director, HERCAP
Professor & Head
Division of Environment,
Climate & Disaster Risk Management



राष्ट्रीय आपदा प्रबंधन संस्थान
(गृह मंत्रालय, भारत सरकार)

National Institute of Disaster Management
Ministry of Home Affairs, Govt. of India
Plot No. 15, Block B, Pocket 3, Sector 29, Rohini, Delhi 110042

Preface

The global climate has changed substantially over the last century. There is strong evidence of global climate change in the form of an increase in air and sea surface temperature, recession of glaciers, changes and shifting of climate regimes, increasing number of extreme events and sea level changes. The increasing frequency of climate change induced disasters in particular is posing a threat to resilience, lives and livelihoods at global, regional and local levels. Major ecosystems of the world have experienced several climate induced disaster events in recent past. It is human nature to be somewhat resistant to change as long as people are comfortable in their current situations. We do not want to believe or accept changes that might bring us uncertain or possibly negative impacts. Nevertheless, more people than ever before are aware of the threats associated with climate change and of the need for both mitigation and adaptation.



Climate change, disaster risk reduction, national development, and sectoral management all have direct correlations. Significant relevant knowledge and technical capacities exist, along with necessary international strategies and frameworks for action. Disaster risk reduction seeks to identify the hazards that exist in a location, based on long-term risk and the primary people, systems, and natural systems that are exposed and vulnerable to the hazard. A number of tools and methods have been developed to target these components; the composition of which has varied through time. It is extremely unlikely that all disasters will be avoided. The most extreme events will have consequences on vulnerable people and on poor countries' economies and these cannot be entirely

This manual has been especially designed with the aim to provide an insight to the trainees and build capacity of all the people working in different sector about the Disaster Risk Reduction (DRR), Climate Change Adaptation (CCA). I am sure that the contents of this publication will be useful to the trainers, professionals and related stakeholders working on different related aspects and sectors.

(Prof. Anil K Gupta)

Acknowledgement

I, on behalf of the team, acknowledge Maj. Gen. Manoj Kumar Bindal, Former ED, NIDM for his encouragement, motivation and support throughout. The preparation of this training manual has been expedited with the help of Ms. Thinles Chandol, Ms. Fatima Amin. I owe to their sincere efforts and contributions.

Guidance and inputs from Dr. Akhilesh Gupta, Advisor, Climate Change Programme, DST-GOI, is gratefully acknowledged.

Special thanks to the publication cell of NIDM for facilitating the printing and publication of this manual especially Mr. Santosh Kumar Tiwari, Ms. Sonali Jain and Ms. Karanpreet.



(Anil Kumar Gupta)

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List of Abbreviations

ADPC	Asian Disaster Preparedness Center
ARDC	Asian Disaster Reduction Center
BIS	Bureau of Indian Standard
BMZ	Federal Ministry for Economic Cooperation and Development
CAMPA	Compensatory Afforestation Management and Planning Authority
CC	Climate Change
CCA	Climate Change Adaptation
CG	Cloud-to-ground lightning
CH₄	Methane
CO₂	Carbon Dioxide
CRED	Centre for Research on the Epidemiology of Disaster
DDMA	District Disaster Management Authority
DIA	Disaster Impact Assessment
DM	Disaster Management
DRR	Disaster Risk Reduction
EA	Environmental Assessment
EA	Environmental Auditing
EIA	Environmental Impact Assessment
EM-DAT	Emergency Events Database
EMS	Environmental Management System
EWS	Early Warning System
FEAT	Flash Environmental Assessment Tool
GFDRR	The Global Facility for Disaster Reduction and Recovery
GHG	Green House Gas
Gol	Government of India

Ha	Hectare
HFA	Hyogo Framework for Action
HRVCA	Hazard, Risk, Vulnerability and Capacity Analysis
HSE	Health, Safety and Environmental
IC	Intra-cloud lightning
IDNDR	International Decade for Natural Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
IMD	Indian Meteorological Department
IPCC	International Panel for Climate Change
ITEWC	Indian Tsunami Early Warning Centre
JFM	Joint Forest Management
LCA	Life Cycle Assessment
LCD	Liquid Crystal Display
LU	Learning Unit
MoEF&CC	Ministry of Environment, Forest & Climate Change
N₂O	Nitrous oxide
NAPCC	National Action Plan for Climate Change
NbS	Nature based Solution
NDMA	National Disaster Management Authority
NDRF	National Disaster Response Force
NEAA	National Environment Appellate Authority
NGO	Non-Governmental Organization
NGOs	Non-governmental Organizations
NIDM	National Institute of Disaster Management
NOAA	National Oceanic and Atmospheric Administration
NPDM	National Policy on Disaster Management
OCHA	Office for the Coordination of Humanitarian Affairs
PDNA	Post Disaster Need Assessment

Ppb	Parts per billion
PPP	Polluter Pays Principle
SAPCC	State Action Plan for Climate Change
SAR	Search and Rescue
SDG	Sustainable Development Goals
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SEA	Strategic Environmental Assessment
SFDRR	Sendai Framework for Disaster Risk Reduction
SME	Small and Medium Enterprises
ToT	Training of Trainers
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCAP	The United Nations Economic and Social Commission for Asia and the Pacific
UNFCC	United Nation Framework Convention on Climate Change
UNGA	United Nation General Assembly
UNISDR	United Nations International Strategy for Disaster Reduction
UN-OCHA	United Nations Office for the Coordination of Humanitarian Affairs
USD	United States Dollar
WMO	World Meteorological Organisation

Basic Terminologies

Adaptive Capacity	The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
Capacity	The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.
Capacity Development	The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions.
Contingency Planning	A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.
Disaster	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.
Disaster Risk	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.
Disaster Risk Management	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 Reduction	The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to 11 hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
Early Warning System	The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.
Environmental Degradation	The reduction of the capacity of the environment to meet social and ecological objectives and needs.
Exposure	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Hydro-Meteorological hazard	Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters.
Non-Structural Measures	Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Prevention	The outright avoidance of adverse impacts of hazards and related disasters.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduces health impacts, ensure public safety and meet the basic subsistence needs of the people affected.
Risk	The combination of the probability of an event and its negative consequences.
Structural Measures	Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard resistance and resilience in structures or systems.
Sustainable Development	Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Source: UNISDR Terminology on Disaster Risk Reduction (2009)

Training Brief

Introduction to the Manual

Disasters are occurring all over the globe at varied degree of severity, intensity and frequency hampering our daily life activities. In 2018, in Asia alone 141 major extreme events occurred which includes affected countries like Afghanistan, India, China, Myanmar, Japan, Vietnam, Philippines and Indonesia, 65 disasters occurred in America in 2018, 48 in Europe and 46 in Africa. If we look into disaster type, according to the Disaster Review report by EM-DAT 2019, flood are the most frequent occurring disaster events followed by storm, but the deaths are majorly occurring by floods followed by extreme temperature which maybe a heat wave or a cold wave which is followed by storm. According to the 5th Assessment Report by IPCC, it has been clearly mentioned that the affect of climate change is occurring in three major ways-

1. Increasing surface temperature
2. Sea level rise and
3. Increase in the frequency, duration and severity of extreme events

EM-DAT report shows that the numbers of extreme events are increasing especially floods. Floods have increased to 41% in the decade of 2008-2017, which was earlier 36% in the decade of 1998-2007. Similarly, storms have also increased from 23% to 27%. Extreme events such as heat waves, cold waves, cloudburst, flashflood, squall, hailstorms, etc are also increasing and it is a matter of concern worldwide because of its potential impact and damage on physical, social and environmental systems posing a great threat to the development pace in the country. These extreme events are caused due to climate change and various other anthropogenic interventions. The number and severity of climate extreme events have been increasing. With increase in frequency and intensity of such events, it has become essential for us to understand these extreme events holistically in order to reduce its impact. India is highly prone to varying degrees to a large number of natural and man-made disasters and it is estimated that more than 44 million people are affected by natural disasters annually.

In past decade, certain areas, which were not prone to a specific hazard, have started witnessing those hazards thus causing heavy damage to economy, livelihood, property and environment. For instance, Leh, Ladakh flashflood (2010), Uttarakhand Flood (2013), Summer cyclone in Bay of Bengal-Fani (2019), Heat wave in Kerala (2019), Cyclone Amphan (2019), etc. Such disasters may cause massive loss of life, livelihood, economic structure and loss of environmental resources. Extreme events have greatest impacts on crucial sectors including water, agriculture, food security, forestry, health and tourism. Poor, elderly, infants and differently abled people are more vulnerable to extreme events.

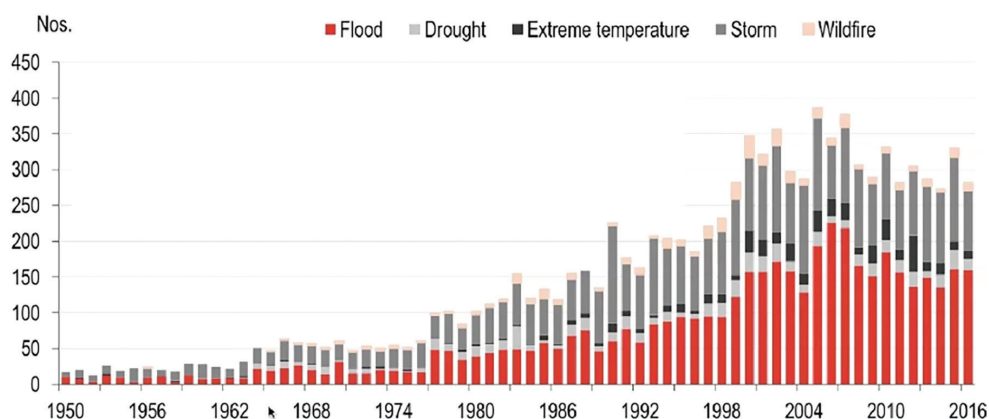


Figure 1: Global Occurrence of Extreme Events

(Source: EM-DAT: The CRED/OFDA International Disaster Database)

According to the IPCC 2012, extreme events and extreme climate events are collectively known as climate extremes and it is defined as the occurrence of climate anomalies above/below threshold causing unusual, erratic and unpredictable events, affecting a massive damage to life, property and ecosystem. Three points are clearly mentioned in the IPCC 5th Assessment report that there is an increasing trend in global surface temperature, global sea level rise and increased frequency and severity of extreme weather events. If all these three consequences of climate change occur at a time, it is going to pose a big challenge. Studies also have shown that the number of heavy rain days have increased, number of low rainfall days have decreased and on

an average number of rainfall days have significantly decreased. Due to the increase in heavy rain days there are more run-offs and less percolation that deteriorates the soil quality.

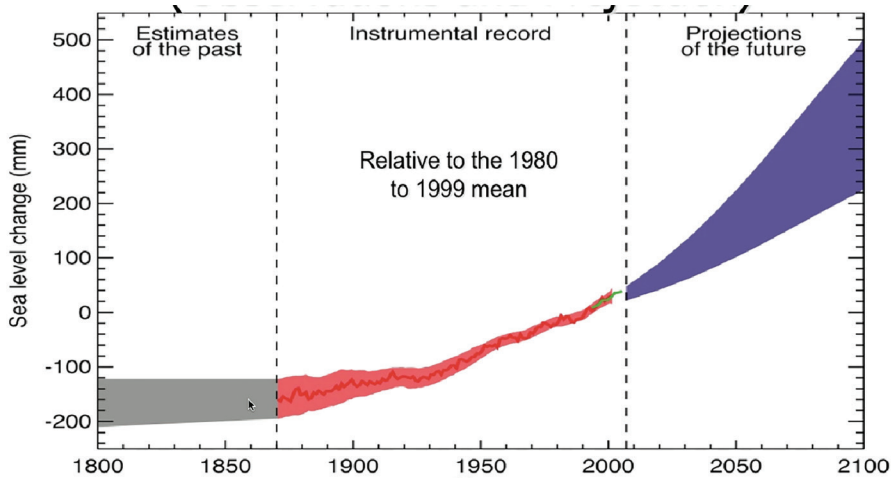


Figure 2: Global Mean Sea Level Rise (Observations and Projections)

Therefore, it has become the need of the hour to have a sound understanding and knowledge of climate change and extreme weather events in order to enhance/improve one's capacity to withstand any of the extreme events as consequences of climatic changes. This module will help in building your concepts and understanding about the climate and weather related extreme events.

Aim

The aim of this training module is to update the understanding and knowledge of the participants on aggravating cases of extreme events, climate-disaster and development nexus, causes, effect and management of extreme events, mainstreaming of CCA-DRR and effective coordination mechanism since disaster is a multi-disciplinary subject.

Training Objectives

The module is designed to enable the trainers/faculty to make the course participants to have a holistic knowledge of extreme events and hydro-meteorological and to equip them with knowledge and skills for risk mitigation/prevention of extreme events and recovery.

Training Brief

Key objectives are following:

- i. To enable understanding of the linkages of climate, disaster and development.
- ii. To enable participants with knowledge of climate change trends and increased frequency of extreme events.
- iii. To define various extreme events and hydro-meteorological disasters.
- iv. To associated causes and impacts of extreme events.
- v. To equip with knowledge and skills on understanding and assessment of risk, vulnerability and impact to extreme events.
- vi. To facilitate participants to have holistic knowledge about Risk Mitigation and Management.
- vii. To enable understanding of mainstreaming of DRR in developmental strategies.

Training Group and Audiences

The module is developed looking to the performance gaps and training needs of the following target participants:

- i. Senior to middle level officials from the state and district level officials from various departments or executives/professionals from other government agencies/boards, programmes/schemes, including public sector undertakings,
- ii. Members/representatives on non-governmental and community organizations engaged in activities to assessment, planning, implementation or monitoring of any aspect of disaster management, environment and development, etc.
- iii. Faculty members/professionals from training, education and research centres and other master trainers related to environment/ecology, disaster management, rural development, urban planning, health, forestry, land and water, agriculture, housing, etc.
- iv. Research scholars, academicians, researchers, and students at graduate/post-graduate level, etc.
- v. Private sector officials/professionals involved in water supply, environmental-health, waste management, power, industries, communication, risk management, NGOs etc.

Contents and structure of the Manual

The training manual offers a training tool with guidelines that will enable participants to develop a holistic knowledge on extreme events concerns with basic understanding of climate trends, typology of extreme events and understanding of climate-disaster and development linkages. This training manual will help provide an understanding on appropriate mitigation and preparedness measures to deal with extreme events and vulnerabilities with respect to climate change related disasters. The manual provides a good combination of theoretical and practical exercise developed from various literatures available on the subject across a range of sources.

The training manual consists of five modules and has been designed for a five days course with interesting learning activities, case studies and tools to support the overall framework of the manual. The five modules are as below:

1. Understanding climate change trends and extreme events
2. Factors of risk and vulnerability
3. Tools and methods for Assessment
4. Risk Mitigation and management
5. Mainstreaming DRR

Each module is sub-divided into Learning Units (LU).

- | | |
|------------------|--|
| Module 1: | LU 1: Climate change trends and extreme events
LU 2: Climate-Disaster and development nexus
LU 3: Typology and categorization of extreme events
LU 4: Present scenario of extreme events and recent disasters |
| Module 2: | LU 1: Causes of extreme events
LU 2: Risk and vulnerability
LU 3: Urban and peri-urban dynamics
LU 4: Rural environment and livelihood |
| Module 3: | LU 1: Environment policy instruments and their role in CCA-DRR
LU 2: Risk and vulnerability assessment tools
LU 3: Disaster impact assessment methods and tools |
| Module 4: | LU 1: Prevention, mitigation and preparedness |

Training Brief

- LU 2: Early warning and response
- LU 3: Recovery, reconstruction and rehabilitation
- LU 4: Resilient infrastructure and business continuity

- Module 5:**
- LU 1: Mainstreaming of disaster risk reduction
 - LU 2: Pathways, tools and entry points
 - LU 3: Action planning and implementation

The details of 5 days training course are provided below:

Sessions	Learning Units	Duration
Inaugural Session and welcome remarks		30 min.
Module 1: Understanding climate change trends and extreme events	LU 1: Climate change trends and extreme events LU 2: Climate-disaster development nexus LU 3: Typology and categorization of extreme events LU 4: Present scenario of extreme events and recent disasters	5.5 hours
Module 2: Extreme events and factors of risk and vulnerability	LU 1: Causes of extreme events LU 2: Risk and vulnerability LU 3: Urban and peri-urban dynamics LU 4: Rural environment and Livelihood	6 hours
Module 3: Tools and Methods for Assessment	LU 1: Environment policy instruments and their role in CCA-DRR LU 2: Risk and vulnerability assessment tools LU 3: Disaster impact assessment methods and tools	6 hours
Module 4: Risk mitigation and management	LU 1: Prevention, mitigation and preparedness LU 2: Early warning and response LU 3: Recovery, reconstruction and rehabilitation LU 4: Resilient infrastructure and business continuity	6 hours
Module 5: Mainstreaming DRR	LU 1: Mainstreaming of Disaster Risk Reduction LU 2: Pathways, tools and entry points LU 3: Action planning and implementation	5 hours
Valedictory Session		20 min.
Vote of Thanks		10 min.

Tips to use the Manual

Each learning unit has been developed to enable learning through discussions, presentations and involvement of the trainee groups. Following are the important methods that can be applied to make the learning easy and interesting for the participants:

- Question-Answer/Quiz Sessions: These sessions have been kept to evaluate understanding of concepts of disasters, climate change and development.
- Group discussions/work: Group activity is included in each learning unit to facilitate knowledge on developing skills related to analysis, planning and formulating strategies.
- After each group work, a presentation session has to be included, to motivate the participants in knowledge grasping, participation and sharing.
- Table-top/classroom exercises to enhance ability of focused discussion in the group.
- Field visit to be organized, to facilitate understanding of data collection, group reality and situation analysis.
- Case studies to provide live examples from the field so that knowledge could be connected with the ground reality.

Training Methods

Each learning unit has been developed to enable learning through discussions, presentations and involvement of the trainee groups. Following are the important methods that can be applied to make the learning easy and interesting for the participants:

- Question-Answer/Quiz Sessions: these sessions have been kept to evaluate understanding of concepts of disasters, climate change and development.
- Group discussions/work: Group activity is included in each learning unit to facilitate knowledge on developing skills related to analysis, planning and formulating strategies.
- After each group work, a presentation session has to be included, to motivate the participants in knowledge grasping, participation and sharing.
- Interactive session
- Table-top/classroom exercises to enhance ability of focused discussion in the group.

Training Brief

- Field visit to be organized, to facilitate understanding of data collection, group reality and situation analysis.
- Case studies to provide live examples from the field so that knowledge could be connected with the ground reality.
- Presentation (slides), lecture and discussions followed by query answers.
- Movie screening followed by discussion: This will make the session more interesting.

Training Materials and Facilities

- Training hall/class room with suitable capacity and fixers
- Computers
- LCD projector
- Screen
- Mike(s)
- Speaker(s)
- Flip chart and its stand
- White board
- Computer stationary
- Photocopies/printouts of resource materials
- ToT workbook
- Chart papers
- Folders
- Note pads/diaries
- Pens/Pencils

Selection of Trainees/Faculty

The criteria for selection of trainees/faculty may be as given below:

Target level of trainees:	Senior to middle level officials/professional/agency representative.
Nature of the group:	Heterogeneous (From various departments, agencies and academic institutions), with equal representation of women colleagues.
Qualification:	At least graduation and preferably post-graduation, having written and spoken ability in English/Hindi.

Disaster experience:	Substantial/Little/Nil
Medium of Instructions:	Predominantly English with use of Hindi/regional language whenever required

Pre-requisite for the Trainers/Course Faculty

A minimum team consisting three or more faculty members is required to organize (design, conduct and coordinate) the course. One of the team members shall be from the region where training is being planned. Other criteria for course faculty/trainer may be as follows:

Eligibility:	Expert of Disaster Management with a good knowledge on Environment & Climate change/ Natural Resource Management and Developmental Planning Issues
Characteristic of an effective Facilitator:	• Self-confident (but not over-confident) • Enthusiastic and flexible • Good humored and friendly • Attentive and active listener
Teaching Approach:	Friendly and informal approach and have ability to involve heterogeneous group at a single platform
Challenges to be addressed by the Trainer:	Motivating the participants to bring them at similar level of knowledge and experience sharing.
Strategies to Overcome the Challenges:	• Provide reading materials during registration (or preferably can be mailed in advance) • Involve the participants through group exercise, video clippings and quiz sessions, etc.

Facilitation

Aim of the Facilitator: The aim of the facilitator is to assist and impart the lessons/lectures based on the existing background of the participants.

Task of the Facilitator: There are five essential stages in the facilitating process. That includes:

- Introduce (Aim, methods and timings)

- ii. Brief orientation/introduction of the participants
- iii. Stimulate a brief discussion/debate on the theme
- iv. Summarize the discussion/debate
- v. Focus on the group

During the discussions the course facilitator must:

- i. Balance task (content) and relationship (process) i.e. achieve the task while maintaining good personal relations.
- ii. Clarify issues.
- iii. Summarize the discussions.
- iv. Persuade participants to get actively involved.
- v. Conflict analysis and its resolution.
- vi. Focus the group on the key issues.
- vii. Lead the group to a conclusion.
- viii. Finally, resist the temptation to dominate the discussions.

Use of the Manual

- The manual can be implemented at National/State/District/Regional and departmental level with necessary modifications with proper coordination with different line departments, academic institutions and other agencies. At national level, courses may be organized by Ministries, Institutes/Universities and leading NGOs, whereas at state level the course may be organized by SDMAs, Ecology Commission, Educational Institutes, Environment Directorate, Council for Science & Technology or Disaster Management Institute/Centre.
- Appropriate resource persons shall be selected and invited as speakers/moderators for taking up the case studies and field surveys based technical sessions.
- It is advisable to conduct a Training of Trainers (ToT) courses in every State in order to build their capacities in conducting training programmes at district level.
- The course facilitator shall ensure that the Module has been taught in light befitting the target group's background, time and resources available.
- At the end of the training, the facilitators shall conduct a feedback session

in order to understand the opportunities and shortcomings of the Module. These feedbacks shall be complied and incorporated in the future training programmes.

Expected Outcome

- Better understanding of climate related extreme events amongst various stakeholders.
- Systematic risk/vulnerability and impact assessment of climate related disasters.
- Improved approach in integration of climate change and disaster risks.
- Overall sensitization of officials of the Local Bodies and state bodies to understand climate and disaster causes, effects and impacts.
- Improved ability to collaborate with the each other both horizontally and vertically to mitigate impacts of climate related disasters at National Level.

Validation and Evaluation of the course

The session shall consist of quizzes/discussion/group presentations to evaluate day-wise individual session impact. Question and answer session shall be conducted at the beginning of the course to understand the knowledge level of the participants. A film can also be shown to trigger the expression of participants prevailing knowledge and/or perception on aspects of climate change and extreme events.

At the end of the course, the organizers shall distribute a feedback/evaluation form to the participants. The duly filled form must be collected from the participants before they leave the classroom/training hall. This assessment of the participants about the programme will help in improving the contents and the training methods in the upcoming programmes.

Understanding Climate Change and Extreme Events



Context and Description of the Session

The Inter-governmental Panel on Climate Change (IPCC) defines climate change as: “a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use”. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”. Climate change is the change in long-term average of components and phenomenon associated with meteorology- precipitation, temperature, ocean current, sea surface temperature, etc. It is the result of change in Earth system including various process that involves biophysical and human constituents. Extreme events can be defined as those events/calamity/ disaster that produce unusually very high/low precipitation, temperature,

wind, etc. and which are unlike 90% or 95% of similar weather events that occurred in that area.

It is tedious to predict and ascertain that climate change has caused certain disaster but it is evident that climate change is increasing and altering the risk and frequency of the occurrence of extreme events. The

What is an Extreme Weather Event?

- ❖ Don't happen very frequent
- ❖ Vary from normal in frequency, duration and intensity
- ❖ Have severe social, economical and environmental impact

expected consequences of the increase in climate is the rising frequency of heavy precipitation leading to flood like situation in some areas while drought in other areas. Various climate scientists are now doing research to know the role of climate change in disasters using computer simulations, climate models and real-time datas. Scientists have used climate models to simulate weather conditions and occurrence of extreme events with factors contributing to climate change and without it. This new field of research that studies the linkage between climate change and the extreme weather events is called Attribution Science. It was found that the human-induced change to the climate has largely contributed to the increase in extreme weather events. In case of the Hurricane Harvey (2017), the extremely heavy rainfall leading to flooded was found to be worsened due to the climate change. Studies have also shown that the increased heat wave events, unpredictable rainfall pattern and droughts is related to human influence. In addition, it is evident from studies that the increasing sea temperatures is associated with increased incidences of cyclonic events and rise in sea level is related with the coastal flooding.

The current global rise in temperature is majorly due to anthropogenic influences (increased carbon dioxide and other GHG emissions) since the mid 20th century (IPCC, 2014). The paleo-climate data reveals that the current climatic warming is occurring much more rapidly than warming events in past. The evidences can be clearly seen such as Global Temperature rise, warming of oceans, shrinking of ice sheets, glacial retreat, decreased snow cover, ocean acidification and extreme events.

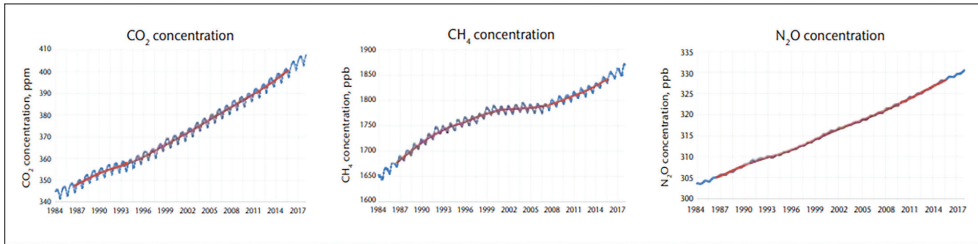


Figure 3: Time series of globally averaged concentrations of CO₂ (ppm), CH₄ (ppb) and N₂O (ppb).

(Source: WMO, The Global Climate in 2015-2019)

The World Meteorological Organization provisional statement on that State of the Global Climate mentioned that the global average temperature in 2019 was 1.1 °C higher than the pre-industrial period and the concentration of Green House Gases like Carbon Dioxide reached upto 407.8±0.1 parts per million (ppm), methane (CH₄) upto 1869±2 parts per billion (ppb) and nitrous oxide (N₂O) at 331.1±0.1 ppb in 2018 (Figure 3).

Increase in the concentration of these gases means further warming of global temperature, which is causing the abrupt rise of global sea level. The rate of global rise of mean sea level was estimated to be 5 mm per year from May 2014-2019 that is significantly faster than the rate since 1993 that was 3.2 mm per year (WMO, 2019). The oceans help to lessen the temperature rise by acting as a heat sink for approximately 90% of the excess heat and absorb 30% of the global GHG emissions. Due to excessive accumulation of CO₂ in the ocean, there is an overall decrease in ocean pH by 26% since the dawn of industrial revolution.

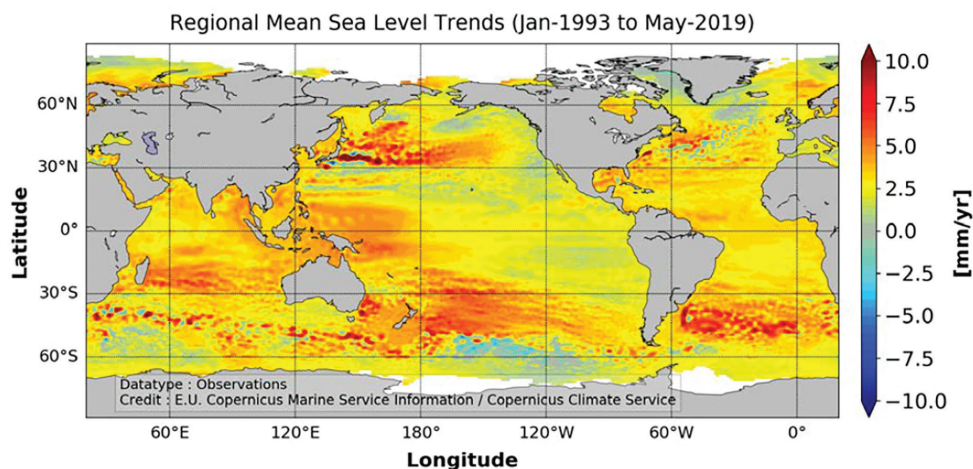


Figure 4: Regional variability in sea level trends (1993-2019)

(Source: WMO, 2019)

Apart from the above discussed consequences of climate change, it is the cause of more than 90% of the natural disasters including storms, floods, heat waves, droughts, cyclones, etc which lead to a huge economic loss, life loss, population displacement, casualties,. Heat waves have become one of the deadliest meteorological hazards in the period of 2015-2019 that is affecting all over the world with huge number of mortality and morbidity cases. It is also aggravating the cases of forest fires/wildfires. Tropical cyclones have caused the highest economic losses (more than US\$ 125 billion in Hurricane Harvey) and the major destructive floods. On the contrary, many countries are also suffering from severe drought causing food shortages.

The increase in the atmospheric temperature contributes in the increased intensity of heat waves by increasing the number of very hot days and warm nights. This warming of air increases evaporation leading to drought like situation. More droughts further contribute in the increased probability of forest fires and wildfires. The increase in temperature also increases the amount of water vapour in the atmosphere leading to more recurrent downpours. Warm atmospheric temperature above oceans contributes the intensification of cyclonic storms and torrential rain. In addition to climate change, extreme events depend on number of factors like natural climate variability, human activities, forest management, etc.

Extreme events and climate events can be broadly categorized into two types based on their impacts-environmental impacts and socio-economic impacts (Figure 5).

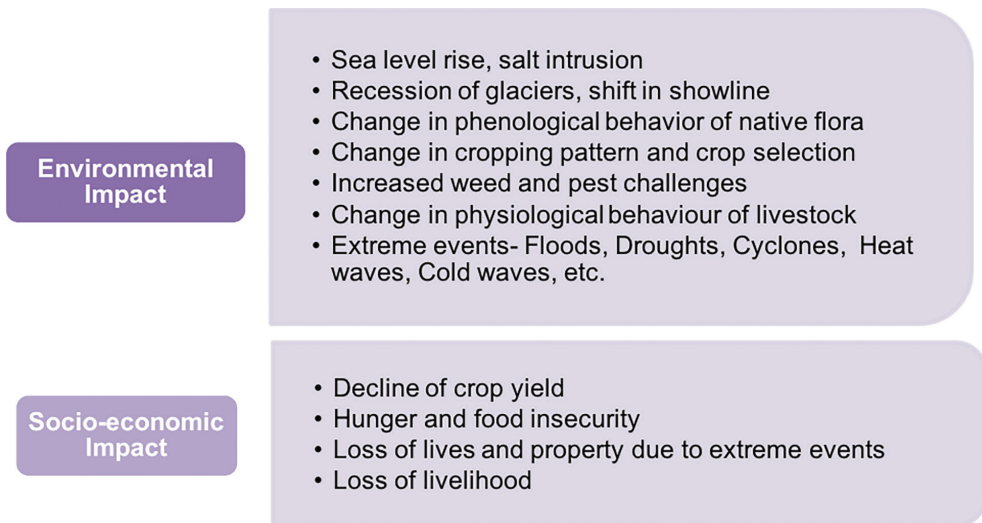


Figure 5: Two types of extreme events and their respective examples

Extreme weather events are becoming more frequent and severe all over the globe and it is most likely to have link with climate change. Extreme events are becoming more frequent due to the climate variability being witnesses in current days. We are increasingly witnessing the changes in the magnitude and frequency of climatic extremes affects in the form of hydro-meteorological and related hazards like Cyclones, Floods, Droughts, landslides, Health hazards, Hailstorms, Lightning, Forest fires, Heat waves, Cold waves, GLOFs, LLOFs, Land erosion and submergence, etc. Change in the average climatic conditions and climatic variability also modulate underlying social, economic and environmental vulnerabilities. Therefore, it is utmost important in current days to understand the linkage between climate change and extreme events. Scientists study many aspects of climate change extreme events that include Frequency, intensity, duration and timing. It important to understand the impact of climate change on the occurrence of extreme events as it can help in mitigation and managing of the risks.

Enabling Objective

At the end of this learning unit, the participants will be able to:

- Mention the global, national and state/regional scenario
- Describe the current climate scenario
- Enumerate the factors responsible to extreme events
- Understand climate-disaster and development linkages

There are three learning units (LU) delineated to draw this module:

- A. Climate trends and projection of extreme events
- B. Climate disaster development nexus
- C. Typology and categorization of extreme events
- D. Case studies

Learning Objectives

- Mention the global, national and state/regional scenario
- Describe the current climate scenario
- Enumerate the factors responsible to extreme events
- Understand climate-disaster and development linkages

Duration

The module can be run in one day/half day or even run separately.

