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Indira Gandhi National Open University
School of Social Sciences

BPAG-171
DISASTER MANAGEMENT

"शिक्षा मानव को बन्धनों से मुक्त करती है और आज के युग में तो यह लोकतंत्र की भावना का आधार भी है। जन्म तथा अन्य कारणों से उत्पन्न जाति एवं वर्गगत विषमताओं को दूर करते हुए मनुष्य को इन सबसे ऊपर उठाती है।"

– इन्दिरा गांधी

"Education is a liberating force, and in our age it is also a democratising force, cutting across the barriers of caste and class, smoothing out inequalities imposed by birth and other circumstances."

- Indira Gandhi

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Course Contents

INTRODUCTION

Disaster, natural or human induced, is an unwelcome guest and leaves a permanent impression of its visit on the victims. Disasters play havoc with the lives of people. They cause excessive losses to the humanity and infrastructure. Due to disasters, the normal life is thrown out of gear and the existing patterns of regulatory and development administration suffers heavily. The economic, social and psychological dimensions of the wrath of disasters adversely affect the environment around. Frequencies as well as intensity of natural disasters are increasing globally including India. Disaster impacts are felt more in developing countries due to borderline economic status of the vulnerable population, which have inadequate adjustment capacity. India, with a wide range of climatic and topographic conditions, is subject to various types of natural disasters like floods, cyclones, droughts, earthquakes, etc., in various degrees. Ever since, disasters have been causing substantive loss to the community and the exchequer. It not only stalls the ongoing functioning and pattern of life, but puts on hold the development actions planned in the nearby future as the fund earmarked for such development is diverted to disaster relief and response.

There are elements at risk with regard to each disaster. Risk is not an inherent property of a hazard alone. The weak structures are more at risk. It depends on the fury of the disaster as well as the vulnerability of the affected region. Thus, the local communities are required to be prepared to face the aftermath of the disasters effectively. The first step in this direction is to undertake vulnerability analysis, which brings to light the elements at risk such as the population, buildings and infrastructure. The most vulnerable members of the community are the expectant and lactating women, single women, children, old, disabled, handicapped, sick and ailing people. Their needs have to be kept in view while making the analysis. Likewise, the physical vulnerability elements have to be recognised by the community for the purpose of initiating specific measures to reduce the extent of losses in their regions. The community should also identify the potential threats in order to cope with the intensity of future disasters.

Human vulnerability to disasters is an age-old phenomenon. Besides nature's wrath, human interventions have also precipitated many calamities in the recent past. People face the most debilitating consequences in the form of economic and social disruption caused by disasters. The aftermath of disasters is a grim picture of death, destruction and suffering. The long history of disasters and the suffering caused as a result is reason enough to ponder over the question of their management.

The scope of disaster management is quite vast and could be understood through two sub-divisions. These are: Theoretical Foundations and Practical Concerns. Theoretical foundations include elements and facets like planning, organising, staffing, directing, coordinating, reporting, and budgeting. The Practical concerns of the scope of disaster management include subject matter or issue specific namely administration, agriculture, education, food, health, livelihood, livestock, reconstruction, recovery, rehabilitation, relief, rescue, shelter, etc. It also comprises human elements touching upon psychological, social, and economic dimensions. Furthermore, close two-way relationship between disasters and development reveals the development orientations of disasters. In all practical terms, the scope of disaster management is much detailed and comprehensive and calls for a set of systematic approaches to appropriately deal with disasters. Disaster management is not only a post-disaster management activity but is a detailed and proactive approach and exercise to be initiated and put in place at various levels with rather active cooperation of all concerned stakeholders. Gone are the days when relief

distribution in a post-disaster scenario was the only facet of disaster management engaging serious attention.

For disaster management to be effective and efficient, it is not only the government that has to play an active role, but all concerned stakeholders need to work in unison for desired results. Emphasis, of late, has been on sensitising and capacitating the community as the 'first responder'.

Disaster management has evolved into a methodical approach that focuses on systematic observations, their analysis and dissemination of likely events to structure informed application of resources in time. It aims to prevent avoidable loss of life and property, minimise human suffering and expedite recovery and rehabilitation. The most crucial goal of disaster management programmes, as of now, is to take all possible measures for disaster prevention and preparedness to the extent possible besides initiating prompt measures towards effective disaster response, rehabilitation and recovery.

Disaster losses can be substantially minimised and the disaster management systems can be more effective, if serious efforts through research, documentation, knowledge sharing, networking, etc., in the area of disaster management are carried out and the same supplement the initiatives undertaken by the laid-down structures in India.

Disaster management education seeks to provide understanding of different types of hazards, disaster management techniques and impediments in the way of disaster reduction. It could play a crucial role in the areas of analysing risks in disaster management, planning for contingencies, streamlining warning systems, mapping disaster zones, developing data bases, preparing emergency response plans, reducing hazards and vulnerability, and conceiving disaster coping strategies.

The Course on Disaster Management at Under-graduate level is to orient the learners about the negative aspects of the disasters and also to sensitise them with the methods and techniques for effective management of disasters so that the losses arising out of disasters could either completely avoided or minimised to a substantive extent. Disaster management is nothing, but in essence it is everything. When it is said that disaster management is nothing, it is because of the fact that various facets given attention to in disaster management are from other disciplines and professions. For example, when policies and programmes for managing disasters are referred to, it is found as having been taken from political science; geographical considerations, regional planning, spatial planning, etc., stem from geography; reference to community, society, individuals, groups, and the like are from the field of sociology; statistical resources, decision making, computation models are from the areas of statistics and mathematics; plan formulation, micro finance, macro finance emanate from economics; ecological foundations are from the field of biology; and past practices as well as treatment to earlier disasters are from the field of history. It makes one feel that disaster management has nothing of its own and so it is nothing. The other side of it reveals that disasters affect the polity, society, economy, environment, development planning, administration, management, etc., and without appropriate management of disasters each of the professions and disciplines that contribute to the management of disasters is out of place unless there are appropriate mechanisms for disaster management. Thus, disaster management is everything and is equally important and significant for all sections of the society. In keeping with the 'vast reach of and impact of disasters', the said course on Disaster Management shall be of significance to almost all disciplines of studies, may it be social sciences; sciences, engineering, architecture, commerce and management; health sciences, etc. This Course

comprises 4 Blocks, having 15 Units, each covering different important facet of disaster management.

Block 1 Introduction

Unit 1 Meaning and Classification of Disasters

It explains the meaning and classification of disasters. It brings to light the long history of disasters. It signifies that disasters have been affecting societies and had been posing problems and threats to the people and structures. The term 'disaster' composed of two words 'bad' and 'star'. It also highlights the major impacts of disaster, namely, loss of life and property, adverse impact on economy and social structure, epidemiological threats, migration, etc. There is mention of various types of disasters in the Unit, viz. Water and Climate related disasters; Geologically related disasters; Chemical, Industrial and Nuclear Related disasters; Accident related disasters; and Biological disasters in the Unit. It specifically focuses on natural disasters, namely, earthquake, volcanic activity, landslide, tsunami, avalanche, flood, extreme temperature, drought, wildfire, cyclone and storm surge, and epidemics. Besides, man-made disasters namely complex emergencies/conflicts, famine, displaced populations, transport accidents and industrial accidents are highlighted in this Unit.

Unit 2 Hazard, Risk and Vulnerability

Hazard, Risk and Vulnerability are three most important and significant concepts in disaster management. Disaster management has undergone a change with the passage of time. It is no more a piecemeal strategy, but an integrated process. In order to understand disaster management thoroughly, the Unit explains the terms 'Hazard' and 'Disaster' and brings forth the differentiation between the two. It further explains the term 'Risk' for you to better understand Risk Perception and Risk Identification. Detailed explanation of Vulnerability and its various types shall help you better understand Vulnerability and Risk Assessment. The concept of vulnerability covers risk of hazards and the measure of risk combined with the relative inability to cope with the resulting stress. In line with it, various factors contributing to both natural and man-made disasters have been discussed in the Unit.

Unit 3 Natural and Man-made Disasters

Disasters are seen as the consequence of inappropriately managed risk, which is a resultant of a combination of hazard and vulnerability. Natural disasters, causing loss of life or property damage, are naturally occurring physical phenomena, whereas man-made disasters are events that are caused by humans and occur in or close to human settlements. In order to have proper understanding of various disasters, different natural and man-made disasters have been discussed at length in the Unit. For better understanding of the learners, natural disasters, referred to in the Unit, are sub-divided in four major types, namely, Geophysical, Hydrological, Climatological, and Biological. Likewise, under man-made disasters, the focus of discussion is on Complex emergencies and conflicts, Famine, Displaced population, and Transport and industrial accidents.

Unit 4 Disaster Profile of India

India is among the world's most disaster prone areas and a large part of the country is exposed to natural hazards, which often turn into disasters causing loss of life and property. Disaster risks in India are further compounded by increasing vulnerabilities contributing to a situation where disasters seriously threaten India's economy, its

population and sustainable development. You shall be able to know about the vulnerability profile of India classified into three geological divisions, that is, Himalayas, also known as the Extra-Peninsula; Indo-Gangetic Plains and the Peninsula. The Unit provides details about major natural disasters in India, namely Earthquakes, Tsunami, Landslides, Floods, Cyclones, Droughts, and Heat Waves and Cold Waves.

Block 2 Disaster Management: Concepts and Institutional Framework

Unit 5 Disaster Management: Act, Policy and Institutional Framework

In keeping with the substantive loss of life and property caused by disasters, a need for coordinated and concerted efforts towards effective disaster management in the country was felt strongly especially after Super Cyclone of Odisha in 1999 and Bhuj Earthquake in 2001. This Unit highlights the institutional arrangements for disaster management in India. To this effect, you shall be able to know about the Disaster Management Act, 2005, as a new multidisciplinary focus on disaster prevention and risk reduction and a move away from a relief-centric regime. It also highlights, at length, the evolution of National Disaster Management Authority and its major functions. It further brings to light the role of other major forces/agencies like National Executive Committee, State Disaster Management Authority (SDMA), District Disaster Management Authority (DDMA), National Institute of Disaster Management (NIDM), and National Disaster Response Force (NDRF). Besides role of Central Government and State Governments and District Administration, the Unit also discusses other important institutional arrangements viz. Armed Forces, Central Armed Police Forces, State Police, Fire Services, Civil Defence (CD) and Home Guards, Civil Defence (CD) and Home Guards, Local Elected Bodies, Community, International Cooperation, etc. It also brings to fore the aims of the National Policy on Disaster Management (NPDM), 2009, and salient features of the National Disaster Management Plan (NDMP), 2016.

Unit 6 Disaster Management Cycle with Focus on Preparedness, Prevention and Mitigation

The focus in disaster management is more towards disaster prevention, preparedness and mitigation. It is more rightly felt required as it not only helps in preventing a disaster or/and minimising its loss to the humanity, but also saves lot of economic losses. Disaster management is a holistic process and is viewed as a Cycle comprising three stages, that is, pre-disaster; during disaster and post-disaster. Each stage consists of various facets. Accordingly, the Unit discusses prevention, preparedness and mitigation in pre-disaster stage; relief and response in during disaster stage; and rehabilitation, reconstruction and recovery in post-disaster stage.

Unit 7 Disaster Relief and Response

Disasters, in most of the cases, occur suddenly and unexpectedly. These cause lot much of devastation and destruction. India is one of the most disaster prone countries in the world. A major disaster occurs in India almost in every 2-3 years and about 50 million people are affected annually from these disasters. On an annual basis, around 1 million houses are damaged along with human, social, economic and other losses. The requirement is to provide relief to the victims immediately after the disaster. The Unit shall enable you to know about disaster relief carried out through a number of efforts including Evacuation, Search and Rescue (SAR) Shelter, Distribution of Food, Water and Fodder, Clearance of Debris, Movement of Injured to Hospitals, Disposal of Dead Humans, Disposal of the Dead Animals, Sympathetic Attitude towards Victims, Assisting

Rescue Teams, Property Security, Information Dissemination and Checking of Rumours, Immediate Damage Assessment, and Filing of Claims. It also refers to Response Mechanism with focus on Emergency Operations Centre

Unit 8 Damage Assessment

Damage assessment is an important tool for retrospective and prospective analysis of disasters to assimilate the extent of impact of a disaster. It is a prerequisite for effective disaster response effort. It makes an initial and preliminary onsite evaluation of damage or loss that has been caused by an accident or disaster. Through damage assessment exercise, an attempt is made to put on record the amount and degree of damage and also to point out what can be replaced, restored or salvaged. The discussion in the Unit is on various elements and dimensions of damage assessment. The unit also lays emphasis on framework of damage assessment in two parts. It brings forth damage assessment plan for assessing loss and damage to various critical sectors, namely, Human Life, Housing, Community Infrastructure, Environment, Livelihood, and Health, etc.

Unit 9 Rehabilitation, Reconstruction and Recovery

In the post-disaster phase, rehabilitation, reconstruction and recovery are important and inevitable aspects that are to be paid utmost care in bringing back the life of people to normalcy. This phase follows immediately after the disaster relief and response. Rehabilitation and reconstruction are the integral part of recovery and effective rehabilitation and reconstruction ensures the resilience of the society. This Unit explains the concept of rehabilitation and its types such as physical rehabilitation, social rehabilitation, economic rehabilitation and psychological rehabilitation. It also analyses the major steps of reconstruction and gives special emphasis to the funding arrangement patterns for reconstruction which encompasses National Disaster Response Fund; State Disaster Response Fund; National Disaster Mitigation Fund; Recommendations of the Fourteenth Finance Commission; District level funds; Member of Parliament Local Area Development Scheme; Prime Minister's National Relief Fund; and other Insurance schemes. Finally, it also discusses about recovery mechanism and the problems involved in recovery areas.

Block 3 Interrelationship between Disasters and Development

Unit 10 Climate Change

In the contemporary context, climate change is a major environmental and developmental problem, which has no boundary. It affects both the natural ecosystem and society directly as well as indirectly. The major reason for climate change is the human activity towards the global atmosphere in the name of development. The impacts are, thus, the increased frequency of extreme weather, flood, drought, sea level rise and extreme climate variability. In this Unit, the concepts such as weather, climate, climate change and its impact are discussed. Moreover, climate vulnerability and climate change adaptation are also explained from the learners' perspective.

Unit 11 Disasters and Development

This Unit highlights the interrelationship between disasters and development. Sometimes, disasters lead to development and likewise development also leads to disasters. Disaster affects development and causes loss of resources, shifts resources to emergency response, depresses the investment climate and also affects the non-formal sector. In the same way, development also increases vulnerability through dense urban settlement,

development of hazardous sites, environmental degradation, technological failures or accidents, imbalance of pre-existing natural or social systems. This Unit discusses the relationship between disaster and development and specifically focuses on the aspects such as development programs and vulnerability; disasters as opportunities for development initiatives; and missed development opportunities. It brings out the importance of developing infrastructure in a sustainable manner. Finally, emphasis is given to long-term job opportunities, livelihood options and the statutory provisions for mainstreaming disaster risk reduction.

Block 4 Disaster Management: Cross-cutting Issues

Unit 12 Relevance of Indigenous Knowledge

The successful and sustainability of risk reduction activities depends upon the involvement of local populace, their knowledge, culture and traditional practices. In this context, increasing the adaptive capacity of the communities helps in bringing back resilience and also in reducing the levels of vulnerability. The adaptive capacity of community could be maximised by laying more emphasis on the traditional knowledge. This Unit enables us to understand the traditional knowledge and in line with it, discusses the indigenous knowledge and disaster risk reduction. It provides details about the indigenous knowledge and early warning system. Further, it also discusses the indigenous knowledge and coping strategies with special reference to cyclone, flood and drought.

Unit 13 Community Based Disaster Management

Community is the first respondent to any kind of disaster and the major stakeholders of the disaster risk reduction activities. They are the major crusader in bringing back resilience of the society. The concept of Community Based Disaster Management (CBDM) is about bringing together the community and involving them in the various phases of disaster management activities. This is a bottom-up approach to deal with a disaster. This Unit explains the concept of CBDM and Community Based Risk Assessment (CBRA), which covers aspects such as hazard, vulnerability, risk and capacity assessment. It highlights the principles of CBDM and brings out the differences between the traditional approach and the CBDM approach. It also focuses on the institutional framework related to CBDM and gives more emphasis on the planning measures in the pre, during and post-disaster phase.

Unit 14 Disaster Management Strategies

Globally, the occurrence of disasters is increasing due to extreme weather conditions, population growth, unplanned urbanisation and increasing pressure on natural resources. It proves that disaster has no boundaries and it makes setbacks on development. It was in such a context that the International Decade for Natural Disaster Reduction convention was adapted worldwide in the 1990s. After that the relief-oriented approach changed towards risk reduction approach. More emphasis was given to improving the capacities of communities through various disaster risk reduction strategies. This Unit, thus, introduces the concepts and components of disaster management strategies. It brings out various disaster management strategies at the international level such as International Decade for Natural Disaster Reduction; Yokohama Strategy for Disaster Reduction; Hyogo Framework for Disaster Reduction; and Sendai Framework for Disaster Risk Reduction. It also highlights the disaster management strategies that were adopted in the Indian context.

Unit 15 Disaster Management: Case Studies

Case studies of past disasters are more important to understand a disaster and also to examine the measures taken to deal with a disaster. Past disasters serve as an opportunity to learn from the experiences and helps in streamlining disaster risk reduction activities. In earlier days, India had followed relief-oriented approach and it did not have proper institutional mechanism to handle a disaster. The major policy changes and the institutional mechanisms were created after the Odisha cyclone in 1999, Gujarat earthquake in 2001 and the Indian Ocean Tsunami in 2005. This Unit highlights the major lessons learnt from the above mentioned three major disasters; besides bringing out the experiences of Uttarakhand Floods, 2013 and Cyclone Phailin, 2013.

BLOCK 1

INTRODUCTION

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UNIT 1 MEANING AND CLASSIFICATION OF DISASTERS*

Structure

1.0 OBJECTIVES

After reading this Unit, you should be able to:

- Acquire conceptual understanding of relevant disaster terminology;
- Understand the difference between natural and man-made disasters; and
- Give a general overview of classification of disasters.

1.1 INTRODUCTION

Disaster has been with us as long as recorded history, and probably even longer. Our ancestors have had to withstand disasters. They have suffered the consequences and recovered from them, and life has continued. Most of the old problems remain as threatening as ever. Natural phenomena such as earthquakes, cyclones, volcanic eruptions, tsunamis, wildfires, floods, landslides, and droughts still persist. So do man-made disasters such as major accidents. These disasters continue to cause human casualties, economic and social loss, and damage to the environment. It is certainly true that we have learned to cope with these problems to some extent. However, we have neither eliminated nor contained them.

1.2 MEANING OF DISASTER

The term 'Disaster' owes its origin to the French word 'Desastre' which is the combination of two words – 'des' meaning 'bad'and 'astre' meaning 'star'. In earlier days, a disaster was considered to be due to some unfavourable star. Nowadays, the term 'Disaster' is commonly used to denote any odd event, be it natural or man-made, which brings about immense misery to a region so that it becomes difficult to cope with the situation through local resources.

* Contributed by Dr. Poonam Rautela, Associate Professor, M B Govt. PG College, Haldwani (Uttarakhand).