Methodology

- Perception-check questionnaire or Question/Answer session
- Lecture/power-point presentation
- Case study
- Group exercises
- Experience sharing
- Discussion

Trainer's Guide

The course coordinator shall conduct an ice breaking exercise to allow trainees to introduce themselves. This session may be included within the inaugural/introductory session so that the luminary experts of inaugural session are also apprised with the background and profile of the participants. The trainees shall be asked to introduce themselves mentioning their name, designation, qualification and area of interest/work, organization, state/district, previous exposure on disaster management, etc.

Introduction round can also be done separately and relatively comprehensive. Even if a small and formal introduction round during the inaugural session, a more informal and detailed introduction of participants can be organized with the ice breaking session, for around 30 minutes that would help the participants to know each other. It will also initiate some level of group participation process to continue during the entire training course.

In case of 'no formal inaugural function', the programme director and coordinators/trainers shall explain to the participants about the programme objectives and contents, limitations, the process of participatory learning and some general ground rules of the course, if any.

A short video or documentary can be shown to show the impact of climate change and increased incidences of climate extreme events. Some of the suggestive videos are:

Attributing Extreme Weather Events (Hindi)

<https://youtu.be/4ivr2vB1tPY>

Attributing Extreme Weather Events (English):

<https://youtu.be/IOATnRr4al0>

Does Climate Change Make Extreme Weather Worse?

https://youtu.be/1jzQF_IEIGk

Does Climate Change Causes Extreme Weather?

<https://youtu.be/L4U4H5xLCoM>

Recommended Readings

- World Meteorological Organization (2019). The Global Climate in 2015-2019. Available at: https://library.wmo.int/doc_num.php?explnum_id=9936
- World Meteorological Organization (2019). WMO Provisional Statement on the State of the Global Climate in 2019. Available at: https://library.wmo.int/doc_num.php?explnum_id=10108
- World Meteorological Organization (2019). Global Climate in 2015-2019: Climate change accelerates. Available at: <https://public.wmo.int/en/media/press-release/global-climate-2015-2019-climate-change-accelerates>
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management-Addressing Climate Change. National Institute of Disaster Management, New Delhi

Learning Unit 1.1: Climate Change Trends and Extreme Events

Context and Description of the Session

Extreme events are the most visible consequences of the change in climate. It is very likely that we get to witness any extreme weather events every other day, which shows that extreme events are a new normal. Climate change is expected to aggravate the intensity and frequency of current extreme events that have the potential to further aggravate new vulnerabilities. This in turn may have an adverse impact on the biochemical cycle, ecological balance and ecosystem services. It is a matter of concern, as it is evident that the observed change in precipitation and temperature increases the chances of extreme weather events.

According to the World Meteorological Organization (WMO), 2015-2019 was the warmest five-year period on record and witnessed impacts of climate change like rise in sea level, ice loss and extreme weather in this period. During this period, the global average temperature is said to have rose from 0.2°C during 2011-2015 to 1.1°C since the pre-industrial period. In addition the global greenhouse gases in the atmosphere also increased during this period. The CO_2 concentrations increased by 20% higher than the past five-year period.

Global Climate Trend

Earth's climate is changing at a rapid pace primarily due to human interventions, especially due to emission of Green House Gases (GHG) from burning of fossil fuels and land-use change. This change has impacted every country, region and sector of the economy. Researchers have shown the increase in temperature at earth's surface, atmosphere and oceans. The average global temperature for the years 2015-19 is calculated approximately to be $1.1 \pm 0.1^{\circ}\text{C}$ above the pre-industrial period. The duration of 2015-19 is $0.2 \pm 0.08^{\circ}\text{C}$ warmer than 2011-2015 and therefore the warmest five-year period. The global land-surface air temperature was approximately 1.7°C above pre-industrial period and 0.3°C higher than 2011-15. The global mean sea-surface temperature (2015-2019) was about 0.8°C higher than pre-industrial period and 1.13°C higher than 2011-

15 (Figure 6). According to the World Meteorological Department, 2019, the global mean surface concentration of CO_2 has reached 403ppm, CH_4 1852ppb and N_2O 329 ppb. The continued rise of green house gases will cause further rise in global temperature and the earth system may undergo irreversible change- impacting our biodiversity, ecosystem, environment and economy. Substantial reduction in emissions and undertaking mitigation/adaptation strategies to cut-down emission can help in reducing the risks of climate change. The sporadic behavior of the precipitation pattern is observed all over the world.

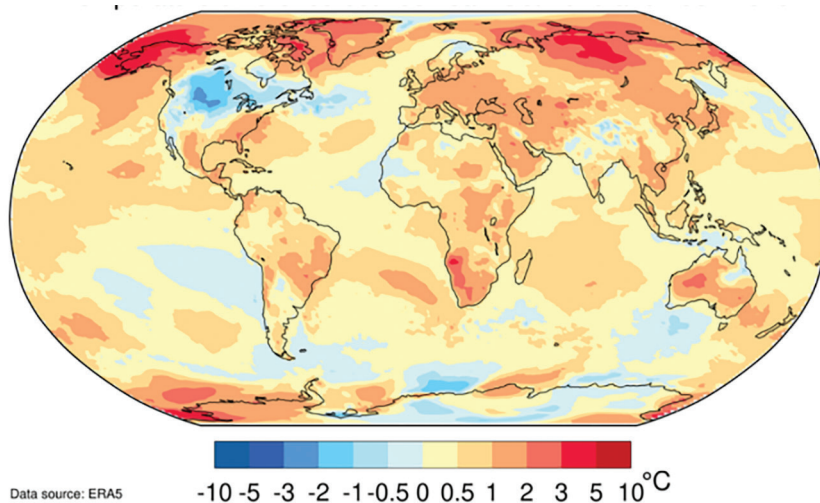


Figure 6: Global surface -air temperature difference between Jan-Oct 2019 and 1981-2010

(Source: ECMWF ERA5 data, Copernicus Climate Change Service)

Climate change will exacerbate the existing risks of extreme events. The disadvantage, developing/underdeveloped nations, poor communities, dependent populations are at higher risk.

Sea-level Rise: The global sea level rise during the period of 2014-2019 increased to 5 mm per year as compared with 4 mm per year in 2007-2016 ten-year period. The ice sheet at Arctic, Antarctica and Greenland has shrunk largely. The amount of ice lost annually from the Antarctic ice sheet increased at least six-fold, from 40 Gt per year in 1979-1990 to 252 Gt per year in 2009-2017.

Met Office

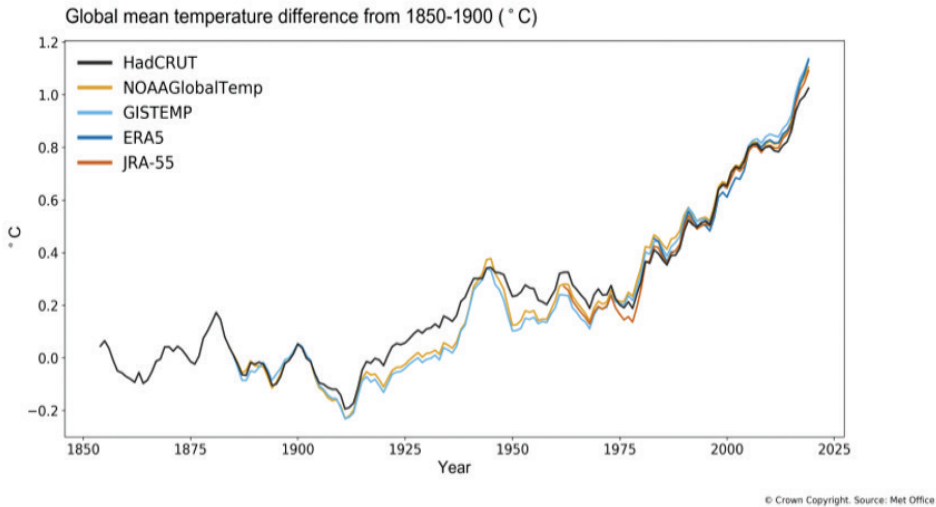


Figure 7: Five year average of global temperature from 1854-2019

(Source: WMO Report on the Global Climate in 2015-2019)

Climate Trend in India

India is also facing the brunt of climate change and it is the fourth most vulnerable country due to its wide range of geo-climatic conditions. It has high population density with majority living in rural areas that are dependent on natural resources for their livelihood. India is facing the impacts of climate change with long droughts, floods and frequent cyclones. The annual average rainfall in India has reduced by 86 mm in past decades with a decline of 26 mm kharif rainfall and 33 mm of rabi rainfall, according to the Economic Survey, 2017-18. This has led to decline in kharif and rabi yield by 12.8% and 6.7% respectively (Rattani, 2018). Developing countries like India has a limited capacity to deal with climate change and it is making it more vulnerable. On top of that, India has nearly 70% of its total population directly or indirectly dependent on agriculture the impact is inevitable. According to the report of Assessment of Climate Change over the Indian Region by Ministry of Earth Sciences have shown that the temperature of warmest day of the year have risen by 0.63°C and the temperature of the warmest night have risen by

Understanding Climate Change and Extreme Events

0.4°C during the recent thirty-year period. The report also mentions that the country’s average temperature have risen by 0.7°C during 1901-2018 and it is further projected to rise by 4.4°C by 2100. There have been notable decline in summer rainfall in Indo-Gangetic plains and Western Ghats by 6% from 1951-2015. India is facing frequent incidences of dry-spells. Such events increased by 27% from 1951-1980 and 1981-2011 while the incidences of wet spells have also increased particularly in the Central India that receives 75% more rainfall between 1950-2015. The sea level rise in North Indian Ocean is mentioned to have been occurring at the rate of 1.06-1.75 mm per year during 1874-2004. The frequencies of severe cyclonic storms have also increased significantly. The natural disasters caused due to climate change are creating havoc. India is vulnerable to a wide range of extreme events and over a decade, the number of extreme events increased.

Table 1: Examples of Extreme Weather Events

Primary Climate Events	Secondary Climate Events
• Cold wave, fog, snow storms and avalanches	• Epidemics and pandemics
• Hailstorm, thunderstorm, dust storms	• Urban and Rural Water Shortage
• Extreme temperature	• Crop failure
• Tropical cyclone, tidal wave	• Malnutrition, famine
• Floods, heavy rain	• Landslide, mudflows
• Droughts (Hydrological, Meteorological and Agricultural, etc.)	• Saline water intrusion

Trends in Extreme Events

The major impacts of climate change are due to the extreme events which can be a short-term event (Cyclones, Tsunamis, etc.) or a long-term event (droughts, heat waves, etc). These climate extreme events pose a great threat to lives and bring a sizeable loss of economy and property. Data recorded by the EM-DAT have shown that most of the occurring disaster are weather related which primarily accounts for storms and floods. Some of the major extreme events are listed below:

Table 2 : List of Some Major Extreme Events

(Data Source: WMO, 2019)

Tropical Cyclone	<i>Hurricane Matthew</i> ; North Atlantic (Haiti, USA; October 2016) <i>Hurricane Harvey</i> ; North Atlantic (USA-Texas; August 2017) <i>Hurricane Irma</i> ; North Atlantic (Dominica, Puerto Rica; Sept. 2017) <i>Cyclone Idai and Kenneth</i> ; SW Indian Ocean (Mozambique, Zimbabwe; Mar 2019) <i>Cyclone Harold</i> <i>Cyclone Amphan</i>
Flood	<i>China Flood</i> (June-July 2016) <i>Bangladesh & Nepal Flood</i> (August 2017) <i>Kerala, India Flood</i> (August 2018 & 2019) <i>Japan Flood</i> (June-July 2018)
Heat Wave	<i>Pakistan Heat Wave</i> (May-June 2015) <i>South Africa Heat Wave</i> (2015/16) <i>Europe Heat Wave</i> (2015, 2018, 2019) <i>Australia Heat Wave</i> (2018-19)
Drought	<i>Northwest South America, Central America; Caribbean Drought</i> (2015/16) <i>Africa Drought</i> (2015-2018) <i>Australia Drought</i> (2017-2019) <i>Northern Argentina; Uruguay Drought</i> (October 2017-March 2018)
Wildfire	<i>Indonesia Wildfire</i> (2015) <i>Canada (Alberta) Wildfire</i> (May 2016) <i>Australia Wildfire</i> (2016, 2019) <i>Greece Wildfire</i> (July, 2018); <i>California Wildfire</i> (November, 2018)

When the decadal, trend in the extreme events are compared, it was found that weather related disasters increased by 53.7% in the decade 2008-2017 which was earlier 46.5%. Weather related disasters comprised of Hydrological disasters, meteorological disaster and climatological disasters. The data in the

table summarizes the increase in the climate extreme events like floods, storm surges, extreme temperature events, droughts, wildfire and cyclonic events. These disasters are majorly causing as a result of climatic change. In addition, other disasters or emergency situation which maybe directly or indirectly related with the changing climate includes food insecurity, landslides, civil unrest and other complex emergencies have also increased. But the overall trend of geophysical disasters have reduced significantly to 6.3% in the decade 2008-2017 which was earlier 8.2% in the decade 1998-2007 (IFRC, 2018).

	1998–2007	2008–2017
Weather	46.5%	53.7%
Hydrological	31.0%	36.9%
Flood	30.5%	32.6%
Pluvial/flash flood	0.0%	2.2%
Storm surge	0.5%	2.1%
Climatological	7.4%	7.5%
Cold wave	2.6%	4.1%
Drought	4.8%	2.6%
Wild fire	0.0%	0.8%
Meteorological	8.1%	9.3%
Cyclone	8.1%	9.3%

Figure 8: Trends in natural hazards between two decades (1998-2007) and (2008-2017)

(Source: World Disaster Report 2018)

Asia is the most affected continent in terms of both people affected and the damage that has caused due to any disaster. The people affected have also significantly decreased when we compare it with the past decade whereas the damage occurred on property has increased substantially.

Learning Objectives

The objectives of this learning unit are:

1. To understand global/national/regional climate trends
2. To know the future projection of extreme events due to climate change

3. To enable participants to identify the current scenario of climate change and extreme events



Duration

Duration of 90 minutes is delineated to this unit.

Method

- ✓ Question-answer session
- ✓ Lecture/power point presentation
- ✓ Case study (preferably based on film)
- ✓ Group exercise
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The course moderator may conduct a question and answer session. It can be facilitated by dividing the participants into 3 groups. Each group may be provided with different questions/topics that may be discussed and presented later. Suggestive topics are listed below:

1. Climate change and extreme events
2. What are the contributing factors to climate change?
3. Why India is more vulnerable to climate extremes?

Recommended Readings

- Rattani, V. (2018), Coping with Climate Change: An Analysis of India's National Action Plan on Climate Change, Centre for Science and Environment, New Delhi
- Goswami, B. N., Venugopal, V., Sengupta, D., Madhusoodanan, M. S., & Xavier, P. K. (2006). Increasing trend of extreme rain events over India in a warming environment. *Science*, 314(5804), 1442-1445.
- Guhathakurta, P., Sreejith, O. P., & Menon, P. A. (2011). Impact of climate change on extreme rainfall events and flood risk in India. *Journal of earth system science*, 120(3), 359.

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- De, U. S., Dube, R. K., & Rao, G. P. (2005). Extreme weather events over India in the last 100 years. *J. Ind. Geophys. Union*, 9(3), 173-187.
- Dash, S. K., Jenamani, R. K., Kalsi, S. R., & Panda, S. K. (2007). Some evidence of climate change in twentieth-century India. *Climatic change*, 85(3-4), 299-321.
- Gupta, A. K. & Nair, S. (2012). *Environmental Extremes Disaster Risk Management- Addressing Climate Change*. National Institute of Disaster Management, New Delhi
- Kulkarni A. et al. (2020) Precipitation Changes in India. In: Krishnan R., Sanjay J., Gnanaseelan C., Mujumdar M., Kulkarni A., Chakraborty S. (eds) *Assessment of Climate Change over the Indian Region*. Springer, Singapore

Learning Unit 1.2 : Climate Disaster Development Nexus

Context and Description of the Session

The conventional developmental challenges faced by the policy makers were majorly revolving around economic growth, globalization, poverty, hunger, malnutrition and illness. In 1950s the development focused primarily on economy which later got shifted to poverty reduction and social wellness in 1960s and post 1970s the concern for environment gradually appeared. There is a huge paradigm shift in the development challenges from time to time. Earlier disaster was majorly relief centric, which shifted to prevention and mitigation centric. Now the notion of disaster had a new paradigm shift to mainstreaming DRR into developmental planning. Numerous initiatives have been undertaken by India including formulation of disaster specific Action plans, NAPCC, SAPCC, etc. The relation between climate-disaster and development forms a causal loop. The developmental pathways adopted by the human system causes deforestation, land-use change, burning of fossil fuel, land degradation, biodiversity loss, etc. The development paths have direct impact on our natural system, damaging the balance between various components of the environment. Adaptation reduces the impact of climate change on natural systems while mitigation reduces the causes of climate change at the source like reduced emission of Green House Gases and sustainable development increases the adaptive capacity and mitigation.

Disasters and development are inherently linked. Disasters can destroy development initiatives and at the same time can create opportunities for development. Development initiatives or activities can reduce vulnerability by having a resilient built environment and multi-hazard resistant buildings but can also increase vulnerability by engaging in a hazardous occupations leading to occupational hazards. Many years back when humankind did not know the science behind the disasters, we used to think disaster as an act of god, particularly the natural disasters and are beyond the control of humans. With such an attitude towards disaster, development activities never considered mitigation measures and resilience. The approach was such that whenever any

disasters occur, immediate relief was to be initiated. However, the current approach believes that more and more measures must be undertaken to reduce the severity and impact of any disaster. Improved understanding of the inter-relationship between climate, disasters and development focuses primarily on the following themes:

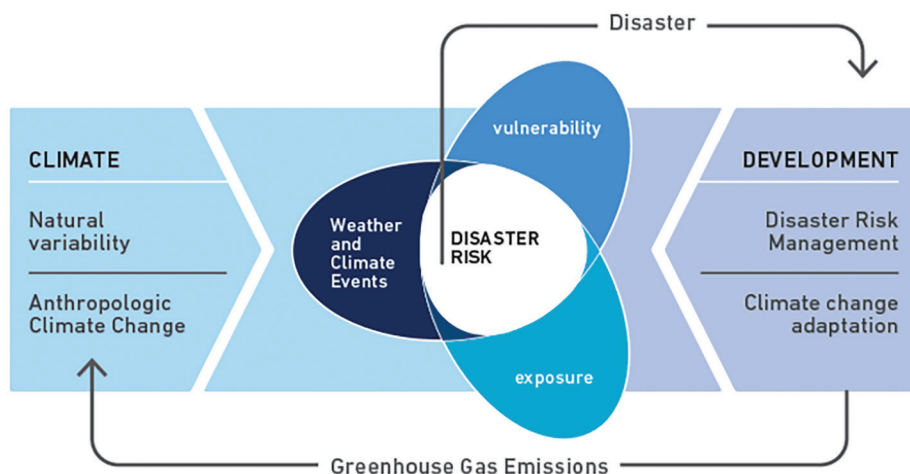


Figure 9: Climate, disaster and development nexus

- Disasters can retard development and destroys many years of development investments in seconds.
- Development can also exacerbate the factors of vulnerability and hazard exposure
- Disaster provides an opportunity for building back better and incorporating resilience in the built environment
- Development can reduce the susceptibility to any disasters by implementing proper mitigation, preparedness and prevention measures
- Disasters can degrade environment by mishandling and poor management of disaster debris, wastes, carcasses, etc aggravating the climate change and extreme events
- Climate change can further increase the frequency, duration and intensity of extreme weather events

Therefore, the policy makers and decision-makers cannot ignore the relationship between climate, disaster and development. Various developmental projects

have now included disaster resilient and mitigation component keeping the long-term disaster risk reduction in mind. Also many global agreements are being signed by various countries to strengthen the development and disaster linkage.

Climate Change and Disasters

With increase in global atmospheric temperature and sea level rise the possibilities of climate extreme events like droughts, floods, cyclones, heat wave, cold wave, etc is likely to increase. As more water vapour is being evaporated in the atmosphere creating a favorable environment for the likeliness of the occurrence of storms, cyclones, tornadoes, etc have increased. More heat in the atmosphere, warmer oceanic temperatures leads to the increased severity and intensity of the tropical storms. In addition, rising sea-level is submerging the small island countries, coastal areas and also lead to coastal erosion impacting the coastal agriculture by saltwater intrusion.

Disasters also have to potential to create favorable conditions to aggravate the pace of climate change since many a times a large forest areas are being destroyed, spillage of hazardous chemical/gases affecting the wildlife, thus further disturbing the ecological balance. Unsustainable recovery post disaster many also pose threats to environment thus exacerbating climate change.

Development and Climate Change

Development can aggravate climatic change in the form of increased emission of greenhouse gases, deforestation to accommodate large population in cities, establish industries on large-scale, indiscriminate generation of wastes (hazardous and non-hazardous), plastics, use of chemicals to meet the food demand, etc. Large scale clearing of forestland causes reduction in carbon sink and largely contributes in alteration of atmospheric temperature, humidity and biodiversity loss that plays a crucial role in maintaining the ecological balance. It also alters the precipitation pattern thus posing threats of hazards like droughts, soil erosion, landslide, floods, etc. Nature inclusive development needs to be emphasized on in order to reduce the negative impact caused in the name of development. Sustainable development also can reduce the

climate change impact and reduce the negative consequences of the climate related extreme weather events.

Climate change also affects development as extreme weather events are on rise due the changing climate. It is a fundamental threat to sustainable development and poverty eradication. This hampers the development and delays the projects and schemes that have the potential to benefit the public.

Disasters and Development

A disaster hinders and leads to the postponement of the development projects, which can further enhance the disaster risk due to the lack or inadequate adaptive capacity. A continuous or a series of disaster in an area may render the area inaccessible due to inability to undertake developmental activities. Disasters also increase conflict, poverty and forcing many to engage in hazardous jobs or even die of starvation.

Unsustainable development exacerbates disaster risks. Non-compliance to the safety standards, building codes and bye-laws increases hazard exposure and vulnerability factors. Recently great emphasis is given on green growth, green relief, low-carbon economies, carbon-neutrality considering climate change and climate extreme events as an opportunity for building resilience.

The current model of development must be realigned and redesigned and integrated/mainstream climate change and its consequences particularly the climate extreme events to address the problems in a sustainable manner. The idea of resilience and holistic development must be promoted to large scale and break the silos of climate change, disasters and development. The relationship between climate, disaster and development is illustrated in detail in the figure below.

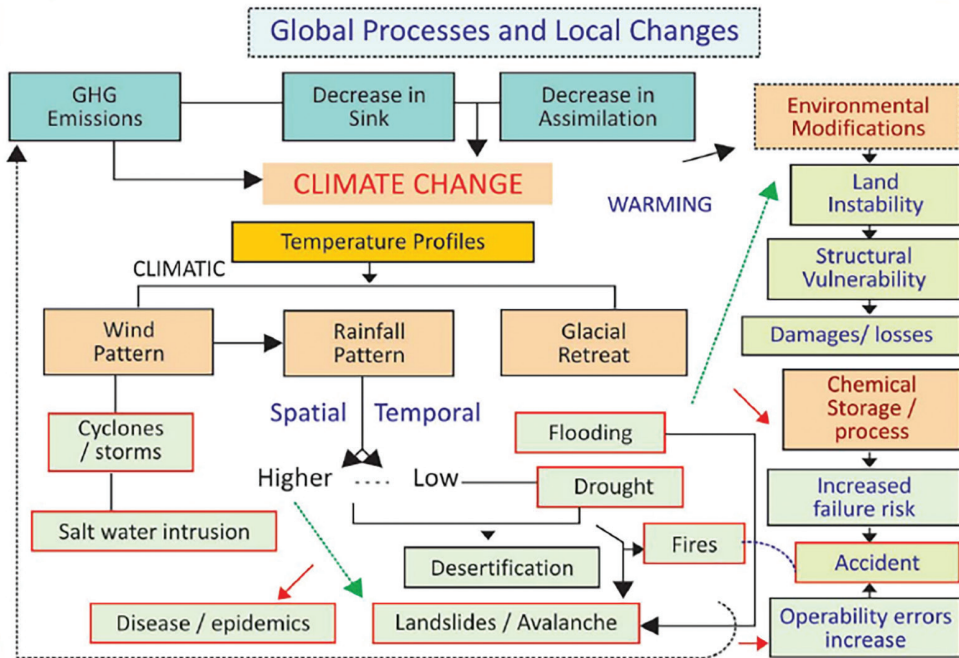


Figure 10: Environment, Climate and Disasters

(Source: Gupta & Nair, 2012)

Linking Climate, Disaster and Development: Major Initiatives

Several international agreements related to sustainable development and to reduce the global climate related disaster losses and damages that hamper the development of a nation were signed-

- The Sendai Framework for Disaster Risk Reduction (SFDRR; UNISDR, 2015)
- The Sustainable Development Goals (SDGs; UNGA, 2015)
- The Paris Agreement (UNFCCC, 2015)

HFA (Hyogo Framework for Action) was the first 5 years global agreement between international agencies, governments, disaster experts and

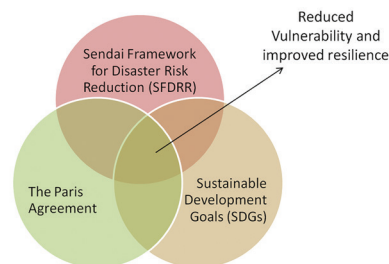


Figure 11: Major international agreements for building resilience and reducing vulnerability

professionals to work collectively on disaster risk reduction, which had 5 set of priorities of action. SFDRR (Sendai Framework for Disaster Risk Reduction) is a 15 years successor agreement to HFA. It is set to substantially reduce global disaster mortality/casualties/number of affected people/ direct disaster economic loss/infrastructure damage/disruption of basic services/health and education facilities and enhance the international cooperation to developing countries and improve dissemination of early warnings. SFDRR had 4 set of Priorities of Action which is supported by seven global targets to fulfill by 2030.

Table 3: Major International Agreements and their Respective Priority of Action/Goals

International Agreements	Priority of Action/Goals
HFA (Hyogo Framework for Action)	1. Making disaster risk reduction priority 2. Improving risk information and early warning 3. Building a culture of safety and resilience 4. Reducing the risks in key sectors 5. Strengthening preparedness for response
SFDRR (Sendai Framework for Disaster Risk Reduction); (UNISDR, 2015)	1. Understanding disaster risk 2. Strengthening disaster risk governance to manage disaster risk 3. Investing in disaster risk reduction for resilience 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction

SDG (The Sustainable Development Goals) ; (UNGA, 2015)	1. No Poverty 2. Zero Hunger 3. Good Health and well-being 4. Quality Education 5. Gender Equality 6. Clean Water and Sanitation 7. Affordable and clean energy 8. Decent work and economic growth 9. Industry, Innovation and Infrastructure 10. Reducing Inequality 11. Sustainable cities and Communities 12. Responsible Consumption and Production 13. Climate Action 14. Life Below water 15. Life on Land 16. Peace, Justice and strong institutions 17. Partnerships for the Goals
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In September 2015, the General Assembly adopted 17 Sustainable Development Goals that is targeted to fulfill till 2030. It covers environmental issues, climate action and development of resilient cities along with the conventional development goals with various targets under each goal. All the 17 SDG goals and the set targets are directly or indirectly linked with development. Poverty, Hunger, health, equality, The SDG Goal 11: ‘Make cities and human settlements inclusive, safe, resilient and sustainable’ and SDG Goal 13: ‘Take urgent action to combat climate change and its impact’ directly relates with Disaster Risk reduction. Target 11.5 of goal 11 which says, ‘By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations’ directly relates with the linkage of climate-disaster and development.

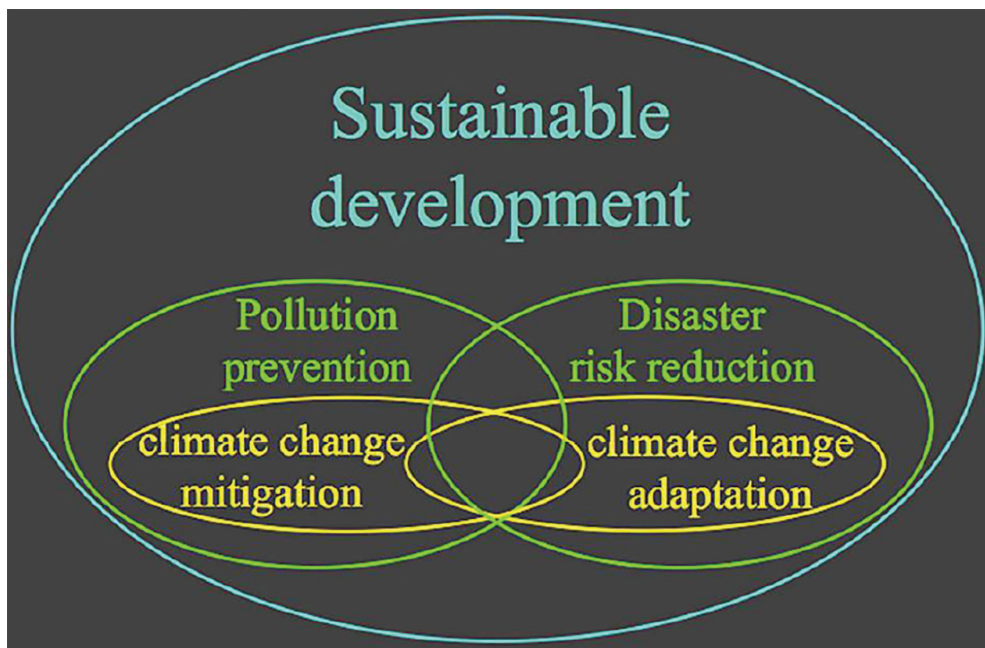


Figure 12: Linking Climate Change, DRR and SDGs

(Source: Kelman, 2017)

The Paris Agreement is a global effort to keep the temperature rise below 2°C. A very strong coordination is necessary to tackle the global rise in climate stresses, climate related extreme events and achieving the set SDGs by reducing vulnerability, enhancing resilience, which can be achieved by adopting nature, based solutions, and ecosystem based approaches.

Climate change can be linked with economic growth and development of a nation. The major sectors in India that is being affected by climate change and climate related extreme events-Forests, Agriculture, Water, Biodiversity, etc. Deforestation and clearing of large forest areas for new urban setups in the name of development is aggravating the change in climate which deteriorates the natural vegetation in forests and changes in the precipitation pattern. These climate stresses also affects the agriculture production and food security due to the change in cropping pattern, crop-cycles and crop selection. Agriculture is the backbone of India's economy and climate change, natural disasters like flood/droughts, unseasonal rain, etc are hampering the development of the nation. Climate change, habitat fragmentation and shrinking water supplies are a major threat to human population as well as biodiversity.

Some of the small initiatives that can taken in India:

- Establishment of environment friendly SMEs and promotion of cottage Industries that have very low carbon footprint
- Promotion of ecosystem based development approaches
- Promotion of local farmer's market will minimize the use of refrigerators and packaging costs.
- Promotion of low emission and eco-friendly vehicles.

Learning Objectives

The objectives delineated to this unit are:

1. To understand the linkages of climate change-disaster and development
2. To appraise the participants on international agreements related to sustainable development and to reduce the global climate related disaster losses.
3. To enable participants to understand the synergy between international agreements on Disaster Risk Reduction and Climate Change and development

Duration

90 minutes

Method

- Question-answer session
- Lecture/power point presentation
- Group exercises
- Experience sharing
- Discussion



Trainer's Guide

Goals/targets of international agreements that address the issues of climate change, extreme events affecting development can be enlisted and shown to the participants within the presentation/lecture. Linkages between climate change, disasters and extreme events can be mapped in a quick group exercise.

Recommended Readings

- Schipper, L., & Pelling, M. (2006). Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters*, 30(1), 19-38.
- Gupta, A. K., Singh, S., Katyal, S., Chopde, S., Wajih, S. A., & Kumar, A. (2016). Training Manual on Climate Resilient and Disaster Safe Development-Process Framework. NIDM, New Delhi (India), GEAG, Gorakhpur (UP, India) and ISET, Colorado (USA), supported by CDKN, UK.