As per Disaster Management Act, 2005, "*disaster* means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area." A more detailed meaning of disaster, according to the International Federation of the Red Cross and Red Crescent Societies, is: "A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. A disaster occurs when a hazard impacts vulnerable people" (UNISDR, 2009). Disasters are serious disruptions of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of the affected people to cope using its own resources. The following are the related impacts of disasters:

- Falling apart of normal pattern of life.
- Loss of life and property.
- Adverse impact on economic and social structure.
- Disruption in community needs of shelter, food, clothing and medical help.
- Onset of psychological trauma.
- Loss of livelihood.
- Disruption of communication, transport and infrastructure.
- Law and order problems
- Epidemiological threats.
- Migration (Both short-term and long-term).

However, the above impacts are not always negative, since the negatives could open up positive avenues of development and growth, as depicted in the table below:

Table 1.1: Disaster: Negative and Positive Aspects

Aspects	Negative	Positive
D	Damage	Development
I	Interruption	Innovation
S	Severe	Sharing
A	Antagonistic	Awareness
S	Scourge	Self-sufficiency
T	Trauma	Transformation
E	Emergency	Education
R	Risk	Resilience

***Source*:** IGNOU, 2012.

1.3 TYPES OF DISASTERS

As per High Powered Committee Report (2001), disasters can be classified into two major categories (both natural and man-made) and several sub-categories. Overview of the disasters categorises them into:

i) Water and Climate Related Disasters
- Floods
- Cyclones
- Tornadoes and Hurricanes
- Hailstorm
- Cloud Burst
- Heat Wave and Cold Wave
- Snow Avalanches
- Droughts
- Sea Erosion
- Thunder and Lightning
- Tsunami

ii) Geologically Related Disasters
- Landslides and Mudflows
- Earthquakes
- Dam Failures/ Dam Bursts

iii) Chemical, Industrial and Nuclear Related Disasters
- Chemical and Industrial Disasters
- Nuclear Disasters

iv) Accident Related Disasters
- Forest Fires
- Urban Fires
- Mine Fires
- Mine Flooding
- Oil Spill
- Major Building Collapse
- Serial Bomb Blasts
- Festival Related Disasters
- Electrical Disasters and Fires
- Boat Capsizing
- Village Fire

v) Biological Disasters

- Biological hazards
- Epidemics
- Pest Attacks
- Cattle Epidemics
- Food Poisoning

Out of these, some major disasters are focused in the following sections.

1.4 NATURAL DISASTERS

Natural disasters are naturally occurring physical phenomena caused either by rapid or slow onset of events which can be geophysical, hydrological, climatological and biological.

Earthquakes

Earthquake is the result of forces responsible for the structural deformation deep within the earth's interior. Sudden break within the upper layers of the earth, resulting in the vibration of the ground, which when strong enough causes the collapse of buildings and destruction of life and property. Earthquakes usually happen at faults along plate boundaries. Earthquakes often trigger landslides, tidal waves and tsunamis. Magnitude scales, like the Richter magnitude scale, measure the size of the earthquake at its source. On the Richter scale - the most devastating effects are seen on level 6 and above, and if the epicentre of the earthquake is located in highly populated areas, it can cause large numbers of deaths and injuries as well as serious destruction of buildings and infrastructure. The basic characteristics of earthquake include: forecasting is not possible; sudden onset; areas prone to earthquakes are generally well known and identified due to geological features and past occurrences (IGNOU, 2006).

Volcanic Eruptions

Volcanic eruptions happen when lava and gas are discharged from a volcanic vent. The most dangerous type of volcanic eruption is referred to as a 'glowing avalanche'. This is when freshly erupted magma forms hot pyroclastic flows which have temperatures of up to $1{,}200^0$ C. The pyroclastic flow is formed from rock fragments following a volcanic explosion, the flow surges down the flanks of the volcano at speeds of up to several hundred kilometers per hour, to distances often up to 10km and occasionally as far as 40 km from the original disaster site. There are two modes in which the volcanoes usually erupt. These are explosive eruptions and effusive eruptions. In the former mode of eruption, the gas contents are high and magma is thick and viscous. Sudden release of confining pressure allows the gases to boil explosively from the magma. In the later mode, the gas content in the magma is low and the magma is of relatively low viscosity, therefore the gases boil out less violently (IGNOU, 2006a).

Landslides

A landslide is the movement of soil or rock controlled by gravity and the speed of the movement usually ranges between slow and rapid. It can be superficial or deep, but the materials have to make up a mass that is a portion of the slope or

the slope itself. The term landslide is used in its broad sense to include downward and outward movement of slope forming materials (natural rock and soil). It is caused by heavy rain, soil erosion as well as earth tremors and may also happen in areas under heavy snow. Landslides are difficult to estimate as an independent phenomenon. It seems appropriate, therefore, to associate landslides with other hazards such as tropical cyclones, severe local storms and river floods.

Tsunami

Tsunamis (Japanese for "harbour wave"), also known as a seismic sea wave, are a series of very large waves with extremely long wavelength, in the deep ocean, the length from crest to crest may be 100 km and more. It is usually generated by sudden displacements in the sea floor caused by earthquake, landslides, or volcanic activity (Government of India, 2016). Tsunamis are a series of large waves generated by sudden displacement of seawater by earthquakes or volcanic eruption, capable of propagation over large distances and causing a destructive surge on reaching land (CRED, 2011). Tsunamis can originate hundreds or even thousands of miles away from coastal areas. Local geography may intensify the effect of a tsunami (Kanal, 2013). The impact in coastal areas can be very destructive as the waves advance inland and can extend over thousands of kilometers. Triggers of a tsunami can be: earthquakes, volcanic eruptions, mass movements, meteorite impacts or underwater explosions.

Avalanches

Avalanche describes a quantity of snow or ice that slides down a mountainside under the force of gravity. It occurs if the load on the upper snow layers exceeds the bonding forces of the entire mass of snow. It often gathers material that is underneath the snow pack like soil, rock, etc. A debris avalanche is a type of slide characterised by the chaotic movement of rocks, soil and debris mixed with water or ice (or both). They are often triggered by earthquakes and volcanic eruptions. Snow Avalanche can be classified as "dry snow type" or "wet snow type". Both these types can be further sub-divided into "direct action" or "delayed action" avalanches. It brings forth four categories of Snow Avalanches, namely Dry Snow Direct Action Avalanche; Dry Snow Delayed Action Avalanche; Wet Snow Direct Action Avalanche; Wet Snow Delayed Action Avalanche. (IGNOU, 2003).

Floods

Floods are also a regular phenomenon of the country and almost every year, one or the other parts of the country is frequently affected by floods (Kanal, 2013). A flood is an overflow of water on land which is usually dry. Sometimes a water resource (river, lake or pond) gets flushed too much with water, resulting in floods in the nearby regions. The National Disaster Management Division of the Ministry of Home Affairs defines that "floods are a temporary inundation of large regions as the result of an increase in reservoir, or of rivers flooding their banks because of heavy rains, high winds, cyclones, storm surge along coast, tsunami, melting snow or dam bursts". Flash floods are defined as floods which occur within six hours of the beginning of heavy rainfall, and are usually associated with cloud bursts, storms and cyclones requiring rapid localised warnings and immediate response if damage is to be mitigated (NDMA, 2008). Unusually heavy rain can also cause floods. A particular kind of flood, that is, flash flood, is sudden wherein extreme volume of water flow rapidly and cause inundation.

Extreme Temperature

A heat wave is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills by pushing the human body beyond its limits. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. A cold wave can be both a prolonged period of excessively cold weather and the sudden invasion of very cold air over a large area. Along with frost, it can cause damage to agriculture, infrastructure and property. Cold waves, heavy snowfall and extreme cold can immobilise an entire region. Winter storms can result in flooding, storm surge, closed highways, blocked roads, drowned power lines and hypothermia.

Droughts

Drought is defined as a deficiency of rainfall over an extended period – a season, a year or several years – relative to the statistical multi-year average for the region. It is an insidious phenomenon. Severe and rare droughts occur in arid and semi-arid zones. Droughts can occur due to long spells of water shortage as a result of scanty rainfall, inadequate water management techniques, and sheer government neglect. The severity of drought depends on the degree of moisture deficiency, duration of dry spells, extent of irrigation facilities; and size of the affected area. An erratic pattern, both low (less than 750 mm) and medium (750-1125 mm) makes 68 per cent of the total area in India vulnerable to periodic droughts (IGNOU-NDMA, 2012). Unlike rapid onset disasters, it tightens its grip over time, gradually destroying an area. In severe cases, drought can last for many years and have a devastating effect on agriculture and water supplies. Due to lack of rainfall, there is inadequacy of water supply for plants, animals and human beings. A drought may result in other disasters like food insecurity, famine, malnutrition, epidemics and displacement of populations.

Wildfires

Wildfire is a general term which includes forest fires, grassland fires, bushfires, brush fires and any other vegetation fire. Speed of onset of a wildfire may vary. It can be rapid under conditions of high temperatures and high wind, when major fire fronts advance very quickly. Also, during high winds, fragments of fire from a main front may be carried forward by the wind, starting new fires further ahead. This causes the fire to spread much faster. They occur more in coniferous forests and evergreen broadleaf forests. If the basic requirement of air and the burning fuel (grass, bush, fallen leaves, branches of trees, deadwood) is dry, fires are more likely. Hot sunny days with low humidity and strong breeze are conducive to the rapid spread of fire in a forest. Many trees in forests emit oily or wax-like substance, which intensifies forest fire. Extinguishing a forest fire is not easy. Generally forest fire once started, continues until there is heavy rain or the burning fuel is finished (IGNOU-NDMA, 2012).

Cyclones and Storm Surges

A cyclone is a large-scale air mass that rotates around a strong center of low atmospheric pressure. Cyclone is characterised by inward spiraling winds that rotate about a zone of low pressure. The term “cyclone” refers to the storms’ cyclonic nature, with counterclockwise rotation in the Northern Hemisphere and clockwise rotation in the Southern Hemisphere. A tropical cyclone is a storm system characterised by a low-pressure centre and numerous thunderstorms that produce strong winds and flooding rain. A tropical cyclone feeds on heat released

when moist air rises, resulting in condensation of water vapor contained in the moist air. Depending on their location and strength, tropical cyclones are referred to by other names, such as hurricane, typhoon, tropical storm, cyclonic storm, tropical depression, or simply as a cyclone. A storm surge is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather systems (such as tropical cyclones), the severity of which is affected by the shallowness and orientation of the water body relative to storm path, and the timing of tides. Most casualties during tropical cyclones occur as the result of storm surges.

Epidemics

Epidemic is a derivation of two Greek words *epic* (upon/among) and *demons* (people). An epidemic is the unusual increase in the number of cases of an infectious disease which already exists in a certain region or population. It can also refer to the appearance of a significant number of cases of an infectious disease in a region or population that is usually free from that disease. Epidemics may be the consequence of disasters of another kind, such as tropical storms, floods, earthquakes, droughts, etc. Epidemics may also attack animals, causing local economic disasters. The types of diseases generally recognised as communicable or transmissible include: hepatitis, typhoid, diphtheria, malaria, cholera, influenza, enteritis, diarrhea, skin diseases, food poisoning, etc. Health affecting lifestyle like smoking, drug addiction and health related events like accidents also fall into category of epidemics. But during disasters, we are more concerned about the epidemics of communicable diseases (IGNOU, 2003).

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Define 'disaster' and list its various types.

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2) Briefly discuss the nature of Earthquakes and Landslides.

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3) Explain the nature of Cyclones and Storm Surges.

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1.5 MAN-MADE DISASTERS

Technological or man-made disasters are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents. Some disasters can result from several different hazards or, more often, from a complex combination of both natural and man-made causes of vulnerability. Food insecurity, epidemics, conflicts and displaced populations are some of the examples.

Complex Emergencies/Conflicts

It is a humanitarian crisis in a country, region or society, where there is total or considerable breakdown of authority resulting from internal or external conflict and which requires an international response. On a national level, conflict may involve warlike encounters between armed groups from the same country which take place within the borders. Such outbreaks of war may pose large-scale medical problems such as epidemics, lack of water, accumulation of rubbish, displaced persons, refugees, food shortage, hunger, etc. Internationally, war may break out between two or more armies from different countries. Similarly such conflict may cause large scale mass movements of refugees and displaced persons. Such "complex emergencies" are typically characterised by extensive violence and loss of life; displacements of populations; widespread damage to societies and economies and the need for large-scale, multi-faceted humanitarian assistance.

Famines

Food-security emergencies are complex disasters with multiple root causes. Severe drought and/or conflict can produce an acute food emergency, whereas chronic food insecurity is often a reflection of poverty, a worsening debt crisis, and economic effects at household level of the HIV/AIDS pandemic or mismanagement or abuse of water resources. In such cases, food can be both unavailable (insufficient production) and inaccessible (distribution problems, beyond consumers' purchasing power). Poor nutrition, brought on by food shortages, reduces people's resistance to disease, and makes outbreaks of preventable diseases likely. Water shortages, which force people to use polluted water, increase the risk of waterborne diseases. Food-security problems may drive populations to other areas, such as the outskirts of towns, in search of better living conditions.

Displaced Populations

"Displaced populations leave their homes in groups, usually due to a sudden impact, such as an earthquake or a flood, threat or conflict. There is usually an intention to return home. Migration and displacement are interlinked, but must be distinguished. Displaced populations – either across borders such as refugee influxes, or within a country because of disasters or armed conflict – usually need relief operations combined with efforts aiming at collective and lasting solutions. Migration on the other hand usually involves more individual social assistance, legal protection and personal support. The responsibility for refugees and all displaced populations primarily rests with the host government. It is the mandate of the United Nations High Commissioner for Refugees to protect and assist refugees." (IFRC, 2017)

Transport Accidents

These are used to describe technological transport accidents involving mechanised modes of transport. It comprises four disaster subsets: accidents involving air, boat, rail transport and accidents involving motor vehicles on roads and tracks.

Transport accidents will address issues pertaining to bulk transportation of chemicals both by road, rail or marine means and safe transportation of petroleum products including combustible gases through pipelines. Comprehensive rules and guidelines under various acts provide for safe transportation of hazardous chemicals or dangerous goods. Transportation on land under the Petroleum Rules has laid down safety requirements for tank vehicle, tank capacity, engines, electrical installations etc., and has also highlighted restriction on loading/unloading of tank vehicles (NDMA, 2007).

Industrial Accidents

These accidents include explosions such as chemical explosion, nuclear explosion and mine explosion. Disasters will only be classified as explosions when the explosion is the actual disaster. If the explosion is the cause of another disaster, the event will be classified as the resulting disaster. Such disasters result in subsequent disasters such as:

- Pollution and degradation of one or more aspects in the environment by noxious industrial, chemical or biological wastes, from debris or man-made products and from mismanagement of natural and environmental resources.
- Acid rain: A washout of an excessive concentration of acidic compounds in the atmosphere, resulting from chemical pollutants such as sulphur and nitrogen compounds. When deposited they increase the acidity of the soil and water causing agricultural and ecological damage.

1.6 OTHER CLASSIFICATION OF DISASTERS

Disasters are on a rise throughout the world. Frequency of disasters provides evidence of human ignorance or neglect to certain key developmental issues. It is worth noting that one of the most important decisive factors in any disaster is its disruptive impact that creates pervasive uncertainty, suffering and trauma. Disasters cause severe loss to lives and property, destroy infrastructure and productive capacity, interrupt economic activity and create irreversible changes in a country's natural resource base. Besides, there is an adverse affect of disasters on development process of the society because there is diversion of scarce resources towards relief, reconstruction and rehabilitation activities. Disasters are also classified as compound and complex. Compound disaster is explained as one type of hazard, for example, disaster leading to other contingencies, such as famines followed by civil strife, mass displacement of peoples, etc.

Complex disasters are those that lead to collapse of the political authority or lead to some other complexity where the problems involved/generated are intensely political in nature such as communal bias in distribution of relief, etc.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Bring out the difference between Natural and Man-made disasters.

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2) Describe Famines.

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3) Discuss the impact of Industrial Accidents.

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1.7 CONCLUSION

Most disasters that affect our society are often a combination of two or more disasters. For example, earthquakes and volcanic activities can cause an industrial accident; or droughts which can lead up to famine. A major factor which bears upon today's situation is that new disaster threats have developed, particularly since World War II. Increased social violence has drastically affected many nations and communities. Hijacking, terrorism, civil unrest, and conflict with conventional arms have become very common all over the world. These have sometimes inflicted intolerable burden on governments and societies whose existence is already precarious because of poor economic and social conditions. Though we have devised various methods to manage crisis caused due to disasters, many more challenges still persist.

1.8 GLOSSARY

Disaster : A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. A disaster occurs when a hazard impacts vulnerable people.

Natural Disaster : A natural disaster is caused by natural phenomenon which can cause loss of life or

property damage, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience or ability to recover and also on the infrastructure available.

Man-made Disasters : Technological or man-made disasters are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.

Compound Disaster : Compound disaster is explained as one type of hazard, for example, disaster leading to other contingencies, such as famines followed by civil strife, mass displacement of peoples etc.

Complex Disasters : Complex disasters are those that lead to collapse of the political authority or lead to some other complexity where the problems involved/generated are intensely political in nature such as communal bias in distribution of relief, etc.

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1.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- A disaster is a sudden calamitous event bringing great damage, loss, or destruction.
- Five types of disaster such as Water and Climate Related disasters; Geological disasters; Chemical, Industrial and Nuclear related disasters; Accident related disasters; and Biologically related disasters.

2) Your answer should include the following points:

- Earthquakes are the result of forces deep within the earth's interior. Sudden break within the upper layers of the earth, resulting in the vibration of the ground, which when strong enough cause the collapse of buildings and destruction of life and property.
- Landslide is the movement of soil or rock controlled by gravity and the speed of the movement usually ranges between slow and rapid. It can be superficial or deep, but the materials have to make up a mass that is a portion of the slope or the slope itself.
- It is used in its broad sense to include downward and outward movement of slope forming materials (natural rock and soil).

3) Your answer should include the following points:

- Cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure. Cyclones are characterised by inward spiraling winds that rotate about a zone of low pressure.
- The term "cyclone" refers to the storms' cyclonic nature, with counterclockwise rotation in the Northern Hemisphere and clockwise rotation in the Southern Hemisphere.
- A tropical cyclone is a storm system characterised by a low-pressure center and numerous thunderstorms that produce strong winds and flooding rain.
- Storm surge is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather systems (such as tropical cyclones), the severity of which is affected by the shallowness and orientation of the water body relative to storm path, and the timing of tides.
- Most casualties during tropical cyclones occur as the result of storm surges.

Check Your Progress 2

1) Your answer should include the following points:

- Natural disasters are naturally occurring physical phenomena caused either by rapid or slow onset events which can be geophysical, hydrological, climatological and biological.

- Technological or man-made disasters are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.

2) Your answer should include the following points:

   - Famine is a complex disaster with multiple root causes.
   - Severe drought and/or conflict can produce an acute food emergency, whereas chronic food insecurity is often a reflection of poverty.

3) Your answer should include the following points:

   - Pollution and degreadation of one or more aspects in the environment by noxious wastes.
   - Acid rain.

UNIT 2 HAZARD, RISK AND VULNERABILITY*

Structure

2.0 OBJECTIVES

After reading this Unit, you should be able to:

- Acquire conceptual understanding of relevant disaster terminology;
- Discuss vulnerability factors in brief; and
- Understand vulnerability and risk assessment.

2.1 INTRODUCTION

Throughout the twentieth century, the theory and practice of disaster management had been dominated by the scientific perspective, whereby, disasters were thought of purely as a geological or a climatic problem, the solutions for which lay in engineering and management sciences. In the last two decades, there has been a paradigmatic shift in the understanding of disasters per se the human factor, which had been neglected in the earlier approach, is now in focus. The attempt consequently is to inquire into sociological processes that determine or undermine a community's resilience, coping capacity and response to disasters. Presently, the term disaster is a more inclusive concept, in that it includes man- made, and technological hazards, as also terrorism, which has added a new dimension to its understanding.

* Contributed by Dr. Poonam Rautela, Associate Professor, M B Govt. PG College, Haldwani (Uttarakhand).

There are two important perceptions on disasters. According to one school of thought, disasters are natural, revengeful acts of nature: an opportunity for man to atone for his sins, wherein death and destruction are inevitable. As per the other perspective, disasters are man-made. An event, whether a product of natural phenomena or human activities, turns out to be a catastrophic disaster, if the community or society fails to adequately cope up with it. Natural hazards do not necessarily lead to disasters. Intense, inevitable or unpredictable natural hazards like tsunamis, cyclones and earthquakes prove to be disasters only when the population is affected and more so when it is unprepared to respond to and unable to cope with it.

Disaster sociologist Carr (1932) has endeavoured to understand disasters in terms of social action. Carr indicates that disasters are the collapse (that is, failure or inadequacy) of cultural protection, a result of human activities and not of natural or supernatural forces; therefore, they are essentially human-made. An understanding of causes of disasters and timely appropriate intervention can effectively reduce the disaster threat.

2.2 UNDERSTANDING HAZARDS

Hazard is defined as a potential or a latent/dormant cause, which is activated when the right configuration of factors, natural or man-made or both, present themselves. For example, a chemical plant in a populated area presents a hazard having a potential threat to life and property in that area or within defined vicinity. Disaster is the actual occurrence of the apprehended catastrophe. Hence, disaster is "any occurrence, that causes damage, ecological disruption, loss of human life, deterioration of health and health services, on a scale sufficient to warrant an extraordinary response from outside the affected community or area"(World Health Organisation (WHO)).

A *hazard* technically is not a disaster unless the 'trigger' (natural or man- made) sets it off. Disaster, involving large-scale loss of life and property, is a sudden onset event, on a scale large enough to require outside assistance, which threatens the continuity of social systems and processes. "A disaster should be defined on the basis of its human consequences, not on the phenomenon (hazard) that caused it. Earthquakes, floods and cyclones are 'natural hazards' which cause large-scale loss of life and property (disaster) when the trigger mechanism (natural or man-made) is activated." *Risk* is a technical concept, which is used by engineering and management specialists to arrive at an estimation of losses in the event of a disaster and the expected probability of its occurrence. *'Elements'* are identified as life and property likely to suffer damage in the event of a disaster. *Observation* and *perception* of risk involves ascertaining, specifically, such 'elements' at risk. "*Identification* of risk involves inquiring into the specific natural, technological or chemical, etc., processes that create the vulnerability of the elements identified for risk analysis".

Vulnerability can be natural or man-made. It can be physical, owing to factors such as weak buildings, habitation in hazard prone areas; or socio economic, arising due to poverty or marginalisation of the weaker sections of society who lack the wherewithal of defending themselves in the event of a disaster.

Hazards

"Extreme geophysical events, biological processes and major technological accidents,

characterised by concentrated release of energy or materials, which pose a largely unexpected threat to human life, and can, cause significant damage to goods and the environment" are described as *hazards*.

The difference between a hazard and a disaster is very important and crucial. A disaster takes place when a community is affected by a hazard (usually defined as an event that exceeds the community's capacity to cope). In other words, the impact of the disaster is determined by the extent of a community's vulnerability to the hazard. This vulnerability is not natural. It is the human dimension of disasters, the result of the whole range of economic, social, cultural, institutional, political and even psychological factors that shape people's lives and create the environment that they live in (Twigg, 2001).

Observation and Perception of Hazards

Though hazards could be classified on many criteria; some of the general classifications are as follows (S. Gopalakrishnan). Hazards could be:

- Sudden onset hazards — (geological and climatic hazards) earthquakes, tsunamis, floods, tropical storms, volcanic eruptions, landslides.
- Slow onset hazards — (environmental hazards) drought, famine, environmental degradation, desertification, deforestation, and pest infestation.
- Industrial/technological—system failures/accidents, spillages, explosions, fires.
- Wars and civil strife—armed aggression, insurgency, terrorism, and other actions leading to displaced persons and refugees.
- Epidemics—water and/or food-born diseases, person-to-person diseases (contact and respiratory spread), vector-born diseases and complications from wounds.

Hazards could also be classified as *direct* and *indirect*. For example, earthquake hazard would lead to direct and indirect consequences, tabulated as under (*ibid):*

Direct Hazards

i) Ground shaking;

ii) Differential ground settlement;

iii) Soil liquefaction;

iv) Immediate landslides or mud slides, ground lurching and avalanches;

v) Permanent ground displacement along faults;

vi) Floods from tidal waves, Sea Surges & Tsunamis, etc.

Indirect Hazards

i) Dam failures;

ii) Pollution from damage to industrial plants;

iii) Delayed landslides.

Besides, Hazards can be of both short term and long-term duration, as per the classification proposed by K. Smith (1996).

Identification of Hazards

Identification of hazards involves analysis of scientific data to trace the *causal path* of events leading up to a disaster. For example, identification of chemicals causing water pollution; their source, impact on specific 'elements' such as human health, etc.; inquiring into the nature and characteristics of a hazard with a view to distinguish the man-made and natural components thereof; for example, floods, which are caused by both natural and man-made factors. Man-made factors include bad land use management policies such as allowing habitation and locating critical facilities in flood prone areas, etc., which increase the vulnerability of 'exposed' populations. It also entails policy analysis in that the *unintended* consequences of policies have to be examined with a view to framing more environment friendly legislation in the future. Hazard analysis is the basis of 'sustainable development' policies. For example, desertification is a *slow-onset* disaster. Desertification arises from the interaction between a "difficult, unreliable and sensitive dry land environment and the human use and occupation of it in an effort to make a living." Following a hazard analysis of the process of desertification, effective strategies can be devised to address the problem.

Hazards can be of short- term duration. Most of the widely recognised hazards, viz., earthquakes, volcanoes, severe weather conditions, occur naturally in the environment. Another group of hazards is created by the action of human beings. Pollution of water, fire hazard and air frequently fall into the man-made hazards category and include high levels of carbon monoxide (CO) and sulphur dioxide (SO2) in the atmosphere. Other man-made hazards include oil spills, pesticides, etc., which build up in the environment as a result of or due to excessive or repeated application of chemicals by agriculturalists, and flooding and erosions resulting from inappropriate land management practices. Flooding, for example, may be the result of ill-conceived policies, which has allowed construction and intensive land use on flood plains and flood-prone regions.

2.3 UNDERSTANDING RISKS

Risk is precisely defined by the International Strategy for Disaster Reduction (ISDR) as "the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions". Conventionally, risk is expressed by the notation:

Risk = Hazards x Vulnerability.

Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability. In scenario analysis, *risk* is different from *threat*. Threat is a more abstract concept; risk is an expression of perceived threat in specific terms. Threat is a danger that has an extremely low probability of occurrence. For purposes of public policy, threat has to be articulated objectively in terms of component risks, the probability of their occurrence and damages involved. The difference is most clearly illustrated by the 'precautionary principle', which needs specific articulation of risks involved for development of comprehensive strategy to mitigate risks involved. A set of well-defined risks has to be derived from threat before an action; project, innovation or experiment is allowed to proceed. For example, apprehension of terrorism was a threat. No policy could be devised to meet the threat, which led to September 11 attacks in United States. Threat was not articulated as risk for preventive policy in this regard. Vulnerability is

understood as system faults or weaknesses, which a threat *exploits* to create the negative 'impact.' Risk management involves minimising the vulnerabilities so as to reduce the impact of the threat. Risks, *created,* or *exist,* are both inherent in social systems, due to specific environmental variables in the 'ecology' of a system. The ecological context is therefore significant in understanding of vulnerabilities of people in different cultures as the causes of vulnerability and the level of risk perception in different countries is likely to be different.

Risk contains a probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

Risks are mainly witnessed due to the increased pressure on resources or because of the side effects of external linkages and interventions. Intense use of a resource in mountains exposes them. As a result, it leads to serious degradation. Major forces behind such intensified resource use are rapid population growth, market induced demand, greed of the rich and resource exploitative public policies. Irrespective of the factors behind resource use intensification, invariable consequences are the disruption of conditions conducive to biophysical processes that finally harm the stability and sustainability of mountain environments.

2.3.1 Risk Assessment and Evaluation

Risk assessment is defined as "the methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend".

Such assessment has significant administrative implications in that precise understanding of the underlying process of formulation of targeted risks reduction policies. Precise quantification of risk is often difficult in the absence of adequate data and proper analysis techniques. Moreover, certain areas are multi-hazard prone, which pose another challenge for risk assessment. Risk reduction policy for such areas would require risk assessments regarding each hazard to arrive at an estimation of total loss. Besides, risks are not amenable to simple quantification and cannot be easily either identified or quantified.

Disaster risk is seen as a function of the *hazard, exposure* and *vulnerability, denoted by the mathematical function:*

Disaster Risk = function (Hazard, Exposure, Vulnerability)

Where "Exposure" refers to the element, which is affected by natural disasters; *people* and/or *property.*

To reduce disaster risk, it is important to reduce the level of vulnerability and to keep 'exposure' as far away from hazards as possible by relocating populations and property away from the hazard prone zone"(Wisconsin Disaster Management Center).

*"*The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios…."(ISDR). Risk evaluation entails assessment of

proposed risk reduction measures from the point of view of cost efficiency. Efficiency is examined by means of cost benefit comparisons, which imply assessing benefits procured or expected to be procured from a measure against costs likely to be incurred.

2.3.2 Risk Perception

Risk perception is understood as the 'awareness' of risk, which differs among societies. Poor countries with other pressing problems do not attach too much priority to disaster mitigation. General level of awareness among people regarding the significance of disaster mitigation and preparedness is also quite low. Consequently, there is less interest articulation for policy inputs in this area. On the other hand, risk perception is found to be quite high in the developed world where much effort has been put in disaster mitigation efforts, though vulnerability is low as compared to developing countries. It has been stated that Risk Perception depends on the following four specific factors (Coburn, Sspence & Pomonis., 1994).

Exposure: actual quantitative risk level, as articulated through risk assessments.

Familiarity: personal experience, which makes one alive to the dangers of disasters.

Dread: horror of the disasters' scale and consequences, which makes policy imminent.

Preventability: belief in prevention methods, which leads to disaster mitigation policies.

2.3.3 Risk Identification

The political representatives informally do risk assessments as part of daily governance, which use it to justify legislations in foreign policy, the judicial system, law enforcement, etc. Risk assessments are now being conducted in more sophisticated ways, particularly in the field of environmental legislation. Risk has to be 'empirically' ascertained, for which subjective biases arising due to cultural or ideological inclinations need to be kept out of policy judgments. The best example of risk assessment comes from the insurance industry where "the insurers have well-defined roles of actuary, underwriter, agent, auditor and adjustor." Each of these is an assessor in somewhat different circumstances or stages of the insuring, reinsuring, adjustment, recovery and claims payment processes. Hence, risk assessment is a continuous process of 'articulation', which needs to be undertaken periodically at every stage, or phases in a said activity/process. Objectivity of the risk assessment depends on the availability of adequate and timely data.

Risk, essentially *in the context of disasters*, is the probability that injury to life or damage to property and the environment may happen. However, in disaster management, risk refers to the combined susceptibility and vulnerability of the community to potential damage caused by a particular hazard within a specified time period. Risk is rooted in conditions of physical, social, economic and environmental vulnerability that need to be assessed and managed on a continuing basis.

Further, for understanding the above concepts, a technical evaluation process is usually undertaken, commonly called *hazard assessment, vulnerability analysis,* and *risk analysis*. These are structured analytical procedures for identifying hazards and estimate the probability of their occurrence and consequences given certain conditions. Taken altogether a similar structured analysis of actual or potential vulnerabilities, these estimations are compared with a standard criterion in order

to decide whether or not an action is desirable to reduce the probabilities or to protect the people, property, or environment. Realistically, it is necessary also to consider that to what extent perceived constraints of time and resources may slow down the application of desirable countermeasures.

Hazard and vulnerability are aggregated into risk. Risk can be seen subjectively or objectively analysed or perceived. A subjective risk is the risk perceived by the people affected which determines their willingness to accept a potential hazard and take steps to tackle it.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) What do you mean by Hazards?

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2) Explain the concept of Risk.

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3) Discuss the nature of Risk Assessment.

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2.4 UNDERSTANDING VULNERABILITY

Vulnerability gives the *extent to which* a community is affected by a disaster. It involves the measure of 'resilience' and 'coping capacity' of a community in the face of adversity. Resilience and coping capacity develop over time as a result of proactive government policies. Vulnerability is an 'inclusive' concept in which vulnerability of a particular community to a particular type of disaster (flood or earthquake) is a resultant effect of a number of factors, which include physical factors, (geographical perspective) social (sociological perspective) and economic

factors (income and employment, involving micro and macroeconomic policy) besides institutional or administrative, which are essentially governance related issues. The process of vulnerability has been evidenced as proceeding along phases as follows; *root causes*, *dynamic pressures* that translate these into *active problems*, which are a result of a priority decision-making in governance related matters over time, for example, drought in a dry land area, leading to a famine in the absence of disaster mitigation efforts.

Social scientists and climate scientists often interpret vulnerability differently. Social scientists tend to view vulnerability as representing the set of socio-economic factors that determine people's ability to cope with stress or change (Allen, 2003). Climate scientists often view vulnerability in terms of the likelihood of occurrence and impacts of weather and climate related events. Related terms are fragility, stability, resilience and sensitivity of a system. These are the constituents of 'vulnerability'. There are some definitions of vulnerability and vulnerability assessment like: "Vulnerability is the likelihood that an individual or group will be exposed to and adversely affected by a hazard. It is the interaction of the hazard of place (risk and mitigation) with the social profile of communities" (Cutter, 1993). "By vulnerability, we mean the characteristics of a person or a group in terms of their capacity to anticipate, copes with, resists, and recovers from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood are put at risk by a discrete and identifiable event in nature or in society" (Blaikie, et.al, 1994). So, vulnerability is conceived as both physical risk and social response within a specific location and time.

The science of ecology, as Turner and Benjamin have pointed out, lacks a precise/ accepted definition of ecosystem fragility. Ecologists use "fragility" to denote a "system at risk", where the notion of "risk" is linked to ecological concepts of stability/instability and susceptibility. The chain of linkages characterising the system provides the ecological base for the notion of fragility. This complex internal structure of the organic ties of species at risk, is receiving detailed analysis in the emerging field of ecological risk assessment. (Travis & Morris, 1992).

According to Holling (1986), "Stability" is "the propensity of a system to attain and retain the equilibrium condition of a steady state or stable oscillation," where as "resilience" is "the ability of a system to maintain its structure and patterns of behaviour in the face of disturbance".

"Sensitivity" is used to measure the magnitude of negative impacts of environmental change. Change can have both positive and negative impact on human societies. Blaikie and Brookfield (1987) use the terms "sensitivity" and "resilience" to describe the quality of land system. They use "sensitivity" to refer to "the degree to which a given land system undergoes change due to natural forces, following human interference" and "resilience" to refer to " the ability of land to reproduce its capability after interference, and the measure of the need for human artifice to that end". In such manner, we may define sensitivity or susceptibility as "the degree of ecosystem or ecosystem component change associated with a given degree of human induced stress", and resilience as " the ability of a particular ecosystem to maintain the basic structure essential to support human uses during perturbations and to recover from such (and especially damaging) changes".

"Fragility" reflects both of these properties of human ecosystem interactions. This way, fragility is "the sensitivity of a particular ecosystem to human induced perturbations and its resilience to such perturbations."

Green (1990), in reference to flood hazards, expresses vulnerability as a relationship between changing conditions and normal use patterns. He defines vulnerability as a function of "susceptibility (the extent to which the presence of water will affect inputs or outputs of an activity); "dependency" (the degree to which an activity requires a particular good as an input to function normally); and "transferability" (the ability of an activity to response by deferring demand, using substitutes or relocating)"

2.4.1 Vulnerability Identification

Vulnerability is defined as the conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the hazards. Vulnerability identification implies examining the root causes of vulnerability that could lie in technological, physical, or socio economic conditions and addressing the same through empirical research and policy. Identification of vulnerability is challenging because in that complex *processes interact* in resultant vulnerability of a system or a specific region/ people(s). Tackling vulnerability involves both short-term and long-term measures in that the problem of vulnerability has essentially come across as a problem of development. The solution therefore lies in policy analyses of developmental planning with a view to making sustainable development measures more precise and 'need based' with respect to reducing of vulnerability.

2.4.2 Types of Vulnerability

Type	Nature
Material/Economic Vulnerability	Inadequate access to resources
Social Vulnerability	Disintegration of local institutions and structures
Ecological Vulnerability	Degradation of environment and inability to protect it
Organizational Vulnerability	Lack of strong central, state and grassroots institutional structures
Educational Vulnerability	Insufficient access to information and knowledge
Attitudinal and Motivational Vulnerability	Low levels of public awareness and desire to change
Political Vulnerability	Limited access to political power and representation
Cultural Vulnerability	Blind faith in beliefs and customs
Physical Vulnerability	Weak building and other infrastructure, as well as physically weak or vulnerable people

Source: IGNOU, 2006.

2.5 VULNERABILITY AND RISK ASSESSMENT

The international community pioneered by the United Nations has attempted to analyse disasters over time and prepare an inventory of causes that lead to them, the extent of damage suffered, what and how mitigation needs to be applied, and where, successfully. Risk assessment is an investigation into the disaster phenomenon through detailed study and investigation of repeat events over time, such as floods or earthquakes, assessment of damage and estimation of future losses possible in the absence of disaster mitigation measures. Vulnerability assessment is a subset of risk assessment, which analyses differential vulnerability of communities in differential areas of disaster impact (such as increasing or decreasing degree of hazard proneness).

Precise quantification of risk, however, is difficult. At best, a gross estimation of risk is possible, for example, number of deaths and the number of people exposed to a hazard. Such crude estimates give only a limited idea of the likely damage from a hazard for different people at different places or even the probability of its occurrence.

Vulnerability Analysis entails assessing the loss of life and property from a *particular hazard* striking at a particular *intensity.* For example, '*x'* number of people are expected to be killed and property worth '*y'* destroyed, if a cyclone strikes with strong winds at 130km/hr.

Disaster vulnerability needs to be studied over time. It does not happen all of a sudden; rather communities gradually slip into a disaster mode. Thus, comprehensively, disaster vulnerability is understood both as 'products' and 'processes' in three main aspects:

- As 'product' of ongoing social-cultural and economic transformation 'processes' within communities;
- As product of normal (under) developmental process; and
- As product of immediate and long term disaster response.

An attempt should be made at redefining disasters in a dynamic and integrated perspective, integrating socio-cultural, developmental and ecological outlook.

The desirable in an academic analysis of vulnerability with the practical perspective of policy design shall include:

- Development of an integrated perspective, integrating socio-cultural, developmental and ecological perspectives to develop a comprehensive framework on disaster mitigation;
- Emphasis on poverty alleviation and community empowerment through local control on land and material resources, cultural continuity and compatibility, sustainability of livelihoods, equitable participation through empowerment, ethics, roles and responsibilities of local governance.