Learning Unit 1.3 : Typology and Categorization of Extreme Events

Context and Description of the Session

India is highly prone to extreme events and nearly 80% of the geographical area is prone to disasters like floods, cyclones, droughts, earthquakes, landslides, etc. Hazards leading to disasters can be classified into two types- Natural and human-induced. Natural hazards are those, which are caused due to natural phenomenon while human induced are the ones caused due to human interferences. These days with increasing industrialization and urbanization most of the disasters are some or the other way human induced. The natural and human-induced hazards are often linked as even the natural hazards, for instance, floods, landslides, wildfire, etc can be caused due to human interference that can often lead to and one disaster can provoke another. This is leading to difficulties in categorization whether it has a natural cause or anthropogenic cause. Key human-induced hazards that may turn into major disasters are Chemical, Biological, Radiological, terrorism, etc.

Conventionally the natural hazards are further classified into – Geophysical hazards, Hydrological hazards, Meteorological hazards, climatological hazards and biological hazards where as human-induced or man-made hazards are classified into Environmental hazards and Technological hazards. Disasters falling under each category are shown in the table below.

Table 4: Categorization of Hazards

Categories of Hazards		Hazards
Natural Hazards	Geophysical Hazards	Earthquake; Volcano; Mass Movement (Dry); Landslide; Tsunami
	Hydrological Hazards	Flood; Mass Movement (Wet)
	Meteorological Hazards	Dust Storm; Squall; Cyclone; Hailstorm; Cloudburst; Blizzard; Thunderstorm; Lightning
	Climatological Hazards	Heat Wave; Cold Wave; Drought; Wildfire; GLOF
	Biological Hazards	Epidemic; Pest attack; Cattle Epidemics; Food Poisoning

Human-induced/ Man-made Hazards	Environmental Hazards	Deforestation; Global Warming; Drying of Lakes
	Technological Hazards	Chemical Disasters; Nuclear Disasters; Oil Spill; Terrorism; Violence; Fire

The disaster management have undergone a two major paradigm shift, first from ‘response & relief centric approach’ to ‘mitigation and preparedness approach’ and the second is towards climate and environment centric approach. Currently the environment dimensions of disasters are emphasized that recognizes disasters as an environmental event. Disasters is now viewed as having an inherent relationship with environment and environmental/ ecosystem approach for disaster risk reduction is being accepted worldwide. This primarily focuses on the use of environmental management tools and practices in all the phases of disaster management cycle. This has led to reclassification of disasters broadly into three categories (Gupta & Nair, 2012) -

- 1. Environmental disasters
- 2. Technological disasters and
- 3. Civil disasters and conflicts

Different disasters fallings under each disaster typology is shown in the figure below:

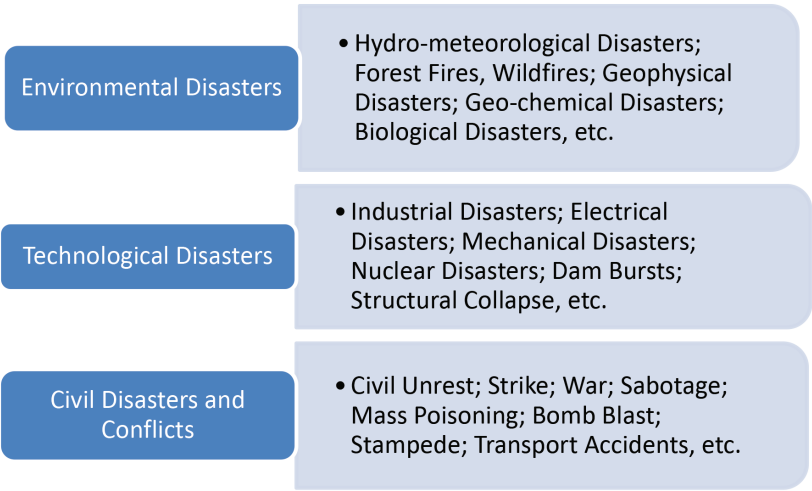


Figure 13: Environmental Classification of Disasters

(Source: Gupta & Nair, 2012)

Environmental disasters include those disasters that are caused as a consequence of disruption in normal functional of natural environment. Example: Hydro-Meteorological Disasters; Forest Fires, Wildfires; Geophysical Disasters; Geo-chemical Disasters; Biological Disasters, etc. Technological disasters include those disasters that are caused due to technical failures in industries or developmental activity site. Example: Industrial Disasters; Electrical Disasters; Mechanical Disasters; Nuclear Disasters; Dam Bursts; Structural Collapse, etc. Civil disasters are caused due to civil unrest, communal conflicts, terrorism, and damage caused with an intention of mass destruction. For example: Civil Unrest; Strike; War; Sabotage; Mass Poisoning; Bomb Blast; Stampede; Transport Accidents, etc. Political instability leading to conflicts and terrorism is also a civil disaster.

Some the disasters that are directly or indirectly triggered by the extreme weather events are briefly defined below:

Floods: It is an overflow of water that submerges land causing life loss, property damage, breakdown in drinking water and electricity supply, damage to heritage buildings and natural environment usually caused due to heavy rainfall, blockage of drains, landslides, sudden release of water from reservoirs, river basin encroachment leading to blockage, etc. Floods can be classified majorly into four types:

1. Flash floods
2. Coastal floods
3. Urban floods
4. Riverine floods

Flash floods occurs usually on hills due to intense rainfall over a limited area leading to strong run-off. It also occurs due to sudden discharge/release of water, breaches in landslide dams and embankments on the river banks creating a great damage. Coastal floods occur due to heavy rainfall during cyclones, tsunamis/hurricanes/tornadoes, etc. Urban floods usually causes inundation of built environment due to heavy rainfall, blockage of drainage system, exceeding the capacity of drains, etc. Urban flooding has become a recent phenomenon. Riverine floods occurs due to heavy inflow of water due to excessive rainfall, snowmelt and cloudburst.

Droughts: It is a situation of significant water shortage that may have caused due to insufficient rainfall or increased water demand. It effects smaller to larger area over a longer period of time. Drought is a silent and a complex disaster because it has not defined beginning and end. This is why it is often known as a creeping disaster as it slowly occurs and impacts various sectors. The Indian Meteorological Department (IMD) has defined drought as a situation occurring in any area when the mean annual rainfall is less than 75% of the normal rainfall. IMD has further classified droughts into the broad categories viz., a severe drought when the deficiency of rainfall exceeds 50% of the normal rainfall and moderate drought when the deficiency of rainfall is between 25% and 50% of the normal rainfall. Drought can be classified into:

1. Meteorological drought
2. Hydrological drought
3. Agricultural drought
4. Socio-economic drought

Meteorological drought occurs when a dry weather patterns dominate an area due to the underlying atmospheric conditions. Meteorological drought is classified based on rainfall deficiency with respect to long-term average - 25% or less is normal, 26-50% is moderate and more than 50% is severe. It may cause due to lean monsoon rainfall or late onset/early withdrawal of monsoons. Meteorological drought is classified based on rainfall deficiency with respect to long-term average - 25% or less is normal, 26-50% is moderate and more than 50% is severe. Hydrological drought occurs when there is a low water availability in streams, reservoirs, groundwater, etc. It usually occurs after a prolong meteorological drought. Hydrological drought takes longer time to recover than that of a meteorological drought. It can be classified further into- Surface water drought and Groundwater drought. Agricultural drought is identified by four consecutive weeks of meteorological drought, weekly rainfall is 50 mm from 15/5/ to 15/10, 6 such consecutive weeks rest of the year and crop planted is 80% in kharif season. Agricultural drought occurs when there soil moisture and rainfall conditions are not adequate to support a healthy crop growth to maturity thereby causing extreme moisture stress and wilting of major crop area. while a socio-economic drought occurs due to the inaccessibility of the water or non-availability of clean water.

Heat Wave: It is an extended period of unusual high temperature that leads to physiological stresses and even death which lasts for 5 or more days consecutively. The temperature to declare a heat wave varies from region to region depending on their local conditions. In India, when the maximum temperature in a station reaches at least 40°C or more for plains, 37°C or more for plains and 30°C or more for hilly regions. According to the Indian Meteorological Department (IMD), a heat wave is qualified when air temperatures of at least 40 °C (104 °F) in the plains or greater than 30 °C (86 °F) in the hilly regions. For the IMD classification of heat waves, temperatures greater than 46 °C (114.8 °F) are considered and classified as severe heat waves.

Cold Wave: It is an extended period of unusual low temperature that leads to physiological stresses and even deaths. A cold wave is declared after the night temperature fall. A severe cold day is recorded when the maximum temperature is at least 6.4 degrees Celsius below normal, and the lowest temperature goes below 10 degrees Celsius. A cold wave is recorded when minimum temperature is less than 4.4 degrees Celsius below normal in at least two stations of a meteorological subdivision. It causes various health impacts including vasoconstriction, platelets aggregation, frostbites, hypothermia, trench foot, chilblains, etc.

Cloudbursts: It is a very heavy rainfall at a rate higher than 100 mm per hours over a small area accompanied by a strong winds and lightning. It affects a very small area not more than 20-30 km². It occurs majorly in Himalayan region, northeastern states and western ghats.

Squall: A sudden increase of wind speed by atleast 29 kmph (16 knots) with the speed rising to 40 kmph (22 knots) or more and lasting for at least 1 minute. It is categorized into two types: Moderate squall and Severe squall.

Hail: It is a precipitation composed of balls or lumps of ice (hailstones) with diameters ranging from 5 to 50 mm or more and is formed in cumulonimbus clouds and freezing of water droplets updrafts.

Cyclones: It is a large scale atmospheric disturbances that rotates around a strong center of low atmospheric pressure. The word cyclone is derived from the Greek word 'Cyclos' which means 'the coils of a snake' as the cyclones appear

like a coiled serpent of the sea. Air circulates in an anticlockwise direction in Northern Hemisphere and clockwise direction in Southern Hemisphere. Cyclones are usually accompanied by violent storms, torrential rainfall, storm surges that disrupts the normal life, causes floods, damages property and life loss. Cyclones are given many names in different regions of the world – They are known as typhoons in the China Sea and Pacific Ocean; hurricanes in the West Indian islands in the Caribbean Sea and Atlantic Ocean; tornados in the Guinea lands of West Africa and southern USA; willy-willies in northwestern Australia and tropical cyclones in the Indian Ocean. Cyclones are classified as:

1. Extra-tropical cyclones (or temperate cyclones)
2. Tropical cyclones

Tropical Cyclones develop in the regions between Tropic of Cancer and Tropic of Capricorn and they are the progeny of ocean and atmosphere, powered by the heat from the sea; and driven by easterly trades and temperate westerlies, high planetary winds and their own fierce energy. Extra-tropical cyclones occur in temperate zones and high latitude regions, though they are known to originate in the Polar Regions.

Indian Meteorological Departments classifies cyclones based on its intensity and the capacity to damage- Low pressure, Depression, Deep depression, Cyclonic Storm, Severe Cyclonic Storm, and Super-cyclonic Storm.

Table 5: Classification of Cyclones by IMD

Types of Disturbances	Wind Speed	
	km/h	Knots (1 knot=1.85 km/h)
Low Pressure	Less than 31	Less than 17
Depression	31-49	17-27
Deep Depression	49-61	28-33
Cyclonic Storm	61-88	34-47
Severe Cyclonic Storm	89-117	48-63
Very Severe Cyclonic Storm	118-165	64-89
Extremely Severe Cyclonic Storm	116-220	90-119
Super-Cyclonic Storm	More than 221	More than 120

How the cyclones are named?

Earlier the cyclonic storms were named arbitrarily but nowadays they are named systematically. Some names of the cyclones are kept in the names of men and women but majorly on the basis of flowers, animals, birds, trees, and food items, etc. Cyclonic storms rising in Indian Ocean are named by the Indian Meteorological Department and since 2004, 8 countries including Pakistan, India, Sri Lanka, Bangladesh, Maldives, Myanmar, Oman, and Thailand started naming the cyclones. These countries have already contributed a set of names that are assigned sequentially on the basis of first alphabet of the member country. The cyclone 'Okhi' (November 2017) was named by Bangladesh meaning 'eye' in Bengali, cyclone 'Fani' (May 2019) was also named by Bangladesh meaning 'hood of a snake', cyclone 'vayu' was named by India meaning 'Air/wind' and the current cyclone 'Amphan' was named by Thailand meaning 'sky'.

Thunderstorm: It is a sudden electrical discharges of a flash of light (lightning) accompanied by a rumbling sound (thunder). It is caused majorly due to the intense heating of atmosphere.

Lightning: It is a powerful electrical discharge with a total path length of a few kms which is followed by thunder. It is of three types: Intra-cloud lightning (IC), Inter-cloud lightning (CC) and Cloud-to-ground lightning (CG).

Duststorm: A dust storm (aandhi) is a strong, violent wind that carries fine particles such as silt, sand, clay, and other materials, often for long distances and can spread over hundreds of miles and rise over 1000 meters with wind speeds of at least 41 kmph and even exceeding 74 kmph.

Learning Objectives

- To enumerate the different types of disasters based on their categorization
- To enable participants a basic understanding of each extreme events caused due to climate change
- To understand each type of disasters and its typology

Duration : 90 minutes

Method

- Lecture/power point presentation
- Group exercises

- Video clips
- Discussion

Trainer's Guide

Trainer may use flipcharts to deliver this session along with small video clips. A quick group exercise can also be conducted to understand the linkages of disaster with another and how one disaster may trigger another.

Recommended Readings

- Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi. (2016). Manual for Drought Management
- IMD (2003) Cyclone manual. Published by IMD, Lodi Road, New Delhi-110003
- Mohapatra, M. Mandal, G. S. Bandyopadhyay, B. K. Tyagi, A and Mohanty, U. C. (2011). Natural Hazards. 63:1601-1620. DOI: 10.1007/s11069-011-9891-8
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi

Learning Unit 1.4: Present Scenario of Extreme Events and Recent Disasters

Context and Description of the Session

We live in an uncertain world with growing frequency and intensity of extreme events with each passing years leading to immense property and material loss. All the development and technological advances happening have some or the other kind of ecological damage. The large-scale urbanization have used the vulnerable areas and degraded lands causing huge alteration in the land-use land-cover of the area. According to EM-DAT data, During the year 2011-2018, about 2711 natural disasters occurred all over the globe causing 122857 deaths and an economic loss of nearly 1532.5 billion USD. In 2018 alone, 315 natural disasters occurred which is 20 less than what occurred in 2017 but the number of life loss is 11,804 in 2018 and 9,697 in 2017 that is significantly higher. This shows how the intensity of disasters has increased even if there is reduction in the frequency of disasters.

According to EM-DAT data, in 2019 about 396 natural disasters have been reported which killed nearly 11,755 individuals and over 95 million were affected. The overall estimated economic losses due to the reported disasters were calculated to about 130 billion USD. It has also been noticed that the number of extreme events that occurred during this years was higher than the average of past 10 years (343 disasters). Asia was the most vulnerable continent as 40% of the reported disasters occurred in Asia alone, which accounted for the total deaths of 45% and 74% affected individuals.

Present Scenario of Disasters

In 2019, storms and floods alone accounted for 72 percent of the total disasters (49% floods and 23% storms), which lead to a deaths of 64% (43% floods and 21% storms) and 68% people were affected due to floods (33%) and storms (35%) alone. Extreme temperature events like heat wave was also very devastating during these years and it caused a total of 25% deaths and 31% were severely affected. Majority of the deaths and affected people due to disasters were

concentrated in few of the developing countries of India, Iran, Philippines and Zimbabwe while the economic losses were majorly reported in developed countries.

The European heat wave of 2019 was one of the severe heat wave reported that has caused deaths of more than 2500 people primarily in the countries of France, Belgium, and the Netherlands. Another deadly disaster was the Indian flood (July-October), affected more than 13 Indian states, which was a result of intensive monsoon shower and killed about 2000 individuals. The deadliest storms reported in 2019 was Cyclone Idai (March) and Cyclone Dorian (September). Cyclone Idai took the lives of nearly 1000 people in the countries of Mozambique and Zimbabwe while Cyclone Dorian killed atleast 358 people and many went missing in United States and the Bahamas.

Wildfires have been another major disaster in the same year that affected not only humans but also the natural vegetation, wildlife and the entire environment. It has caused a great economic losses of about 30 billion USD which was only 279 million USD in 2014. The Australian bushfire alone caused an economic loss of 5 billion USD. Some of the major wildfire of the year 2019 are-

- **California Wildfire** — It had low human influences but economic losses accounted upto 25 billion USD.
- **South America and Amazonia Wildfire** — No realistic figure of the estimated loss
- **Australian Bushfire** — It occurred from September 2019 to February 2020 lead to total wipeout of 6 million hectares of forestland and more than 500 million wild animals were burnt to death. It killed about 32 people and many were rendered homeless as their houses were either burnt or evacuated.
- **South Sudan wildfire** — It occurred in the month of May and caused death of nearly 50 people.
- **China Wildfire** — It occurred in April and lead to a death of about 30 people.

When we look at the decadal data, we can see that the number of hydro-meteorological disasters have increased significantly from the decade of 1940-1949 and since then it is exponentially increasing. The Geological disasters are also increasing about not as significantly as hydro-meteorological disasters. This

exponential increase in the climate extreme events is a matter of concern and also clearly tells us that timely climate action is needed since climate extreme events are a direct consequences of climatic change.

Decadal Climate Extreme Events

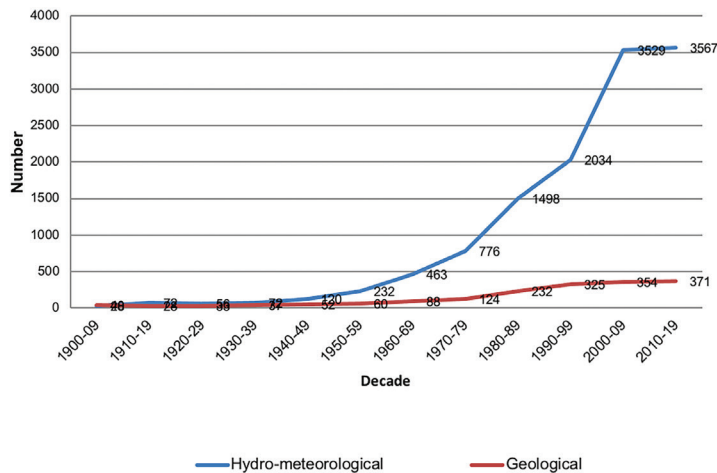


Figure 14: Number of Climate Extreme Events from the decade 1900-09 till 2010-19
(Data Source: EM DAT)

India due to its diverse geo-climatic and topographical features have been facing many types of extreme events. Some of the events are listed below.

Table 6: Some of the Extreme Events from 2005-2019

Year	Disaster
2005	Maharashtra Flood
2008	Bihar Flood
2009	Cyclone Phyan
2010	Ladakh Flood; Ahmadabad Heat Wave
2011	North Indian Cold Wave
2012	Indian Cold Wave
2013	North India Floods
2014	Malin Landslide; Cyclone Hudhud
2016	Uttarakhand Fire

2017	Gujarat Flood; West Bengal Flood; Bihar Flood
2018	Kerala Floods
2019	Cyclone Fani; Cyclone Vayu; Indo-Pakistan Heat Wave; Australia Wildfire
2020	Cyclone Amphan

Recent Extreme Events

Cyclone Amphan (2020)

It is a super cyclonic storm (Category 5 tropical cyclone) that caused severe damage to the states of Eastern India, particularly West Bengal and Bangladesh. It has caused a loss of about 13 billion USD, which surpassed the damage caused by Cyclone Nargis in 2008. This super cyclonic storm has maximum wind speed of 240km/h (150mph) causing nearly 128 deaths (98 in India, 26 in Bangladesh and 4 in Sri Lanka).

India: Flood (2020)

Intensive monsoon rainfall is severely affecting the Northern parts of India since June 2020. In Assam alone 1.3 million people have been affected, 25 people have been reported dead and more than 27,000 people have been evacuated, displaced and living in relief camps. This floodwater has affected livelihood also and has inundated a crop area of 83,000 hectare. In Bihar, as of 3rd August, 5.6 million people were affected, 13 people died and more than 17,554 people were taking shelter in the relief camps.

Cyclone Nisarga (2020)

Cyclones have always been very frequent in the Bay of Bengal but according to the scientists, the trend has been changing. In 2019, five cyclones (Cyclone Vayu, Cyclone Hikka, Cyclone Kyarr, Cyclone Maha, and Cyclone Pavan) originated in the Arabian sea which normally only one or two are formed.



Cyclone Nisarga originated in the Arabian Sea and was the first tropical cyclone to hit Maharashtra after Cyclone Phyan in 2009. It had highest wind speed of 110 km/h but it got weakened before the landfall. It caused six deaths in Maharashtra and damage is estimated to be 664 million USD.

Indian Heat Wave (2019)

It is one of the longest heat wave period (from mid-May to mid June, 2019) which resulted to many mortality and morbidity cases. This period of heat wave coincided with drought and water scarcity across India.

Australian Bushfire (2019)

Fires in Australia are not new however, the fire season is getting more unpredictable and its intensity has gotten severe. Australia witnessed severe heat and drought at same time in the month of December, which fueled the conditions for bushfire. Scientists say that it is a function of climate change, which has lead to the burning of an area of about 25.5 million acres, death of 33 people and wildlife.

Learning Objectives

- ✓ To understand the present scenario of extreme events
- ✓ To validate and evaluate the understanding of disaster management/climate change and extreme events concepts.
- ✓ To know about the past and the recent disaster events in India

Duration

This Unit can be delivered in 30-40 minutes.

Method

- ✓ Group Discussion
- ✓ Question and Answer Session
- ✓ One-to-One Discussion
- ✓ Quiz

Trainer's Guide

This learning unit can be delivered by using Q&A/Quiz. The participants can be divided into a group of 3-4 depending on the number and the course facilitator may pose questions to each groups. There can be different rounds for the quiz-

- Basic understanding of climate extreme events
- Institutional setup of disaster management
- Past extreme events, etc.

Recommended Readings

International Centre for integrated Mountain Development. (2007). Disaster Preparedness for Natural Hazards: Current Status In India.

IFRC. (2018). World Disaster Report. Pp. 167-210

Climate Extremes and Factors of Risk and Vulnerability

Context and Description of the Session

Change in the occurrence of extreme events such as heat waves and droughts are the primary way of experiencing climate change. The frequency of extreme events is increasing and their impacts are intensifying due to human-induced climate change, factors aggravating risks and vulnerabilities. Earthquakes, floods, cyclones, heat waves etc are considered as a hazard and not a disaster unless these risks are exposed to a population/property that resulted in a huge loss/damage, which is without one's coping capacity. Vulnerability and exposure are two components of disaster risk that increases the susceptibility of a community to the impact of a hazard. Studies have shown that 68% of the extreme weather events are caused by human-induced climate change.

Vulnerability has many definitions as interpreted differently by different experts. Vulnerability is commonly described as the characteristics and circumstances of a community, system or asset that make a population/society or an object susceptible to the damaging effects of a hazard. Other working definitions of vulnerability are “degree of loss likely to cause when a disaster occurs” or “Susceptibility to harm forms any external shocks”. There are different aspects of vulnerability that arises from various factors. It includes factors like physical, social, economic, environmental and attitudinal. Physical vulnerability is the susceptibility of any physical structures or an community due to its propinquity to the hazard source. Earlier only the vulnerability of the physical structures is considered while with improvement in understanding and dynamicity of vulnerability, other factors are also considered. Social vulnerability is the susceptibility and the capacity to anticipate any hazard by any society due to its accessibility and availability of resources. The detail about each factors is elaborated in the following learning units. Vulnerability is a function of exposure, adaptive capacity and resilience while economic vulnerability is the susceptibility to any hazard due to the economical condition of the society. Poverty is a major factor that aggravates vulnerability of any population or a community.



Risk is the probability that any structure or a population is to be damaged or disrupted by the impact of any hazard. Risk is a function of Hazard (H), Exposure (E) and Vulnerability (V). It can be reduced by improving the adaptive capacity and reducing the vulnerability.

Adaptive capacity is the ability of a population/community or a structure to withstand or cope with any adverse situation using its available resources, facilities and skills.

Climate Extremes and Factors of Risk and Vulnerability

Climate extremes have an uneven impact on populations even in a same geographical region. This differential impact of any extreme event is a result of a range of social, economic, physical and environmental vulnerabilities operating at various scales. Therefore, it is essential to identify these factors of vulnerabilities that is resulting into a disproportionate vulnerability to any extreme events. Human activities are one major reason for the increase in vulnerability. For example: Felling of trees at a faster pace than the pace of replacement by nature increases the vulnerability of the community during heavy precipitation days causing mudslides, landslides, floods, etc. Another example of throwing wastes and plastics in the river, hinders the natural flow of river making the area vulnerable to floods and inundation during monsoon days. Hence a well informed and well-organized community are less vulnerable and more able to withstand any extreme events.

Any hazard will turn into a disaster when certain factors of vulnerability come into picture. Vulnerability may result from faulty developmental planning, marginalization of a particular social group, social inequality, unplanned urbanization and built environment, discrimination, etc.



Figure 15: Relation between Hazards, Risk and Vulnerability

(Source: Adepoju et al, 2017)

Factors of Vulnerability

Vulnerabilities in disaster management is generally categorized into – Physical vulnerability, Economic vulnerability, Social Vulnerability, Attitudinal Vulnerability and environmental vulnerability. Physical vulnerability is caused as a result of the location of any element at risk which is compounded by the difficulty to access the basic critical services like healthcare system, water, food and means/mode of transportation/communication. This factor is further exacerbated by lack of proper planning, poor implementation and unorganized development practices. Economic vulnerability is a result of the variation/inequality in the economic statuses of the community and the variability in the access to any natural resources. Social vulnerability is caused owing to the weak family structures, lack of participation, racial/linguistic/cultural/gender or religious discrimination. Social vulnerability is highest in a poor and economically backward community due to their lack of awareness, inaccessibility to education, lack of participation and affordability to basic services. Social vulnerability is a complex factor that can be addressed if there is political will and community's attitude towards a positive change. Attitudinal vulnerability refers to the negative attitude towards change and the willingness to take initiative within the community without any external support. Individualism and lack of collectiveness in the society enhances the attitudinal vulnerability leading to conflicts and lack of participation in community capacity development and awareness programmes. These factors of vulnerability will be discussed in details in the succeeding learning units of this module.

Factors of Disaster Risks

Any hazards can have social, economic and environmental consequences and this probability of occurrence of any consequences may vary greatly depending on certain factors. For instance, the death toll in developing countries may be high but the economic losses maybe low, relatively whereas the death toll in a developed countries maybe low but the economic losses may be very high. Hazard risks increases due to various factors like poverty, inequality, climate change and variability, population growth, unplanned and rapid urbanization, land-

use land-cover change, pressure on natural ecosystem, alteration in the natural environment, lack of disaster risk consideration in land, environment and natural resource management, etc. Other compounding factors such as demographic change, non disaster risk-informed policies, the lack of regulations and incentives for private disaster risk reduction investment, complex supply chains, the limited availability of technology, unsustainable uses of natural resources, declining ecosystems, pandemics and epidemics are also an important factor. The three main factors that define disaster risks are Hazard, exposure to that hazard and the underlying vulnerability factors. Another factor that also plays a crucial role in disaster risk is the adaptive capacity. Each factor or the components of disaster risks will be explained in detail in the succeeding learning units.



Figure 16: Factors/Components of Disaster Risk

Enabling Objectives

At the end of this learning unit, participants will be able to

- ✓ Understand the causes of extreme events
- ✓ Explain the concept of risk and vulnerability and various aspects/factors associated with it
- ✓ To identify the challenges and risks faced by the urban and peri-urban areas

There are four learning units delineated to draw this module

LU A: Causes of extreme events

LU B: Vulnerability and risk

LU C: Urban and peri-urban dynamics

LU D: Rural environment and livelihood

Learning Objectives

- ✓ To facilitate participant's knowledge on causes of climate extreme events
- ✓ To develop the understanding of concept risk and vulnerability
- ✓ To disseminate knowledge on the challenges faced in urban and peri-urban areas

Duration

This module can be run for 1 day or separately from the whole manual.

Methodology

- ✓ Lecture/power point presentation
- ✓ Case study
- ✓ Group discussion
- ✓ Group exercise
- ✓ Quiz/Question-Answer Session

Trainer's Guide

This session shall deliver on the causes of climate related extreme events. Trainer should cover the concept of risk and vulnerability with relevant examples. The challenges faced by peri-urban and urban areas can be covered comprehensively with the help of case studies.

To make the sessions interactive and participatory, group activities, quizzes, group discussions, etc can be used.

Recommended Readings

- Coburn, Andrew & Spence, R.J.S. & Pomonis, Antonios. (1994). Vulnerability and Risk Assessment.
- Bizikova, L. Belali, J. Habtezion, Z. Diakhite, M & Pinter, L. (2009). Vulnerability and Impact Assessments for Adaptation to Climate Change. 2. Available at: https://www.iisd.org/pdf/2010/iea_training_vol_2_via.pdf. Last Accessed on 25th March 2020

Learning Unit 2.1 : Causes of Extreme Events

Context and Description of the Session

In recent few years, the numbers of extreme weather events have increased significantly. Areas that have never witnessed a particular disaster have seen many unusual events occurring. The anthropogenic interferences with the climate system is posing a threat to the natural systems and certain changes like sea level rise, receding of polar ice-caps are happening. These climatic changes are expected to increase the frequency and intensity of hydro-meteorological disasters in the country. The extreme temperature events like heat wave/cold wave, heavy/low precipitation, intense cyclonic events is likely to be very frequent.

Many studies have mentioned that extreme events are caused by climate change but in addition to human-caused climate change, it is also dependent on factors like natural climate variability like El Nino and La Nina, anthropogenic activities, land-use change, etc. However, the pace at which humans have been interfering with the natural processes happening on this earth and that are vital for sustenance of life is alarming. This is the major reason for the frequent occurrence of extreme weather events and also aggravating the climatic change which otherwise is a natural process.

Climate Change and Extreme Events

An extreme event is determined based on the historical record of weather in a particular region. It attributes to unusually high/low temperature, high/low precipitation, wind, snow and storms. It is linked with climate change since such extreme weather events occur due to the change in climate. We can't say that climate change is causing such extreme events but we can say that climate change is contributing in its intensification and increase in frequency. Example: Rise in sea levels due to the melting of polar ice caps may increase the impact of cyclones and coastal storms. Studies have found that the number of heat waves, heavy downpours, major cyclones, etc has increased. The increase in global temperature may also pose a huge stress on water availability causing the problem of water security and even droughts.

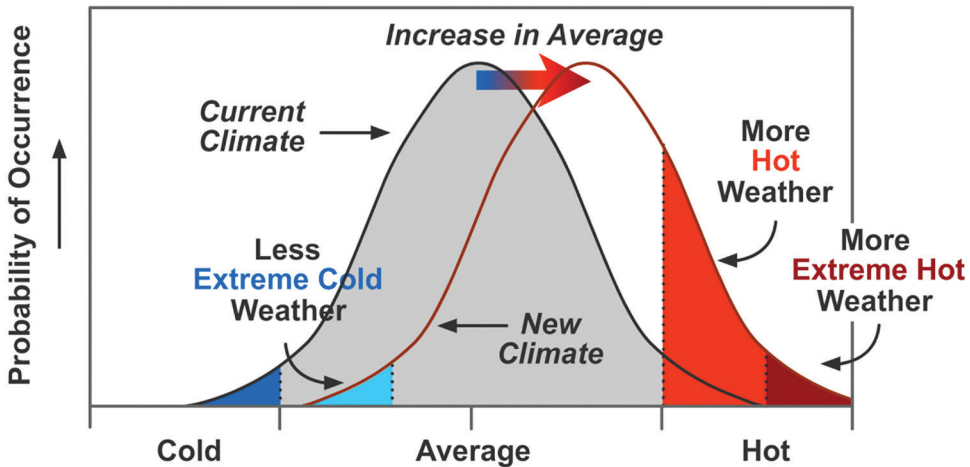


Figure 17: Increase in probability of extreme events in warmer climate

(Source: The U.S. Climate Change Science Program, 2008)

Rise in global temperature increase the number of very hot days and nights and it attributes to increase in water demand putting stress on water supplies and even drought in severe condition. Droughts create dry forests causing wildfires. Rise in global temperature increases water vapor content in the atmosphere that can lead to more frequent heavy rain and snowstorms. High water vapor content in the atmosphere over the oceans may intensity of cyclones/hurricanes and causes heavy rainfall. Temperature rise also causes melting of glacial snow and rise in sea level leading to inundation of inhabited coastlines and islands. Studies have ascertained that rise in global temperature is sourced by various anthropogenic activities including the increased emission of heat absorbing gases (GHGs) in the atmosphere that is released from the burning of fossil fuels (Coals, natural gases, petroleum, etc) in industries and vehicles. Land surface processes regulate the intensity, frequency and severity of heat waves, droughts and other extreme events especially the change in vegetation cover. Understanding the factors contributing to extreme events is important as it can help in managing risks and vulnerability. Example if a community knows the factors causing drought in their area, they may come up with a sustainable solution of water resource management.