2.6 VULNERABILITY FACTORS

The concept of vulnerability covers risk of hazards and the measure of risk combined with the relative inability to cope with the resulting stress. Timmerman (1981) defined vulnerability at the society or community scale as 'the degree to which a system, or part of a system reacts adversely to a hazardous event.' Most signs of

reducing system scale vulnerability can be seen as expressions of either resilience or reliability. Anderson (2000) showed how the concept of human vulnerability has been refined through time, although there is still no fully acceptable and discipline free, definition available.

'Resilience' is a measure of the rate of recovery from a stressful experience, reflecting the social capacity to absorb and recover from the occurrence of a hazardous event. Traditionally, resilience has been the main weapon against hazard in poverty-dominated areas where disaster is often accepted as a 'normal' part of life. In this situation, community coping strategies are important. For example, nomadic herdsmen in semi-arid areas have tended to accumulate cattle during years with good grazing lands as an insurance against drought.

'Reliability', on the other hand, reflects the frequency with which protective devices against hazards fail. This approach is applicable to developed areas, where technology and engineering design have provided what is perceived to be a high degree of reliability for most urban services. However, extreme stress, for example, from an earthquake, can easily disrupt road networks, electric power lines or water systems.

In Asia and the Pacific, a significant number of people lost their lives from natural disasters over the past 45 years. The region was only hit by around 43 per cent of the disasters experienced globally, but the impact of these disasters in terms of lives lost was notable. Between 1970 and 2014, more than 2 million people died, accounting for 56.6 per cent of the total deaths in the world due to disasters. The impact and susceptibility of Asian and Pacific countries to disasters is evident when considering the total number of people affected. Over 6 billion people in the region have suffered from natural disasters, accounting for 87.6 per cent of the global total (UNESCAP, 2015). Most of these people are in poor regions, where vulnerability arises from poverty, discrimination and lack of democratic functioning hampering the development process. The poorest people often have little choice but to live in unsafe settings, whether it is urban shanties or degraded rural environments. In terms of loss of life and relative economic impact, disasters hit hardest where poverty stricken people are concentrated. In less developed countries, rural inhabitants outnumber people in the urban areas. Even then, now there are more urban dwellers in the third world than in Europe, North America and Japan in total. Metropolitan cities are growing at faster rate. In urban squatter settlements, population densities may reach as high as ten times of present level. Many buildings, without suitable material or construction skills, are erected on steep slopes or flood prone land, exposed to strong winds and landslides. In highly populated rural areas, population density can exceed 1000 per km² and life is a recurrent struggle to secure cultivable land. Many people are landless and disadvantaged by land tenure systems, which deny them access to the means to support themselves.

As has been rightly pointed out, "The study of the vulnerability of human and natural systems to climate change and variability, and of their ability to adapt to changes in climate hazards, is a relatively new field of research that brings together experts from a wide range of fields, including climate science, development studies, disaster management, health, geography, policy development and economics, to name but a few areas. There is need for an integrating framework to bring together diverse traditions in a coherent yet flexible fashion, allowing researchers to assess vulnerability, and the potential for adaptation in a wide variety of different contexts"(IPCC, 2001).

Both natural and man-made factors contribute to vulnerability. Some of the contributing factors are discussed below:

Population Displacement

Population displacement is both a *cause* and a *consequence* of disaster. There is evidence of correlation between poverty and economic inequality and rural to urban migrations, in that more the level of poverty, more is the extent of rural to urban migrations. The phenomenon is most observed in poor third world countries where the poor migrate from rural to urban areas in search of livelihood options. The social order remains basically 'oligarchic' and 'oligopolistic' in that inequality in income and wealth distribution persists. System change through 'soft' democratic options, such as legislation and rhetoric is not successful as entrenched powers are hard to reconcile to socialist philosophy. Result has been corruption and implementation hurdles, more specifically at the implementation level. This largely explains why land reforms and social forestry legislations have not met with expected success. While the size of agricultural holdings has gradually reduced, 'exploitation' at the hands of rich and resourceful farmers has persisted. Frequent droughts have compounded existing problems. The cumulative effect of such conditions has been mass migration of rural folk to urban metropolitan towns.

Urbanisation

Rural to urban migration has led to unmanageable urbanisation and urban congestion that has forced human and physical capital extension in high-risk zones. Consequently, the loss potential of hazards has gone up. Urbanisation has brought in its wake growth of informal settlements, unsafe living conditions, disease, class conflict and social capital depletion as some segments have been socially and economically marginalised. Globalisation has also contributed in many ways to increasing the vulnerability of the urban poor by creating 'uncertain' conditions regarding employment though the obvious impact seems to be betterment of life and better opportunities for all. Though urbanisation is a worldwide phenomenon, it is more pronounced in the third world, because of the above recounted factors. Illustrations to this effect from India substantiate it, as per the 2011 census figures, (provisional) 377 million, that is, 31.16% of the total population lived in 7,935 cities and towns in the country. The number of cities and towns has increased by 2,774 since last Census. Corresponding figures from the first census of India, (the 1901 census) indicate that 25.8 million persons, that is, one-tenth of the total population lived in 1,917 cities and towns. It thus shows vast increase in the number and proportion of total population living in cities and towns since the first census (Census, 2011).

On the other hand, population displacement is also a consequence of disasters. In the event of disasters, large-scale displacement of populations from affected areas takes place, which leads to temporary to permanent loss of livelihood for people. Small-scale industries and micro enterprises are particularly hit. Much work has not been done on providing insurance against disasters to people residing in hazard prone areas. Though some initiatives have been taken, all disasters have not yet been covered properly and resource mobilisation also is far from adequate (Dhar, 2002). Relocation options have also to be carefully weighed so as not to result in unintended consequences that negate the very purpose of the exercise. Unintended consequences as different forms of vulnerability that might be induced because of relocation for example, loss of livelihood for small businessmen because of increased distance from urban commercial centers.

Migration also has significant cultural impact, besides the more obvious, physical

dislocation of populations in that mass migrations introduce communities to alien cultural practices which disturb the cultural homogeneity of a community. In extreme conditions, they can cause civil strife. Different building practices and construction technologies may be introduced, which might be unsuited to the requirements of that particular area. Besides, administrative and political problems are caused due to the influx of refugees, which disturb the political and social matrix of the region, like the influx of Bangladeshi refugees did in India, following the 1971 war. Epidemics and congestion are other administrative problems caused due to mass influx of refugees.

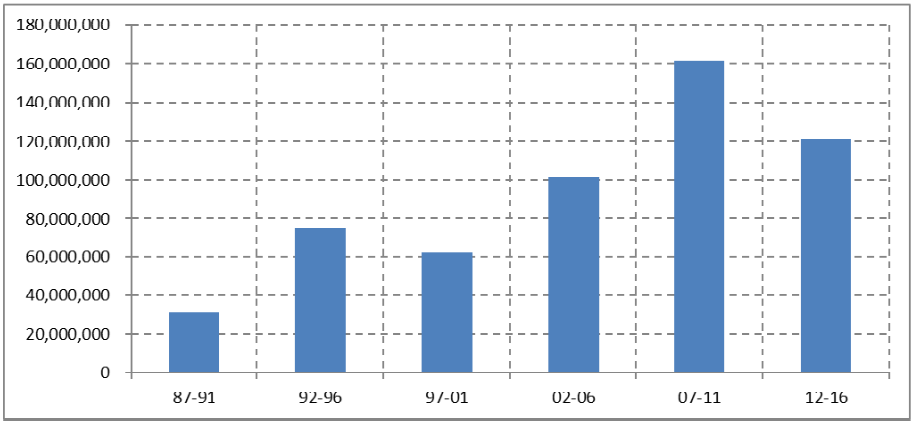
Gender

Gender based vulnerability is an accretion over time which causes disempowerment of women in social economic and political spheres. Gender inequality in social, economic and political spheres results in vast differences between men and women in emergency communication; household decisions about use of relief assets; voluntary relief and recovery work; access to evacuation shelter and relief goods; and employment in disaster planning, relief and recovery programmes, are among other areas of concern in disaster relief. Disaster mitigation as also response policy, particularly concerning control over relief resources, have to factor this component in decision-making with a view to making it more equitable and on the whole, more effective.

Economic Factors

Close correlation has been evidenced between poverty, disasters and environmental degradation. Relative vulnerability of people is comparatively much higher in developing third world countries than in the developed world. As per United Nations estimates, although least developed countries show less physical exposure to hazards (11%), they account for far greater number of casualties, (53%). On the other side, the most developed countries represent more (15%) physical exposure to hazards and account for significantly less (2.8%) victims. The inference drawn is that the magnitude of disaster suffered is directly correlated to the level of development, which explains largely the fact of the third world accounting for significantly more losses than the developed countries. This difference is shown by a list of disaster events and fatalities over 1960-82. Japan suffered 43 earthquakes and other disasters and lost 2,700 people that mean 63 deaths per disaster. Peru suffered 31 disasters with 91,000 dead, the vast majority lost in the single event of the 1970 earthquake.

Economic Damage (million USD) in the World (1987-2016)



***Source*:** ADRC, 2017.

The world economy functions and works against the poor who have little opportunity

to process and market what they produce and are dependent on the imports from the industrialized nations for manufactured goods which are quite often unstable. The poor regions have little opportunity to process and market what they produce and are dependent on the import from the industrialised nations of manufactured goods, which are often highly priced or tied to aid packages. The progressive hardship for the small-scale farmer, combined with a foreign debt burden that may be many times the normal annual export earnings, takes resources away from long-term development in a process that has been described as a transfusion of blood from the sick to the healthy. The cycle is reinforced when natural disaster destroys local products and undermines incentives for investment. Major disasters, such as the drought, disrupts and destroys local economies, and brings shortages in neighbouring regions, as a result create innumerable international refugees and stimulate aid programmes to the extent that the consequences of environmental hazards are truly global. The World Meteorological Organisation (WMO) report on "atlas of mortality and economic losses from weather, climate and extreme events" mentioned that around 2,682 extreme events have occurred in Asia during 1970-2012, resulting in 0.92 million deaths and US$ 798.8 billion of economic damages (WMO, 2015). The above diagram shows that the economic damage caused by natural disasters, in the year 2016 sees an increase from the year 2015. By contrast, in the 5-year period average analysis, the 2012-2016 average sees a decrease (ADRC, 2017).

Poverty situation increases vulnerability to disasters and contributes in enabling poverty. In order to facilitate sustainable development, it is essential to eliminate this vicious circle. The sustainable development, with emphasis on the long-term and intergenerational aspects, also enables us to face challenges. Compatibility between economic growth and sustainable development demands a method to measure the kind of growth that encompasses all important aspects pertaining to quality of life, such as human exposure to risk situations and species and lifestyles.

Geographical Factors

Global warming threatens to disrupt agriculture in developing countries though most green house gas emission has taken place from the developed world. Global warming has particularly increased the vulnerability of coastal areas, especially in the Small Island Development States (SIDS) sea level rise will threaten the fragile eco system of these regions, raising the frequency and intensity of natural hazards like tsunamis, cyclones, floods and storm surges. Coastal zones, wetlands and coral reefs are likely to be harmed which act as natural buffers against hazards like cyclones. The magnitude of disasters is also likely to be greater because of the increased pace of infrastructure development that has taken place in these regions in the last few years, owing to population pressure and growing attractiveness of these regions from the point of view of tourism (UNDP, 2002).

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Define Vulnerability.

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2) What are the types of Vulnerability?

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3) Discuss various factors of Vulnerability.

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2.7 CONCLUSION

Shift of emphasis from disaster response to risk reduction has opened up areas of exploratory research in the subject of disaster management. Vulnerability analysis seeks to preempt disaster management by ensuring timely preparedness on the part of people and institutions and government agencies involved. Disaster management is an imminent administrative task for reduction of disasters through prevention, preparedness, mitigation and response. There has been a paradigmatic shift of emphasis in the last decade from disaster relief and rehabilitation to prevention and mitigation strategies. Post-occurence treatment of disasters has proved an insufficient measure for proper protection of lives and property. There is also an emphasis on mainstreaming disaster management in everyday governmance by treating it as integral to policy formation and implementation process. In keeping with it, the focus in this Unit has been on Hazard, Risk and Vulnerability.

2.8 GLOSSARY

Biological Hazards : Processes of organic origin or those conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substances, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Examples of biological hazards are outbreaks of epidemic diseases, plant or animal contagion, insect plagues and extensive infestations.

Disaster : Serious disruption of the functioning of society, causing widespread human, material or environmental losses which exceed the ability of the affected people to cope using its own resources. Disasters are natural and man-made.

Geological Hazards : Geological hazards include internal earth processes or tectonic origin, such as earthquakes, tsunamis, volcanic activity and emissions as well as external processes such as mass movements: landslides, rockslides, rock falls or avalanches, surface collapse, expansive soils and debris or mud flows. Geological hazards can be single, sequential or combined in their origin and effects, for example, floods, debris and mud floods; tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wild land fires, temperature extremes, sand or dust storms; permafrost and snow or ice avalanches.

Hazard : A precise definition of hazard is difficult. The International Secretariat of Disaster Reduction has defined hazard as a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards have both natural and human components.

Hydro-meteorological Hazards : These hazards are of *atmospheric, hydrological or oceanographic nature.* Hydro-meteorological hazards include: floods, debris and mud floods; tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wild land fires, temperature extremes, sand or dust storms; permafrost and snow or ice avalanches. Hydro-meteorological hazards can be single, sequential or combined in their origin and effects.

Risk : Risk is explained as the likelihood or probability of a loss (es). Risk could be voluntary as for example, a game of boxing or bull fighting, or involuntary, which is unforeseen and unprepared for. The word is employed in general usage as also technical usage whereby it denotes the extent of likely damage or the hazard potential of a particular event.

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2.10 ANSWERS TO CHECK YOUR PROGRESS EXCERCISES

Check Your Progress 1

1) Your answer should include the following points:

   - Hazard is a potential or a latent/dormant cause, which is activated when the right configuration of factors, natural or man-made or both, present themselves.
   - Disaster takes place when a community is affected by a hazard and the, impact of the disaster is determined by the extent of a community's vulnerability to the hazard.

2) Your answer should include the following points:

   - Risk is a probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.
   - Risk = Hazards x Vulnerability.
   - It is as a function of the hazard, exposure and vulnerability.

3) Your answer should include the following points:

   - Risk Assessment is a methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.
   - It is a continuous process of 'articulation', which needs to be undertaken periodically at every stage, or phases in a said activity/process.

Check your Progress 2

1) Your answer should include the following points:

   - Vulnerability is the conditions determined by physical, social, economic,

and environmental factors or processes, which increase the susceptibility of a community to the hazards.

- It is a function of susceptibility, dependency, and transferability.

2) Your answer should include the following points:

- Material/Economic Vulnerability; Social Vulnerability; Ecological Vulnerability; Organizational Vulnerability; Educational Vulnerability; Attitudinal & Motivational Vulnerability; Political Vulnerability; Cultural Vulnerability; and Physical Vulnerability.

3) Your answer should include the following points:

- Population Displacement
- Urbanisation
- Gender
- Economical factors
- Geographical factors.

UNIT 3 NATURAL AND MAN-MADE DISASTERS*

Structure

3.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand various types of natural disasters; and
- Explain different types of man-made disasters.

3.1 INTRODUCTION

In contemporary academia, disasters are seen as the consequence of inappropriately managed risk. These risks are the product of a combination of both hazards and vulnerability. Hazards that strike in areas with low vulnerability will never become disasters, as in the case of uninhabited regions. A disaster occurs when a hazard impacts vulnerable people, and it can be classified into two broad categories: Natural disasters and Man-made disasters.

A natural disaster can cause loss of life or property damage, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience or ability to recover and also on the infrastructure available. Man-made disasters are result of human actions. This can include environmental degradation, pollution and accidents. The difference between natural and man-made disasters is the element of human intent or negligence that leads to human suffering and environmental damage.

Though often caused by nature, disasters can have human origins. The combination of hazards, vulnerability and inability to reduce the potential negative consequences of risk results in disaster.

* Contributed by Dr. Poonam Rautela, Associate Professor, M B Govt. PG College, Haldwani (Uttarakhand).

3.2 TYPES OF NATURAL DISASTERS

Natural disasters can be classified into four major categories and several sub-categories categories:

- **Geophysical:** Geophysical disasters are those destructive events that originate within or are caused by the processes of the earth. These disasters include: Earthquakes, Volcanic activity, Landslides and Tsunamis.
- **Hydrological:** Hydrological disaster is a violent, sharp and harmful amendment either in quality of earth's water or in distribution or movement of water ashore below the surface or in atmosphere. These disasters include: Avalanches and floods.
- **Climatological:** Climatological disasters are defined as events caused by long-lived/meso to macro scale processes in the spectrum from intra-seasonal to multi-decadal climate variability. Such events are further classified as: Extreme Temperature; Drought; Wildfire and Cyclones.
- **Biological:** Biological disasters define the devastating effects caused by an enormous spread of a certain kind of living organism – that may cause the spread of a disease, virus, or an epidemic. Biological disasters can also be simply, a sudden growth in the population of a certain kind of plants or animals, e.g., a locust plague.

3.2.1 Geophysical Disasters

Earthquakes

Earthquake has been termed as a devastating phenomenon. It is felt that the key to reduce its toll on human life, livestock and property lies in understanding the causes and mechanisms of earthquake. (Sinvhal, 2010). Earthquakes are the vibrations caused by rupturing of rocks under stress. The underground surface along which the rock breaks and moves is called a fault plane. The size or magnitude of earthquakes is determined by measuring the amplitude of the seismic waves recorded on a seismograph and the distance of the seismograph from the earthquake. These are put into a formula which converts them to a magnitude, which is a measure of the energy released by the earthquake. For every unit increase in magnitude (measured by Richter Scale), there is roughly a twenty three-fold increase in the energy released. The focus of an earthquake is the point where it originated within the Earth. The earthquake epicentre is the point on the Earth's surface directly above the focus. The amplitude of the shaking caused by an earthquake depends on many factors, such as the magnitude, distance from the epicentre, depth of focus, topography, and the local ground conditions.

Earthquake effects, as noted by people, are rated using the Modified Mercalli (MM) intensity scale, which ranges from I (imperceptible) up to XII (total destruction). At the Earth's surface, earthquakes manifest themselves by shaking and sometimes displacement of the ground. When the epicenter of a large earthquake is located offshore, the seabed may be displaced sufficiently to cause a tsunami. Shaking and ground rupture are the main effects created by earthquakes, principally resulting in more or less severe damage to buildings and other rigid structures. The severity of the local effects depends on the complex combination of the earthquake magnitude, the distance from the epicenter, and the local geological and geomorphological conditions, which may amplify or reduce wave propagation. Earthquakes, along

with severe storms, volcanic activity, coastal wave, and wildfires, can produce slope instability leading to landslides, a major geological hazard. Earthquakes can also cause fires by damaging electrical power or gas lines.

"The Great Chilean Earthquake" – world's largest earthquake with an instrumentally documented magnitude occurred on May 22, 1960 near Valdivia, in southern Chile. It was assigned a magnitude of 9.5 by the United States Geological Survey. It is referred to as the "Great Chilean Earthquake" and the "1960 Valdivia Earthquake" (Geologynat, 2017).

Volcanic Eruption

A volcano is a rupture in the crust of a planetary-mass object, such as Earth, that allows hot lava, volcanic ash, and gases to escape from a magma chamber below the surface. Earth's volcanoes occur because its crust is broken into rigid tectonic plates that float on a hotter, softer layer in its mantle. Therefore, on earth, volcanoes are generally found where tectonic plates are diverging or converging and most are found underwater. Volcanic eruptions can generally be characterised as either explosive eruptions, sudden ejections of rock and ash, or effusive eruptions, relatively gentle outpourings of lava.

Large, explosive volcanic eruptions inject water vapor, carbon dioxide, sulfur dioxide, hydrogen chloride, hydrogen fluoride and ash (pulverized rock and pumice) into the stratosphere to heights of 16–32 kilometres above the earth's surface. The most significant impacts from these injections come from the conversion of sulfur dioxide to sulfuric acid, which condenses rapidly in the stratosphere to form fine sulfate aerosols. These aerosols grow and coagulate, they settle down into the upper troposphere where they serve as nuclei for cirrus clouds and further modify the earth's radiation balance. Most of the hydrogen chloride and hydrogen fluoride are dissolved in water droplets in the eruption cloud and quickly fall to the ground as acid rain. Ash thrown into the air by eruptions can present a hazard to aircraft, especially jet aircraft where the particles can be melted by the high operating temperature; the melted particles then adhere to the turbine blades and alter their shape, disrupting the operation of the turbine. Erupting volcanoes can pose many hazards, not only in the immediate vicinity of the eruption. Large eruptions can affect temperature as ash and droplets of sulfuric acid obscure the sun and cool the earth's lower atmosphere (causing volcanic winters); however, they also absorb heat radiated from the earth, thereby warming the upper atmosphere (or stratosphere). Historically, volcanic winters have caused catastrophic famines. While many eruptions only pose dangers to the immediately surrounding area, Earth's largest eruptions can have a major regional or even global impact, with some affecting the climate and contributing to mass extinctions.

The massive Tambora Strato Volcano forms the entire 60-km-wide Sanggar Peninsula on northern Sumbawa Island. On 10 April 1815, Tambora produced the largest eruption known on the planet during the past 10,000 years. The volcano erupted more than 50 cubic kilometers of magma and collapsed afterwards to form a 6 km wide and 1250 m deep caldera. The eruption produced global climatic effects and killed more than 100,000 people, directly and indirectly (Klingaman, W.K. & Klingaman, N.P., 2013).

Landslides

A landslide is the slope down movement of rock, debris or earth. They result from the failure of the materials which make up the hill slope and are driven by

the force of gravity. Landslides are also known as landslips, slumps or slope failure. It has been pointed out by Crozin and Glade (2005) that "In general terms, landslides generate a small but important component of the spectrum of hazard and increasing the risk that faces mankind. Landslides present a threat to life and livelihood throughout the world ranging from minor disruption to social and economic catastrophe". Some of the most common types of landslide are earth slides, rock falls and debris flows. The movement of landslide material can vary from abrupt collapses to slow gradual slides and ranges from almost undetectable to extremely rapid. Sudden and rapid events are the most dangerous because of a lack of warning and the speed at which material can travel down the slope as well as the force of its resulting impact. Extremely slow landslides might move only millimeters or centimeters a year and can be active over many years. Although this type of landslide is not a threat to people, however, they can cause considerable damage to property.

Landslides can be triggered by natural causes or by human activity. They range from a single boulder in a rock fall or topple to tens of millions of cubic meters of material in a debris flow. They can also vary in their extent, with some occurring very locally and impacting a very small area or hill slope while others affect much larger regional areas. The distance travelled by landslide material can also differ significantly with slides travelling from a few centimetres to many kilometres depending on the volume of material, water content and gradient of the slope. Slope material that becomes saturated with water may develop into a debris flow or mud flow. The resulting slurry of rock and mud may pick up trees, houses and cars, thus blocking bridges and tributaries causing flooding along its path.

Landslides occur when the slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone.

Natural causes of landslides include:

- increase in groundwater (pure water) pressure destabilizing the slope;
- loss or absence of vertical vegetative structure, soil nutrients, and soil structure (for example, after a wildfire – a fire in forests lasting for 3–4 days);
- erosion of the toe of a slope by rivers or ocean waves;
- weakening of a slope through saturation by snow melting, glaciers melting, or heavy rain;
- earthquakes adding loads to barely stable slope;
- earthquake-caused liquefaction resulting into destabilize slopes;
- volcanic eruptions.

Landslides are aggravated by human activities, such as

- deforestation, faulty cultivation and ill-conceived construction, which destabilize the already fragile slopes.
- vibrations from machinery or traffic or blasting
- earthwork which alters the shape of a slope, or which imposes new loads on an existing slope

- construction, agricultural or forestry activities (logging) which change the amount of water infiltrating the soil.

Tsunamis

Tsunamis are giant waves caused by earthquakes or volcanic eruptions under the sea. Out in the depths of the ocean, tsunami waves do not dramatically increase in height. But as the waves travel inland, they build up to higher and higher heights as the depth of the ocean decreases. When a tsunami travels over a long and gradual slope, it allows time for the tsunami to grow in wave height. This is called shoaling and typically occurs in shallow water less than 100 m. Successive peaks can be anywhere from five to 90 minutes apart. In the open ocean, even the largest tsunamis are relatively small with wave heights of less than one meter. The shoaling effect can increase this wave height to a degree such that the tsunami could potentially reach an onshore height of up to 30 meters above sea level. The speed of tsunami waves depends on ocean depth rather than the distance from the source of the wave. Tsunami waves may travel as fast as jet planes over deep waters, only slowing down when reaching shallow waters. While tsunamis are often referred to as tidal waves, this name is discouraged by oceanographers because tides have little to do with these giant waves.

The 2004 Indian Ocean earthquake occurred on 26 December with the epicenter off the west coast of Sumatra, Indonesia. The shock had a moment magnitude of 9.1–9.3 and a maximum Mercalli intensity of IX (Violent). The undersea megathrust earthquake was caused when the Indian Plate was subducted under the Burma Plate and triggered a series of devastating tsunamis along the coasts of most landmasses bordering the Indian Ocean, killing 230,000–280,000 people in 14 countries, and inundating coastal communities with waves up to 30 meters (100 ft) high. It was one of the deadliest natural disasters in recorded history. Indonesia was the hardest-hit country, followed by Sri Lanka, India, and Thailand (Government of India, 2016).

3.2.2 Hydrological Disasters

Avalanches

An avalanche is considerable amount of snow sliding down a mountainside. It can be compared to a landslide, only with snow instead of earth. Another common term for avalanche is “snowslide”. As an avalanche reaches nearer to the bottom of the slope, it gains speed and power, this can cause, even the smallest of snowslides, to be a major disaster.

There are two common types of avalanches, a surface avalanche that occurs when a layer of snow with different properties slides over another layer of snow, for example, when a layer of dry loosely packed snow slides over a dense layer of wet snow. The other common avalanche is known as a Full-Depth Avalanche which occurs when an entire snow cover, from the earth to the surface, slides over the ground. Although primarily composed of flowing snow and air, large avalanches have the capability to entrain ice, rocks, trees, and other surface material. Avalanches happen on mountains with extreme amounts of slow fall and build-up. Wherever snow is lying on ground on an extreme and sufficient angle there is potential for a sleeping avalanche. Three main factors effect whether or not avalanches are probable to occur. These three factors are the weather, the snow pack and the terrain. The weather is the most important factor when deciding whether avalanches

are likely to happen or not. For example, if the temperature were to have a rapid increase then a wet slab avalanche is likely to occur. The height of the snow pack is also dependent on the weather.

Avalanches are not rare or random events and are endemic to any mountain range that accumulates a standing snowpack. Avalanches are most common during winter or spring but glacier movements may cause ice and snow avalanches at any time of year. In mountainous terrain, avalanches are among the most serious objective natural hazards to life and property, with their destructive capability resulting from their potential to carry enormous masses of snow at high speeds.

Floods

A flood occurs when water overflows or inundates land, that's normally dry. This can happen in a multitude of ways. Most common is when rivers or streams overflow their banks. Excessive rain, a ruptured dam or levee, rapid ice melting in the mountains, or even an unfortunately placed beaver dam can overwhelm a river and send it spreading over the adjacent land, called a floodplain. Coastal flooding occurs when a large storm or tsunami causes the sea to surge inland. Moving water has awesome destructive power. When a river overflows its banks or the sea drives inland, structures poorly equipped to withstand the water's strength are no match. Bridges, houses, trees, and vehicles can be picked up and carried off. The erosive force of moving water can drag soil from under a building's foundation, causing it to crack and tumble.

When floodwaters recede, affected areas are often blanketed in silt and mud. The water and landscape can be contaminated with hazardous materials, such as sharp debris, pesticides, fuel, and untreated sewage. Potentially dangerous mold blooms can quickly overwhelm water-soaked structures. Residents of flooded areas can be left without power and clean drinking water, leading to outbreaks of deadly waterborne diseases like typhoid, hepatitis A, and cholera.

3.2.3 Climatological Disasters

Extreme Temperature

Heat Waves: A heat wave is a prolonged period of excessively hot and sometimes also humid weather relative to normal climate patterns of a certain region. Heat kills people by stressing the human body beyond its limits. In extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Consequently, people living in urban areas may be at greater risk from the effects of a prolonged heat wave than those living in rural areas. Also, asphalt and concrete store heat longer and gradually release heat at night, which can produce higher nighttime temperatures known as the "urban heat island effect."

Cold waves, winter storms and extreme winter conditions: A cold wave can be both a prolonged period of excessively cold weather and the sudden invasion of very cold air over a large area. Along with frost, it can cause damage to agriculture, infrastructure, and property. Cold waves, heavy snowfall and extreme cold can immobilise an entire region. Even areas that normally experience mild winters can

be hit with a major snowstorm or extreme cold. Winter storms can result in flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia.

Droughts

A drought is a period of below-average precipitation in a given region; resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water. A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the ecosystem and agriculture of the affected region and harm to the local economy. Periods of heat can significantly worsen drought conditions by hastening evaporation of water vapor.

Many plant species, such as those in the family Cactaceae (or cacti), have drought tolerance adaptations like reduced leaf area and waxy cuticles to enhance their ability to tolerate drought. Some others survive dry periods as buried seeds. Semi-permanent drought produces arid biomes such as deserts and grasslands. Prolonged droughts have caused mass migrations and humanitarian crises. Droughts can be categorised into:

- Meteorological drought is specific to different regions.
- Agricultural drought accounts for the water needs of crops during different growing stages. For instance, not enough moisture at planting may hinder germination, leading to low plant populations and a reduction in yield.
- Hydrological drought refers to persistently low water volumes in streams, rivers and reservoirs. Human activities, such as drawdown of reservoirs, can worsen hydrological droughts. Hydrological drought is often linked with meteorological droughts.
- Socio-economic drought occurs when the demand for water exceeds the supply. Examples of this kind of drought include too much irrigation or when low river flow forces hydroelectric power plant operators to reduce energy production.

Wildfires

A wildfire is a fire in an area of combustible vegetation that occurs in the countryside or rural areas. Depending on the type of vegetation where it occurs, a wildfire can also be classified more specifically as a brush fire, bush fire, desert fire, forest fire, grass fire, hill fire, peat fire or vegetation fire. Earth is an intrinsically flammable planet owing to its cover of carbon-rich vegetation, seasonally dry climates, atmospheric oxygen, and widespread lightning and volcano ignitions.

Wildfires can be characterised in terms of the cause of ignition, their physical properties, the combustible material present, and the effect of weather on the fire. Wildfires can cause damage to property and human life, but they have many beneficial effects on native vegetation, animals, and ecosystems that have evolved with fire. Many plant species depend on the effects of fire for growth and reproduction. However, wildfire in ecosystems where wildfire is uncommon or where non-native vegetation has encroached may have negative ecological effects. Wildfire behaviour and severity result from the combination of factors such as available fuels, physical setting, and weather.

The most noticeable adverse effect of wildfires is the destruction of property. However, the release of hazardous chemicals from the burning of wildland fuels

also significantly impacts human health. Wildfire smoke is composed primarily of carbon dioxide and water vapor. Other common smoke components present in lower concentrations are carbon monoxide, formaldehyde, acrolein, polyaromatic hydrocarbons, and benzene. Despite carbon dioxide's high concentration in smoke, it poses a low health risk due to its low toxicity. Rather, carbon monoxide and fine particulate matter have been identified as the major health threats.

The degree of wildfire smoke exposure to an individual is dependent on the length, severity, duration, and proximity of the fire. People are exposed directly to smoke via the respiratory tract though inhalation of air pollutants. Indirectly, communities are exposed to wildfire debris that can contaminate soil and water supplies.

Cyclones

In meteorology, a cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure. The term "cyclone" refers to the storms' cyclonic nature, with counterclockwise rotation in the northern hemisphere and clockwise rotation in the southern hemisphere. Cyclones are characterised by inward spiraling winds that rotate about a zone of low pressure. The largest low-pressure systems are polar vortices and extra tropical cyclones of the largest scale (the synoptic scale). Warm-core cyclones such as tropical cyclones and subtropical cyclones also lie within the synoptic scale. Mesocyclones, tornadoes and dust devils lie within the smaller mesoscale Cyclogenesis is the development or strengthening of cyclonic circulation in the atmosphere. Cyclogenesis is an umbrella term for several different processes that all result in the development of some sort of cyclone. It can occur at various scales, from the microscale to the synoptic scale.

Tropical cyclones are formed as a result of significant convective activity, and have warm core. Mesocyclones are formed as warm core cyclones over land, and can lead to tornado formation. There are six main requirements for tropical cyclogenesis:

- sufficiently warm sea surface temperatures
- atmospheric instability
- high humidity in the lower to middle levels of the troposphere
- enough Coriolis force to develop a low-pressure center
- a preexisting low-level focus or disturbance
- low vertical wind shear.

Tropical cyclones can produce extremely powerful winds and torrential rain, they are also able to produce high waves and a damaging storm surge. The winds increase the wave size, and in so doing they draw more heat and moisture into their system, thereby increasing their strength. They develop over large bodies of warm water, and hence lose their strength if they move over land. This is the reason coastal regions can receive significant damage from a tropical cyclone, while inland regions are relatively safe from strong winds. Heavy rains, however, can produce significant flooding inland. Storm surges rise in sea level, caused by the reduced pressure of the core that in effect "sucks" the water upward and from winds that in effect "pile" the water up. Storm surges can produce extensive coastal flooding up to 40 kilometres from the coastline. Although their effects on human populations can be devastating, tropical cyclones can also relieve drought

conditions. They also carry heat and energy away from the tropics and transport it toward temperate latitudes, which make them an important part of the global atmospheric circulation mechanism. As a result, tropical cyclones help to maintain equilibrium in the Earth's troposphere as well.

3.2.4 Biological Disasters

Disease epidemics

An epidemic is the rapid spread of infectious disease to a large number of people in a given population within a short period of time, usually two weeks or less. For example, in meningococcal infections, an attack rate in excess of 15 cases per 100,000 people for two consecutive weeks is considered an epidemic (CTI Reviews, 2017).

Epidemics of infectious disease are generally caused by several factors including a change in the ecology of the host population (for example, increased stress or increase in the density of a vector species), a genetic change in the pathogen reservoir or the introduction of an emerging pathogen to a host population (by movement of pathogen or host). Generally, an epidemic occurs when host immunity to either an established pathogen or newly emerging novel pathogen is suddenly reduced below that found in the endemic equilibrium and the transmission threshold is exceeded.

An epidemic may be restricted to one location; however, if it spreads to other countries or continents and affects a substantial number of people, it may be termed a pandemic. The conditions which govern the outbreak of epidemics include infected food supplies such as contaminated drinking water and the migration of populations of certain animals, such as rats or mosquitoes, which can act as disease vectors. Certain epidemics occur at certain seasons.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss Geophysical disasters.

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2) Explain Climatological disasters with special reference to cyclone.

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3) Write a note on Biological disasters.

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3.3 TYPES OF MAN-MADE DISASTERS

Complex emergencies and conflicts

"Complex emergencies" are typically characterised by:

- extensive violence and loss of life;
- displacements of populations;
- widespread damage to societies and economies;
- the need for large-scale, multi-faceted humanitarian assistance ;
- the hindrance or prevention of humanitarian assistance by political and military constraints;
- significant security risks for humanitarian relief workers in some areas.

Famine

A famine is a widespread scarcity of food, caused by several factors including crop failure, population imbalance, or government policies. This phenomenon is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality. Every inhabited continent in the world has experienced a period of famine throughout history.

According to the United Nations humanitarian criteria, even if there are food shortages with large numbers of people lacking nutrition, a famine is declared only when certain measures of mortality, malnutrition and hunger are met.

The criteria are:

- At least 20% of households in an area face extreme food shortages with a limited ability to cope
- The prevalence of acute malnutrition in children exceeds 30%
- The death rate exceeds two persons per 10,000 persons per day.

Food shortages in a population are caused either by a lack of food or by difficulties in food distribution; it may be worsened by natural climate fluctuations and by extreme political conditions related to oppressive government or warfare.

Transport and industrial accidents

Transport disaster is a term used to describe technological transport accidents involving mechanised modes of transport. It comprises of four disaster subsets:

accidents involving air, boat, rail transport and accidents involving motor vehicles on roads and tracks.

Industrial disasters are non-natural disastrous occurrences that include:

- Accident release occurring during the production, transportation or handling of hazardous chemical substances.
- Explosions disasters (only be classified as explosions when the explosions is the actual disaster). If the explosion is the cause of another disaster, the event will be classified as the resulting disaster.
- Chemical explosion: violent destruction caused by explosion of combustible material, nearly always of chemical origin.
- Nuclear explosion/Radiation accidental release of radiation occurring in civil facilities, exceeding the internationally established safety levels.
- Mine explosion accidents which occur when natural gas or coal dust reacts with the air.
- Chemical pollution: A sudden pollution of water or air near industrial areas, leading to internal body disorders with permanent damage of the skin.
- Atmosphere pollution: Contamination of the atmosphere by large quantities of gases, solids and radiation produced by the burning of natural and artificial fuels, chemicals and other industrial processes and nuclear explosions.
- Pollution or degradation of atmosphere.
- Acid rain.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the types of man-made disasters?

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2) Write a note on famines.

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3) Discuss transport and industrial accidents.

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3.4 CONCLUSION

In recent years, disasters took toll of thousands of lives and caused massive destruction of property. These have adversely affected the vital sectors of our development as agriculture, communication, irrigation, power projects and rural and urban settlements. The time and cost overrun in some cases have been enormous but their indirect impact on our economy has never been calculated. India is among the world's most disaster prone areas and a large part of the country is exposed to natural hazards, which often turn into disasters causing loss of life and property. The unique geo-climatic conditions have exposed this country to natural catastrophes. They are sudden, drastic and normally occur without any alarm or warning. Some disasters may be short lived such as earthquakes and some other may be of long duration, such as drought. However, irrespective of the duration of a disaster, the damage in the form of deaths, injuries and losses of property is immense. The magnitude of the disasters can be judged by the fact that only during the past two decades; occurrences of floods, earthquakes, landslides, cyclones, etc. have killed several million people. Though most of the disasters have a natural origin, man-made disasters are also becoming significant. Since we cannot control the natural disasters, it is necessary to keep a check on human activities so as to reduce the possibilities of occurrences of man-made disasters. Furthermore, we can mitigate the suffering caused by disasters by following an effective disaster management plan for reduction of disasters through prevention, preparedness, mitigation and response.