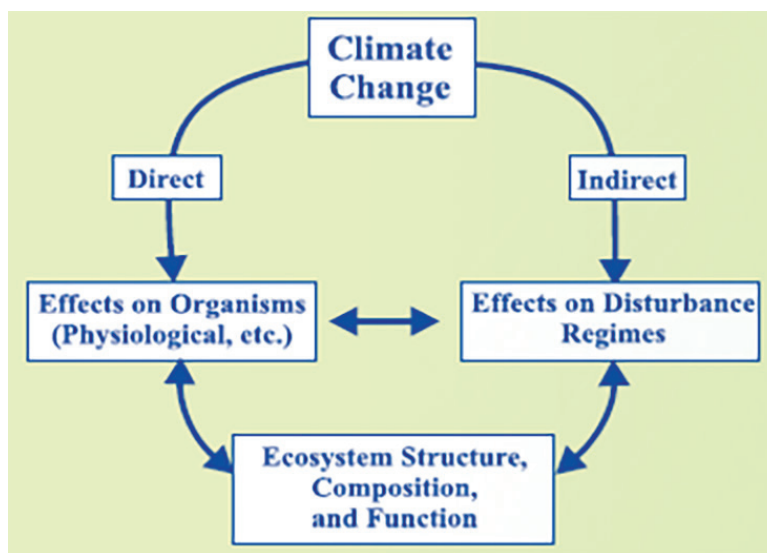


Figure 18: Direct and Indirect impact of climate change on ecosystem

(Source: Gupta & Nair, 2012)

Climate change is impacting directly or indirectly to the ecosystem. It is directly affecting the organisms and their ecological functionality and directly affecting the disturbance regime. These ultimately add up to the occurrence of climate extreme events like floods, droughts, cyclones, extreme temperatures, etc.

Anthropogenic Activities and Climate Extreme Events

Humans have been ruling the planet Earth since the dawn of civilization and we have been constantly molding the natural environment and landscapes according to our needs. Humans affect the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water. Climate change is one of the consequences due to the anthropogenic activities that is causing the extreme weather events. Apart from that the large scale clearing of forestland alters the atmospheric condition of that particular area and causes natural disturbances which we call as natural disasters. In reality, there is no naturalness in these natural disasters, humans have a huge hand in its cause. Rapid urbanization and construction of real

estate also alters the natural environment in the form of rising albedo and urban heat island, thus altering the natural physical state of the environment and atmosphere.

Human activities also changes the natural vegetation of an area due to the introduction of invasive plant species and growing of genetically modified plants which leads to extinction of the natural, disease resistant wild varieties. Mass extinctions and extinction of many important species of both plants and animals have also occurred due to human interventions. Such extinctions and alteration of the natural state of an environment causes imbalance in the ecosystem and even disturbs the natural biochemical cycles and food chain, which changes the natural pace of climate change and occurrence of extreme weather events.

Different disasters pose different threats. These threats can be substantially reduced by adopting proper measures to build resilience. In the table below some of the disasters, threats associated and the way to build resilience is tabulated.

Table 7: Disasters-its Threats and ways to Build Resilience

Disaster	Threats	How to Build Resilience
Drought	— Increased temperatures enhance evaporation from soils — Affect livestock and crops — Wildfires — Increased energy demand	— Identification of drought vulnerable areas/sectors — Efficient water usage — Promotion of drought resistant crops — Promotion of energy efficient infrastructure and technologies
Heat Waves	— Heat stress/Heat stroke/Heat Syncope/Death/cardiovascular/respiratory complications/kidney diseases — Deterioration of air quality — Crop damage/cattle heat stress/decline conception rate in cattle/reduced milk production — Increase in energy demand	— Preparedness of Action Plans at State/District and Block level — Identification of vulnerable populations — Installation of cool roof and pavement to reduce UHI — Afforestation — Switching to energy efficient appliances

Heavy Precipitation	— Increases the risk of landslides/floods — Degradation of water quality — Soil erosion — Increased cases of water borne diseases	— Construction of flood resilient buildings — Discourage the use of concrete in urban areas — Promotion of the use of permeable surface — Construction at elevated platform
Cyclones	— Property damage — Loss of human lives, livestock and wildlife — Loss of vegetation	— Mangrove protection — Adopting stringent building codes — Strengthening EWS
Wildfires	— Loss of property — Loss of human lives, livestock, wildlife and vegetation	— Strengthening fire fighting system — Maintenance of firelines

Learning Objectives

The objectives of this learning unit is:

- To enable participants the understanding of the factors contributing to extreme events
- To understand the link between climate change and extreme events

Duration: 90 minutes

Method

- ✓ Lecture/power point presentation
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The trainer may use group discussion/exercises to enhance the understanding of the participants. The second objective may be delivered using a group exercise in which each group can be asked to prepare a web diagram or a flow diagram to explain/show their understanding on the linkage between climate change and extreme events. The trainer may also refer to the recommended readings for the clarity of the topic.

Recommended Readings

- CCSP, 2008: Weather and Climate Extremes in a Changing Climate. Global Change Research. Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA, 164 pp.
- Gupta, A. K & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi

2.2: Risk and Vulnerability

Context and Description of the Session

Vulnerability is a defining concept when we talk of disaster risks. It is a complex concept as it is dependent on a wide range of factors-physical, social, environmental, psychological, political, cultural, institutional factors, etc. It is defined differently by different people which makes it more challenging to understand. Some use the term 'predisposition' while others use 'fragility', 'weakness', 'deficiency' or 'lack of capacity' to define vulnerability in context of disaster risks. Some people relate vulnerability with poverty but it's not only the factor. However, poverty is the driver and consequence of disaster risk, particularly in countries with weak risk governance because economic pressures force people to live in unsafe locations and conditions.

The trainer may use group discussion/exercises to enhance the understanding of the participants. The second objective may be delivered using a group exercise in which each group can be asked to prepare a web diagram or a flow diagram to explain/show their understanding on the linkage between climate change and extreme events. The trainer may also refer to the recommended readings for the clarity of the topic.

Vulnerability

It is a characteristics and circumstances of a community that increases the susceptibility of an individual, a community, assets or systems to the impacts of hazards. The concept of vulnerability is relative and it is complex to define as it means different to different people and definitions of vulnerability have included various terms like predisposition, fragility, lack of knowledge, lack of capacity, etc. Poverty is one of the key contributor to vulnerability as they tend to lack proper housing facility, resources, preparedness and coping capacity to hazards that makes them more vulnerable. It can be counteracted by reducing



the impact of hazard by Preparedness, Mitigation, Prediction and Early Warning, capacity building to cope with any hazard, reducing poverty and inequality and improving the governance system, resource availability and livelihood. For instance, a person living on the flood plains are more vulnerable to flood than living on an elevated area.

Vulnerability is one of the defining components of disaster risk which is determined by various factors including physical, Social, economic and environmental that increases the susceptibility of a community/individual to a specific hazard. Apart from these factors, vulnerability also results from historical, political, cultural, institutional, natural resource, etc. (IPCC, 2012).

Physical Vulnerability

It depends on the geographical location and proximity to the origin of hazard. Example: The community living near the sea shore is more vulnerable to cyclones than the one living in plains. Lack of proper access to water, mode of communication, transportation, type of housing, poor design and construction of buildings, unregulated land use planning, etc. results in physical vulnerability.

Economic Vulnerability

Vulnerability depends on the economic status of the nation/community/individual. The poor are more vulnerable to disasters due to the lack of proper housing, access to necessary resources like water, lack of preparedness and coping capacity. Uninsured informal sector, vulnerable rural livelihoods, dependence on single industries, globalization of business and supply chains, results in economic vulnerability.

Social Vulnerability

It depends on the ability of the nation/community/individual to cope with a hazard that is driven by characteristics like age, social interactions, family structures, culture, discrimination based on gender/linguistic/religious/race, economic standard, etc. Social vulnerability is greatest among the poor/developing/politically instable countries. Children, elderly and differently able individuals are considered as the most vulnerable in a society. Poverty, inequality, marginalization, social exclusion, discrimination by gender, social status, disability, age (amongst other factors) psychological factors, etc results in social vulnerability.

Environmental Vulnerability

It is caused due to the poor environmental management, non-judicious use of natural resources, deforestation, unplanned developmental activities, etc. Climate change is the major aspects of environmental vulnerability. Poor environmental management, overconsumption of natural resources, decline of risk regulating ecosystem services, climate change, etc. results in environmental vulnerability.

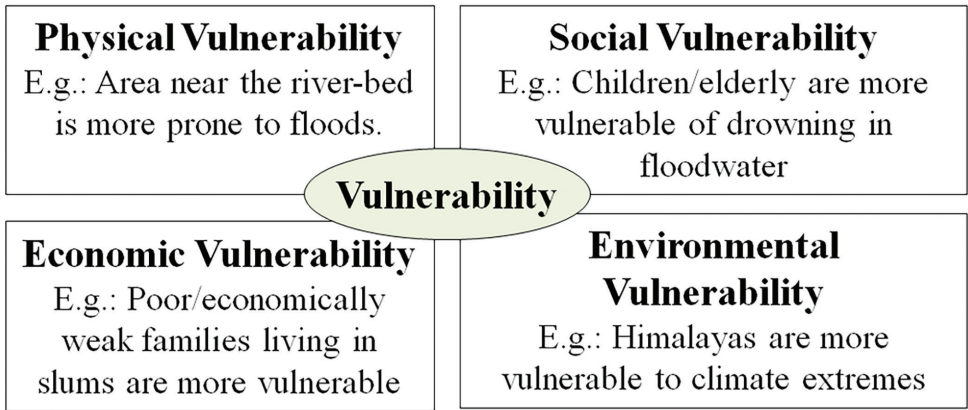


Figure 19: Major factors of Vulnerability

Vulnerability is about Susceptibility and Resilience. Susceptibility is the ability to be exposed to incur harm and avoid loss. Example: Heavy rainfall is threatening an area but the houses are built with flood and run-off resistant materials to prevent being washed away by heavy rain. Resilience is the ability to adjust and recover. It implies to the access to resources, skills, etc. For example: The people of that locality shifts to another area during the rainy season. Vulnerability can be determined by addition of exposure (E) and Sensitivity (S) minus the Adaptive Capacity (AC).

$$\text{Vulnerability} = \text{Exposure (E)} + \text{Sensitivity (S)} - \text{Adaptive Capacity (AC)}$$

Exposure

Exposure is the degree to which the system is exposed to certain hazard or any climate extremes. It is one of the important component of disaster risk. It is also defined as the presence and number of people, property, livelihood,

systems or any other elements in hazard prone areas subjecting it to potential damage. To understand the exposure more clearly we will take an example of Typhoon Lekima (240 km/h) and Typhoon Haiyan (315 km/h). Both the cyclones were of category 5 but they had differential impact in terms of both physical and economical losses. Typhoon Lekima had not significant losses as it had no exposure to people and assets while Typhoon Haiyan caused more than 6,000 casualties and more than 1.5 billion USD losses. These days due to urbanization, population growth, migration and unorganized development are forcing people to concentrate in a hazard prone area making them more exposed to these hazards.

Sensitivity

Sensitivity is the extent to which a system, asset or a community is affected due to climate extremes which maybe adversely or beneficially. Sensitivity of a system/asset/community or individual is attributed to the factors of vulnerability.

Adaptive Capacity

Adaptive Capacity is the capability or the ability of a system to withstand or cope with the climate extremes. It is the opposite of vulnerability. Greater sensitivity and exposure increases the vulnerability while the adaptive capacity reduces the vulnerability. Adaptive capacity recognizes the ability of any individual/community/system/asset to reduce the impact of hazard and reduce its adversity. It includes preventive and mitigation measures against any hazard that has the potential to cause any severe impact. Many a times the indigenous communities play a crucial role in improving the adaptive capacity as their age-old strategies maybe effective in coping with the area specific hazards.

Risk

It is the probability of an unwanted consequences like death/injuries/livelihood loss/property damage, etc that results from interaction of a hazard (natural and human-induced) and vulnerable conditions. Risk is depends on three components- hazard, Exposure and Vulnerability. Risk can be reduced by improving the adaptive capacity. These terminologies have been explained already in the earlier sections.

$$\text{Hazard} \times \text{Exposure} \times \text{Vulnerability} = \text{Risk (Probability of losses)}$$

When all the three components of risk or the factors of risk are met, then a disaster risk occurs. Otherwise, it will just be a hazard. For instance, cloudburst in a valley where there is not inhabitants, infrastructure or any agriculture fields is a hazard. It will become a disaster when the underlying factors of vulnerabilities are exposed with that particular hazard. Risk can be reduced if we are aware of exposure and vulnerability by preparedness, response and recovery. Delay in reduction of vulnerability and increased exposure result in greater loss during a disaster.

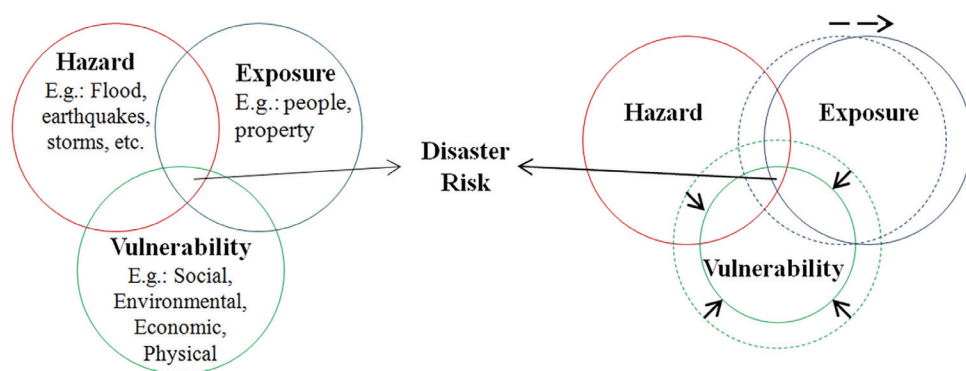


Figure 20: Mechanism of Disaster Risk Reduction

Risk assessment/risk mapping includes the reviewing of characteristics of risks (intensity/frequency/probability), analysis of the exposure, analysis of the vulnerability factors and evaluation of the adaptive capacities. It can be carried out at different scales (Global/international, National/provincial, Municipality/ site-specific), depending on the purpose. There are many ways to deal with risks. Some of them are:

Risk Acceptance: It means the informed decision to accept the possible consequences of any particular risk.

Risk Avoidance: It means averting of the activities that leads to any risk or aggravated probability of risk occurrence.

Risk Reduction: It involves the measures to reduce the likelihood of risk occurrence and consequences.

Risk Transfer: It includes shifting of risks from one party to another commonly through insurance.

Risk Assessment

Risk assessment can be done in number of ways/methods and each method has certain advantages and disadvantages. Some of the methods are: Quantitative Risk Assessment (QRA) method, which provides quantitative risk information that, can be used in analysis of alternatives of risk reduction through comparative analysis. The disadvantage of this method is that it is very data demanding and sometimes it is challenging to quantify hazard intensity and vulnerabilities. Event-tree analysis is another method for risk assessment that is used in modeling a sequence/chain of events and associated probabilities. Risk matrix approach is the most widely used method as it allows the use of risk classes instead of using exact values. The disadvantage of this method is that it uses qualitative values and biasness may be an issue in this method. Indicator-based approach is considered to be the best method when there is data deficient and also takes the various factors of vulnerability (social, economic, physical and environmental) and adaptive capacity into account.

The risk reduction requires integration of risk assessment/mapping into disaster risk management approaches and inclusion in policy-making and planning.

Multi-Hazard Risk Assessment

Various factors including the topography, geomorphology, geology, climatic condition, etc contribute to the occurrence of multi-hazard or more than one hazard at a time. These hazards can be interrelated or even cascading in nature. If the hazards are considered as independent events then the risk assessment gets simpler which can be calculated by addition of the average losses of each hazard. This approach can be used only when the source or the origin of hazard is different, for example: An earthquake and a flood hazard. However, when there is a coupled event or any two/more hazards having same triggering factor, the assessment becomes complex and therefore hazard modeling is used in such scenarios. Another scenario when there is a cascading hazard or domino effect, it becomes complex. The best approach in such scenarios is to use event-tree method that considers all the probabilistic scenarios into account. GIS can also be used for the risk assessment.

Learning Objectives

The objectives of this learning unit are:

1. To define the concept of vulnerability and risk
2. To identify the different factors and aspects of vulnerability
3. To enable participants the basic understanding of the mechanism of disaster risk reduction

Duration: 90 minutes

Method

- ✓ Lecture/power point presentation
- ✓ Case study
- ✓ Group discussion
- ✓ Group exercise
- ✓ Quiz/Question-Answer Session



Trainer's Guide

The trainer should have a sound knowledge of the concept of vulnerability, risk associated factors. Group discussion/group exercise using flip charts can be used to explain the concepts using various examples.

An exercise on different types of vulnerability can be facilitated taking a disaster as a reference. For example: Australian Bushfire.

Physical Vulnerability: Houses near the forest; Houses made of wooden materials, etc.

Social Vulnerability: People dependent on forest as their source of livelihood; children; elderly.

Economic Vulnerability: Economically weak families are more vulnerable.

Environmental Vulnerability: Dry forest/bushes are more vulnerable.

Recommended Readings

Cardona, O.D., M.K. van Aalst, J. Birkmann, M. Fordham, G. McGregor, R. Perez, R.S. Pulwarty, E.L.F. Schipper, and B.T. Sinh, 2012: Determinants of risk: exposure and vulnerability. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 65-108 <https://www.preventionweb.net/risk/disaster-risk>

Learning Unit 2.3: Urban and Peri-Urban Dynamics

Context and Description of the Session

India is undergoing a rapid rural to urban transformation. Urban and peri-urban sprawls are growing at an unprecedented rate. These are the hub of business, administration, education, job opportunities and mass migration from rural to urban. It is constantly expanding with high human density and built up structures that have lead to drastic change in environmental features. These urban sprawls are very resource and energy extensive to meet the demand of the growing population. Peri-urban is not a geographically defined area. It is defined as the transition area of rural to urban that consists of the characteristic of both urban and rural.

People living in peri-urban areas are more vulnerable to climate change and extreme events due to the inadequate availability of basic needs and services. There is a lack of proper developmental planning, governance, finance, environment, etc in urban area and peri-urban area that is creating severe problems in developing countries like India.

Peri-urban areas are future cities and it is important to have an understanding of the challenges and opportunities. Most of the urban and peri-urban areas, not only in developing nations, are suffering from the wrath of disaster due to the increased factors aggravating hazard, exposure and vulnerability. These areas are in constant pressure of becoming a city and it often leads to improper and unplanned development that impact its resilience aggravating various environmental challenges such as drain overflow, urban flooding, air, soil and pollution, heat waves, cold waves, Urban heat island and loss of vegetation, etc. The urban sprawls have shown a profound impact on heat emission, energy consumption thus adversely impacting the microclimate and local climate dynamics. These areas are several degrees warmer due to the presence of heat absorbing materials and this exacerbates the deterioration of air quality. The construction of new buildings in these areas is done without understanding the new risks and impacts. For instance: building collapse, water shortages, urban flooding, electricity shortages, power outages, etc.

Issues of Urban and Peri-Urban Areas

This transition from rural to urban spaces is facing a serious issue of planning and execution. Peri-urban development has led to problems like Poor Infrastructure, Unstable economic activities, Fragile land-use planning, encroachment, slum dwellings, legal and robbery issue, social and environmental problems, poor government and political system, etc. The issues can be broadly categorized into four major types- Physical issues, Financial issues, Governance issues, and Environmental issues.

Table 8: Issues of Peri-urban areas

Issues	Details
Physical	• Lack of infrastructure • Non-contiguous development • Lack of basic amenities
Financial	• More investment compared to returns • Lack of financial resources
Governance	• Multiplicity of authorities • Lack of coordination • Encroachment of land
Environmental	• Depletion of environment due to over burden • Degradation of ecosystem services • Waste dumping sites • Contaminated water resources • Poor quality soil

(Source: Gupta et al., 2017)

Peri-urban areas are fringe areas that are unplanned and undergoing unregulated fast transition, which is why infrastructures are often poorly developed with lack of basic amenities like clean drinking water, sanitation, transportation facilities, security, etc. Weak infrastructure is caused due to the lack of proper institutional structure for governance and development. Peri-urban areas are also vulnerable to environmental degradation as well due to its proximity to cities, which has degraded natural resources like land/water and air due to large-scale waste generation and improper handling of those wastes. The governance in peri-urban areas is very complex as several agencies are involved including Panchayats, Town Planning department, Urban Development and rural development, etc. The roles of these agencies in transition areas are not very clear and many a times there is an overlapping of responsibilities.

Cities or the urban areas have pressing challenges like poverty, environmental degradation, poor planning and high population. Poor air quality, poor water quality, insufficient water resources, waste management and handling issues, high cost of living and increased slum dwellers, etc are some of the common problems in urban areas. These issues contribute in increasing the vulnerability factors and increasing the likely impact of climate change and related extreme events.

Figure 21: Issues of Urban areas

Issues	Details
Physical	• Lack of resilient infrastructure • Unequal availability of basic amenities
Financial	• Lack of adequate job opportunities • Poverty
Governance	• Lack of political will • Lack of coordination
Environmental	• Degraded environment • Poor air and water quality • Excessive waste generation and unregulated waste management

Approaches

- Adequate economic development and alternate livelihood sources
- Ecosystem based approach and nature-based solutions to reduce the environmental degradation
- Green growth approach must be promoted and encouraged on wider scale
- Development of livelihood sources in rural areas as well as urban areas equally can help in migration of people from rural to urban areas

In addition, working on the sustainable development goal number 11 will help in improving the issues of urban and peri-urban areas. The Global Sustainable Development Goal 11 focuses on making cities and human settlements inclusive, safe, resilient and sustainable with ensured safe housing facilities, tackle growing environmental consequences by reducing disaster vulnerabilities. The targets of the Sustainable Development Goal 11 are enlisted below.



Figure 22: Targets of the Sustainable Development Goal 11

	Target 11.1: Safe and Affordable Housing By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
	Target 11.2: Affordable and Sustainable Transport Systems By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
	Target 11.3: Inclusive and Sustainable Urbanization By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.
	Target 11.4: Protect the World's Cultural and Natural Heritage Strengthen efforts to protect and safeguard the world's cultural and natural heritage.
	Target 11.5: Reduce the adverse effects of Natural Disasters By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.
	Target 11.6: Reduce the Environmental Impact of Cities By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.
	Target 11.7: Provide Access to Safe and Inclusive Green and Public spaces By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.
	Target 11.8: Strong National and Regional Development Planning Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

	Target 11.9: Implement Policies for Inclusion, Resource Efficiency and Disaster Risk Reduction By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.
	Target 11.10: Support Least developed Countries in Sustainable and Resilient Building Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.

Role of Urban and Peri-urban Ecosystem in Urban Resilience

Cities are important for climate change mitigation and adaptation, disaster risk management and enhancing the climate resilience. The peri-urban ecosystem is constantly deteriorating due to the lack of sound knowledge about the ecological impacts caused due to rapid urbanization. Therefore, it is important to understand the role of peri-urban ecosystem in improving urban resilience.

Conversion of agricultural lands to urban settlement areas adversely impact the environment as it plays a crucial role in providing environmental services as well as diversifying urban diets. The exponential growth of population in cities is exerting a huge pressure on water resources. This pressure is likely to exacerbate with changing climate. The rapid urban and peri-urban growth increases the highly vulnerable communities with the poor being worst affected (Dubbeling, 2019). The energy extensiveness of cities releases a huge amount of GHG due to fossil fuel burning that deteriorates the air, water and soil quality thus impacting the health of the

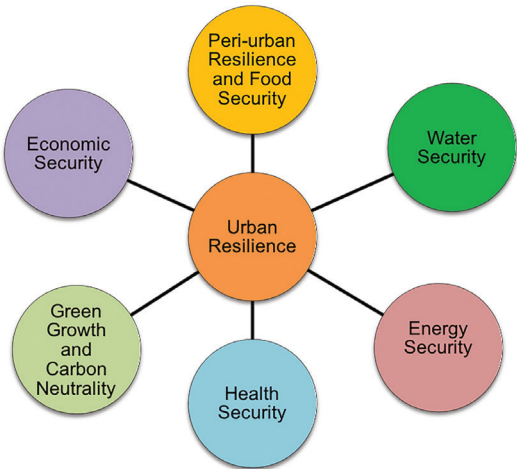


Figure 23: Key aspects of a resilient urban and peri-urban area

people living in urban hubs. Therefore, cities play an eminent role in addressing the challenge of climate change by reducing the emission and energy usage. Integration of climate change adaptation measures and disaster risk reduction plays a major role in urban resilience and sustainability through peri-urban ecosystems. Extensive study on the carrying capacities of the urban and peri-urban centres needs to be undertaken considering the role of ecosystem in development processes.

Case 1: Case Study of Jorhat, Assam

The area have undergone a huge land use changes from 1962-2005 and approximately the vacant area has decreased from 87.35 ha to 39.88 ha. This led to decrease in surface flow capacity thus causing the problem of water logging. The area has now become prone to recurring floods and water logging in past years.

Case 2: Case Study of Bashirhat, West Bengal

Rapid urbanization, increase in urban sprawl, huge rural to urban migration and drastic change in the land use change have led to the loss of ecosystem services in this area. In addition, to make the condition worse climate change is having additional impact due to that unpredictable rainfall pattern, high temperatures and humidity. Drinking water crisis, contamination of groundwater and water logging has become another issue in this area due to the massive land-use change.

Case 3: Case Study of Gomti Nagar, Lucknow

Gomti Nagar in Lucknow is one of the largest and fast developing commercial and residential set-up. Numerous real-estate and shopping malls are coming up in the area which lead to the migration of many from rural areas to these places. The cultivating lands are in close proximity with the residential and commercial areas and large portion of agricultural lands are constantly being diverted to non-agricultural lands. And the development is taking place in the low-lying area of trans-Gomti river posing a future risks of flood and water-borne diseases due to poor water quality. The area is developed in a planned manner but there still lack adequate water supply system, sewerage and solid waste management system.

Learning Objectives

- ✓ To identify and define the risks and challenges faced by the urban and peri-urban areas.
- ✓ To learn about the consequences of rapid urbanization and land use change.
- ✓ To understand the role of urban and peri-urban ecosystems in urban resilience.

Duration: 90 minutes

Method

- ✓ Lecture/power point presentation
- ✓ Case study
- ✓ Group discussion
- ✓ Group exercise
- ✓ Quiz/Question-Answer Session

Trainer's Guide

Trainers should develop a conceptual understanding of the benefits and linkages of per-urban ecosystem services in urban resilience and develop a critical thinking to instill a healthy group discussion. The recommended readings may be referred for the detailed study of the cases mentioned.

Suggested Readings

- Gupta, A.K., Singh, S., Wajih, S.A., Mani, N., Singh, A.K. (2017). Urban Resilience and Sustainability through Peri-Urban Ecosystems: Integrating Climate Change Adaptation and Disaster Risk Reduction, Gorakhpur Environmental Action Group, Gorakhpur (U.P.) India.
- Ravetz, J. fertner, C. Nielsen, T.S. (2013). The Dynamics of Peri-Urbanization.
- Gupta, A. K., Gotmare, S., Nair, U., & Babu, S. (2019). Green Growth Benefits for Climate and Disaster Resilience: Concerns for Urban and Infrastructure Systems. Position Paper, NIDM and GGGI, P, 17.
- Gupta, A. K., Wajih, S. A. Mani, N & Katyal, S. (2017). Vulnerabilities of Urban Poor Children and Urban/Peri-urban Ecosystem Based Resilience. Thematic Paper. Gorakhpur Environmental Action Group (GEAG), Gorakhpur, Uttar Pradesh.

- Gupta, A.K., Mani, N., Sarkar, B.B., Singh, S., Katyal, S. (2019). Developing Disaster Risk Resilient Cities. Gorakhpur Environmental Action Group (GEAG), Gorakhpur (UP), National Institute of Disaster Management, New Delhi, India and United Nations Children's Fund (UNICEF), India. September 2019. Pages 72.

Learning Unit 2.4: Rural Environment and Livelihood

Context of the Session

We all know that climate change has a huge impact on our natural resources, livelihood activities, food security, health and infrastructure and rural environment and livelihood are majorly dependent on these. Multiple stressors aggravated as a result of climatic change increases risk to rural environment and livelihood due to extreme events thus reducing adaptive capacity, resilience and increasing vulnerability. In addition, India having more than 70% rural population, directly dependent on the natural resources and more severely affected by the climate change and the related extreme events. Therefore, it makes necessary to know and study about the impact of climate extreme events on rural environment and livelihood. In countries like India, climate adaptation measures plays a significant role in safeguarding rural livelihoods, stepping stones towards sustainable development and resilient building. Rural communities also face many challenges in responding and adapting to climate change that enhances their factors of vulnerability and under the umbrella of climate change thriving of economic activities like agriculture, forestry, etc are a major challenge. In addition, rural communities have physical isolation, limited economic diversity, higher poverty rates and poor adaptive capacity are further aggravating the vulnerability factors. Global warming, climate variability, extreme weather events and sea level rise is affecting the rural livelihood and economies. Many communities are facing considerable risks to their culture, livelihood and food security in terms of climate extreme events including pest attacks, droughts, floods, extreme temperature events, etc and additionally affecting the health and well-being of rural communities. Rural communities are also associated with wildlife related activities, fishing and other recreational activities, which are likely to get affected by climate change. Coastal areas are also adversely getting affected by sea level rise, saltwater intrusion, storm surge, heat waves, etc that can alter the characteristic of rural area as a tourist attractions and other recreational activities.

In addition there are higher rates of unemployment, illiteracy and dependence on government/NGOs for resilience building against climate change and adaptation towards the extreme weather events.



Figure 24: Extreme events in rural environment affecting their livelihood sources

Approaches

- Emphasize needs to be given on the integration of climate adaptation measures in various sectors, policies and schemes to reduce the risks associated with climate variability and the extreme events.
- State-level or even district/block level vulnerability and risk assessment should be undertaken to identify risks associated with the area owing to climate change and help in policy-making and decision-making processes.
- A public-private partnership and working together with NGOs should be encouraged in order to have a mass reach of the benefits associated with government schemes and monitor the ground-level implementation.
- Monitoring and evaluation of schemes/programmes like CAMPA/JFM programme, watershed development programme, etc. should be time timely done.
- Most importantly, capacity building is the key for development of adaptive capacity at local level.
- Promotion of public participation, community involvement in any developmental programmes and community centric disaster risk reduction approaches.
- Diversifying rural livelihood sources and finding alternatives during the times of crisis for those who are solely relied on natural resources.

A Case Study of Bihar Flood

Northern part of Bihar witnesses a recurring flood in the river systems of Kosi, Gandak, Bagmathi and Mahananda. Nearly 70 percent of its geographical land area is prone to flood hazard. In addition, Bihar is one of the state with high poverty rates, high illiteracy rates and high population density that has resulted to low availability of land per capita and low agricultural productivity. Due to the recurring flood, lakhs of people lose their homes leading to mass displacement. Not only that flood affects the livelihood of many since majority of the population are agriculture dependent and due to water logging agriculture activity and livelihoods are severely affected. Many reports and studies says that due to large-scale diversion of forestland to agricultural land and grazing land in upstream areas of Nepal in turn affecting the downstream areas and in addition, the rainfall in these river basins have significantly increased. Another reason could be due to the encroachment of the flood plains that increase the physical factor of vulnerability.

A Case Study of Africa

The African countries of Ethiopia, Somalia and Kenya have been facing a series of drought year, which has lead to severe food shortages, affecting their livelihood and rendering millions to displace. The situation is likely to get worse as the impact of climate change and global temperature is still rising at a fast pace. The temperature in these areas is already very high due to their geographical location and physiographic features and a small increase is becoming a huge matter of concern to them. Because of climate change, these areas are also facing erratic precipitation pattern and more extreme weather events like flooding and heavy rains. As a result, families have lost their income sources, food shortages and leaving with no option then engaging in hazardous jobs and even begging for food.