3.5 GLOSSARY

Natural Disaster : A natural disaster can cause loss of life or property damage, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience or ability to recover and also on the infrastructure available.

Man-made Disaster : Man-made disasters are events that are caused by humans and occur in or close to human settlements. This can include environmental degradation, pollution and accidents.

Geophysical Disaster : Geophysical disasters are those destructive events that originate within or are caused by the processes of the earth. These disasters include: earthquakes, volcanic activity, landslides and tsunamis.

Hydrological Disasters : Hydrological disasters are violent, sharp and harmful amendment either in quality of earth's water or in distribution or movement of water ashore below the surface or in atmosphere. These disasters include: avalanches and floods.

Climatological Disasters : Climatological disasters are defined as events caused by long-lived/meso to macro scale processes in the spectrum from intra-seasonal to multi-decadal climate variability. Such events are further classified as: extreme temperature; drought; wildfire and cyclones.

Biological Disasters : Biological disasters define the devastating effects caused by an enormous spread of a certain kind of living organism – that may the spread a disease, virus, or an epidemic. Biological disasters can also be simply, a sudden growth in the population of a certain kind of plants or animals, e.g., a locust plague. These disasters include: Disease epidemics.

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3.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

   - Geophysical disasters are destructive events that originate within or are caused by the processes of the earth.
   - Earthquakes, Volcanic activity, Landslides and Tsunamis.

2) Your answer should include the following points:

   - Climatological disasters are events caused by long-lived/meso to macro scale processes in the spectrum from intra-seasonal to multi-decadal climate variability.
   - Extreme Temperature; Drought; Wildfire and Cyclones are considered as climatological disasters.

- Cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure.
- Based on the intensity the tropical cyclones are referred as hurricane, typhoon, tropical storm, cyclonic storm, tropical depression, or simply as a cyclone

3) Your answer should include the following points:

- Biological disasters is the outcome of devastating effects caused by an enormous spread of a certain kind of living organism – that may the spread a disease, virus, or an epidemic.
- It may be called disaster epidemics.
- Epidemic is the rapid spread of infectious disease to a large number of people in a given population within a short period of time.
- It occurs when host immunity to either an established pathogen or newly emerging novel pathogen is suddenly reduced below that found in the endemic equilibrium and the transmission threshold is exceeded.

Check Your Progress 2

1) Your answer should include the following points:

- Complex emergencies and conflicts.
- Famine.
- Transport and Industrial Accidents.

2) Your answer should include the following points:

- Famine is a scarcity of food, caused by several factors including crop failure, population imbalance, or government policies.
- It is usually accompanied or followed by regional malnutrition, starvation, epidemic, and increased mortality.

3) Your answer should include the following points:

- Transport disaster is a technological transport accident involving mechanised modes of transport. Accidents involving air, boat, rail transport and accidents involving motor vehicles on roads and tracks are come under the category of Transport and Industrial Accidents.
- Chemical/Nuclear/Mine Explosion, Pollution degradation, Acid rain and Chemical/Atmospheric Pollution are considered as industrial accident related disasters.

UNIT 4 DISASTER PROFILE OF INDIA*

Structure

4.0 OBJECTIVES

After reading this Unit, you should be able to:

- Discuss the disasters that occur in India;
- Understand the statistics of natural disasters in India; and
- Know the Disaster Profile of India.

4.1 INTRODUCTION

The Indian sub-continent is among the world's most disaster prone areas. Almost 85% of India's area is vulnerable to one or multiple hazards. Of the 29 states and 7 union territories in India, 22 are multi-disaster prone. It is vulnerable to wind storms spawned in the Bay of Bengal and the Arabian Sea; earthquakes caused by active crustal movement in the Himalayan mountains; floods brought by monsoons, and droughts in the country's arid and semi-arid areas. India is vulnerable, in varying degrees, to a large number of disasters. More than 58.6 per cent of the landmass is prone to earthquakes (high seismic zones III–V) of moderate to very

* Contributed by Dr. Poonam Rautela, Associate Professor, M B Govt. PG College, Haldwani (Uttarakhand).

high intensity; over 40 million hectares (12%) of its land is prone to floods and river erosion; close to 5,700 kms, out of the 7,516 kms long coastline is prone to cyclones and tsunamis; 68% of its cultivable area is vulnerable to droughts; and, its hilly areas are at risk from landslides and avalanches. Moreover, India is also vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other man-made disasters (NDMA, 2016).

Disaster risks in India are further compounded by increasing vulnerabilities related to changing demographics and socio-economic conditions, unplanned urbanisation and development within high-risk zones, environmental degradation, climate change, geological hazards, epidemics and pandemics. Clearly, all these contribute to a situation where disasters seriously threaten India's economy, its population and sustainable development.

4.2 VULNERABILITY PROFILE OF INDIA

India, due to its, physiographic and climatic conditions is one of the most disaster prone areas of the world. It is vulnerable to windstorms from both the Arabian Sea and Bay of Bengal. Floods brought about by heavy rains and drought in arid and semi-arid areas also contribute in making hostile environment of this sub-continent. The western region of the country, represented by the Thar Desert and the central India by the Deccan Plateau, face recurring droughts due to acute shortage of rainfall. India has increasingly become vulnerable to Tsunamis since the 2004 Indian Ocean Tsunami. India has a coastline running 7600 km long; as a result is repeatedly threatened by cyclones.

India has been classified into three main geological divisions, that is, Himalayas, also known as the Extra-Peninsula; Indo-Gangetic Plains and the Peninsula. The Himalayan is sub-classified by two methods. In method-1, the Himalaya is divided from west to east, into four regions. They are Punjab Himalaya-the area between Indus and Sutlej rivers, Kumaon Himalaya-area between Sutlej and Kali Rivers, Nepal Himalaya- area between Kali and Tista Rivers and Assam Himalaya-area between Tista and Brahmaputra Rivers. As per method-2, the Himalaya is divided in to three regions only. These are the Nepal Himalaya that constitutes the Central Himalayas, the mountainous area on its west and east as western and eastern Himalayas. Every region has its own risk of disaster. The region and risk wise classification will be explained in subsequent paragraphs.

4.2.1 The Himalayan Region

As per Hindu mythology, the Himalayas are the place of abode for Gods and thus every year, thousands of pilgrims religiously visit the important sacred places in this region. However, the young Himalayan mountain range on the north still shows focal signs of neo-tectonism. High atmospheric precipitation concentrated to the monsoon season, together with high relative relief and highly trusted, folded, faulted, metamorphosed and weathered rocks make this region highly prone to landslides and flash floods. Landslides are a routine phenomenon in the region. The Malpa slide (1998), Okhimath (1998), Uttarkashi (2003 & 2012) Uttarakhand flash flood (2013) represent the extreme events. The entire Himalayan region is seismically highly active and marked in Zones V and IV on earthquake risk map. The seismic hazard in the Himalayan region is very high. It doesn't mean the other regions are safe from the threat of earthquakes. No part of the country that falls in the least affected Zone I of the seismic risk map. The Uttarkashi earthquake

(1991), Killari earthquake (1993), Koyana earthquake (1997), Chamoli earthquake (1999), Bhuj earthquake (2001), Jammu and Kashmir earthquake (2005), Sikkim earthquake (2011) are some of the recent ones.

In mountainous region, the area above 3500 meters is devoid of vegetation and normally snow bound. These areas are considered as high altitude areas. The weather is much unpredictable. There is shortage of oxygen in the atmosphere. The steep mountainous peaks, permanent glaciers, moraines, and cold water lakes are common. Area is cold, windy and prone to crevasses; fresh snow falls and avalanches. In summer due to melting of snow and glacier, the water inflow increases in lakes and stream, which may cause flood. The hilly area below 3500 feet, depending up on the geographical and climatic condition, is more prone to heavy rain, cloud burst, flash flood, landslide and mudflow. The major natural risks in this region are: Earthquake, Landslides, Forest fires, Soil erosion, Snow avalanches and Flash floods.

4.2.2 The Gangetic Plain

The Indo-Gangetic plain that is densely populated and is drained by the Himalayan river is prone to both floods and droughts. Floods in the Indo–Gangetic–Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year. Nearly 75% of the total rainfall occurs over a short monsoon season (June – September). 40 million hectares, or 12% of Indian land, is considered prone to floods. Floods are a perennial phenomenon in at least 5 states – Assam, Bihar, Odisha, Uttar Pradesh and West Bengal. In the other extreme, about 50 million people are affected annually by drought. Of approximately 90 million hectares of rain-fed areas, about 40 million hectares are prone to draught (Rajan, 2018).

4.2.3 Arid and Semi Arid Regions

Arid and semi-arid regions are characterised by a climate with no or insufficient rainfall to sustain agricultural production. Within India, almost 53.4 per cent land area comprises arid and semi-arid region (Patra, 2016). The rains are erratic and often come in a few heavy storms of short duration, resulting in high run-off, instead of replenishing the ground water. Protective vegetation cover is sparse and there is very little moisture for most part of the year. In these regions, cultivation is restricted to more productive but limited land, while a large animal population depends on native vegetation. Irrigation with surface or ground water is inevitable for growing crops in the arid and semi-arid zones. The rainfall pattern roughly reflects the different climate regimes of the country, which vary from humid in the northeast (about 180 days rainfall in a year), to arid in the Thar deserts of Rajasthan (20 days rainfall in a year) (Pechlivanidis & Arhemer, 2015).

4.2.4 Deccan Plateau

The Deccan is a peninsular plateau located in central India that includes inland sections of the states of Andhra Pradesh, Maharashtra and Karnataka. The Deccan is delineated by the Western Ghats on the west, the Nilgiri Hills on the south, the Eastern Ghats on the east, and the Aravalli and Chota Nagpur hills on the north. The Deccan Plateau also faces acute scarcity of water though there are Narmada, the Tapi, the Mahanadi, the Godavari, the Krishna and the Cauvery rivers flowing in this area. These rivers have mostly well defined stable courses. They have adequate capacity within the natural banks to carry the flood discharge

except in the delta area. The lower reaches of the important rivers on the East Coast have been embanked, thus largely eliminating the flood problem.

4.2.5 Western and Eastern Ghats

The Western and Eastern Ghats running parallel to the coastline face the problem of landsliding and droughts in the rain shadow areas. The Western Ghats extend from the Satpura Range in the north, to south past Maharashtra, Goa, through Karnataka and into Kerala and Tamil Nadu. Western Ghats is one of the 33 recognised ecologically sensitive zones in the World. The Western Ghats and Nilgiris are geologically stable but still prone to landslide in rainy season. The environmental degradation rising out of population pressure, illegal mining, curies, deforestation has made both ghats very vulnerable from natural disasters. The Eastern Ghat is not a continuous range of scrap lands as the Western Ghat. Also scraps are nearly absent here. The range is actually cut up into a number of separate circumdenudation hills. The only compact mountainous region is found in Orissa. Mahanadi, Godavari and Krishna that have cut gaps through Eastern Ghat and have completely broken its continuity. The mountains are much more away from the sea than the Western Ghat. The mountain ranges run parallel to the Bay of Bengal. The Deccan Plateau lies to the west of the range, between the Eastern Ghats and Western Ghats. The coastal plains, including the Coromandel Coast region, lie between the Eastern Ghats and the Bay of Bengal. The Eastern Ghats are not as high as the Western Ghats. The structure of the Eastern Ghats includes thrusts and strike-slip faults.

4.2.6 Coastal Region

The Indian subcontinent is one of the worst affected regions in the world. The subcontinent with a long coastline of 7,500 KM is exposed to nearly 10 per cent of the world's tropical cyclones. Of these, the majority has their initial formulation over the Bay of Bengal and strike the east coast of India. On an average, five to six tropical cyclones form every year, of which two or three could be severe. More cyclones occur in the Bay of Bengal than the Arabian Sea and the ratio is approximately 4:1. Cyclones occur frequently on both the coasts (The west coast – Arabian Sea; and the east coast – Bay of Bengal). An analysis of the frequency of cyclones on the east and west coasts of India between 1877 and 2005 shows that nearly 283 cyclones occurred (106 Severe) in a 50 km wide strip on the east coast. Less severe cyclonic activity has been noticed on the west coast, with 35 cyclones occurring in the same period, out of which 20 of them were severe. Tropical cyclones occur in the months of May-June and October-November (NDMA, 2016).

4.3 NATURAL DISASTER PROFILE

4.3.1 Earthquakes

Earthquakes are a sudden violent shaking of the ground, typically causing great destruction, as a result of movements within the earth's crust or volcanic action. Of the total earthquake-prone areas, 12% is prone to very severe earthquakes, 18% to severe earthquakes and 25% to damageable earthquakes. The biggest quakes have occurred in the Andaman and Nicobar Islands, Kutch, Himachal and the North-East. The Himalayan regions are particularly prone to earthquakes. The last three major earthquakes shook Gujarat in January 2001; Jammu and Kashmir in October 2005; and Sikkim in 2011. Many small-scale quakes have

occurred in other parts of India in 2006. 7 North-East States of India (Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya), Andaman & Nicobar Islands; and parts of 6 other states in the North/North-West (Bihar, Jammu and Kashmir & Uttarakhand) and West (Gujarat), are in Seismic Zone V (Government of India, 2016). Table-4.1 below brings to light the location and magnitude of earthquakes in India during the past 200 years.

Table 4.1: Major Earthquakes in India

Date	Location	Magnitude
16 Jun 1819	Kutch, Gujarat	8
10 Jun 1869	Near Cachar, Assam	7.5
30 May 1885	Sopor, J&K	7
12 Jun 1897	Shilong Plateau	8.7
04 Apr 05	Kangra, HP	8
08 Jul 18	Srimangal, Assam	7.6
02 Jul 30	Dhubri, Assam	7.1
15 Jan 34	Bihar- Nepal Border	8.3
26 Jun 41	Andaman Island	8.1
23 Oct 43	Assam	7.2
15 Aug 50	Arunachal Pradesh- China Border	8.5
21 Jul 56	Anjar, Gujarat	7
10 Dec 67	Koyna, Maharashtra	6.5
19 Jun 75	Kinnuar, HP	6.2
06 Aug 88	Manipur-Myanmar Border	6.6
21 Aug 88	Bihar- Nepal Border	6.4
20 Oct 91	Uttarkhashi, Uttarakhand	6.6
30 Sep 93	Latur- Osmanabad, Maharashtra	6.3
22 May 97	Jabalpur, MP	6
29 Mar 99	Chamoli Dist, UK	6.8
26 Jan 01	Bhuj, Gujarat	7.7
08 Oct 05	Kashmir	7.6
18 Sep 2011	Sikkim	6.9

***Source*:** Government of India, 2011.

The Indian sub-continent has a history of devastating earthquakes. The major reason for the high frequency and intensity of the earthquakes is that the Indian plate is driving into Asia at a rate of approximately 47 mm/year. Geographical statistics of India show that almost 54% of the land is vulnerable to earthquakes. A World Bank & United Nations Report estimates that around 200 million city dwellers in India will be exposed to storms and earthquakes by 2050. The latest version of seismic zoning map of India given in the earthquake resistant design code of India assigns four levels of seismicity for India in terms of zone factors. In other words, the earthquake zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5) unlike its previous version, which consisted of five or six zones for the

country. According to the present zoning map, Zone 5 expects the highest level of seismicity whereas Zone 2 is associated with the lowest level of seismicity.

4.3.2 Tsunami

A tsunami (in Japanese "tsu" means harbor and "nami" means wave) is a series of water waves caused by the displacement of a large volume of a body of water, usually an ocean. Seismicity generated tsunamis are the result of abrupt deformation in the sea floor resulting vertical displacement of the overlying water. Earthquakes occurring beneath the sea level displace the water above the reformed area from its equilibrium position. Tsunamis are giant waves caused by earthquakes or volcanic eruptions under the sea. Out in the depths of the ocean, tsunami waves do not dramatically increase in height. But as the waves travel inland, they build up to higher and higher heights as the depth of the ocean decreases. The speed of tsunami waves depends on ocean depth rather than the distance from the source of the wave. Tsunami waves may travel as fast as jet planes over deep waters, only slowing down when reaching shallow waters. While tsunamis are often referred to as tidal waves, this name is discouraged by oceanographers because tides have little to do with these giant waves. The sudden release of energy produces tsunami waves which have small amplitude but a very long wavelength (often hundreds of kilometer long). It may be caused by non-seismic event also such as marine landslides or impact of a meteor. The Tsunami in Indian Ocean on 26 December 2004 had devastating effects on India. Many people died and millions were displaced. The hardest hit areas were on Southern coast and the Andaman and Nicobar Island (Government of India, 2016).

4.3.3 Landslides

A landslide is the movement of rock, debris or earth down a slope. They result from the failure of the materials which make up the hill slope and are driven by the force of gravity. Landslides are also known as landslips, slumps or slope failure. India has the highest mountain chain on earth, the Himalayas, which are formed due to collision of Indian and Eurasian plate, the northward movement of the Indian plate towards China causes continuous stress on the rocks rendering them friable, weak and prone to landslides and earthquakes. The slow motion of the Indian crust, about 6 cm/year accumulates stress to which natural disasters are attributed. Some landslides make devastating and unparalleled catastrophes. Landslides and avalanches are among the major hydro-geological hazards that affect large parts of India. Besides the Himalayas, the northeastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats and the Vindhyans, covering about 15 % of the landmass, are some other potential landslide zones. The Himalayas alone count for landslides of every fame, name and description- big and small, quick and creeping, ancient and new. The Northeastern region is badly affected by landslide problems of a bewildering variety. Landslides in the Darjeeling district of West Bengal as also those in Sikkim, Mizoram, Tripura, Meghalaya, Assam, Nagaland and Arunachal Pradesh pose chronic problems, causing recurring economic losses worth billions of rupees. A different variety of landslides, characterised by a lateritic cap, pose constant threat to the Western Ghats in the South, along the steep slopes overlooking the Konkan coast besides Nilgiris, which is highly landslide prone.

Some spectacular events of tragedies are reported as Chamoli Garhwal landslide (1868), Nainital landslide (1880), Malpha landslide (1998) Pithoragarh district, Ukhimath landslide (2001) in Chamoli district, Varnavat landslide(2003) Uttarkashi

District, Dasgaon landslide (2005) Raigad district and Paglajhora (2010) in Darjeeling district as well as in Sikkim, Aizawl sports complex, Mizoram (Parkash & Kathait, 2014). The problem, therefore, needs to be tackled for mitigation and management for which hazard zones have to be identified and specific slides to be stabilised and managed in addition to monitoring and early warning systems to be placed at selected sites. Landslides occur in the hilly regions such as the Himalayas, North-East India, the Nilgiris, and Eastern and Western Ghats. Landslides in India are another recurrent phenomenon. Landslide-prone areas largely correspond to earthquake-prone areas, that is, North-west and North-East, where the incidence of landslides is the highest (NDMAa, 2016).

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Bring out the Vulnerability Profile of India.

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2) Write a short note on Earthquakes in India.

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3) Discuss the nature of Tsunami and Landslide with reference to India.

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4.3.4 Floods

Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries. It may also occur due to the accumulation of rainwater on saturated ground. On an average, in India, about 30 million people are affected annually. Floods in the Indo–Gangetic–Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year. 40 million hectares, or 12% of Indian land, is considered prone to floods. Floods are a perennial phenomenon in at least 5 states – Assam, Bihar, Orissa, Uttar Pradesh and West Bengal (Rao, 2018). On account of climate change, floods have also occurred in recent years in areas that are normally not flood prone. The principal reasons for

flood lie in the very nature of natural ecological systems in this country, namely, the monsoon, the highly silted river systems and the steep and highly erodible mountains, particularly those of the Himalayan ranges. The average rainfall in India is 1150 mm with significant variation across the country. The annual rainfall along the western coast and Western Ghats, Khasi hills and over most of the Brahmaputra valley amounts to more than 2500 mm (ADRC, 2015). Table 4.2 brings about the major floods in India from 2008 to 2018.

Table 4.2: States hit by Flood from 2008 to 2018

Year	Location	Killed
2008	Tamil Nadu, Karnataka	37
2008	West Bengal, Orissa	1063
2008	Assam, Bihar, Gujarat	NA
2008	Assam	142
2008	Bihar	47
2008	Bihar	245
2008	Assam, Tamil Nadu	54
2009	Bihar, Orissa, West Bengal	992
2009	Bihar, West Bengal	52
2009	Karnataka	300
2009	Tamil Nadu	70
2010	Andhra Pradesh	27
2010	Bihar	98
2010	Haryana	53
2010	New Delhi	11
2010	Jammu and Kashmir	196
2010	Assam	NA
2010	Punjab, Haryana, Uttar Pradesh	NA
2010	Uttarakhand	200
2010	Tamil Nadu	203
2011	Uttar Pradesh, Uttarakhand	50
2011	Uttar Pradesh	19
2011	West Bengal	47
2011	Assam	204
2011	Assam	7
2011	Odisha	42
2011	Odisha	239
2012	Assam	120
2012	Uttarakhand, Uttar Pradesh	30
2012	Himachal Pradesh	26
2012	Rajasthan	37
2012	Uttarakhand	45
2012	Assam, Sikkim, Arunachal Pradesh	21
2013	Uttarakhand, Himachal Pradesh	580; 5,474
2015	Gujarat	70
2016	Assam	1.8 million People affected
2017	Gujarat	200
2018	Kerala	NA

***Source*:** Government of India, 2011 & www.emdat.de.

4.3.5 Cyclones

Any large system of winds that circulates about a centre of low atmospheric pressure in a counter clockwise direction north of the Equator and in a clockwise direction to the south is known as cyclone. Cyclonic winds move across nearly all regions of the earth except the equatorial belt and are generally associated with rain or snow. Also occurring in much the same areas are anticyclones, wind systems that rotate about a high-pressure centre. Anticyclones are so called because they have a flow opposite to that of cyclones — that is, an outward-spiraling motion, with the winds rotating clockwise in the northern hemisphere and counterclockwise in the southern. These winds are usually not as strong as the cyclonic system and commonly produce no precipitation.

About 8% of the land in India is vulnerable to cyclones of which coastal areas experience two or three tropical cyclones of varying intensity each year. Cyclonic activities on the east coast are more severe than on the west coast. The Indian continent is considered to be the worst cyclone-affected part of the world, as a result of low-depth ocean bed topography and coastal configuration. The principal threats from a cyclone are in the form of gales and strong winds; torrential rain and high tidal waves/storm surges. Most casualties are caused due to coastal inundation by tidal waves and storm surges. Cyclones typically strike the East Coast of India, along the Bay of Bengal, that is, the states of West Bengal, Odisha, Andhra Pradesh and Tamil Nadu, but also parts of Maharashtra and Gujarat in the West Coast in front of Arabian Sea. Table 4.3 reveals the number of causalities due to cyclones in India is over the years.

Table 4.3: Major Cyclones in India

Year	Name of the Place	No. of Death
1737	Hoogli, West Bengal (India)	3,00,000
1876	Bakerganj (Bangladesh)	2,50,000
1885	False point (Orissa)	5,000
1971	Paradeep, Orissa (India)	10,000
1977	Chirala, Andhra Pradesh	10,000
1990	Andhra Pradesh	990
1998	Porbander Cyclone, Gujarat	1,173
1999	Paradeep, Orissa	9,885
2011	Thane Cyclone, Tamil Nadu & Puducherry	47
2013	Phailin Cyclone, Odisha & Andhra Pradesh	45
2014	Hudhud Cyclone, Andhra Pradesh	124
2016	Vardah Cyclone, Tamil Nadu & Andaman and Nicobar Islands	38
2017	Ockhi Cyclone, Kerala, Tamil Nadu & Gujarat	282

***Source*:** Government of India, 2011 & www.emdat.de.

4.3.6 Droughts

A drought is a period of below-average precipitation in a given region; resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water. A drought can last for months or years, or may be declared after as few as 15 days.

About 50 million people are affected annually by drought in India. Of approximately 90 million hectares of rain-fed areas, about 40 million hectares are prone to scanty or no rain. The primary cause of any drought is deficiency of rainfall and in particular, the timing, distribution and intensity of this deficiency in relation to existing reserves. Drought is not uncommon in certain districts of Uttar Pradesh, Madhya Pradesh, Orissa, Andhra Pradesh, etc. Although a slow onset emergency, and to an extent predictable emergency, drought has caused severe suffering in the affected areas in recent years, including effects on poverty, hunger, and unemployment. A prolonged period of relatively dry weather leading to drought is a widely recognized climate anomaly. Drought can be devastating as water supplies dry up, crops fail to grow, animals die, and malnutrition and ill health become widespread The environmental effects of drought, include salinisation of soil, groundwater decline, increased pollution of freshwater ecosystems and regional extinction of animal species.

4.3.7 Heat Waves and Cold Waves

A heat wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the north-western parts of India. Heat waves typically occur between March and June, and in some rare cases they even extend till July. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions. Extreme positive departures from the normal maximum temperature result in a heat wave during the summer season. The rising maximum temperature during the pre-monsoon months often continues till June, in rare cases till July, over the northwestern parts of the country.

The Indian Meteorological Department (IMD) has given the following criteria for heat waves:

- Heat wave need not be considered till maximum temperature of a station reaches at least 40^0C for plains and at least 30^0C for hilly regions;
- When normal maximum temperature of a station is less than or equal to 40^0C, heat wave departure from normal is 5^0C to 6^0C. Severe heat wave departure from normal is 7^0C or more;
- When normal maximum temperature of a station is more than 40^0C heat wave departure from normal is 4^0C to 5^0C. Severe heat wave departure from normal is 6^0C or more; and
- When actual maximum temperature remains 45^0C or more irrespective of normal maximum temperature, heat waves should be declared. Higher daily peak temperatures and longer, more intense heat waves are becomingly increasingly frequent globally due to climate change. India too is feeling the impact of climate change in terms of increased instances of heat waves which are more intense in nature with each passing year, and have a devastating impact on human health thereby increasing the number of heat wave casualties.

Introduction

A cold wave is a weather phenomenon that is distinguished by cooling of the air. Cold waves are recurrent phenomenon in North India. Hundreds of people die of cold and related diseases every year, most of them from poor urban areas in northern parts of the country.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the nature of Floods in India.

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2) 'India is much prone to Cyclones'. Discuss.

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3) Explain Heat Waves and Cold Waves.

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4.4 CONCLUSION

India is much prone to multi-disasters. Major natural disasters, over the years, in India have been discussed in the Unit. These disasters have been causing great loss of life and property in the country. These disasters are droughts, floods, tsunami, landslides, cyclones among others.There is much felt need for concerted and coordinated endeavours for effective disaster management.

4.5 GLOSSARY

Hills of Circumdenudatioin : Denudation around or in hills which have been produced by surface erosion. These are the elevators which have been left after denudation of a mass of high ground.

Seismic Zone : A seismic zone is an area of seismicity probably sharing a common cause.

Richter scale : The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes.

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4.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- India's 57% of the land is vulnerable to earthquake (high seismic zones III–V) and 68% is to drought.
- 12% of land is vulnerable to floods and river erosion.
- Out of 7,516 KM coastline, 5700 KM are vulnerable to Cyclone.

2) Your answer should include the following points:

- Earthquakes are a sudden violent shaking of the ground, typically causing great destruction, as a result of movements within the earth's crust or volcanic action.
- Reason for the high frequency and intensity of the earthquakes is that the Indian plate is driving into Asia at a rate of approximately 47 mm/year.

- 12% is prone to very severe earthquakes,18% to severe earthquakes and 25% to damageable earthquakes.

3) Your answer should include the following points:

- A tsunami is a series of water waves caused by the displacement of a large volume of a body of water in the ocean.
- It's a giant waves caused by earthquakes or volcanic eruptions under the sea.
- Landslide is the movement of rock, debris or earth down a slope. It's the failure of the materials which make up the hill slope and are driven by the force of gravity.
- It may be called as landslips, slumps or slope failure.
- The Himalayas, the Northeastern hill ranges, the Western Ghats, the Nilgiris, the Eastern Ghats and the Vindhyans are vulnerable to the Landslides.

Check Your Progress 2

1) Your answer should include the following points:

- Flood is occurring due to overflow of water from water bodies.
- Floods in the Indo–Gangetic–Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year 40 million hectares, or 12% of Indian land, is considered prone to floods. Floods are a perennial phenomenon in at least 5 states – Assam, Bihar, Orissa, Uttar Pradesh and West Bengal.

2) Your answer should include the following points:

- Cyclone is a large system of winds that circulates about a centre of low atmospheric pressure in a counterclockwise direction north of the Equator and in a clockwise direction to the south.
- Indian sub continent is considered to be the worst cyclone-affected part of the world, as a result of low-depth ocean bed topography and coastal configuration. The principal threat from a cyclone is in the form of gales and strong winds; torrential rain and high tidal waves/storm surges. Most casualties are caused due to coastal inundation by tidal waves and storm surges.

3) Your answer should include the following points:

- Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India.
- It typically occurs between March and June, and in some rare cases even extends till July.
- Cold wave is a weather phenomenon that is distinguished by a cooling of the air and which are recurrent phenomenon in North India.
- Uttarpradesh and Bihar rank the highest in terms of casualties from cold wave.

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BLOCK 2

DISASTER MANAGEMENT: CONCEPTS AND INSTITUTIONAL FRAMEWORK

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UNIT 5 DISASTER MANAGEMENT ACT, POLICY AND INSTITUTIONAL ARRANGEMENTS*

Structure

5.0 OBJECTIVES

After reading this Unit, you should be able to understand:

- Policies of disaster management in India;
- Acts related to disaster management in India; and
- Institutional structure of disaster management in India.

5.1 INTRODUCTION

Disaster management can be defined as the organisation and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in

* Contributed by Dr. Poonam Rautela, Associate Professor, M B Govt. PG College, Haldwani (Uttarakhand).

particular preparedness, response and recovery in order to lessen the impact of disasters. The institutional arrangements for disaster management in India can be understood through the various steps initiated in the country for managing disasters effectively.

5.2 DISASTER MANAGEMENT ACT, 2005

The Disaster Management Act, 2005, (23 December 2005) received the assent of the President of India on 9 January 2006. The Act extends to the whole of India. The Act provides for "the effective management of disasters and for matters connected therewith or incidental thereto". The Disaster Management Act, enacted in 2005, has a new multidisciplinary focus on disaster prevention and risk reduction and a move away from a relief-centric regime.

- The institutional framework under the Act mandated the creation of the National Disaster Management Authority (NDMA) and State Disaster Management Authorities (SDMAs) as the bodies responsible for disaster preparedness and risk reduction at the respective levels.
- The Disaster Management Division of the Ministry of Home Affairs retained responsibility for overall steering of the national disaster response.
- It mandated the concerned Ministries and Departments to draw up their own plans in accordance with the National Plan.
- The Act further contains the provisions for financial mechanisms such as the creation of funds for the response, National Disaster Mitigation Fund and similar funds at the state and district levels.

5.3 INSTITUTIONAL FRAMEWORK UNDER THE DISASTER MANAGEMENT ACT

5.3.1 National Disaster Management Authority (NDMA)

Evolution of NDMA

Emergence of an organisation is always an evolutionary process. NDMA has also gone through the same process. The Government of India (GOI), in recognition of the importance of disaster management as a national priority, set up a High-Powered Committee (HPC) in August 1999 and a National Committee after the Gujarat earthquake, for making recommendations on the preparation of Disaster Management plans and suggesting effective mitigation mechanisms. The Tenth Five-Year Plan document, for the first time, also had a detailed chapter on Disaster Management. The Twelfth Finance Commission was also mandated to review the financial arrangements for Disaster Management.

On 23 December 2005, the Government of India enacted the Disaster Management Act, which envisaged the creation of National Disaster Management Authority (NDMA), headed by the Prime Minister, and State Disaster Management Authorities (SDMAs) headed by respective Chief Ministers, to spearhead and implement a holistic and integrated approach to Disaster Management in India.

National Disaster Management Authority (NDMA) as the apex body for disaster management has the responsibility for laying down policies, plans and guidelines for disaster management and coordinating their enforcement for effective response. The Guidelines have assisted the Central Ministries, Departments and States to

formulate their respective Disaster Management (DM) plans. It can also take other measures, as it may consider necessary, for the prevention, mitigation, preparedness and capacity building, for dealing with a threatening disastrous situation. Central ministries or departments and State Governments are expected to extend necessary cooperation and assistance to NDMA for carrying out their mandate. NDMA has to oversee the provision and application of funds for mitigation and preparedness measures. It has the power to authorise the departments or authorities concerned to make emergency procurement of provisions or materials for rescue and relief in a threatening disaster situation or disaster.

The NDMA is mandated to deal with all types of disasters, natural or man-made. Whereas such other emergencies including those requiring close involvement of the security forces or intelligence agencies such as terrorism, counter-insurgency, law and order situations, serial bomb blasts, hijacking, air accidents, chemical, biological, radiological and nuclear weapon systems, mine disasters, ports and harbour emergencies, forest fires, oilfield fires and oil spills will continue to be handled by the National Crisis Management Committee (NCMC). NDMA may, however, formulate guidelines and facilitate training and preparedness activities in respect of Chemical Biological Radiological Nuclear (CBRN) emergencies. Cross-cutting themes like Medical Preparedness, Psycho-Social Care and Trauma, Community Based Disaster Preparedness, Information and Communication Technology training, Preparedness awareness generation, etc., of natural and man-made disasters in partnership with the stakeholders concerned. Resources available with the DM authorities at all levels, which are capable of discharging emergency support functions, will be made available to the nodal ministries and agencies concerned during times of such disasters (Government of India, 2011).

Functions of NDMA

The major functions of NDMA are as follows:

i) Lay down policies on disaster management;

ii) Approve National Plan;

iii) Approve plans prepared by the Ministries or departments of the Government of India in accordance with the National Plan;

iv) Lay down guidelines to be followed by the State Authorities in drawing up the State Plan;

v) Lay down guidelines to be followed by the different Ministries or departments of the Government of India for the purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects;

vi) Coordinate the enforcement and implementation of the policy and plan for disaster management;

vii) Recommend provision of funds for the purpose of mitigation;

viii) Provide such support to other countries affected by major disasters as may be determined by the central Government;

ix) Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;

x) Lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management.

5.3.2 National Executive Committee (NEC)

The National Executive Committee (NEC) is composed of Secretary level officers of the Government of India in the Ministries of Home, Agriculture, Atomic Energy, Defence, Water Resources, Environment and Forests, Finance (Expenditure), Health, Power, Rural Development, Science and Technology, Space, Telecommunication and Urban Development, with the Home Secretary serving as the Chairperson, ex officio. The NEC under section of the Act is responsible for the preparation of the National Disaster Management Plan for the whole country and to ensure that it is "reviewed and updated annually".

5.3.3 State Disaster Management Authority (SDMA)

All State Governments are mandated under Section 14 of the Act to establish a State Disaster Management Authority (SDMA) in their States. The SDMA consists of the Chief Minister of the State as the Chairperson, and not more than eight members appointed by the Chief Minister. State Executive Committee is responsible (Section 22) for drawing up the State Disaster Management Plan (SDMP), and implementing the National Plan. The SDMA is mandated under section 28 to ensure that all the departments of the State prepare disaster management plans as prescribed by the National and State Authorities.

5.3.4 District Disaster Management Authority (DDMA)

The Chairperson of District Disaster Management Authority (DDMA) is the Collector or District Magistrate or Deputy Commissioner of the district. The elected representative of the area is an ex officio co-Chairperson.

5.3.5 National Institute of Disaster Management (NIDM)

In 1995, the International Decade for Natural Disaster Reduction IDNDR), with the purpose of ensuring the implementation of the International Strategy for Disaster Reduction, prompted the Indian Institute of Public Administration (IIPA) under the Ministry of Agriculture and Cooperation, the then nodal ministry for disaster management in India to establish a National Centre for National Centre for Disaster management (NCDM). With the transfer of the subject of disaster management to the Ministry of Home Affairs on 16th October 2003, NCDM was later upgraded as the National Institute of Disaster management (NIDM). The Institute was inaugurated by the Home Minister of India on August 11, 2004.

The Disaster Management Act of 2005 granted statutory status to NIDM. The Act holds the institute responsible for "planning, promoting training and research in the area of disaster management, documentation and development of national level information base relating to disaster management, policy formulation, developing prevention mechanisms and promoting mitigation measures".

The NIDM has been mandated by the Government of India (NDMA – as per DM Act 2005, guidelines for NIDM) to be a deemed University and institute of excellence of higher learning and capacity building. UGC has worked out with NIDM and developed a model curriculum for strengthening disaster management in higher education and research. Most Central Universities have envisaged Centre for Disaster Management under their School of Environmental Studies. A core group is being formed with UGC-NIDM to promote the subject at Academic Staff Colleges as well.

5.3.6 National Disaster Response Force (NDRF)

The National Disaster Response Force (NDRF) is a specialised force constituted "for the purpose of specialist response to a threatening disaster situation or disaster" under the Disaster Management Act, 2005: section 44–45. When 'calamities of severe nature' occur, the Central Government is responsible for providing aid and assistance to the affected state, including deployment of Armed Forces, the Central Paramilitary Forces, National Disaster Response Force (NDRF), at the State's request, as well as communication, air and other assets, as are available and needed. National Disaster Response Force (NDRF) is under the National Disaster Management Authority (NDMA). The head of the NDRF is designated as Director General. The Director General of NDRF is IPS officer on deputation from Indian police organisations. Director General wears the uniform and badges of rank of an army three-star general. In the Kashmir-floods of September 2014, NDRF played a vital role in rescuing the armed forces and tourists, for which NDRF was awarded by the Government of India.

The NDRF is a top-heavy organisation which in addition to the Director General has several Inspector Generals (IG) and Deputy IGs. National Disaster Response Force (NDRF) is a force of 12 battalions, organised on para-military lines, and manned by persons on deputation from the Indian para-military forces: three Border Security Force (BSF), three Central Reserve Police Force (CRPF), two Central Industrial Security Force CISF), two Indo-Tibetan Border Police (ITBP) and two *Sashastra Seema Bal* (SSB). The total strength of each battalion is approximately 1,149 persons. Each battalion is capable of providing 18 self-contained specialist search and rescue teams of 45 personnel each including engineers, technicians, electricians, dog squads and medical/paramedics (Eapen, 2016).