Adaptation Challenges

- Limited availability of local capacity and resources in rural areas, to deal with the affects of climate change is a huge challenge. They often tend to be dependent on NGOs and other external agencies for immediate assistance

and services or they have to travel to some distance to avail even basic services.

- Inadequate education facilities and awareness are a major reason for the limited livelihood exploration by the rural communities forcing many to migrate to urban settings and live in a vulnerable condition.
- Majority of the communities are directly or indirectly dependent on agriculture and in addition, agriculture is highly dependent on climate and weather conditions making it one of the most vulnerable sector due to climatic change. The impact of climate change on agriculture is very much evident from the instances of the rise in atmospheric temperature and occurrence of extreme weather events like droughts, heat wave, floods, hailstorms, flash floods, cyclones, etc. Such extreme weather events are likely to increase in future thus further reducing their soil fertility due to erosion, crop yield and livestock product yield.
- Climate change is also creating a favorable condition for many new disease vectors to survive and transmit infections and diseases, threatening the lives of humans, animals and plants, thus enhancing the socio-economic challenges.

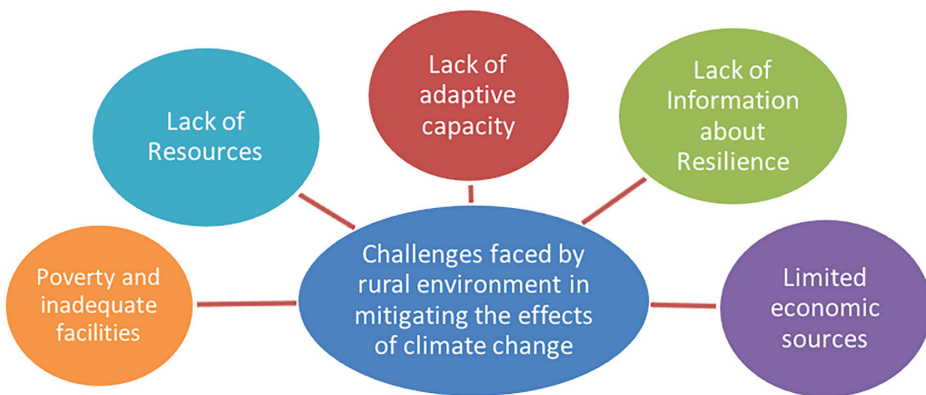


Figure 25: Reason for the challenges faced by rural environment in mitigating the effects of climate change

Case Study of Odisha, India (Source: Patel et al, 2019)

Odisha is one of the disaster prone states in India with frequent occurrence of extreme events like heat waves, droughts, floods and cyclones. In this state, the 83.31% of people live in rural area and their livelihood majorly dependent on agriculture, fisheries, daily wage laborers, dairy farming, etc. The occurrence of extreme events has a significant impact on small and marginal farmers, landless laborers, rickshaw pullers and marginalized communities.

Impact of heat wave on livelihood:

Heat wave affects almost all districts of Odisha and majorly affects the elderly, children, outdoor workers and people living in urban slums and their livelihood gets affected since they are not able to work during the daytime and some even get sick. Many even suffer from health issues including heat stress, heat exhaustion, severe dehydration and even heat stroke.

Impact of drought on livelihood:

Since rain-fed agriculture is the major source of livelihood for most of the people. Poor farmers do not have access to irrigated water and therefore drought pose a great threat to this population. With the increase in the frequency and duration of drought period incidences of crop failure, land alienation, farmer indebtedness, rural to urban migration are occurring in the drought affected areas. In the year 2002, due to severe drought and low rainfall paddy yield was lost by 70-75%.

Impact of cyclones on livelihood:

Cyclone occurs almost every year in Odisha and destroys an array of livelihood sources including submergence of cultivated fields, crop damage, livestock loss and damage to fishing grounds. Due to cyclones, fishing community is affected the most and even the agricultural sector is affected due to salt-water intrusion.

Impact of floods on Livelihood:

Nearly 1.40 lakh ha of the state's geographical area is prone to flood. Due to floods, agriculture is affected the most due to submergence of agricultural fields and crop failure. Flood vulnerability increases majorly due to the encroachment of flood plains.

Learning Objectives

- ✓ To know how extreme events affects rural environment
- ✓ To study the affect of extreme events on rural livelihood

Duration: 90 minutes

Methods

- ✓ Lecture
- ✓ Case Study
- ✓ Group exercise
- ✓ Discussion
- ✓ Quiz/Q&A



Trainer's Guide

The course facilitator may use case study example to explain the impact of climate change on rural environment and their livelihood. A short clips about the extreme events in rural areas may be shown to make the session interesting. For example: A case study of Bihar flood maybe taken to show how the floods get the agricultural fields inundated and livestock gets washed away in floodwater, which are the income/livelihood sources of the people in those areas. At the end of the session, the participants maybe asked some questions related to the session, to check their understanding level and make the session more participatory.

Recommended Readings

- Gupta, A.K., Singh, S., Wajih, S.A., Mani, N., Singh, A.K. (2017). Urban Resilience and Sustainability through Peri-Urban Ecosystems: Integrating Climate Change Adaptation and Disaster Risk Reduction, Gorakhpur Environmental Action Group, Gorakhpur (U.P.) India.
- Patel, S.K. Mathew, B. Nanda, A. Pati, S & Nayak, H. (2019). A review on extreme weather events and livelihood in Odisha, India. Mausam. 70.3. pp.551-560

Tools and Methods for Assessment

Context and Description of the Session

Disaster Assessment can be seen as integral part of a response mechanism as well as in a planning mechanism. It is a continuous process that should be done at every phase of a disaster cycle. A disaster Assessment can be divided into following elements- Pre-disaster Planning, Survey and Data Collection, Interpretation, Forecasting, reporting and Monitoring. The intention of disaster assessment during the initial phase of a disaster is to guide in managing emergency services such as search and rescue, estimate the extent of losses and damage. These information are needed to mobilize the humanitarian support, reconstruction and mitigation needs. In survey and data collection element it majorly focuses on estimation of the losses and damages through a standard survey techniques. All the information needs to be interpreted so that the responsible decision makers can take necessary action and forecasted for trends and needs. In slow onset disasters monitoring is necessary to understand the situation whether it is improving or deteriorating. It will also help us in measuring effectiveness of our action.

Understanding the vulnerability of an asset to climate change and extreme events is very important in decision-making as well as in any developmental planning process. It allows identification of area of concern and help in mobilizing mitigation measures.

The immediate phase after a disaster is the period during which efforts to save human lives, alleviate suffering, and reduce economic loss take priority. During this phase, emergency needs, water supplies and sanitation, food aid, temporary shelters, and health needs must be supplied as quickly as possible. While environmental issues are often not considered during this phase, environmental damages can be caused that can negatively impact those trying to recover from the disaster. For example, debris created by disasters is often cleared into unsafe or low lying ecologically sensitive habitats such as lagoons or wetlands that sustain livelihoods (e.g., fishing grounds) and provide other ecosystem services (e.g., clean drinking water), thereby causing additional problems for affected communities.

Environmental Assessment (EA)

Environmental Assessment is a set of procedure that considers holistic environmental implications prior to making any final decision about any developmental project and undertaking of new construction of a project, project expansion or modernization. It analysis the impact of that activity on environment, reports those effects, propose alternate solutions and undertake public consultation exercise before finalization. The final decision is revealed to public after addressing the comments and solutions proposed by a board of experts. EA is an important tool to overcome the shortcomings of any project and also strengthens the decision-making within a project. It is tool using which we can make an environmental sound development when it is implemented properly. EA when undertaken for individual projects such as multi-purpose dams, industries, power plants, airports, etc is called as ‘Environmental Impact Assessment’ while when EA is undertaken for any plans, programs, and policies is called as ‘Strategic Environmental Assessment’ (SEA).

Environmental Impact Assessment (EIA)

Nowadays with growing concern for environment, mindful development, sustainable development, EIA is gaining a lot of focus. It is defined as an activity designed to identify and predict the impact of legislative proposals, policies, programmes, projects and operational procedures on the bio-geophysical environment and on the health and well being of human beings and to interpret and communicate information about the impact.

Salient Features of EIA:

1. EIA focuses on problems, conflicts or natural resource constraints that could affect the viability of a project.
2. Examines implications of a project that might harm people, their livelihoods, or other nearby developments
3. Identifies measures to minimize the problems and outlines ways to improve the project’s suitability for its proposed environment
4. wider in scope and less quantitative than other techniques, such as cost-benefit analysis
5. EIA has the potential to be a basis for negotiation among the developers, public interest groups and planning regulators.

6. It facilitates decision making by proving a systematic examination of the environmental implications of the proposed project and find alternatives.
7. EIA considers the environmental implications of a developmental activity in the planning phase which lead to an environmentally sound and sensitive development.
8. It is a tool to find out a way to modify the project in order to minimize or eliminate the adverse environmental impact.
9. It is an important instrument for sustainable development.

Strategic Environmental Assessment (SEA)

It is an advanced tool in EIA, which is defined as the formalized, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making. SEA is the EIA of policies, plans and programmes like town plans, regional development programmes, etc. It is often considered as an instrument for decision-aiding rather than decision-making process. The scale of SEA is wider than that of EIA as it involves a number of activities and impacts to assess. However, time taken is longer in SEA and the data collection is time consuming.

Table 9: Comparison between EIA and SEA

Environmental Impact Assessment	Strategic Environmental Assessment
Is usually reactive to a development proposal	Is pro-active and informs development proposals
Assesses the effect of a proposed development on the environment	Assesses the effect of a policy, plan or programme on the environment, or the effect of the environment on development needs and opportunities
Addresses a specific project	Addresses areas, regions or sectors of development

Assesses direct impacts and benefits	Assesses cumulative impacts and identifies implications and issues for sustainable development
Focuses on the mitigation of impacts	Focuses on maintaining a chosen level of environmental quality
Narrow perspective and a high level of detail	Wide perspective and a low level of detail to provide a vision and overall framework
Focuses on project-specific impacts	Creates a framework against which impacts and benefits can be measured

Environmental Auditing

Environmental Auditing (EA) is defined as a systematic and documented verification process of objectively obtaining and evaluating evidence to determine whether an organization's Environment Management System (EMS) conforms with audit criteria set by the organization, and for communicating the results of this process to management (ISO 14001). It is a methodical review to check whether any activity or method used to achieve the product goal is environmentally sound or not. It verifies and evaluates the level of deviations between targets and results. EA is used to check the effectiveness of the environmental efforts at various levels and at various organizations. It is undertaken to:

1. Verify compliance
2. Review implementation of policies
3. Identify liabilities
4. Review management systems
5. Identify needs, strengths and weaknesses
6. Assess environmental performance
7. Promote environmental awareness

Environmental Audits can be categorized into three categories:

1. Liabilities Audit

- i) Compliance auditing is the most common form of environmental audits. It is a verification process whereby the facility establishes the extent to which it is complying with environmental legislations, regulations, emission limits, etc.
- ii) Operational risk concentrates on the potential frequency and consequences of environmentally damaging activities in the raw material and product storage/handling and manufacturing process.
- iii) Acquisition audits assess the liability due to contaminated land and building remediation costs.
- iv) Health and safety audits normally form part of health, safety and environment (HSE) audit and involve assessment of adequacy of personal protective equipment (e.g., safety shoes, goggles, helmets, etc.), emergency preparedness and disaster management plans.

2. Management Audit

- i) Management system audits are carried out to check the systems against the policy and standards such as ISO 14001.
- ii) Policy audit is carried out to appraise and re-assess the relevance of policy in developmental activities (legal, technical, financial) within the organization and outside.
- iii) Issues audit is carried out to establish environmental management plan and targets.

3. Activities Audit

- i) Environmental site audit examines all aspects of the facilities performance with respect to the environment.
- ii) Waste Audit assesses waste management practices and procedures.
- iii) Product audits cover several aspects of their environmental impacts through design, manufacture, use and disposal.
- iv) Cross boundary audits assess activities, which cut across departments or business units (e.g., transport and supply chain audits).

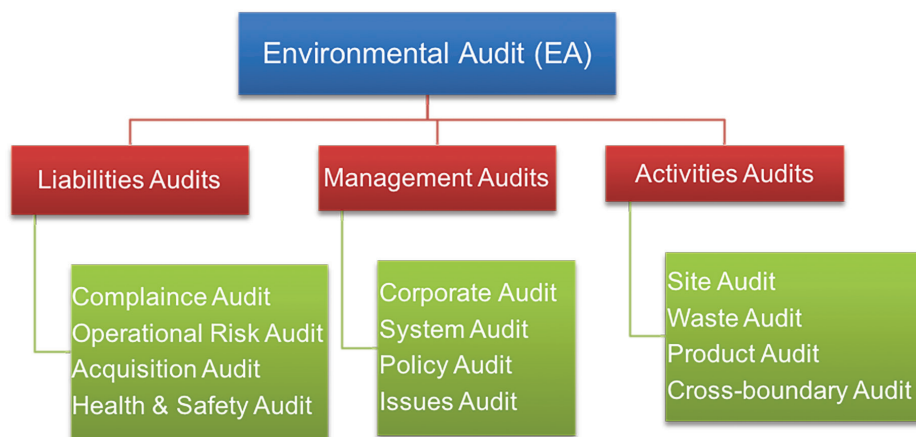


Figure 26: Categories of Environmental Audit (EA)

Life Cycle Assessment (LCA)

Life cycle assessment (LCA) is a tool to evaluate the environmental effects of a product or process throughout its entire life cycle. An LCA entails examining the product from the extraction of raw materials for the manufacturing process, through the production and use of the item, to its final disposal, and thus encompassing the entire product system. The unique feature of this type of assessment is its focus on the entire life cycle, rather than a single manufacturing step or environmental emission. The theory behind this approach is that operations occurring within a facility can also cause impacts outside the facility's gates that need to be considered when evaluating project alternatives.

Steps in LCA:

1. Goal definition (ISO 14040): The basis and scope of the evaluation are defined.
2. Inventory Analysis (ISO 14041): Identification and quantification of energy and resource use and environmental releases to air, water, and land.
3. Impact Assessment (ISO 14042): Emissions and consumptions are translated into environmental effects.
4. Improvement Assessment/Interpretation (ISO 14043): Evaluation and implementation of opportunities to reduce environmental burden.

Uses of LCA

- In the design process to determine which of several designs may leave a smaller “footprint on the environment”
- After the fact to identify environmentally preferred products in government procurement or eco-labeling programs.
- The study of reference or benchmark LCAs provides insight into the main causes of the environmental impact of a certain kind of product and design priorities and product design guidelines can be established based on the LCA data.

Environmental Management System

The growing concern for environment and the increase of pollution/ environmental degradation has led to the development of various environmental standards and pollution control regimes. Some of the examples are BS 7750, the European Union’s Eco-Management and Audit Scheme (EMAS) and the ISO 14000 series. EMS involves preparing a list of all environmental legislation, making a register of all environmental effects associated with the company’s activities, setting targets (such as reducing waste production by a quantifiable amount), keeping appropriate records and undertaking regular reviews of the system. Most of the environmental management systems are built on the model of ‘Plan-do-check-act’.

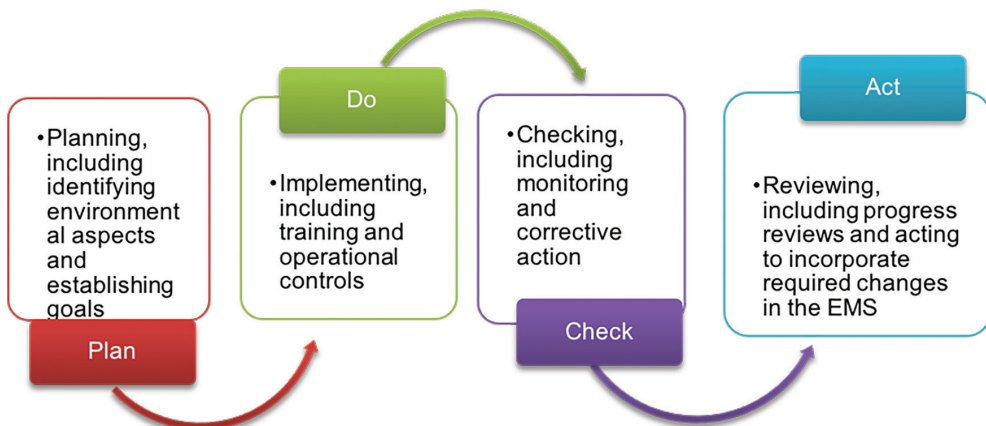


Figure 27: Plan-do-check-act Model of EMS

Benefits of EMS

Numerous benefits are associated with the adoption and implementation of EMS. Some of the benefits are enlisted below:

- Improved compliance
- Enhanced and better environment performance
- Prevention and reduction of environmental pollution and degradation
- Increased efficiency in the resource use
- Awareness and concern for environment and environmental issues
- Increased collective and individual responsibility for environment protection

Table 10: ISO 1400 series

ISO Number	Title of the Standard
ISO 14000	Guide to Environmental Management Systems: General Guidelines
ISO 14004	Environmental Management Systems-General Guidelines on Principles, systems and supporting techniques
ISO 14010	Guidelines for Environmental Auditing-General Principles
ISO 14011/1	Guidelines for Environmental Auditing-Audit procedures- Auditing of environmental management systems
ISO 14012	Guidelines for environmental Auditing-Qualification criteria for environmental auditors
ISO 14013	Management of Environmental Audit Programs
ISO 14014	Initial reviews
ISO 14015	Environmental Site Assessments
ISO 14020	Environmental Labeling-General principles
ISO 14022	Environmental Labeling-Symbols
ISO 14023	Environmental labeling-Testing and verification methodologies

Enabling Objectives

By the end of this module, the participants will be able to

- ✓ Understand the existing environment management tools like EIA, SEA, LCA, EA, EMS, etc. and purpose, uses and benefits of these tools.
- ✓ Enlist various Environmental Policy Instruments and understand the relation between these policy instruments and CCA-DRR.

- ✓ Explain the concept of various tools for Risk Assessment, Vulnerability Assessment and Impact Assessment.
- ✓ Apply various tools for climate extreme events.

There are four Learning units delineated to draw this module:

LU-1: Environment Policy Instruments and their role in CCA-DRR.

LU-2: Risk and vulnerability Assessment Tools.

LU-3: Disaster Impact Assessment methods and tools.

Learning Objectives

- ✓ To facilitate participant's knowledge on the importance of Environmental Policy Instruments and their role in CCA-DRR.
- ✓ To understand the concept of various tools for Risk, Vulnerability and Impact Assessment.
- ✓ To learn to apply various tools for climate extreme events.

Duration: 90 minutes

Methodology

- ✓ Lecture/PowerPoint Presentation
- ✓ Hands-on exercise on different tools
- ✓ Group exercise

Trainer's Guide

The Session faculty is advised to include hands-on exercises to have a comprehensive understanding of various assessment tools and its applications. This module includes a session with group exercise wherein course facilitator can incorporate exercises to use tools like HRVCA/Risk Matrix.

Recommended Readings

- Skavdal, T. (2003). Introduction to Disaster Assessment and Assessment Methodologies. International Training Program on Total Disaster Risk Management. United Nations Office for the Coordination of Humanitarian Affairs (OCHA) Kobe, Japan
- Gupta and Nair. (2012). Applying environmental impact Assessments and Strategic Environmental assessments in Disaster Management. The Role of Ecosystems in Disaster Risk Reduction. Edition: 1. Publisher: United Nations University Tokyo.
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi

Learning Unit 3.1: Environment Policy Instruments and their Role in CCA-DRR

Context and Background of the Session

Environmental Policy Instruments are the means for executing environmental policies. There are many instruments that are relevant for environmental policies and structures activities, which aim in streamlining policies in the society toward environmental goals and simplifying the policy making and application. It is basically a tool used by governments to implement their environment policies. The most common instruments for environmental policies is price incentives in the form of taxes or subsidies. For example, Taxes and fees can be effective to encourage compliance with environmental policy. Such instruments help to link policy development and decision making to policy implementation. Environmentally related taxes, fees and charges increase the cost of polluting products or activities, and as a consequence discourage their consumption and production, regardless of whether this was the intended purpose of the tax or not. Taxing carbon dioxide emissions and other greenhouse gases has become more and more popular, although in most countries explicit carbon taxes still play a minor role compared to excise taxes on energy products.

As we gradually have known the linkage between environment and disasters, concerns for integrating Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) are growing in recent years as both addresses the issues of climate extreme events and focuses on reducing vulnerability and enhancing resilience. The disaster management approach have undergone a second paradigm shift wherein the link between environment and Disasters are established which prioritizes on the use of environmental approach for Disaster Risk Management. Most of the hazards are associated with environmental processes and strategic management of disasters calls for a ecosystem based DRR and mainstreaming CCA & DRR.

Environmental Policy Instruments

Instruments useful in the formulation and implementation of policy are called ‘policy instruments’. There are many instruments that are pertinent

for environmental policy. Environmental Policy Instruments can be seen as the means for executing environmental objectives in project & policy design and defined as an Instruments for environmental policy are structured activities aimed at changing other activities in society towards environmental goals. The prime role of environmental policy instruments (EPIs) is in reducing the risk to manageable proportions. The Environmental Policy Instruments are necessary for mainstreaming and implementing CCA and DRR with minor customization and inclusion of DRR as a co-section. Some of the common EPIs are (Gupta & Nair, 2012):

1. Regulatory Instruments

- a. Command and Control Strategies
 - i. Policy statements
 - ii. Environmental laws, acts, rules
 - iii. Regulatory notifications
- b. Market-based instruments
 - i. Environmental taxes, levy and cess
 - ii. Environmental clearance
 - iii. Discharge and liability permits

2. Socio-commercial Instruments

- a. Environmental economics and resource accounting
- b. ISO/EMS certification
- c. Environmental Auditing
- d. Eco-mark and eco-labeling

3. Ecological Planning Instruments

- a. Environmental Impact Assessment (EIA)
- b. Environmental Risk Assessment
- c. Life Cycle Assessment (LCA) and Industrial Ecology
- d. Ecological footprints
- e. Environmental Vulnerability Indicators (EVI)
- f. Strategic Environmental Assessment (SEA)

Role of Environmental Policy Instruments in DRR

Policy instruments like EIA, provides avenues for integrating CCA and DRR into developmental process by effective planning and decision with the help

of reporting anticipated environmental impacts. Disaster generate direct or indirect impact to environment and assessment of environmental impacts due to disasters provides a strategic understanding of vulnerabilities and potential risks which helps us in mitigation of anticipatory risks and reduce the impact. Environmental Assessments (EAs), therefore, of any kind and any levels are known to provide scientific and strategic insights on potential risks and vulnerabilities in the defined region, and thus, help in approach to disaster risk reduction. Millennium Ecosystem Assessment (MA), an exercise of global significance, itself is an extended application of EIA, and is known as a milestone in disaster risk reduction worldwide. It also helps in bringing development and disaster risk reduction concerns within one umbrella. Similarly, SEA is another important tool for integrating DRR in developmental plans and policies at national as well as sectoral levels but it covers wider range of activities than EIA. SEA is a policy-focused tool while Cumulative EIA (C-EIA) is EIA expertise taking the cumulative or combined impact of multiple sources in a regional context.

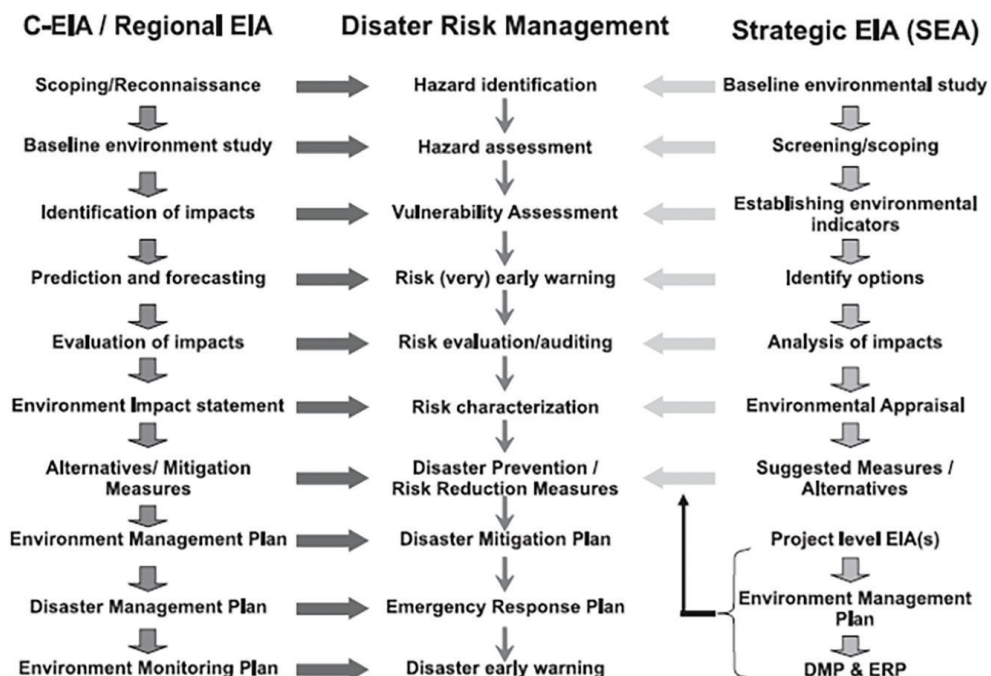


Figure 28: Inputs of SEA and C-EIA to DRR (Source: Gupta & Nair, 2012)

Some examples of policy instruments for environment protections and their role in CCA-DRR are briefly discussed below in Table below.

Table 11: Environmental Policy Instruments and their role in CCA-DRR
(Adapted from Gupta & Nair, 2012)

Name of the Policy Instrument	Description	Role in CCA-DRR
Environmental Impact Assessment (EIA)	A tool used to identify the environmental, social, and economic impacts of a project prior to decision-making.	With the paradigm shift in disaster management to prevention and mitigation and arising question on the naturalness of the “Natural” disasters, EIA contributes in development with ecosystem approach while considering the SDGs.
Strategic Environmental Assessment (SEA)	A tool for evaluating the effects of proposed policies, plans and programmes on natural resources, social, cultural and economic conditions and the institutional environment in which decisions are made. (www.epa.gov)	It strengthens the policy and plan process. It leads to better environmental protection, management and promotes sustainable development.
Life Cycle Assessment (LCA)	A tool for examining the inputs/outputs of materials and the associated environmental impacts directly attributed to the functioning of a product/service throughout its life cycle.	Prediction and forecasting of changing patterns of hazards and risk profiles over time to cause a disaster.
Environmental Management System (EMS)	A set of processes and practices that enable an organizations to reduce its environmental impacts and increase its operating efficiency. (www.epa.gov)	It helps to find out the impact of a strategy or activities of an organization/facility, person or business on environment leading to hazards, vulnerability or mitigation, and related data/ documentation.

Eco-labeling/ Eco-mark	Eco-labeling is a method of certification of environmental performance of a product/ service to identify as environmental friendly.	It's a way of encouraging the people's contribution in reducing environmental impact and future disaster prevention by reducing hazards.
The Polluter Pays Principle (PPP)	The polluter should bear the cost of pollution/ environmental degradation and the pollution prevention/ reduction control measures.	It's a way of reducing environmental degradation and future disaster risks.
Environmental Taxest	Payment to limit the negative environmental impacts	Limit the origin of environmental of hazards and vulnerability
Natural Resource Accounting (NRA)	Use of data on environmental features in economic decisions	Anticipatory risk and vulnerability assessment, resilient potential
Environmental Auditing/ Environmental Management System (EMS)	Water Audit, Health & Safety Audit, environment audit, etc	Impact of any activity/project by an organization/agency on environment leading to an anticipatory hazard and increasing vulnerability

Learning Objectives

1. To build an understanding of environmental policy instruments and their role in CCA-DRR
2. To enlist various environmental policy instruments and identify their role in CCA-DRR

Duration: 90 minutes

Method

- ✓ Lecture/power point presentation
- ✓ Group exercises
- ✓ Discussion

Media

- ✓ Flip Charts
- ✓ LCD/Projector
- ✓ White board
- ✓ Markers



Trainer's Guide

This session shall cover the basic understanding of the environmental policy instruments and their importance in mainstreaming Climate Change Adaptation and Disaster Risk Reduction in developmental planning/process. Some of the policy instruments are discussed here but the course facilitator may add more policy instruments for better understanding and clarity of the participants.



Recommended Readings

- Gupta, A.K. Nair, S.S. Wajih, S. A. Chopde, S. Gupta, G & Aggarwal, G. (2014). Training Module on Mainstreaming Climate Change Adaptation and Disaster Risk Reduction into District Level Development Plans.
- Huppes, Gjalt. (2001). Environmental policy instruments in a new era, WZB Discussion Paper, No. FS II 01-404, Wissenschaftszentrum Berlin für Sozialforschung (WZB), Berlin
- Gupta, A. K & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi
- Gupta, A. K. Chopde, S & Singh, D. (2016). Integration of Disaster Risk Reduction-climate Change Adaptation in Developmental Planning: The Actions at Sub-national levels. Proceedings of National Workshop. Technical Report.

Learning Unit 3.2: Risk and Vulnerability Assessment Tools

Context and Background of the Session

The concept of risk and vulnerability has been discussed in detail in the preceding learning units. The factors of risk and vulnerability have also been explained in brief. In this learning unit, the tools for the assessment of hazard, Risk, Vulnerability will be discussed and the adaptive

Exposure “is the nature and degree to which a system is exposed to significant climatic variations.”

Sensitivity “is the degree to which a system is affected, either adversely or beneficially, by climate related stimuli.”

Adaptive Capacity “is the ability of a system to adjust to climate change to moderate potential damages to take advantage of opportunities or cope with the consequences”

capacity to withstand the risks posed by hazards and underlying vulnerability factors. Vulnerability to Climate Change and extreme events are assessed in terms of exposure, sensitivity and adaptive capacity. Vulnerability Assessment identifies the vulnerability of the selected assets based on the information available while risk assessment identifies the likelihood of experiencing a particular impact, usually assessed with medium or high level vulnerability. Based on the risk profile priority of action for retrofitting or reconstruction is decided. HRVCA systematically evaluates the potential damage, severity of the impact and the capacity to reduce or cope with the hazard and impact.

Hazard, Risk, Vulnerability and Capacity Analysis (HRVCA)

The aim of this tool is used for integrated, multi-hazard, inclusive approach to address hazards, vulnerability, risk assessment and holistic disaster management.

Hazard Analysis

It is defined as “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” (UNDRR). Hazard analysis refers to prioritizing hazard based on its frequency of occurrence and intensity of the impact. It investigates, identifies and documents natural hazards (drought, floods, landslides, cyclones, earthquakes, etc), their causes and impact chains. The common tools for Hazard analysis are:

- a. **Hazard Mapping:** Hazard maps provide important information to help people understand the risks of natural hazards and mitigate disasters. Hazard maps indicate the extent of expected risk areas and can be combined with disaster management information such as evacuation sites, evacuation routes, etc.
- b. **Historical profiling or Trend Analysis or Timeline:** It helps to collate information about past hazards and changes in the behavior that can be used to understand the changes in the nature of the hazards with respect to present situation.
- c. **Seasonal Calendar:** It is a visual method of showing the distribution of seasonally varying phenomenon that is used to prepare prior to any disaster.
- d. **Hazard Matrix:** This tool helps in defining the hazard intensity/severity by considering the category of probability or likelihood against the category of consequence severity.

Risk Analysis

According to UNDRR risk is “the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, and capacity”.

$$\text{Risk} = (\text{Hazard} \times \text{Exposure} \times \text{Vulnerability}) / \text{Capacity}$$

Risk Assessment is the process of evaluating and assessing the risk associated with each hazards and identifies the nature and severity of the hazard to cause a potential harm. Risk Assessment gives us the likelihood that a particular system or an asset would experience a particular hazard impact. Risks are assessed in terms of high, medium and low level. The system that has low likelihood are identified to have low risk while the asset that has high likelihood are identified to have high risk. Based on the risk level, a risk matrix is constructed.

UNISDR 2009 defines risk assessment as “An approach to determine the nature and extent of risk by analyzing potential hazards and evaluating existing

conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend”.

	Consequence					
		1	2	3	4	5
Likelihood	1	2	3	4	5	6
	2	3	4	5	6	7
	3	4	5	6	7	8
	4	5	6	7	8	9
	5	6	7	8	9	10
Risk	Low	Moderate			High	

Figure 29: Risk Matrix

High Risk (RED): Unacceptable, major disruption likely, immediate management required

Moderate Risk (ORANGE): Some disruption; additional management attention may be needed

Low Risk (GREEN): Minimum impact; minimum attention needed

Vulnerability Analysis:

It is defined as “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”. Vulnerability analysis studies the ability of a system (or element) to withstand, avoid, neutralize or absorb the impacts of hazardous natural events. Some of the tools for vulnerability Assessment:

- Transect Walk:** Walking systematically with key informants in the community through the area to identify danger zones, vulnerable area, evacuation sites, etc. Transect helps intervening agencies to observe directly and to have a firsthand knowledge about any location/item/situation/condition.
- Problem Tree:** It is a pictorial representation of a hazard, its causes and consequences. This analysis tool helps in getting a quick glance of how a range of vulnerabilities can contribute towards and how this hazard branches out into a disaster.

- c. **Focus Group Discussion:** It is a form of a qualitative research where questions are asked to the group of people of a community with similar experiences about their perceptions attitudes, beliefs, opinions or ideas.
- d. **Venn Diagram:** A Venn diagram or Chappati Diagram is a visual depiction of key institutions, organizations and individuals and their relationship with the local community or groups.
- e. **Livelihood Analysis:** shows the different ways people sustain themselves and the varying effects of hazards on different households and groups and their means of survival.

Capacity Analysis

It includes the analysis to determine what people during a crisis or to reduce the damaging effects of the hazard and to protect livelihood as well as services. Capacity assessment helps in understanding previous experiences with hazards that enabled them to develop coping and survival strategies. It also helps in identifying resources which are available and that can be used in community based disaster management. Some tools for Capacity/Resource Assessment are mentioned below:

- a. **Chapatti Diagrams:** This is participatory visual method of understanding how the community views a number of items (social groups, individuals, institution, diseases, natural diseases, etc.)
- b. **Resource Mapping:** A tool for identifying/locating resources and helps in quick response during/post disaster.

Learning Objectives

1. To explain the concept and use of risk and vulnerability assessment tool
2. To build an understanding of the Hazard, Risk, Vulnerability and Capacity Assessment Tools

Duration: 1.5 hours

Method

- ✓ Lecture/power point presentation
- ✓ Group exercises
- ✓ Discussion



Trainer's Guide

The course facilitator may include small hands-on exercise to explain various tools. The participants may be divided into two to three groups and each group will be given a tool (HRVCA, Risk Matrix, Problem Tree, etc). The course facilitator will share a template for each tool that will be used on a disaster or a sector.

Recommended Readings

- RedR India. (n.d.). Operational Guidelines for Vulnerability and Risk Assessment. Available at: https://www.redr.org.in/wp-content/uploads/2019/04/Guidelines-for-VRA_MSSRF.pdf [Assessed on 9th February, 2020].
- UN-SPIDER knowledge portal. <http://www.un-spider.org/risks-and-disasters/disaster-risk-management> [Assessed on 9th February, 2020].
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.

Learning Unit 3.3: Disaster Impact Assessment Methods and Tools

Context of the Session

Disasters can create a considerable damage and losses to environment, property and livelihood. To minimize this loss measures should be taken to reduce its current impact as well as anticipated impact. Disaster Impact Assessment (DIA) is a methodology to assess development activities from the viewpoint of disaster risk reduction by identifying improvement points of the intervention. It should be implemented in coordination and integration with EIA. There are two types of disaster impact assessment:

1. Anticipatory Disaster Impact Assessment
2. Post Disaster Need Assessment (PDNA)
3. Post Disaster Environment Assessment

Anticipatory Disaster Impact Assessment

It is an extension of Environmental Impact Assessment (EIA) tool. EIA is explained in the Learning Unit 3.3 in detail.

Post Disaster Damage, Loss and Need Assessment (PDNA)

The PDNA is a multi-sectoral and multidisciplinary structured approach for disaster recovery, reconstruction, future developmental planning and implementation by estimating post disaster needs on the basis of assessment of disaster effect, damages, losses, impacts and needs when the government is in a shock and disrupted the institutional functionaries. It is undertaken during or after an emergency phase when the recovery is about to start as it helps in strategizing reconstruction procedure and incorporating the concept of Build Back Better in developmental process.

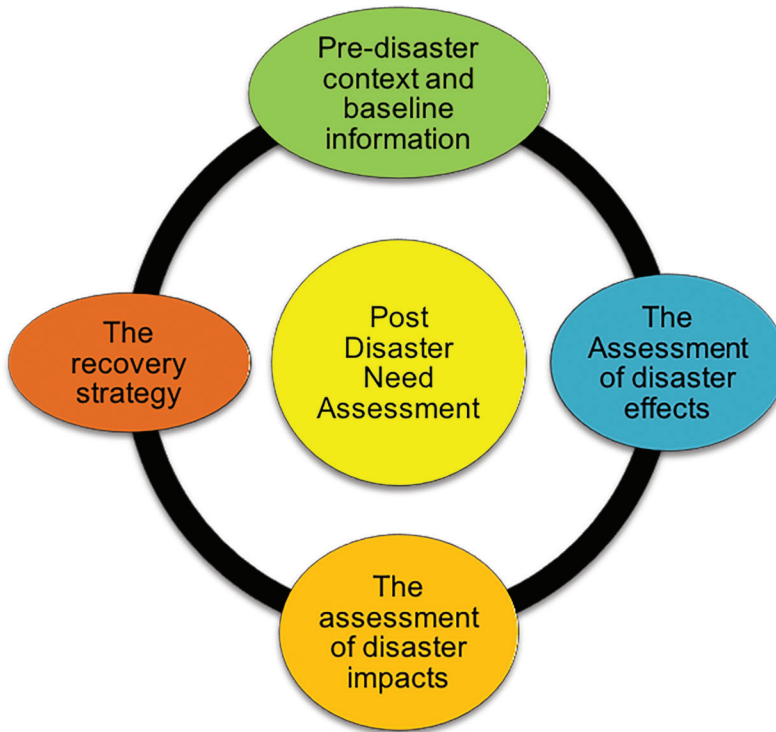


Figure 30: Core elements of Post Disaster Need Assessment

It is a tool to assist government in rebuilding homes, communities and life of people, as it acts as a road map to recovery. It helps to put together a recovery framework based on the needs both in terms of replacing the damage and losses and align all the international and national government systems to support the recovery in the most organized way possible. This tool looks at the every layer of the community and brings forth the need of the most vulnerable. It acts as the bridge between the disaster and the management of risk.

Core elements of PDNA are:

1. Pre-disaster context and baseline information: To determine the pre-disaster social, economic, cultural, financial and political status for the comparison with the post disaster condition in the disaster affected area.
2. The Assessment of disaster effects: It is determined by the loss and damage occurred to the infrastructure/physical assets, interruption in the accessibility of certain goods and services, increased risks and vulnerabilities and disorder in governance/policy making process.

3. The assessment of disaster impacts: It is determined by the estimation of economic impact on micro and macro level and short-term as well as long-term impact of disaster on human life.
4. The recovery strategy: The collective result of the assessment of disaster effects and impacts defines the recovery needs making a road map to building back better with the help of recovery strategies.

We conduct Post Disaster Need Assessment to:

- Quantify the loss and damage caused due to disaster
- Quantify the resource financial need for recovery and reconstruction
- Strategize for building back better and resilient recovery
- Produce an actionable and sustainable Recovery Strategy for mobilizing financial and technical resources.

Post Disaster Environmental Need Assessment

It is evident from various studies that environment related disasters is currently on increase and as an impact of climate change, those areas that may have not experienced serious impact of climate change in the form of extreme events is most likely to become vulnerable to extreme weather events. In almost every disasters there are some environmental impact or even alteration of land use, some of the impact may lead to additional secondary impact or a domino effect. Disaster may cause landscape alteration, hydrology change thus aggravating flood, drought and extreme temperature risks. This kind of assessment is necessary as many a times new disaster risks often emerge due to a disaster. In addition, even during a disaster recovery phase while dealing with the existing risks new may give rise to new risks.

For this type of assessment tools like Flash Environment Assessment Tool (FEAT) and Rapid Environment Assessment Tools are used. FEAT was developed to assess the impact of chemical releases due to technological accidents while the tools like Rapid Environment Assessment Tools do not have any specific aim. These tools can be used in all the phases of disaster management.

Post Disaster Environmental Assessment is needed for the post disaster recovery phase as this phase often faces sporadic strategic leadership and amalgamation of isolated initiatives is common which further lead to duplication of efforts,

absence of comprehensive strategy, wastage of resource, and often leading to the failure of long-term sustainable recovery. It is a tool that helps in building back better by combining environment needs with early recovery and reliefs.

Learning Objectives

1. To explain about the need to undertake disaster impact assessment and need of disaster impact assessment tools.
2. To build a basic understanding of Post Disaster Need Assessment and its uses.

Duration: 90 minutes

Method

- ✓ Lecture/PowerPoint presentation
- ✓ Group exercises
- ✓ Discussion
- ✓ Quizzes
- ✓ Experience sharing
- ✓ Case Study may also be used



Trainer's Guide

The session faculty is advised to provide an overview for disaster impact assessment and methods used to assess the disaster impact. This learning unit can be delivered using a group exercise along with a lecture or a PowerPoint presentation.

Recommended Readings

- Chaturvedi, S & Kumar. S. (2019). Manual for Post Disaster Need Assessment India. National Institute of Disaster Management. (Vol. 1 & 2)
- European Union, The world Bank and UNDP. (2013). Post Disaster Needs Assessment Guidelines. (Volume A).
- Nijenhuis, R., & Wahlstrom, E. (2014). The use of the Flash Environmental Assessment Tool in developing countries for environmental emergency prevention, preparedness and response. *Journal of Environmental Assessment Policy and Management*, 16(03), 1450026.
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.
- GFDRR. (2013). Post Disaster Needs Assessments Guidelines. Available at: <https://www.gfdr.org/en/publication/post-disaster-needs-assessments-guidelines-volume-2013>.

Disaster Risk Management

Context and Description of the Session

A natural hazard becomes a disaster when it strikes a vulnerable section of the community depending on its social, economical, biological, environmental and physical conditions. Emphasis is given more on disaster risk management and reducing the vulnerability and exposure for risk reduction, since we cannot change the severity and intensity of the natural hazards. This will help in managing risks by mitigating its impacts. Smith & Petley (2009) mentions that the risk from disasters cannot be eradicated completely but it can be identified, evaluated, assessed, and managed to reduce the adverse impact.

Disaster Management is defined as organization, planning and preparing for, responding and recovering from a sudden, calamities or event that may/have disrupt/disrupted the functioning of a community or society and causes/caused human, material, economical or environmental losses that are beyond the coping capacity of the community or society using its own resources. It includes measures that can be taken before, during and after a disaster hits in order to avoid adverse disaster impact, reduce the losses and fast recovery.

Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk reduce existing disaster risk and manage the existing risks, building resilience and reduction of disaster losses/damages (NIDM, 2019). According to UNDRR, disaster-risk management is the systematic process of using administrative directives, organizations and operational skills/capacities to implement strategies, policies and improved coping capacities in order to reduce the adverse impact of hazards, and the possibility of a new disaster. For Example: Proper land use planning, disaster resilient building, etc.

Disaster Risk Management

Disaster Risk Management intends to avoid/reduce losses, prompt response, fast recovery and risk transfer the impact of any hazards. It is a set of methodical process of using adaptive capacities, resources, skills, policies, action plans/guidelines to deal with any hazard with minimum negative impact. Disaster

Risk Reduction (DRR) is the preparation of policies and strategies to reduce the factors of vulnerabilities and improve the adaptive capacities, reduce exposure, and improve preparedness.

There is a huge overlap between climate change adaptation and disaster risk reduction as research have shown that the increase in frequency and intensity of climate extreme events is attributed to the global change in climate. Efforts are being made continuously in mainstreaming Disaster Risk Reduction, Climate Change Adaptation and Developmental Planning but due to the lack of coordination within and between disaster related organization and policy/decision makers, the mainstreaming process is still inefficient. There is a need of knowledge and capacity enhancement of first responders (locals), policy makers, disaster managers to face the disasters, reduce the impact and building back better.

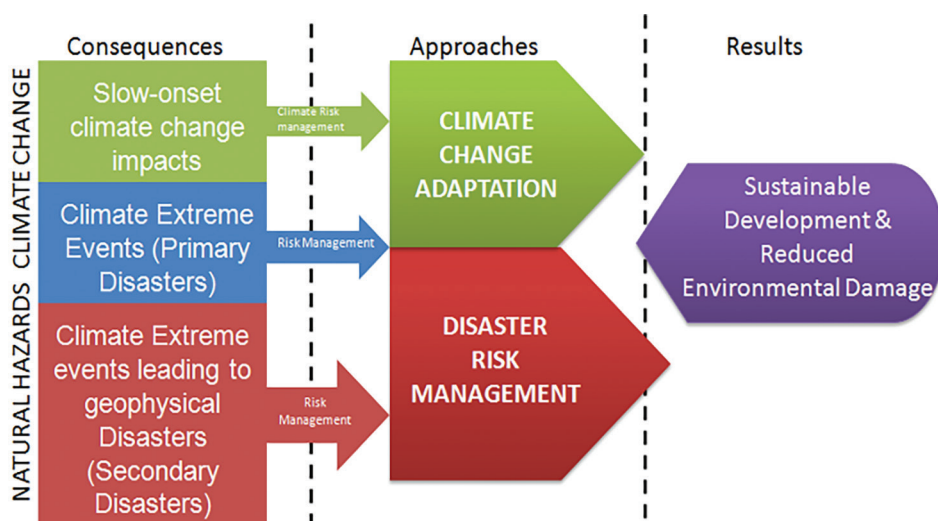


Figure 31: Overlap between Disaster Risk Management and Climate Change Adaptation (Adapted from BMZ, 2015)

Disaster Risk Management Approaches

Disaster can be managed by various approaches. Some of the approaches are discussed in brief below.

Risk Exposure: This particular approach focuses on reducing the exposure to hazards, which in turn will reduce the adverse impact. According to this

approach, no entity is allowed to live in a risk zone where there is a probability of hazard exposure. For instance: A volcano erupts in an uninhabited area, no people, no infrastructure and economy is affected, therefore in this case, eruption of volcano is a hazard. However, if this volcanic lava flows towards a city/human settlement area then it becomes a disaster as it may cause massive damage to infrastructure, communities and livelihood.

Increasing Resilience: It is well known that with change in climatic conditions, the risks are also changing, in terms of intensity, frequency, duration and the nature of disasters. Considering this changing scenario, worldwide emphasizes are given on building the societies and the built environment in such a way that it can resist this changing nature. For instance: Use of ecosystem based approach and nature-based solutions is largely talked about to build resilience without compromising the nature and development.

Reducing Vulnerability: In one of the preceding learning Unit, we have already discussed about vulnerabilities and types of vulnerabilities. It is established that different factors of vulnerability contributes in worsening the disaster impacts. For Instance: Building house on a flood plain is increasing both hazard exposure and aggravating the vulnerability of floods, thus enhancing risks. Therefore, in order reduce vulnerability, we may build the house on an elevated location. Risk communication, public awareness and capacity building can also reduce vulnerability.

Risk Transfer: Risk transfer is defined as shifting the risks to another party through insurance or other means. UNISDR (2009) defines a risk transfer as ‘The process of formally or informally shifting the financial consequences of a particular risk from one party to another, whereby a household, community, enterprise or State authority will obtain resources from the party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party’. Example: Insurance is a common form of risk transfer.

Phases of Disaster Management

Disaster risk management cycle is broadly divided into two phase-pre-disaster phase and post-disaster phase. It is further divided into four phases. The length of each phase depends on the severity of the disaster.

1. Pre-disaster phase
 - i. Prevention/Mitigation
 - ii. Preparedness
2. Post-disaster phase
 - i. Response
 - ii. Rehabilitation/Reconstruction



Figure 32: Disaster Management Cycle

(Source: Khan et al, 2008)

Pre-disaster Phase

Pre-disaster phase begins with risk assessment that includes assessment and evaluation of Hazard, Risk, Vulnerability and the existing capacity to tackle any disaster. It also involves identification of the vulnerable groups/populations. These will help in strategizing an effective prevention and mitigation measures. Prevention and Mitigation comprises of the efforts made to prevent and mitigate damage. Prevention activities are undertaken to reduce the adverse impact of any disaster. For example: Training & capacity building, Community Based Disaster Risk Management, etc. Mitigation is basically all the actions undertaken to reduce the adverse impact of a disaster. Disaster prevention and mitigation refers to the activities, which are undertaken to prevent or mitigate

the adverse effects of a disaster in short and long term. It includes both physical/structural measures and non-structural measures. On the one hand, they include political, legal, administrative and infrastructural measures; while on the other hand it includes educating vulnerable communities influencing their lifestyle and behaviour in order to reduce their disaster risk. Example: Building of embankments is a physical measure and capacity building is a non-structural measure. Preparedness is the activities to ensure effective response to the impact of hazard. Example: Mock drill exercises, public awareness, disaster forecasting and early warnings, risk communication, etc. Early warning and appropriate risk communication is a crucial component of pre-disaster phase. Risk communication refers to the exchange of real-time information, advice and opinions between experts and people facing threats to their health, economic or social well-being. The eventual purpose of risk communication is to facilitate people at risk to take informed decisions to protect themselves. Risk communication uses many communications techniques, social media communications, mass communications and community engagement. It requires a sound understanding of people's perceptions, concerns and beliefs as well as their knowledge and practices. It also requires the early identification and management of rumors, misinformation and other challenges.



Figure 33: Phases of Disaster

(Source: ADPC, 2014)

Post-disaster Phase

Post disaster phase begins with immediate reliefs and search & rescue to provide immediate assistance to the affected. These activities are known as response activities. The response phase includes the search and rescue; fulfilling basic humanitarian needs of victims; assistance by regional, national and international bodies etc. It includes activities that is undertaken just after

a disaster is hit. Example: Search and Rescue, First aid, firefighting, evacuation, etc. Providing special consideration and assistance to the vulnerable groups is a vital part of this phase. Recovery includes activities for bringing normalcy in the disaster-hit area and building back better. Recovery phase starts after the immediate threat to human life has subsided. The immediate goal of the recovery phase is to bring the affected area back to some degree of normalcy. During reconstruction, the location or construction material of the property is considered. Efforts are made to improve the living conditions and re-establishing livelihood sources that are affected by the disaster that can help in rehabilitation and bringing live near to normalcy. It is only when the affected community is brought to normalcy the reconstruction activities begins and the infrastructures are built back better in order to reduce future risks.

Enabling Objectives

At the end of this learning unit, the participants will be able to:

- ✓ Describe the disaster risk management cycle and its components
- ✓ Understand the concept of build back better

There are four Learning units delineated to draw this module:

LU-1: Prevention/Mitigation and Preparedness

LU-2: Early warning and Response

LU-3: Recovery: Reconstruction and Rehabilitation

LU-4: Resilient Infrastructure and Business Continuity

Learning Objectives

- ✓ To discuss the various components of disaster management cycle
- ✓ Understand the overlap between disaster risk management and climate change adaptation

Duration

This module can be run with other modules or independently in a day or half.

Methodology

- ✓ Perception-check questionnaire or Question/Answer session
- ✓ Lecture/power-point presentation

- ✓ Case study
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The session faculty is suggested to explain about disaster management cycle integrating with the disaster cycle. Examples can be used to explain about the components of various disaster management cycle.

The facilitator may provide case study examples to explain about various disaster management phases and the paradigm shift in disaster management approach. A comparative study in groups may be conducted to let the participants understand about the difference between the reactive approach of disaster management and a proactive approach of disaster management.

Recommended Readings

- Federal Ministry for Economic Cooperation and Development, BMZ. (2015). Disaster Risk Management: Approach and Contributions of German Development cooperation. Available at: http://www.bmz.de/en/publications/topics/climate/Materialie245a_disaster_risk_managment.pdf. Last Accessed on 13th February, 2020).
- Khan, H., Vasilescu, L. G., & Khan, A. (2008). Disaster management cycle-a theoretical approach. *Journal of Management and Marketing*, 6(1), 43-50.
- https://www.adrc.asia/publications/TDRM2005/TDRM_Good_Practices/PDF/PDF-2005e/Chapter2_2.2.pdf.
- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.
- Gupta, A. K. Nair, S & Sharma, V. K. (2017). Disaster Risk and Impact Management: Some Ecohydrological and Strategic Issues. Publisher: Astral International New Delhi. ISBN: 9788170358527.

Learning Unit 4.1: Prevention/Mitigation and Preparedness

Context and Description of the Session

With the world, India also evolved in approach to disaster management, which was earlier focused, on post-disaster relief and response centric but during IDNDR (International Decade for Natural Disaster Reduction) 1990-2000 the global attention was drawn to the disaster risk reduction by focusing in prevention, preparedness and mitigation aspects of disaster management. The disaster management approach had a huge paradigm shift since the adoption of global framework signed at World Conference of Disaster Risk held at Kobe Japan in 2005. Hyogo Framework of Action was the first call for a comprehensive approach towards disaster risk management, which prioritizes, on reducing the risk factors by strengthening the preparedness measures and mitigation strategies. It envisages the importance of the investment in prevention/mitigation and preparedness of disasters which is socially and economically more beneficial. Various studies have shown that one impact of climate change is the increased frequency, duration and severity of the disasters and with special emphasizes on the preparedness, prevention and mitigation measures the impact of the climate extreme events can be reduced largely. Strengthening the preparedness/prevention and preparedness measures reduces the vulnerability and increases the adaptive capacity of the community/asset/property or environment. Prevention-Mitigation and preparedness are pre-disaster activities that is undertaken to reduce human and property losses by a potential hazard. This includes carrying out awareness campaigns, strengthening the weak structures, preparing disaster management plans, capacity building, etc.

Disaster Prevention and Mitigation are used inter-changeably. Disaster mitigation measures are the activities undertaken to reduce the impacts of hazards through proactive approach. It aims in avoiding hazards and mitigation the potential impact by reducing vulnerabilities and exposure enhancing capacities. It includes following the building codes, zoning, vulnerability analysis etc that will help in minimizing the effect of disaster. Mitigation reduces severity of the damage and impact caused by the disaster. Primary

Prevention and mitigation is done to reduce/avert the risk of event occurring by reducing the vulnerabilities, as we cannot avoid a disaster. For instance: A person living in a pucca house will be less vulnerable to natural hazards like flood, heavy rain, etc. Moreover, by constructing houses with raised foundation and wet flood proofing houses, the vulnerability can be reduced. These houses will be capable of withstanding in adverse situations. Another example is that the person living in a healthy environment is less vulnerable to most hazards and we can lessen the vulnerability by improving accessibility to healthcare systems.

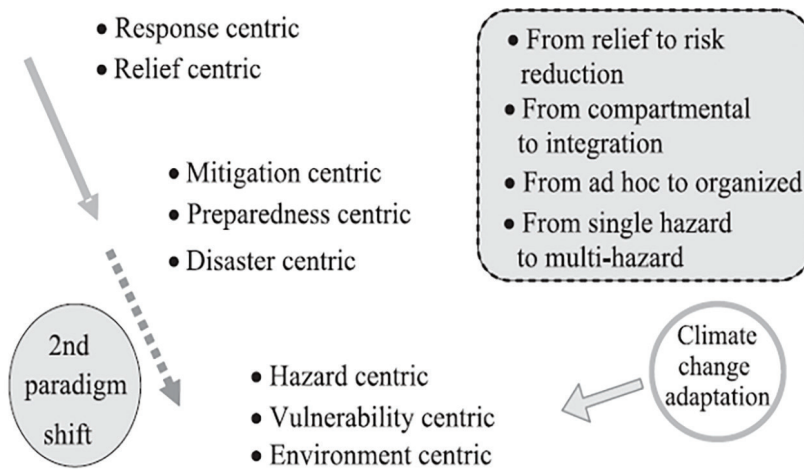


Figure 34: Paradigm Shift in Disaster Management

(Source: Gupta & Nair 2010)

Mitigation

Disaster mitigation measures may include structural as well as non-structural measures. Building of embankments and dykes to reduce the impact of the flood hazard is a structural measure while flood zonation is an example of non-structural measure. Some of the examples of the mitigation measures are:

- Hazard mapping
- Risk assessment
- Disaster zonation
- Implementing building codes
- Disaster resilient construction, etc.

Disaster prevention is a multi-sectoral coordinated effort of all sectors of the society. It can be achieved by planning, diversifying economy, strengthening institutions and infrastructures, enhancing knowledge of bye laws/building codes, encouraging the usage of hazard-proof materials and design, etc.

Mumbai Case Study

Mumbai is located on the windward side of the Western Ghats of India and receives high rainfall, both in magnitude and intensity. The average annual rainfall of Mumbai City is 2050 mm. The city has a huge influx of migrant population in search of job opportunities. There are many vulnerable settlements in the floodplains. The extremely high rainfall have exceeds the capacity of drainage system leading to the flooding of the roads. The 2005 Mumbai flood was one of the worst floods of the city and affecting many other parts of the state. Post this disaster, government have taken various steps as a mitigation measure for future flood events including setting up of a fact finding committee called Chitale Committee, setting up of Mithi River Authority, strengthening of emergency control system, removal of wastes/blockages from the drains, etc by the Government of Maharashtra.

Preparedness

Preparedness aims at establishing and strengthening capacities of communities to cope, anticipate and recover from the damage/losses caused due to a disaster. Disaster preparedness primarily constitutes the knowledge and capacity building of the governments, professionals, stakeholders, developmental planners, policy-makers and the community to respond and recover effectively during any anticipated disasters. It involves scenario development, emergency planning, training, preparing DM Plans, emergency exercises, training, warning systems, mock drills, etc. Disaster preparedness is a constant multi-sectoral process of varied range of risk reduction activities that can prevent disasters and result in minimized loss of lives/livelihood and asset during any disaster and enable the affected population to get back to normal condition faster. The strengthening of the early warning systems and timely and correct information dissemination of the information to the community plays an important role in disaster preparedness.

Case Study of Cyclone Amphan

An extensive preparedness measures have been taken during the severe cyclonic storm Amphan (2020). People living in the coastal areas were evacuated to cyclone shelters. Schools were used as rescue centers. NDRF teams were appointed at various districts, which were likely to get affected. Continuous announcement were made using loudspeakers/ radio/ television, etc. Fishing activity was banned when the state was on high alert due to cyclone.

Table 12: Difference between Mitigation and Preparedness

Mitigation	Preparedness
Efforts to reduce the negative impact of a hazard.	It includes efforts to prepare for likely hazards.
Example: Hazard prediction and modeling, Risk Assessment and mapping, spatial planning, public awareness, etc.	Example: Scenarios development, Emergency Planning, Training, etc.

Learning Objectives

The objectives of this Learning Unit are:

1. To enable participants the understanding of disaster preparedness and mitigation.
2. To interpret the importance of disaster preparedness and mitigation measures in disaster management.
3. To explain the phases of pre-disaster management cycle with necessary examples.

Duration: 60 minutes



Method

- ✓ Perception-check questionnaire or Question/Answer session
- ✓ Lecture/power-point presentation

- ✓ Case study
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Media

LCD, White board



Trainer's Guide

The trainer should have a sound knowledge and understanding of disaster management cycle to explain about the pre-disaster phases along with examples. To enable participants a clear understanding of disaster difference between mitigation/prevention and preparedness can be asked to tabulate in a group discussion to make the session more interactive and interesting.

Exercise

- Mention the importance of disaster preparedness/mitigation and prevention.

-
- Divide the participants into groups. Prepare a disaster Management plan for

Group 1: Flood

Group 2: Drought

Group 3: Heat Wave

Recommended Readings

- United Nations. (2008). Disaster Preparedness for Effective response. Guidance and Indicator Package for Implementing Priority Five of the Hyogo Framework. Available at: https://www.unisdr.org/files/2909_Disasterpreparednessforeffectiveresponse.pdf
- International Federation of Red Cross and Red Crescent Society. (2000). Introduction to Disaster Preparedness. Disaster Preparedness Training Programme. Available at: https://www.preventionweb.net/files/2743_Introdp.pdf

Learning Unit 4.2: Early Warning and Response

Context and Description of the Session

Disaster risk reduction consists of a very crucial element of early warning and immediate response as soon as disaster hits. Early warning systems is a life saving tool that helps in reducing economic losses and the number of casualties or deaths due to a disaster by disseminating information that allows individuals/communities to take timely actions prior to a disaster and protect their lives and properties. It will be effective only when integrated with risk assessment, risk communication and action plans. Climate change and associated extreme events can be avoided by conducting risk assessments and impacts can be reduced to a large extent by climate monitoring, enhancement of technological capacities, risk communication and early warning systems. It is important to improve the capacity of meteorological services, prediction of weather events (floods, intensive rains, storms, etc.), and the establishment of strong networks between community level agencies and the community itself. The early warnings should be user friendly wherein use of scientific terms and jargons must be avoided. The use of vernacular languages should be appreciated as the community will better understand the warnings. Communities can also be involved with the dissemination of early warnings. With timely warnings, losses can be reduced. Disaster response comes into picture after a disaster hits which also plays an important role in reducing the risks by evacuating the victims to a safer locations and undertake responses in such a manner which will prevent from the occurrence of a secondary disaster. For Instance, cholera outbreak post flood event. The details of early warning system and disaster response will be covered in this unit.

Early Warning

Early warning is a major element in a pre-disaster phase of disaster management cycle that is a combination of tools and processes embedded within institutional structures. UNDRR defines Early warning as “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”. It is systematic

collection and analysis of information for anticipating and identifying the hazards that allows the emergency responders to take prompt action to lessen the losses.

It is also defined as a set of capacities needed to generate and disseminate timely and meaningful warning information of the anticipated extreme events like floods, droughts, earthquake, cyclone, etc. EWS aims in enabling individuals/communities to prepare and act appropriately in sufficient time to reduce the losses and damage. Such warnings should be clear, meaningful, and simple to interpret and understand.

Case Study 1: Cyclone Fani, 3rd May, 2019

Cyclone Fani was one of the rare summer cyclones in the Bay of Bengal that blew the roofs, electricity poles, disrupted power lines, uprooted power lines and large area of agricultural fields. Despite it being a devastating event, the government's "*Zero Casualty*" policy for natural disasters and the *effectiveness of the early warning system* by IMD have significantly reduced the casualties and live loss. IMD has built an effective EWS to predict accurate timings of cyclone formation and landfall. The close co-ordination and clear communication plan has contributed in timely evacuation and dissemination of do's and don'ts' to the people.

Effective early warning system may include four inter-related key elements:

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

These four elements need to be well coordinated inter as well as intra-sectorally and feedback mechanism should also include for continuous monitoring. Lack of coordination in one element may lead to the failure of the entire system. It is initiated by a designated organization/department that may include meteorological organization, academic institutions, regional interest groups,

agricultural organizations, etc. Some of the nodal agencies in Government of India designated for a particular disaster are mentioned below:

Cyclone	:	Indian Meteorological Department
Tsunami	:	Indian National Centre for Oceanic Information Services Indian Tsunami Early Warning Centre (ITEWC)
Floods	:	Central Water Commission
Landslides	:	Geological Survey of India
Avalanches	:	Snow and Avalanche Study Establishment
Heat/Cold Wave	:	Indian Meteorological Department

A multi-hazard and an integrated early warning system is ideal for an disaster warning and an effective risk communication since a disaster need not necessarily occur one at a time, particularly in a country like India which is vulnerable to multiple disasters. Disasters have the tendency to occur one after another or even occur concurrently, for instance flood may cause secondarily associated disasters like landslides, disease outbreaks, etc or create a situation of crisis within crisis like Tsunami and earthquake occurring together. In such scenarios, Multi-hazard EWS will help in reduce the disaster impacts significantly. The SFDRR also recognizes the need of a multi-hazard EWS that mentions in the 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.

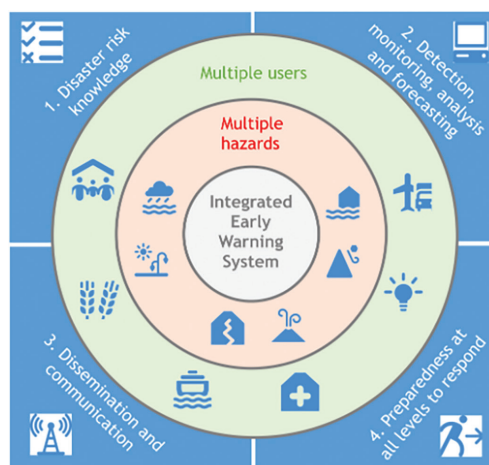


Figure 35: Multi hazard integrated early warning system

(Source, WMO, 2019)

Disaster Response

Disaster response is the immediate intervention, defined as those activities that are undertaken just after any disaster hit at an area to minimize the impact. It includes search & rescue, emergency responses, food supplies, water shelter, sanitation, medical care, evacuation, location based services, communication & coordination, etc. These activities are known as emergency response activities. The effectiveness of disaster response depends on the training, experience, adequate transport, smooth communication and guidelines for humanitarian action of the early responders.



It aims in immediate assistance to support the victim, provide medical aid, trauma care, and temporary shelter, etc to meet the basic needs of the people until more permanent and sustainable solutions can be found. Efforts are made these days to enhance the capacity and knowledge improvement of the community members as they are the first responders in any disaster before any external agencies/organization reach them for help.

Various activities of a disaster response are:

- Warning of the danger level and future threats
- Evacuation and relocation from the affected/vulnerable area to a safer location
- Search and Rescue (SAR) of the area where disaster victims may possibly be trapped and bringing them to a safe location and provide first aid, if required.
- Providing immediate assistance to maintain life, morale support and improve the health condition of the affected people
- Post-disaster assessment/damage assessment
- Response and relief
- Well organized supply of reliefs and logistic facilities for the victims

Many humanitarian organizations come together to respond like UN-OCHA (United nations Office for the Coordination of Humanitarian Affairs), NDMA, NDRF, SDRF, Red Cross/Red Crescent, etc. UN-OCHA is responsible to coordinate

and bring together various humanitarian agencies/actors to guarantee a rational and efficient response during disasters that needs international response. India has NDRF at national level and SDRF at state level to assist during any disasters. Learning Objectives

The objectives of this Learning Unit are:

- ✓ To define and understand the aim of early warning and disaster response
- ✓ To elaborate the importance of early warning system with the help of examples from past disasters
- ✓ To understand the need of a multi-hazard early warning system

Duration: 90 minutes

Method

- Lecture/PowerPoint presentation
- Case Study
- Discussion
- Role plays
- Assessment exercise



Trainer's Guide

This session facilitator shall have a sound understanding of disaster management cycle and explain the unit with the help of a well-illustrated disaster management cycle. The trainer may also use examples from past disasters as example of humanitarian action and the importance of early warning system.

Recommended Readings

- Government of India. Ministry of Home Affairs. (n.d.). Dos and Don'ts on Disaster Response for use of Disaster Magistrate on Natural Disaster
- Government of India. Ministry of Home Affairs. (2012). Disaster Management in India. GoI-UNDP Disaster Risk Reduction Programme (2009-2012)
- Gupta, A. K. & Banzal, P. (2018). Disaster Communication and Early Warning Systems. Publisher: Astral International Pvt Ltd New Delhi. ISBN: 978-93-5124-961-0

Learning Unit 4.3: Recovery: Reconstruction and Rehabilitation

Context and Description of the Session

Recovery, reconstruction and rehabilitation are the components that come after a disaster hits an area. The systematic incorporation of risk reduction approaches into the implementation of recovery programmes is also given special emphasis in international strategies for DRR. Recovery is a phase that involves actions to promote sustainable redevelopment constituted by an overlap of rehabilitation and reconstruction. It is the process to fully restore the community to pre-disaster level of functioning or better than that. It is the long-term measures undertaken by the disaster-affected community to fully restore to normal situation or improved level after the event by rebuilding infrastructures, roads, bridges and other public buildings. Disasters and disaster recovery should be taken as an opportunity to built back better and creating environmental friendly infrastructure and community.

Recovery includes actions undertaken post-disaster for restoration and improvement of pre-disaster living conditions of the disaster affected community considering the scope for reduction of future disaster risks and building back better. It is a means to return the community/individuals to normal situation providing opportunities to develop and apply disaster risk reduction measures. Some examples of recovery measures are:



- Awareness of the community on health and safety measures
- Restoring the basic services
- Constructing the infrastructures in a more resilient manner

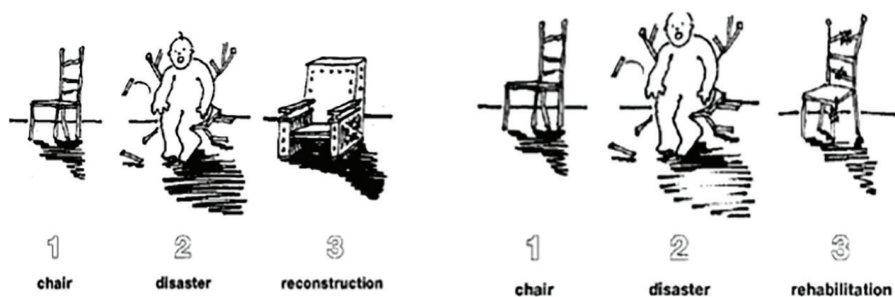


Figure 36: Difference between disaster reconstruction and rehabilitation

(Source: Reddy, A.S. 2015)

Focus should be made on amalgamate the developmental planning processes and disaster reconstruction and it will be an opportunity to construct/re-build with more resilience to prevent from any new hazard turning into a disaster. This phase of the disaster management should be considered an opportunity to increase the resilience of nations and communities through integrating DRR into re-establishing the physical infrastructures, livelihood sources, economy and environment and building back these institutions better than before.

The disaster recovery phase provides us an opportunity to rebuild an environmentally sound and disaster resilient society. The term ‘Build Back Safer’ is often used interchangeably with ‘Build Back Better’. The recovery must be undertaken by taking the future and the long-term resilience measures into consideration.

Reconstruction

It is the permanent construction or replacement of severely damaged infrastructures and restores the services entirely into a pre-disaster functioning and building back better to avoid future disaster risks. Reconstruction must be integrated with the ongoing long-term development plans and taking account of the future disaster risks. It acts as a link between disaster response and the long-term recovery plan. Therefore, it must be considered as an opportunity of reducing the future disaster risks by incorporating of appropriate mitigation



measures and construction undertaken by complying to the safety standards. Disaster reconstruction must begin considering it as an opportunity for sustainable development and must introduce improved systems of buildings, use of green materials and multi-hazard resistant materials for construction.

Rehabilitation

Rehabilitation is a set of actions that enables the functioning of the basic services to resume, revive economic activities and attempt to normalize the situation. It is re-establishing the disrupted functionalities and socio-economic activities. Economic rehabilitation includes livelihood recovery and support actions by finding alternate livelihood/employment options for those who cannot get back to their original jobs due to irreplaceable damage. It includes the decisions and actions undertaken post-disaster keeping the view to relocate/resettle and improve the living conditions in comparison with pre-disaster conditions of the disaster hit community. It also involves psychosocial rehabilitation for those who are traumatized and need support in psychosocial counseling.

Disaster rehabilitation are basically of three major types- Physical rehabilitation, Social Rehabilitation and Psychological Rehabilitation. Physical rehabilitation includes reconstruction of physical infrastructures that are damaged due to the disaster such as houses, bridges, roadways, water supply, electricity, etc. Social rehabilitation is often ignored during most post-disaster programme. As the vulnerable groups are often tend to be more vulnerable post disaster due to their inability/availability of inadequate support, therefore, social support especially for the vulnerable and marginalized population is needed. It includes construction of community centres, day care centres, anganwadis, old age homes, etc. Another type of disaster rehabilitation is psychological rehabilitation. It is common to face a post disaster trauma due to the loss of near and dear ones therefore; social welfare and psychological support programmes are an important part in post disaster phase.

Learning Objectives

- To instill a sound understanding of post disaster recovery phase
- To discuss about the scope for reduction of future disaster risks and building back better

Duration: 90 minutes

Methods

- ✓ Lecture/power-point presentation
- ✓ Case study
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The trainer must have a sound understanding of disaster management cycle. To deliver this session on recovery, rehabilitation and reconstruction phase of disaster management cycle, the trainer can use examples from past disasters to explain about the significant of this phase and emphasize on “Building Back Better” concept.

By the end of this unit, the participants will have good understanding of the disaster management cycle and a small group exercise can be conducted to evaluate their understanding.

The trainer may divide them into groups and make them fill the table as a short group exercise.

Template for group exercise:

Disaster/ Phase	Group 1 Earthquake (<i>Example</i>)	Group 2 Flood	Group 3 Landslide
Prevention/ Mitigation	– Retrofitting of vulnerable buildings – Installation of seismic response control systems		
Preparedness	– Preparation of hazard maps – Food and material stockpiling – Emergency drills – Construction of Early warning Systems		

Response	– Rescue efforts – Fire fighting – First Aid – Search and Rescue – Food and Shelter		
Recovery	– Disaster resilient construction – Appropriate land use planning – Livelihood Support		

Media

Projector, white board

Recommended Readings

- Aga Khan Development Network. (2001). Post-disaster rehabilitation activities in India. <https://www.akdn.org/akdn/press-release/post-disaster-rehabilitation-activities-india>
- Mills, J. Durham, J & Packirisamy, V. (2017). Rehabilitation services in disaster response. Bulletin of the World Health Organization. 95. pp. 162-164. <http://dx.doi.org/10.2471/BLT.15.157024>

Learning Unit 4.4: Resilient Infrastructure and Business Continuity

Context and Description of the Session

Disaster may occur at anytime and may hamper any business functionality. Businesses are crucial for a country's economy as well as provision of uninterrupted supply of the basic services. Businesses may be interrupted by any natural calamity as well as any human dysfunction. Data loss, system failure and damage to the business infrastructure can be caused by natural disasters or any unpredictable events restricted to a specific area or even the entire globe (floods, earthquakes, fires, disease outbreaks, etc.) may be but even a minor malfunction can disrupt functioning and information stored. Disaster recovery is largely dependent on business continuity. For instance, a business is severely affected by a disaster maybe a natural hazard or a human-induced hazard, it may not be able to recover easily due to the losses it have gone and the community may get affected due to the loss in their jobs during post disaster recovery phase. Therefore Atkinson (2017), have mentioned that business continuity in the recovery phase is closely linked with community recovery from any disasters.

Business continuity is defined as a cyclical process that includes the identification of potential risk, evaluating the extent of the damage, estimating the effect and responsiveness to recover to ensure the uninterrupted functioning of system/ institution. It is the ability to make sure that the core business functions are working uninterrupted or not severely/completely dysfunctional/disrupted due to any disaster or emergency situation. It is an interdepartmental process for implementing the approaches for the maintenance of the uninterrupted functionality and fast restoration of the disrupted business. It is not only a recovery plan but prevention, mitigation and preparedness plan. In a business continuity planning, businesses must also take the protection of their employees in consideration along with the protection of the company. It is necessary for all type of organizations but it may not be practical for large business enterprises to maintain all functions during a disaster. For the continuity of businesses it is essential for defining the essential functions and allocating funds accordingly. Measures for the continuity of business must be taken based on the type of

businesses. Alternate work strategies, production, supplies and sales should be figured out for uninterrupted functioning of businesses. Working from home, online, videoconferencing should be promoted in times of emergency situation. Business continuity has three elements: Resilience, Recovery and Contingency Plan. The elements are explained in brief below:

Resilience of an organization maybe increased by identifying critical functions as well as infrastructures to various disasters and maintaining alternative options and back-ups for data. A thorough study of the potential risks for the businesses should be focused.

Recovery of the disrupted business functions post-disaster is necessary. Priorities must be set for different systems or functionalities that are to be recovered first. Recovery plan should be worked out to the earliest with necessary amendments for better future strategies.

Contingency Plan is a set of procedures in place for various scenarios including different responsibilities within the organization during an emergency situation which may include replacement of systems, leasing emergency office spaces, damage assessment, etc.

Resilient Infrastructure is crucial for business continuity as infrastructure is an important asset on which the entire business functioning is dependent. All the sectors and ministries should be mandated to prepare a business continuity plan and disaster management plan with knowing the potential risks. For the resilience in business infrastructure cost benefit analysis of the business functionality should be done and policy instruments like EIA, SEA and LCA should be integrated.

Business Continuity

Disaster Recovery Institute (2016) defines business continuity as a process of management that recognizes risks, threats and vulnerabilities having a potential to affect a business's smooth operations and also offer a framework for building resilience and operationalize an effective response. The primary aim of business continuity is to allow the adversely affected business due to any hazard to come back to a normalized situation and its regular functionality and rather it conceptualize the idea of Building Back Better.

Some of the advantages of Business Continuity are:

1. Services and products remain accessible even during a crisis/emergency
2. Prevent the loss of jobs of the employees
3. Industries continue its basic functionality
4. Improve the awareness about the potential risks
5. Reduces vulnerabilities
6. Build resilience

Business Continuity Planning

Business Continuity Planning is a pre-disaster mitigation strategy that provides a guideline for a business to tackle and respond to a crisis like situation effectively and efficiently. However, such plan in place may not work 100% but it will significantly help in reducing the adverse impact and provide us a way to cope with emergencies. Such plans such be timely revisited and revised so that it remains updated and can be put into use effectively when required. The plans must also comply with the international standards like ISO 22301 and ISO 22313 that focuses on the business continuity. Planning for business continuity is time consuming and resource extensive but not planning is more resource extensive.

Characteristics of a Business Continuity Plan

1. Concise
2. Easy to use
3. Flexible

A business continuity plan should be concise and easy to use. Jargons and difficult terms should be avoided in the plan. A plan should be flexible and not restrict to comply to the procedures mentioned to be followed during a disaster.

The development of a business continuity plan can be divided into three stages:

1. Risk Assessment
2. Develop and Document
3. Test, Approve and Implement

Risk Assessment involves Risk Evaluation and Business Impact Analysis. The objective of Risk Evaluation is to identify the critical business functions whose

uninterrupted functionality is necessary and also identify the events that can adversely affect the business continuity. It also includes identification of measures and strategies needed to minimize the impact of an emergency. Business Impact Analysis includes identification of the impacts on business that is likely to occur due to interruption in the functionality of business. Critical business functions must be prioritized during the impact analysis in order to strategize a suitable plan.

Develop and Documentation of Business Continuity Plan involves development of recovery strategies and documentation of a comprehensive plan.

Test, Approve and Implementation of Business Continuity Plan: Testing of the plan is essential to understand its ground effectiveness and identify gaps and challenges. Testing will help in improvement and refinement of the plan. The most common tests include table-top exercises, structured walk-through and simulations. In the table-top exercise team reviews and goes through the plan and identify gaps and challenges. It usually occurs in a conference room. In a structured walk-through, each member of the team goes through their own components in the plans and identify gaps keeping a hazard in mind. Many a times mock-drill exercise are also conducted to critically test the plan. In the simulation, an environment similar to any disaster is created with all the scenarios and check if critical business functions can be kept functional or not while applying the formulated plan. Finally, a senior person or a team of expertise must endorse the plan. The plan must be timely updated and revisited.

Table 13: Stages of creating a business continuity plan

Stages	Objective
Risk Assessment	
Risk Evaluation	* Identify critical business functions necessary for uninterrupted service * Identify the potential events that can affect the business, potential damages likely to occur, and the mitigation measures needed

Business Impact Analysis	* Identify the impacts that are likely to occur on the business * Prioritize critical business functions
Develop and Document Business Continuity Plan	
Develop Recovery Strategy	* Identify a possible strategy to maintain the functionality of the business during any crisis/emergency
Document Plan	* Document the written plan that is to be reviewed by an expert or a senior person
Test Approve and Implement Business Continuity Plan	
Test Plan	* Test the formulated plan to identify gaps and challenges * Address the identified gaps to improve the plan
Approve and Implement Plan	* Review from a senior person or an expert is needed
Maintain Plan	* Timely updation of the plan is to be operationalized

(Source: American International Group, 2013)

Learning Objectives

- ✓ Explain about business continuity
- ✓ Importance of Business Continuity Plan

Duration: 90 minutes

Method

- ✓ Lecture/power-point presentation
- ✓ Case study
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Media

Projector, white board

Trainer's Guide

An exercise in groups can be instilled and ask the participants to prepare a business continuity plan in different disaster scenario.

Example:

- Group 1-** Business continuity Plan for school/college
- Group 2-** Business continuity plan for a production industry
- Group 3-** Business continuity Plan for tourism industry

Recommended Readings

<https://www.youtube.com/watch?v=oNZNS5G7bsY>

Atkinson, C. L.(2017). Business Continuity. A. Farazmand (ed.),Global Encyclopedia of Public Administration, Public Policy, and Governance. DOI 10.1007/978-3-319-31816-5_2867-1

Mainstreaming DRR (Disaster Risk Reduction)

Context and Description of the Session

Development means improvement in the ways of managing an area's natural and human resources in order to improve the three major dimensions of a country-Economic, Environmental and social conditions. Poor, women, children, disabled, elderly and vulnerable settlements are more prone to disasters.

Unplanned development creates new disaster risks and causes deaths, trauma, damage to infrastructure, loss of ecosystem services, environmental damage, etc. For example: Construction of houses in flood plains, coastal settlements exposed to sea storms, unplanned infrastructure construction without considering the standards, etc may lead to a major disasters in future. This is why initiatives and efforts are taken globally for resilient and sustainable development.

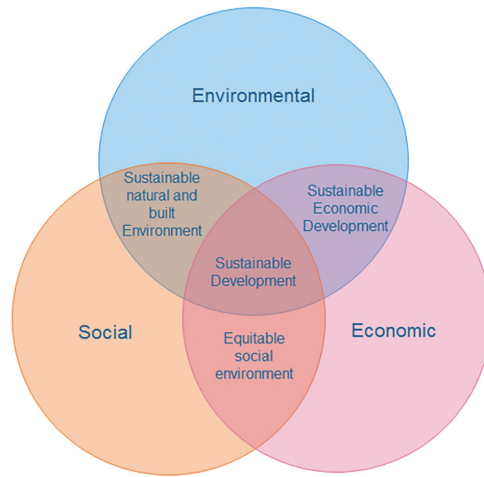


Figure 37: Three dimensions of development (Adapted from UNESCAP)

Sustainable Development is the type of development wherein we consider a holistic approach for development. It is defined as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Globally efforts have been made in mainstreaming some critical and neglected issues with the developmental planning like mainstreaming environment in development, mainstreaming climate change adaptation (CCA) in development, mainstreaming DRR in development, etc.

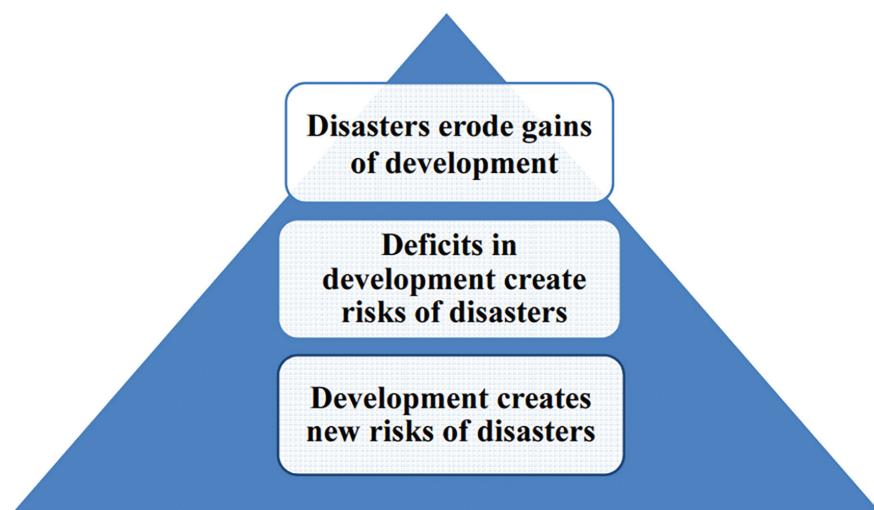


Figure 38: Disaster and Development

(Source: UNESCAP)

According to UNISDR definition mainstreaming disaster management into the development planning process essentially means looking critically at each activity and project that is being planned, not only from the perspective of reducing the existing risks disaster disasters, but also from the perspective of minimizing its potential risks of new disasters.

Mainstreaming of DRR

According to the UNISDR, it defines Mainstreaming DRR into developmental planning process as “looking critically at each programme, activity and project that is being planned, not only from the perspective of reducing the existing risks, but also from the perspective of minimizing its potential contribution to creation of new risks”. It is a process of reducing the disaster risks by factoring in the disaster risks concerns in developmental planning. It means to integrate disaster risk reduction into all the processes of developmental planning, poverty reduction strategies, resource extraction and management and environmental protection, to make disaster risk reduction as a part of development. Mainstreaming of DRR in developmental activities is an important mandate according to the India’s Disaster Management Act (2005). This process of mainstreaming DRR into development is essential to critically look at each developmental activity and identify the potential hazards that it is going to pose and if that particular activity is going to contribute in aggravating any

existing hazards. Therefore, it helps in minimizing the potential hazards and the vulnerabilities due to any developmental activity with the help of policy instruments and regulations. This concern for DRR was born from the global movement for sustainable development like International Decade for Natural Disaster Reduction (1990-1999), Yokohama strategy for Safer World (1994), Hyogo Framework for Action (HFA) (2005), World Conference on Natural Disaster Reduction, Sendai Framework for Disaster Risk Reduction (SFDRR) etc.

To mainstream the DRR into developmental planning the intricate relationship between disaster and development should be understood. The four dimensions of disaster and development linkage are:

1. Disaster limits development
2. Development aggravates disaster risks
3. Development reduces disaster risks
4. Disaster as an opportunity for development

Disasters can limit development diversion of resources to relief, rescue, recovery and reconstruction activities. It may also cause disruption in the existing services and the infrastructures thus setting back the pace of positive development. Further, political instability in a country may prevail due to any disaster leading to riots.

Disasters may aggravate disaster risks by increasing the factors of vulnerabilities if any developmental activity is being undertaken without a proper Environmental Impact Assessment, without following the building codes, without studying about the ground stability and seismicity, etc. or unplanned urbanization is a major cause of concern.

Development may reduce disaster risks by improving vulnerabilities by the structural measures like building multi-hazard resistant houses, and non-structural measures like the development of contingency planning, disaster management plans, crisis management plans and capacity building. Strengthening of the critical facilities like healthcare facilities, schools, road, communication facilities, early warning systems, etc.

Disasters also provides opportunity for development during the recovery phase and offers a chance to build back better using the best technologies and materials that are not only environmental friendly but also a disaster resistant.

New construction maybe undertaken by following the building codes and bye-laws in order to reduce to risk of future disasters. Relocation of the buildings/ settlements at a vulnerable locations may be considered which may not have been possible to do so before.

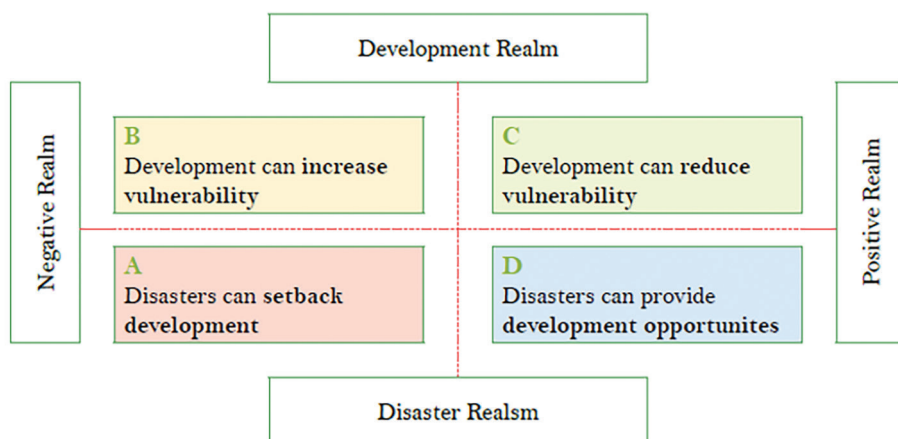


Figure 39: Four dimensions of the linkage of disasters and development

(Source: ADPC, 2014)

Approaches for Mainstreaming DRR

There are three approaches for mainstreaming DRR:

1. Structural Measures
2. Non-structural Measures
3. Disaster Mitigation Projects

Structural Measures

In Structural measures, all the existing structures, ongoing structural projects and the upcoming projects must be review and re-assessed in order to check whether the disaster management concern is incorporated or not. The existing structures should be assessed and retrofitted to reduce the vulnerability to existing hazards and all ongoing and

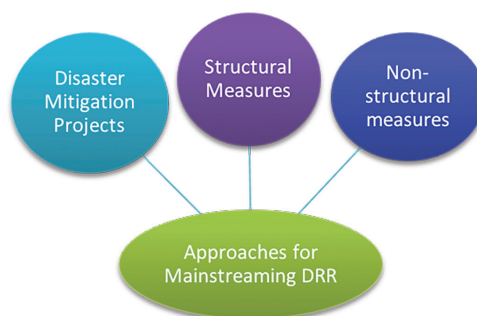


Figure 40: Approaches for mainstreaming DRR

retrofitted to reduce the vulnerability to existing hazards and all ongoing and

future projects should be made sure to comply by the latest safety standards. Building byelaws, town-planning Act, NDMA guidelines for management of various disasters and Bureau of Indian Standard (BIS) codes should be strictly implemented.

Non-structural Measures

It includes timely updation and amendment of Building byelaws, Area zonation for different disasters, land use land cover mapping, vulnerability profiling and reinforce the implementation and obligatory mechanisms.

Disaster Mitigation Projects

Some of the examples of disaster mitigation projects are National Cyclone Risk Mitigation Project, National Earthquake mitigation project, Landslide Mitigation Project and National Flood Mitigation Project, etc. Another approach for the mainstreaming of DRR into developmental planning is by inclusion of the DRR measures and concerns in government schemes like Jawaharlal Nehru National Urban Renewal Mission, Rajiv Awas Yojana, Smart City Mission, etc. Approaches such as Capacity building, Community based DRM projects, strengthening early warning systems and communication networks maybe considered in mainstreaming DRR.

Enabling Objectives

By the end of this module, the participants will be able to

- ✓ Describe the concept of mainstreaming of Disaster Risk Reduction in developmental planning
- ✓ Identify the linkages of CCA, DRR and sustainable development and their associated impacts and challenges
- ✓ Highlight the issues of climate change in Disaster Risk and Development
- ✓ Identify some pathways, tools and entry points for mainstreaming DRR
- ✓ Enumerate existing action plans as well as new scopes for mainstreaming DRR

Learning Objectives

There are four Learning units delineated to draw this module:

LU 1: Mainstreaming CCA and DRR into developmental planning

LU 2: Pathways, tools and entry points

LU 3: Action Plans and Implementation

Duration

This module can be run in a day with other modules or even separately for a day.

Methods

- ✓ Perception-check questionnaire
- ✓ Question/Answer session
- ✓ Lecture/power-point presentation
- ✓ Case study
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The session facilitator must have a sound understanding of sustainable development and the importance of mainstreaming DRR into developmental planning. To deliver this lecture a background of the linkage between the disaster and development should be checked and help the participants to establish the relationship. Case study examples or a flow chart may be used. In order to check their prior understandings and knowledge, a quick group discussion/question & answer session maybe conducted to make the session interactive and involving.

Recommended Readings

- Gupta, A.K., Nair, S.S., Wajih, S.A., Chopde, S., Gupta, G. and Aggrawal, G. (2014). Mainstreaming Climate Change Adaptation and Disaster Risk Reduction into District Level Development Plans. NIDM New Delhi (India), GEAG Gorakhpur (UP, India) and ISET, Colorado (US), P 114.

- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.
- IFRC (2013). Mainstreaming DRR and CCA: a practitioner's guide. Available at: https://www.ifrc.org/PageFiles/40786/DRR%20and%20CCA%20Mainstreaming%20Guide_final_26%20Mar_low%20res.pdf
- SDMA Meghalaya. (2018). Mainstreaming Disaster Risk Reduction (DRR) in Developmental Plans and Schemes. A Manual for Government Departments and Agencies. Available at: http://msdma.gov.in/publications/Mainstreaming_DRR_in_Development_Plans_and_Schemes.pdf

Learning Unit 5.1: Mainstreaming CCA (Climate Change Adaptation) and DRR

Context and Description of the Session

It is evident from the growing number of literature sources that the climate related hydro-meteorological and climatological disasters are increasing in frequency and magnitude. The number of disaster recorded by EM-DAT was over 1,300 events in 1975-1984 to over 3,900 in 2005-2014. According to the EM-DAT data, in the decade 2008-2017, out of total 3,751 natural hazards, 3,157 (84.2%) has weather related causes including two-third of floods and storms incidences.

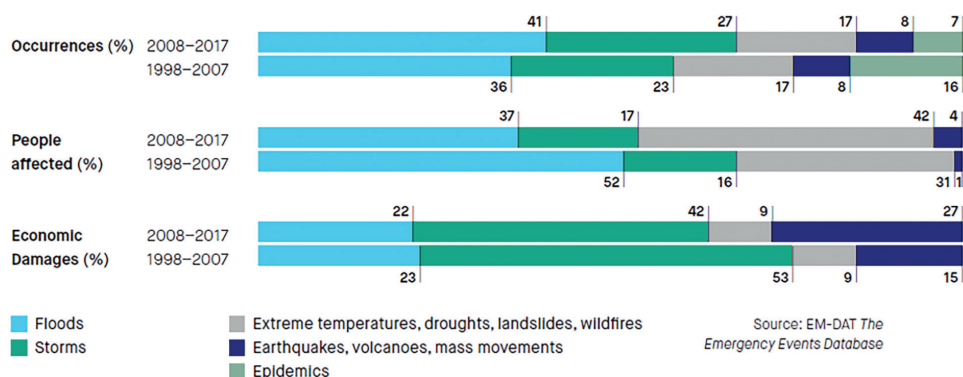


Figure 41: Comparison between different disasters in two decades 2008-2017 and 1998-2007

(Source: IFRC, 2018)

The figure 2 shows that the percentage of occurrence of hydro-meteorological disasters increased in 2008-2017, particularly floods (41%) and storms (27%) while epidemics reduced to 7%. The number of affected people reduced in floods from 52% to 37%, while the affected percentage due to extreme temperatures, droughts, landslides and wildfires increased to 42% and affected percentage due to geophysical disasters increased to 4%.

Disaster risks have been rising due to various contributing factors like increased exposure to hazard (both natural and human-induced) and increased vulnerability of the population, property and environment. It is evident that hazards are increasing to due to different anthropogenic activities including

population growth, environmental degradation, deforestation, political instability, conflict, excessive exploitation of natural resources, climate change, epidemics, poverty, mindless development, etc. However, the disaster risks can be reduced considerably through strategies and actions that can reduce vulnerability, reduce hazard exposure and improve adaptive capacity. With the rise in climate extreme events as well as human induced disasters affecting the country's economy, environment and social costs. It has become important to have an integrated approach with inclusion of key stakeholders- policy makers, planners, scientists, decision makers, and most importantly communities to work together, in order to undertake developmental strategies considering Climate Change Adaptation and Disaster Risk Reduction (DRR).

Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA)

Disasters occur every year and in every country. In past few years, the numbers of disaster events have been increased due to environmental degradation. Imbalance in natural system, unplanned development, population rise, climate change, etc and it cannot be stopped from its occurrence. However, the impact of any disastrous event maybe reduced substantially by proper planning and strategies. The importance of DRR was recognized after 2005 and the global framework called HFA (Hyogo Framework for Action) was signed by 168 countries. DRR is a central component in CCA as climate change is altering the face of disasters by altering its frequency, duration and intensity. The efforts to reduce the climate change impacts would be a significant contribution towards DRR. According to the IPCC, CCA is defined as “The adjustment in natural system or human system in response to actual or expected climate stimuli or their effects which moderates harm and exploits beneficial opportunities”. It is managing the negative impacts caused due to climate change with the help of various adaptive measures.

DRR and CCA largely overlaps by not completely. DRR is related with various hazards including hydro-meteorological hazards, geophysical hazards, biological and technological hazards where as CCA is related with the climatic hazards only that are a result of change in global average climatic conditions. Overall, both are concerned with reducing and managing the climatic extreme events and risks associated with it. They aims in reducing the vulnerability factors,

reducing the hazard exposure, improving adaptive capacities and building resilience.

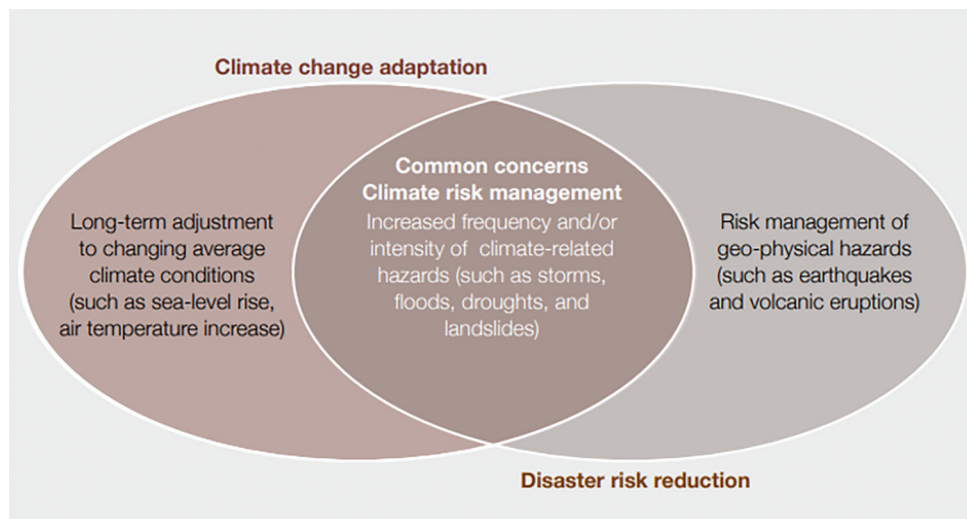


Figure 42: Overlap between climate change and DRR

(Source: IFRC, 2013)

Mainstreaming DRR and CCA

It is associated with the process of joining together of DRR and CCA at all levels of decision making at national, state, district and at community level and also, creating a roadmap from the local/national level commitments like SDGs and SFDRR to the global commitments. Mainstreaming CCA and DRR in the process of development, policy formulation and implementation will help in achievement of the sustainable development goals.

DRR is an important element of CCA as increasing frequency, severity, intensity of extreme events is the consequences of climate change, and it is likely to increase more in coming years. Climate change is causing varied range of disaster risks including weather-related risks, temperature rise, sea-level rise, etc. and increased social vulnerabilities exacerbated due to the agricultural crop failure, water crisis and ecological imbalance leading to livelihood loss, poverty and food insecurity.

All over the world, efforts are made in converging the two concepts of CCA-DRR and work on the overlapping concerns. However, both the concept doesn't

overlap completely but they are closely related to one another i.e. reducing vulnerability, achieving sustainable development and building a resilient society.

Several initiatives have been undertaken by India in integrating CCA (Climate Change Adaptation) and DRR (Disaster Risk Reduction) through approaches like Hyogo Framework for Action (2005-2015), NAPCC, 2008 (National Action Plan on Climate Change), Sendai Framework for Disaster Risk Reduction (2015-2030), Disaster Management Plans, Guidelines for various disaster, Action Plans, etc. Apart from this, sectoral departments have undertaken initiatives like early warning systems, capacity building, increasing disaster preparedness and other initiatives that affect climate and disaster resilience but these are not enough to withstand the increasing severity and intensity of disaster incidences.

Despite of several activities undertaken by the government, the main problem lies in the implementation at lower levels i.e. state, districts and blocks due to the poor horizontal and vertical coordination between departments and sectors. Many a times due to non-availability of smooth inter-sectoral and inter-departmental knowledge dissemination also hampers in the ability of understanding the concepts of CCA-DRR policies and the local government inability to follow the concepts behind the integration of the two. In order to address this gap, improving the capacity of the DDMA's (District Disaster Management Authorities) towards mainstreaming of CCA & DRR seems to be a potential option.

Ecosystem based Approach

The best approach for mainstreaming DRR and CCA is by using an Ecosystem based approach. Now when we have already established the context that how disasters are linked with our ecosystem, we must strategies a ecosystem inclusive disaster management approach. Ecosystem plays an important role in disaster management by reducing physical exposure to hazards. For instance; forests protects soil from getting eroded during floods, forests reduces the wind speed during storms, mangroves reduces the speed of cyclonic winds and tsunamis, wetlands reduces the flood impact, etc. These few examples shows the importance of these natural ecosystem in reducing the hazard impacts with the help of natural disaster management. In addition to it, natural ecosystems also reduce the community vulnerability by providing various

Mainstreaming DRR (Disaster Risk Reduction)

ecosystem services and many rural communities are directly dependent on these ecosystem services for their source of livelihood.

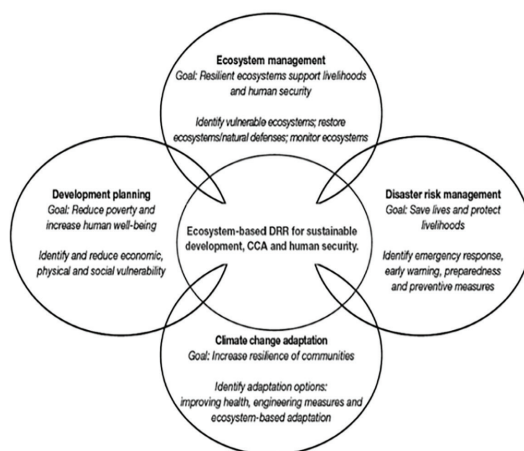


Figure 43: Ecosystem based approach of DRR

(Source: Estrella & Saalismaa, 2012)

Ecosystem Services

Ecosystem provides a range of benefits or services to us that are useful for the sustenance of life on earth. The ecosystem services are broadly categorized into four types:

1. Provisioning Services

Goods produced or provided by the ecosystems. Eg: Food, fuel wood, fiber, timber, etc.

2. Regulating Services

Benefits from regulation of ecosystem processes. Eg:, Climate Regulation, Air Quality, water run-off, erosion, pollination, etc.

3. Cultural Services

Non-material benefits from ecosystem. Eg: Spiritual, recreational, Aesthetic, educational, etc.

4. Supporting Services

Factors necessary for producing ecosystem services. Eg: Nutrient cycling, Hydrological cycle, soil formation, photosynthesis, etc.

Nature-based Solutions

According to Dhyani et al 2020 defines Nature based solutions or NbS as “The conservation, sustainable management and restoration of ecosystems as per site-specific natural and cultural contexts by community engagement, building their capacity and ecosystem resilience against climate adversities and disaster risks and achieving equitable sharing of sustainable and resilient development dividends”. For instance, urban centre are the major contributor of climate change due to loss of green cover, release of GHGs, CFCs, HCFCs, formation of heat islands and flood risks owing to drainage failures. To reduce to risks of climate induced extreme events like heat waves/urban flooding etc. green infrastructure, natural infrastructure, greening urban spaces, urban forestry, urban farming, etc can be promoted.

Greening Roofs in Bangalore, India

Increasing the green cover at the same time when the cities are facing a major space constraint maybe a challenge. However, in Bangalore, India, terrace gardens are in trend. It not only increase the city’s green cover but also facilitate an efficient rain water harvesting system and recharge groundwater table which is a good solution for the Bangalore’s water challenges. Greening of roofs in urban areas also reduces the heat island effect, keeps the building cool and reduces the carbon footprint by the reduced usage of air conditioners.



Learning Objectives

- ✓ To understand the definition of Climate Change Adaptation and Disaster Risk Reduction
- ✓ To elaborate the importance mainstreaming CCA and DRR
- ✓ To identify ecosystem and nature as a central to disaster risk reduction

Duration

Duration of 90 minutes is delineated do this unit.

Method

- ✓ Lecture/power point presentation
- ✓ Case study (preferably based on film)
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The trainer must have the concept of CCA and DRR clear. The importance of mainstreaming CCA and DRR can be explained after the thorough understanding of the commonalities and difference between the two. Group Exercise for identification of areas or sectors for mainstreaming of DRR and CCA can be included in this session by dividing the participants into group of 3-4 depending on the number. Each group shall be given any mission/scheme/project and will be asked to propose mainstreaming of structural and non-structural measures with CCA and DRR. At the end of the group discussion a group presentation can be delivered to the rest of the participants.

Recommended Readings

- International Federation of Red Cross and Red Crescent Societies, Geneva, (2013). Mainstreaming DRR and CCA: A Practitioner's guide.
- Gupta, A.K., Nair, S.S., Wajih, S.A., Chopde, S., Gupta, G. and Aggrawal, G. (2014). Mainstreaming Climate Change Adaptation and Disaster Risk Reduction into District Level Development Plans. NIDM New Delhi (India), GEAG Gorakhpur (UP, India) and ISET, Colorado (US), P 114.
- Gupta, A. K & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.

Learning Unit 5.2: Pathways, Tools and Entry Points for Mainstreaming of DRR into Developmental Planning

Context and Description of the Session

There are several pathway, tools and entry points for the mainstreaming of Disaster Risk Reduction into developmental planning. Disaster Management includes strengthening the institutional framework and implementation of legal frameworks that associates with the inclusion of sectoral concerns in management of disasters.

Institutional Framework for Disaster Risk Management in India

Ministry of Home affairs is the nodal ministry for all the matters concerning with disaster management which also constitute the relief commissioners to coordinate with relief operations.

As provided by the Disaster Management Act, 2005 some of the salient features of the institutional framework for DRM in India are:

1. At centre, the National Disaster Management Authority (NDMA) has been established with State Disaster Management Authority (SDMA) at state level and District Disaster Management Authority (DDMA) at district level, constituted to lay down various policies and guidelines for Disaster management at their respective levels.
2. The National Institute of Disaster Management (NIDM) is the apex body for capacity building, research development and documentation. Improving capacity of the Disaster Management Authorities towards mainstreaming CCA and DRR is one of the possible approaches for addressing the DM concerns.
3. The National Disaster Relief Force is a specialized team trained in various types of disasters for strengthening the humanitarian support and coordination during disaster response.

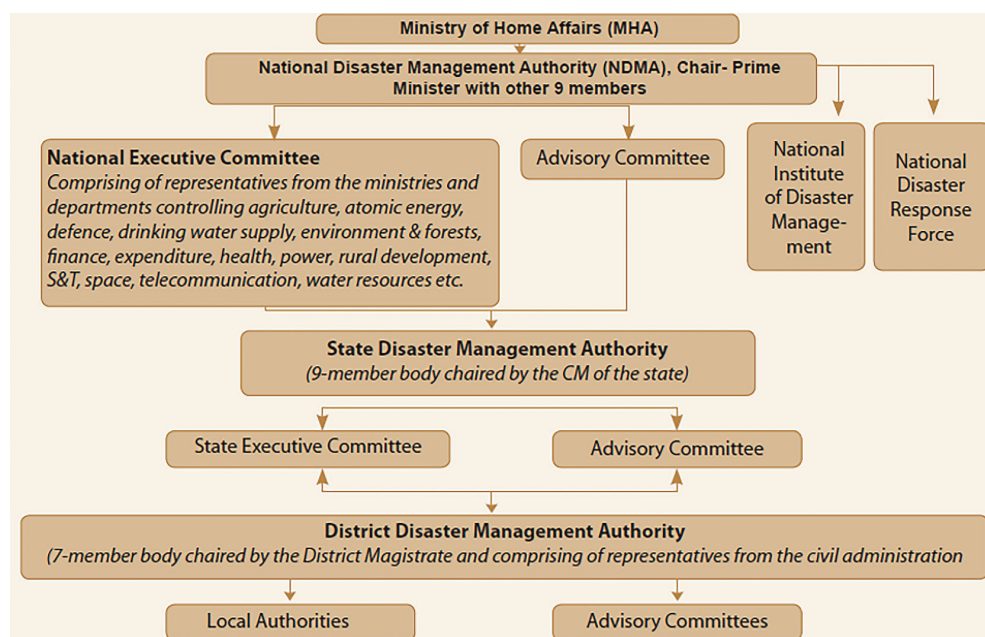


Figure 44: Disaster Management Structure in India

A National Disaster Management Policy, 2009 was formed with a vision “To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response” (GOI, 2015). It provides for the mainstreaming of DRR into disaster planning.

Environment Regulations in DRR

Environment is directly associated with Disaster risks and regulations of environment and natural resources plays a significant role in reducing vulnerability, improving adaptive capacity and thereby reducing hazard exposure. Some of the environmental regulations in India are:

- The Water (Prevention and Control of Pollution) Act, 1974
- The Air (Prevention and Control of Pollution) Act, 1981
- The Environment Protection Act, 1986
- The Noise Pollution (Regulation and Control) Rules, 2000
- The Public Liability Insurance Act, 1981
- The National Environment Tribunal Act, 1995
- The National Environment Appellate Authority (NEAA) Act, 1997

— The Ozone Depleting Substances (Regulation and Control) Rules, 2000

Inclusion of DRR Concerns in Development Schemes

Government has implemented a number of schemes in the course of development and it should be a mandate to incorporate DM concerns in it. For example integration of disaster risk reduction concerns with Smart City Mission.

Integration of CCA-DRR with Policy Instruments

Environmental Policy Instruments like EIA can be applied in the disaster prevention and mitigation phase can help integrate issues of climate change adaptation along disaster risk reduction in the planning (Gupta and Yunus, 2004).

Integration of CCA-DRR with Policy Instruments

Environmental Policy Instruments like EIA can be applied in the disaster prevention and mitigation phase can help integrate issues of climate change adaptation along disaster risk reduction in the planning (Gupta and Yunus, 2004).



Figure 45: EIA in DRR phases

(Source: Gupta & Nair, 2012)

Adoption of Ecosystem-based Approaches and Nature-based Solutions

Adoption of ecosystem based developmental approaches and nature based solutions in the disaster recovery a reconstruction phase can reduce the occurrence of future disaster risks. The ecosystem based or nature based approach for disaster risk reduction provides multiple benefit as the nature is a huge repository for ecosystem services, improve soil, air, water quality,

conserve biodiversity and also act as a natural buffer to reduce the exposure to natural hazards. For instance: Mangrove ecosystem provides a source of livelihood for fishing community, a habitat for a wide variety of biodiversity and also act as a natural buffer to reduce the cyclonic, tsunami and high tidal impacts.



Figure 46: Multiple benefits of ecosystem

(Source: Swiss NGO DRR Platform 2018)

National Adaptation Fund for Climate Change (NAFCC)

NAFCC is a Central Sector Scheme (2015-16) to support adaptation and mitigation activities of climate change. Such schemes help in updating and preparing climate scenario, vulnerability assessment and impact assessment. The projects related to adaptation in sectors such as agriculture, animal husbandry, water, forestry, tourism etc. are eligible for funding under NAFCC. National Bank for Agriculture and Rural Development (NABARD) is the National Implementing Entity (NIE). The States/UTs are required to prepare the project proposal in consultation with NIE i.e. NABARD. The project proposals are required to be approved by the State Steering Committee on Climate Change to be eligible for consideration under NAFCC. It is the discretion of the State Government to engage any organization to assist in project preparation, as per their requirement.

Objectives of NAFCC

- Funding concrete adaptation projects/programmes aligned with the relevant Missions under National Action Plan on Climate Change (NAPCC) and the State Action on Climate Change (SAPCCs) in agriculture, horticulture, agro-forestry, environment, allied activities, water, forestry, urban, coastal and low-lying system, disaster management, human health, marine system, tourism, habitat sector and other rural livelihood sectors to address climate change related issues.
- Preparing and updating climate scenario, assessing vulnerability and climate impact assessment.
- Capacity building of various stakeholders on climate change adaptation and project cycle management and developing knowledge network.
- Mainstreaming the approaches/learnings from project/programme implementation through knowledge Management

National Action Plan for Climate Change (NAPCC)

At national level, we have an action plan on Climate change that comprises of eight missions. Our Honorable Prime Minister developed it in the year 2008. This plan provides for a co-benefit of both development as well as combating climatic change. It continues to evolve based on the latest scientific and technical knowledge.

The eight missions of NAPCC are:

i. National Solar Mission

This mission is also known as Jawaharlal Nehru National Solar Mission. It is under the governance of ministry of new and renewable energy. The mission aims to increase the solar energy share in India's total produced energy and make India a global leader in production in solar energy by 2022. It also emphasizes in promotion of the research and development in the area of solar energy.

ii. National Mission for Enhanced Energy Efficiency

This mission is under the governance of the Ministry of Power. It aims to use clean energy, ensure energy efficiency and enhance the cost effectiveness of the energy. It emphasizes on spreading awareness about

energy efficiency products and creates a demand in market. It also focuses on certifying energy saver to companies.

iii. National Mission of Sustainable Habitat

It is under the Ministry of Urban Development. This mission aims to make cities climate friendly and make sure that climate change do not affect cities negatively. It encourages the adoption of effective measures to deal with waste disposal and liquid wastes and promotes urban development in a sustainable and liveable manner for future generation.

iv. National Water Mission

This mission is under Ministry of water resources, river development & Ganga rejuvenation. It aims to conserve water, reduction of wastage of water and better water resources management. It encourages conducting of research on how to process and deal with the problem of ground water pollution and management of water resources.

v. National Mission for Sustaining the Himalayan Eco-system

This mission is under the governance of Department of Science and Technology, Gol. It aims to protect Himalayan ecosystem including glaciers, forests and biodiversity. It promotes creation and training to specialists in the area of Himalayan ecosystem.

vi. National Mission for Green India

It is governed by the Ministry of Environment, Forest & Climate Change (MoEF&CC), Gol and aims to reduce the forest degradation and increase forest cover in the country.

vii. National Mission for Sustainable Agriculture

It is under the Ministry of Agriculture and aims to make strategies to reduce the impact of climate change on Indian Agriculture. It emphasizes on the use of new crop varieties, implementation of new technologies, new strategies for irrigation, capacity building of farmers, strengthening crop insurance, and promotes research on increase of soil fertility.

viii. National Mission for Strategic Knowledge about Climate Change

This mission is also under DST, Gol. It aims to identify issues of climate change in various areas and deciding how we can respond. It also

encourages foreign collaborators to deal with climate change and ensures funding for conducting research on climate change.

Institutional Arrangement for the Climate Change Policy in India

An advisory council on Climate Change is formulated and chaired by the honorable Prime Minister in order to tackle the challenges due to climate change. This advisory council has multi-expertise representations ranging from the key stakeholders from government organizations/departments, Industries and civil societies. This council provides guidance for necessary actions on the aspects of climate change, review the National Action Plan on Climate Change and provides guidance on matters related to international negotiations.

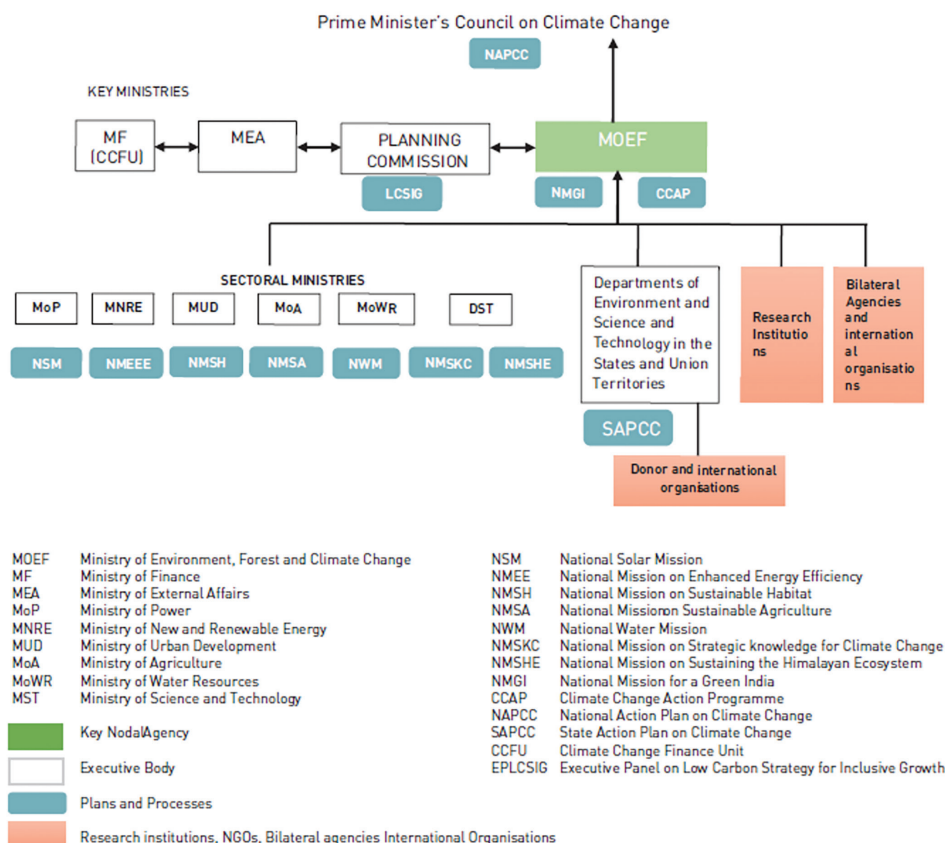


Figure 47: Institutional arrangements for climate change policy in India

(Source: Sheelanere, 2016)

State Action Plan for Climate Change (SAPCC)

At State level, it has become a mandate to prepare a yearly action plan for climate change. It is to be timely updated. Such action plan will help in integrating the DRR concepts in the developmental planning and mainstream CCA and DRR at state level.

Option of preparing action plans at lower level like district and even block level may be considered for CCA-DRR mainstreaming at ground level.

Learning Objectives

- ✓ To enable participants a sound understanding of mainstreaming DRR into developmental planning
- ✓ To enlist some of the key approaches and entry points for the mainstreaming DRR into developmental planning

Duration: 60 minutes

Methods

- ✓ Lecture/power point presentation
- ✓ Group exercises
- ✓ Experience sharing
- ✓ Discussion

Trainer's Guide

The trainer must have a sound understanding of disaster management and the importance of the concept of mainstreaming of DRR into developmental planning. In order to make this session interesting and interactive the facilitator of this session may ask the participants to point out new entry points for mainstreaming DRR into developmental planning.

Recommended Readings

- Gupta, A.K., Nair, S.S., Wajih, S.A., Chopde, S., Gupta, G. and Aggrawal, G. (2014). Mainstreaming Climate Change Adaptation and Disaster Risk Reduction into District Level Development Plans. NIDM New Delhi (India), GEAG Gorakhpur (UP, India) and ISET, Colorado (US), P 114.

- Gupta, A. K. & Nair, S. (2012). Environmental Extremes Disaster Risk Management- Addressing Climate Change. National Institute of Disaster Management, New Delhi.

Learning Unit 5.3: Action Planning and Implementation

Context and Background

An action plan is a document that enlists the set of methodology or guidelines to be followed for disaster risk management. Developing an action plan can help change makers turn their visions into reality, and increase efficiency and accountability. An action plan describes the way we meet its objectives through detailed action steps that describe how and when these steps will be taken. It acts as a guideline in order to meet the objective. Action Plans help the policymakers and the stakeholders to increase the efficiency, accountability and realize their visions into reality. Action Plan for each type of disaster must be prepared by each state/district for the disasters specific to their area. Not only the framing of action plans it should be timely (yearly) updated and must ensure its execution according to the SOP mentioned.

A disaster action plan is necessary to lessen the impact of disasters on vulnerable populations. India has a comprehensive disaster management plan in place that aims to build a disaster resilient India and reduce the losses due to disasters significantly.

Our NDMP (National Disaster Management Plan) is primarily developed based on the SFDRR (Sendai Framework for Disaster Risk Reduction), prioritizing on understanding of Disaster risks, improving disaster risk governance, structural and non-structural DRR and disaster preparedness, efficient early warning and disaster recovery. This plan covers all the phases of disaster management cycle and talks of a multi-hazard disaster risk management approach since India is vulnerable to different types of hazards. NDMA prepares guidelines for the management and preparation of Action Plan of different disasters and each state is mandated to prepare action plans for their state specific disasters following the guidelines.

National Disaster Management Plan (NDMP)

The National Disaster Management Plan (NDMP) aims to make India disaster resilient and significantly reduce the loss of lives and assets. The plan is based on the four priority themes of the “Sendai Framework,” namely: understanding disaster risk, improving disaster risk governance, investing in disaster reduction

(through structural and non-structural measures) and disaster preparedness, early warning and building back better in the aftermath of a disaster.

Along with the mandate given in the DM Act 2005 and the NPDM 2009, the national plan has incorporated the national commitment towards the Sendai Framework. Accordingly, the broad objectives of the NDMP are:

1. Improve the understanding of disaster risk, hazards, and vulnerabilities
2. Strengthen disaster risk governance at all levels from local to centre
3. Invest in disaster risk reduction for resilience through structural, non-structural and financial measures, as well as comprehensive capacity development
4. Enhance disaster preparedness for effective response
5. Promote “Build Back Better” in recovery, rehabilitation and reconstruction
6. Prevent disasters and achieve substantial reduction of disaster risk and losses in lives, livelihoods, health, and assets (economic, physical, social, cultural and environmental)
7. Increase resilience and prevent the emergence of new disaster risks and reduce the existing risks
8. Promote the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures to prevent and reduce hazard exposure and vulnerabilities to disaster
9. Empower both local authorities and communities as partners to reduce and manage disaster risks
10. Strengthen scientific and technical capabilities in all aspects of disaster management
11. Capacity development at all levels to effectively respond to multiple hazards and for community-based disaster management
12. Provide clarity on roles and responsibilities of various Ministries and Departments involved in different aspects of disaster management
13. Promote the culture of disaster risk prevention and mitigation at all levels
14. Facilitate the mainstreaming of disaster management concerns into the developmental planning and processes

Salient Features of the Plan

- The plan covers all phases of disaster management: prevention, mitigation, response and recovery.
- For each hazard, the approach used in this national plan incorporates the four priorities enunciated in the Sendai Framework into the planning framework for Disaster Risk Reduction under the five Thematic Areas for Actions:
 - Understanding Risk
 - Inter-Agency Coordination
 - Investing in DRR - Structural Measures
 - Investing in DRR - Non-Structural Measures
 - Capacity Development
- The Response part of the Plan has identified eighteen broad activities which have been arranged into a matrix to be served as a ready reckoner:
 - Early Warning, Maps, Satellite inputs, Information Dissemination
 - Evacuation of People and Animals
 - Search and Rescue of People and Animals
 - Medical Care
 - Drinking Water/ Dewatering Pumps/ Sanitation Facilities/ Public Health
 - Food & Essential Supplies
 - Communication
 - Housing and Temporary Shelters
 - Power
 - Fuel
 - Transportation
 - Relief Logistics and Supply Chain Management
 - Disposal of Animal Carcasses
 - Fodder for livestock in scarcity-hit areas

- Rehabilitation and Ensuring Safety of Livestock and other Animals, Veterinary Care
- Data Collection and Management
- Relief Employment
- Media Relations
- The Plan has also incorporated a Chapter on Strengthening Disaster Risk Governance. The generalized responsibility matrix given in this section summarizes the themes for strengthening Disaster Risk Governance and specifies agencies at the Centre and State with their respective roles. The matrix has six thematic areas in which Central and State Governments have to take actions to strengthen disaster risk governance:
 - Mainstream and integrate DRR and Institutional Strengthening
 - Capacity Development
 - Promote Participatory Approaches
 - Work with Elected Representatives
 - Grievance Redress Mechanism
 - Promote Quality Standards, Certifications, and Awards for Disaster Risk Management
- It provides for horizontal and vertical integration among all the agencies and departments of the Government. The plan also spells out the roles and responsibilities of all levels of Government right up to Panchayat and Urban Local Body level in a matrix format. The plan has a regional approach, which will be beneficial not only for disaster management but also for development planning.
- It is designed in such a way that it can be implemented in a scalable manner in all phases of disaster management. It also identifies major activities such as early warning, information dissemination, medical care, fuel, transportation, search and rescue, evacuation, etc. to serve as a checklist for agencies responding to a disaster. It also provides a generalized framework for recovery and offers flexibility to assess a situation and build back better.

- To prepare communities to cope with disasters, it emphasizes on a greater need for Information, Education and Communication activities.

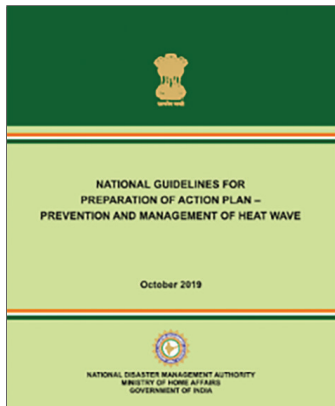
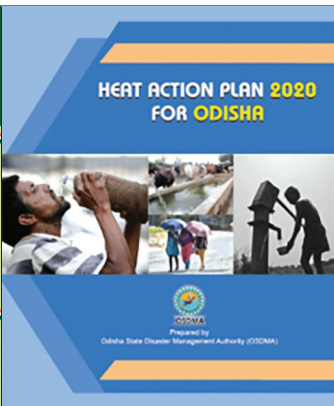
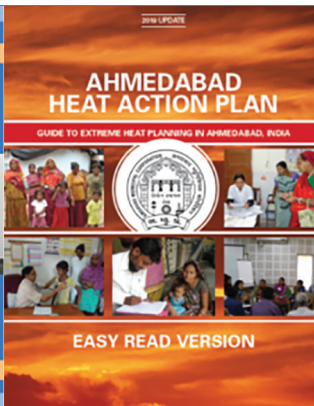
NDMA Guidelines

Some of the guidelines prepared by NDMA are listed below:

- Guidelines on Management of Earthquakes (2007)
- Guidelines on Chemical Disasters (2007)
- Guidelines on Management of Cyclones (2007)
- Guidelines on Management of Biological Disasters (2008)
- Guidelines on Management of Nuclear & Radiological Disasters (2009)
- Guidelines on Management of Landslides and Snow Avalanches (2009)
- Guidelines on Management of Chemical (Terrorism) Disasters (2009)
- Guidelines on Management of Psychosocial Support and Mental Health Services in Disasters (2009)
- Guidelines on Management of Tsunamis (2010)
- Guidelines on Management of Death in the Aftermath of Disaster (2010)
- Guidelines on Management of Urban Flooding (2010)
- Guidelines on Management of Drought (2010)
- Guidelines on Hospital Safety (2016)
- Guidelines for Preparation of Action Plan- Prevention and Management of Heat Wave (2019)

The guidelines issued by NDMA provide a framework for implementation, inter-agency coordination and management of the impact of the hazard. These plans also aim to mobilize resources and capacity to deal with extreme events. Based on the guidelines issued by NDMA, states also prepare their own action plans to be implemented at state level.

For example, Guidelines for preparation of Action Plan for Preparation and Management of Heat Wave is prepared by NDMA yearly. States that are vulnerable to heat wave prepares yearly Heat Wave Action Plan following the guidelines

		
National Guidelines for Preparation of Action Plan-Preparation and Management of Heat Wave prepared by NDMA	Heat Action Plan 2020 for Odisha prepared by Odisha State Disaster Management Authority (OSDMA)	Ahmedabad Heat Action Plan 2019

How to Prepare an Emergency Action Plan

A detailed and well-executed emergency action plan can save lives and reduce impacts. Steps to prepare a disaster management plan for ministries/states/districts are as follows:

1. Identify the scope of the plan
2. Risk Identification
3. HRVC Analysis
4. Identification of existing Hazard specific prevention/mitigation measures
5. Define the role of key stakeholders
6. Capacity building for implementation & execution of Plan

NDMA has also provided templates for the preparation of DM Plan for different ministries (<https://ndma.gov.in/images/policyplan/dmplan/Template-DMP-Ministry-Dept-2019-JAN-Final-Draft1-cpg%20-AT.docx>), Guidelines for preparation of State DM Plan (<https://ndma.gov.in/images/guidelines/sdmp.pdf>) and Guidelines for preparation of District DM Plan (<https://ndma.gov.in/images/policyplan/dmplan/DDMPnote.pdf>).

Implementation of Action Plan

Proper implementation of Action Plans is very important for success in reduction of risks. To implement any emergency response plan, it must be incorporated with the developmental plans and capacity building of the stakeholders must be undertaken for efficient execution of the plans. The goals and objective of the plans must be clear. Detailed roles and responsibilities of each agencies/ organization/departments must be clearly mentioned to avoid confusions and duplication of roles.

Learning Objectives

- ✓ To understand the importance of Action Plans
- ✓ Learn to prepare Action Plans

Duration: 60 minutes

Methods

- ✓ Group Exercise
- ✓ Group Discussion
- ✓ Presentation

Trainer's Guide

This learning unit can be delivered with the help of a group activity or exercise. The participants shall be divided into groups and each group may be asked to prepare an action plan for any disaster along with SOP for the concerned authorities.

Example: Wildfire for Group 1, Cold Wave for group 2, etc

After half an hour of group discussion, a representative from each group shall present the designed action plan.

Recommended Readings

- NRDC. (2018). Ahmedabad Heat Action Plan. Available at: <https://www.nrdc.org/sites/default/files/ahmedabad-heat-action-plan-2018.pdf>
- NDMA. (2019). National Guidelines for Preparation of Action Plan- Preparation and Management of Heat Wave. Available at: <https://ndma.gov.in/images/guidelines/heatwaveguidelines.pdf>
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Website : www.nidm.gov.in

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