5.4 ROLE OF CENTRAL AND STATE GOVERNMENTS

5.4.1 Central Government

In accordance with the provisions of the Disaster Management Act, 2005, the Central Government will take all such measures, as it deems necessary or expedient, for the purpose of disaster management and will coordinate actions of all agencies. The Central Ministries and Departments will take into consideration the recommendations of the State Governments while deciding upon the various pre-disaster requirements and for deciding upon the measures for the prevention and mitigation of disasters. It will ensure that the Central Ministries and departments integrate measures for the prevention and mitigation of disasters into their developmental plans and projects, make appropriate allocation of funds for pre-disaster requirements and take necessary measures for preparedness and to effectively respond to any disaster situation or disaster. It will have the power to issue directions to NEC, State Governments/SDMAs, SECs or any of their officers or employees, to facilitate or assist in disaster management, and these bodies and officials will be bound to comply with such directions. The Central Government will extend cooperation and assistance to the State Governments as required by them or otherwise deemed appropriate by it. It will take measures for the deployment of the Armed Forces for disaster management if required. The role of the Armed Forces will be governed by the instructions laid out in Instructions on Aid to Civil Authorities1970. The Central Government will also facilitate coordination with the UN agency for disaster

management. Ministry of External Affairs, in co-ordination with MHA, will facilitate external co-ordination and cooperation.

i) **Role of Central Ministries and Departments**

As disaster management is a multi-disciplinary process, all Central Ministries and departments will have a key role in the field of disaster management. The Secretaries of the Nodal Ministries and Departments of Government of India, that is, the Ministries of Home Affairs (MHA). Agriculture, Civil Aviation, Environment and Forests, Health, Atomic Energy, Space, Earth Sciences, Water Resources, Mines, Railways, etc., are all members of the NEC and will continue to function as nodal agencies for specific disasters based on their core competencies or as assigned to them.

ii) **National Crisis Management Committee (NCMC)**

NCMC, comprising high level officials of the Government of India headed by the Cabinet Secretary, will continue to deal with major crises which have serious ramifications. It will be supported by the Crisis Management Groups (CMG) of the Central Nodal Ministries and assisted by NEC as may be necessary. The Secretary, NDMA, will be a permanent invitee to this Committee.

5.4.2 State Governments

The primary responsibility for disaster management rests with the States. The institutional mechanisms put in place at the Centre, State and District levels will help the States manage disasters in an effective manner. The Disaster Management Act, 2005, mandates the State Governments, inter alia, to take measures for preparation of state disaster management plans, integration of measures for prevention of disasters or mitigation into state development plans, allocation of funds, establishment of early warning systems and to assist the Central Government and other agencies in various aspects of disaster management.

5.4.3 District Administration

At the District level, DDMAs will act as the planning, coordinating and implementing body for disaster management and will take all measures for the purposes of disaster management in the respective Districts in accordance with the Guidelines laid down by NDMA and the concerned SDMA.

5.4.4 Management of Disasters impacting more than one State

At times, the impact of disasters occurring in one State may spread over to the areas of neighbouring states. Similarly, preventive measures in respect of certain disasters, such as floods, etc., may be required to be taken in one State, though the impact of their occurrence may affect another. The administrative hierarchy of the country is organised into the National, State and District level administrations. This presents some difficulties in case of disasters impacting more than one state. Management of such situations call for a coordinated approach which can respond to a range of issues quite different from those that normally present themselves, before, during and after the event. NDMA will encourage identification of such situations and promote the establishment of mechanisms on the lines of Mutual Aid Agreements, for coordinated strategies, to be dealt by the States, Central Ministries and Departments and other agencies concerned (Eapen, 2016).

5.5 OTHER IMPORTANT INSTITUTIONAL ARRANGEMENTS

i) Armed Forces

Traditionally, the Armed Forces are called upon to assist the civil administration only when the situation is beyond their coping capacity. In practice, however, the Armed Forces are immediate responders in all serious disaster situations. As a result of their training, vast experience, risk taking mentality, swiftness and enormous resources at their disposal, the Armed Forces have historically played a major role in emergency support functions. These include emergency communications, search and rescue operations, health and medical facilities, transportation, airlift, helicopter lift, movement of relief material, emergency response to neighbouring countries, etc. The Armed Forces do give training to trainers, and disaster management managers, especially in Chemical Biological Radiological and Nuclear (CBRN) aspects, helicopter-insertion, high-altitude rescue, watermanship and training of paramedics. At the National level, the Chief of the Integrated Defence Staff to the Chairman, Chiefs of Staff Committee, is a member of the NEC.

ii) Central Armed Police Forces (CAPFs)

The CAPFs which are also the Armed Forces of the Union but under the Ministry of Home Affairs also play a key role in disaster response. The NDRF is a deputation force made out of CAPFs. Each CAPF pools personnel and officers from their share. Besides this, CAPFs over a period of time develop their own capabilities and respond to any disasters which may occur in their area of deployment. As the CAPFs are spread all over India, the resource potential and nationwide presence make their mobilisation much faster. Moreover, they are directly under Union Ministry of Home Affairs, the nodal ministry for disaster management.

iii) State Police, Fire Services and Home Guards

The State Police Forces, the Fire and Emergency Services and Home Guards are crucial and the immediate responders to any incident/disasters. The Police have only limited training in multi-hazard rescue operation. However, Fire Service is better off and adequately trained in emergency response. Home Guard volunteers also will be a force multiplier, if they can be trained in disaster preparedness, emergency response, community mobilisation, etc.

iv) Civil Defence (CD) and Home Guards

The Civil Defence (CD) and the Home Guards can be assigned the responsibility of community preparedness and public awareness in urban area. A culture of voluntarily reporting to duty stations in the event of any disaster, reactivating CD set up in every District can pay dividends in disaster response as the neighbouring community is always the first responder in any disaster. The proposal to make CD District centric and be involved in disaster response has already been approved by the Government of India. However, no visible efforts have been seen from State Governments to organise them properly.

v) Local Elected Bodies

The DM Act, 2005, has defined the roles of Notified Area Committees (NACs), Municipalities, Municipal Corporations, Municipal Councils and Panchayat Raj Institutions (PRIs) under section 41 (1) (2). These bodies are supposed to ensure

that their officials and employees are trained in disaster management and resources relating to disaster management. These bodies are also required to carry out relief activities in the affected areas in accordance with State and District disaster management Plans. The SDMAs/DDMAs are to assign the specific roles and responsibilities to local bodies in their Disaster Management Plan and suitably integrate them with Integrated Response System (IRS).

vi) **Community Participation in Disaster Response**

The community based organisations such as NGOs, Self-Help Groups (SHGs), Youth Organisations, Volunteers of National Cadet Corps (NCC), National Service Scheme (NSS), Nehru Yuva Kendra Sangathan (NYKS), and workers of different projects funded by Government of India like National Rural Health Mission (NRHM), Integrated Child Development Services (ICDS), etc., normally volunteer their services in the aftermath of any disaster. Potential of these youth based organisations can be optimised by giving them special training on disaster management.

vii) **International Cooperation**

Disasters are not limited by geographical boundaries. Major disasters may often simultaneously affect several countries. It should be the endeavour of each nation to develop close cooperation and coordination at the International level in disaster management. Here diplomacy plays a vital role (Eapen, 2016).

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Explain the salient features of Disaster Management Act, 2005.

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2) Discuss the role of SDMA and DDMA.

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3) Write a note on National Disaster Response Force (NDRF).

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5.6 DISASTER MANAGEMENT POLICY

5.6.1 National Policy on Disaster Management (NPDM), 2009

The National Policy Framework has been prepared after due deliberation and keeping in view the National Vision to build a safe and disaster-resilient India by developing a holistic, proactive, multi-disaster and technology-driven strategy for disaster management. It was understood that this could be achieved through a culture of prevention, mitigation and preparedness to put in place a prompt and efficient response during disasters. The entire process centre-staged the community and provide momentum and sustenance through the collective efforts of all government agencies and Non-Governmental Organisations (NGOs).

In order to translate this vision into policy and plans, the NDMA has adopted a mission-mode approach involving a number of initiatives with the help of various institutions operating at the national, state and local levels. Central ministries, States and other stakeholders have been involved in the participatory and consultative process of evolving policies and guidelines.

This Policy aims at:

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

5.6.2 National Disaster Management Plan (NDMP), 2016

The Prime Minister of India released the National Disaster Management Plan (NDMP), as a first ever national plan prepared in the country.

Salient Features

The NDMP incorporates substantively the approach mentioned in the Sendai Framework. The plan covers all phases of disaster management: prevention, mitigation, response and recovery. It provides for horizontal and vertical integration among all the agencies and departments of the government. The aim of the plan is to make India disaster resilient. It is designed to maximise the ability of the country

to cope with disasters at all levels by integrating disaster risk reduction into development and by increasing the preparedness to respond to all kinds of disasters.

The plan also takes into account the Global trends in disaster management. It incorporates the approaches for disaster risk reduction mentioned in the Sendai Framework (2015- 2030), which is an agreement under the United Nations to which India is a signatory.

- The plan has assigned roles and responsibilities at all levels of Government, right up to *Panchayat* and Urban Local body level in a matrix format.
- As the plan follows the regional approach, it is beneficial not only for disaster management, but also for development planning.
- 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.
- The plan emphasises on preparing communities to cope with disasters, so it stresses on a greater need for Information, Education, and Communication activities.

National Disaster Management Plan (NDMP) is also based on the four priority themes of the Sendai Framework, namely: understanding disaster risk, improving disaster risk governance, investing in disaster risk reduction (through structural and non-structural measures) and disaster preparedness, early warning and building back better in the aftermath of a disaster. NDMP covers all phases of disaster management: prevention, mitigation, response and recovery. 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 generalised framework for recovery and offers flexibility to assess a situation and build back better. To prepare communities to cope with disasters, NDMP emphasises on a greater need for Information, Education and Communication activities.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Write down the key points of National Policy on Disaster Management.

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2) Bring out the features of National Disaster Management Plan, 2016.

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5.7 CONCLUSION

There had been great loss of lives and property after major disasters like the Super Cyclone in 1999 and the Earthquake in 2001. As a result of the large scale devastation, there were measures initiated in India towards making institutional arrangement for disaster management. Major initiatives such as the Disaster Management Act, Disaster Management Policy and agencies for disaster management at the Central, State and District levels have been discussed at length in this Unit.

5.8 GLOSSARY

Disaster Management Act, 2005 : The Disaster Management Act, 2005, (23 December 2005) received the assent of The President of India on 9 January 2006. The Act extends to the whole of India. The Act provides for "the effective management of disasters and for matters connected therewith or incidental thereto".

National Disaster Management Authority (NDMA) : The NDMA is responsible for "laying down the policies, plans and guidelines for disaster management" and to ensure "timely and effective response to disaster". It is responsible for laying "down guidelines to be followed by the State Authorities in drawing up the State Plans".

National Disaster Response Force (NDRF) : The National Disaster Response Force (NDRF) is a specialised force constituted "for the purpose of specialist response to a threatening disaster situation or disaster" under the Disaster Management Act, 2005: section 44–45. When 'calamities of severe nature' occur, the Central Government is responsible for providing aid and assistance to the affected state, including deploying, at the State's request, of Armed Forces, Central Paramilitary Forces, National Disaster Response Force (NDRF), and such communication, air and other assets, as are available and needed. National Disaster Response Force (NDRF) is under the National Disaster Management Authority.

National Institute of Disaster Management (NIDM) : The NIDM has been mandated by the Government of India (NDMA – as per DM Act 2005, guidelines for NIDM) to be a deemed University and institute of excellence of higher learning and capacity building. UGC has worked out with NIDM and developed a model curriculum for strengthening disaster management in higher education and research.

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5.10 ANSWERS TO CHECK YOUR PROGRESS EXCERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - Disaster Management Act was enacted in 2005.
   - Institutional frameworks such as NDMA, NEC, NDRF, SDMA and DDMA

2) Your answer should include the following points:
   - State Disaster Management Authority
   - District Disaster Management Authority

3) Your answer should include the following points:
   - NDRF is a specialised force constituted for the purpose of specialist response to a threatening disaster situation or disaster.
   - It is a consist of forces from Border Security Force, Central Reserve Police Force, Central Industrial Security Force, Indo-Tibetan Border Police and *Sashastra Seema Bal*.

Check Your Progress 2

1) Your answer should include the following points:
   - Evolution and aims of the National Policy on Disaster Management, 2009.

2) Your answer should the following points:
   - NDMP covers all phases of disaster management: prevention, mitigation, response and recovery.
   - It points out the roles and responsibilities of all levels of Government right up to Panchayat and Urban Local Body level in a matrix format.
   - It will help to maximise the ability of the country to cope with disasters at all levels by integrating disaster risk reduction into development and by increasing the preparedness to respond to all kinds of disasters.

UNIT 6 DISASTER MANAGEMENT CYCLE WITH FOCUS ON PREPAREDNESS, PREVENTION AND MITIGATION*

Structure

6.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand the disaster management cycle and its stages;
- Examine the concept and principles of disaster prevention;
- Elaborate the disaster preparedness measures and its types; and
- Explain the concept of disaster mitigation and discuss its approaches.

6.1 INTRODUCTION

Disaster management measures in earlier times were oriented mostly to the relief measures, wherein items of relief are distributed to the victims after the disaster. However, there was a realisation in later times on disaster management and it was felt that rather than serving the needs of the victims after a disaster happens, it is better to engage in prevention and mitigation measures which can contribute towards not only preventing huge loss of life and property, but also contribute towards preventing huge burden on the exchequer.

Both at the international and national level, the approach towards disaster management has changed and the focus is on concentrating on the disaster management cycle and promoting the culture of disaster risk prevention and mitigation. In this Unit,

* Contributed by Dr. A. Senthamizh Kanal, Consultant, Faculty of Public Administration, SOSS, IGNOU, New Delhi.

you will be introduced to the Disaster Management Cycle, which encompasses various stages viz. pre-disaster, during-disaster and post-disaster. Rather than focusing on the post-disaster measures, emphasis has been made on the pre and during-disaster measures which cover aspects such as prevention, preparedness and mitigation.

6.2 INTERNATIONAL AND NATIONAL APPROACH TOWARDS DISATER

As stated earlier, the initial measures of disaster management only meant distribution of relief to the victims. It was only after the Yokohama Strategy for Disaster Reduction in 1994 that the approach at the international level took a shift from relief to mitigation and prevention. The Yokohama Strategy states that "disaster prevention, mitigation and preparedness are better than disaster relief as the latter only leads to temporary results with high costs, while the former contributes to lasting improvement in safety thereby focusing on integrated disaster management" (UNISDR, 1994). The same point has been reiterated by UNICEF (2016), which states that, on an average "every $1 spent on preparing is worth more than $2 in the emergency response, and that preparedness saves responders over a week of operational time – doubling the impact of donors' and taxpayers' contributions".

In the Indian context too, the approach towards prevention and mitigation can be found in the Disaster Management Act of 2005. The Act states that the National Plan shall include:

i) measures to be taken for prevention of disasters or the mitigation of their effects;

ii) measures to be taken for the integration of mitigation measures in the development plans;

iii) measures to be taken for preparedness and capacity building to effectively respond to any threatening disaster situations or disaster; and

iv) roles and responsibilities of different Ministries or Departments of the Government of India in respect of measures on the three aspects mentioned above (Government of India, 2016).

Thus, the shift in approach can be observed both at the international as well as national level and the core objective of India towards disaster management is to promote the culture of disaster risk prevention and mitigation at central, state and local levels.

6.3 DISASTER MANAGEMENT CYCLE

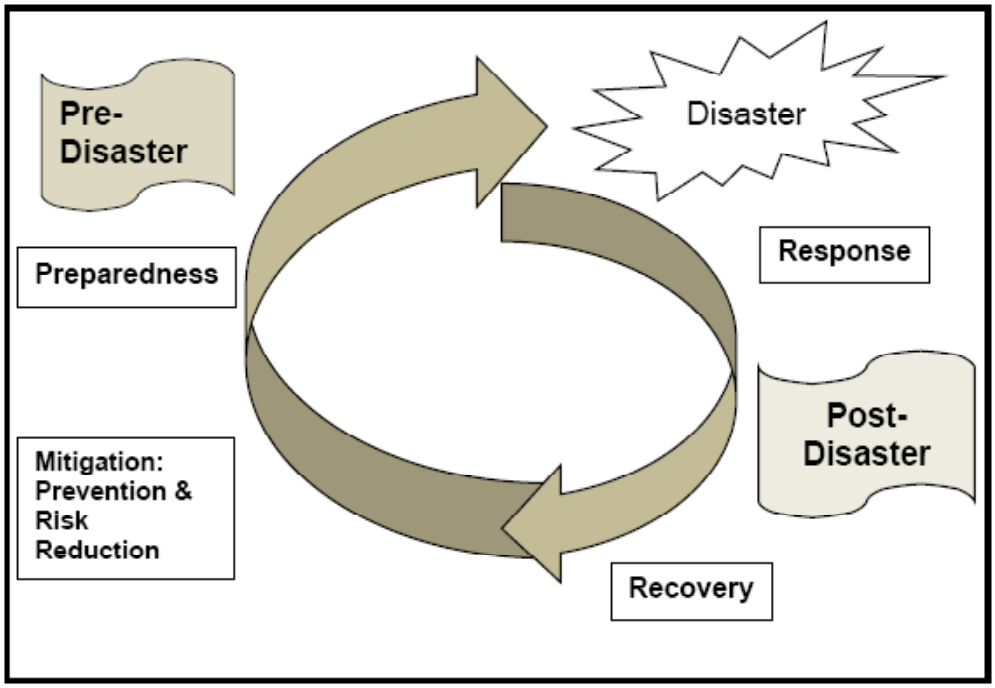
Disaster Management is not a single entity. It involves so many actions and actors as a disaster is not confined to any particular area/ location. It can happen anywhere and at any time, which is so sudden and it makes enormous damage to the lives of the people and the infrastructure. In managing disaster situation, emphasis has been made on the Disaster Management Cycle, which is a new approach to look into disasters in a holistic way. The Disaster Management Cycle thus:

- integrates various isolated activities, attempts and different actors;
- shows new path in handling disasters, which makes a shift from relief-oriented approach to proactive approach.

As per Disaster Management Act, 2005, "Disaster Management" means a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for – (i) prevention of danger or threat of any disaster; (ii) mitigation or reduction of risk any disaster or its severity or consequences; (iii) capacity building; (iv) preparedness to deal with any disaster; (v) prompt response to any threatening disaster situation or disaster; (vi) assessing the severity or magnitude of effects of any disaster; (vii) evacuation, rescue and relief; and (viii) rehabilitation and reconstruction. All these components mentioned in the Act are not an isolated or single activity and should be holistic, integrated and inter-connected. Hence these components should be inbuilt into the development programmes for effective disaster management. Such effective disaster management is based upon the partnership among the Central, State and Local levels to ensure the protection of the people through measures of proper preparedness, mitigation, response, relief, recovery and rehabilitation.

Stages of Disaster Management Cycle

The Disaster Management Cycle can be divided into three stages, that is, Pre-disaster, During-disaster and Post-disaster.



***Source*:** Government of India, 2016.

Pre-disaster: Preparedness, Prevention and Mitigation are the major activities in pre-disaster stage. It is based upon the principle that prevention is better than cure. In this stage, various preventive measures and activities are undertaken well in advance so as to respond to disasters in an effective way. Much of the disastrous effects could be avoided, if we are well equipped with preparedness, prevention and mitigation measures and give serious attention to the early warnings. Pre-disaster activities should, thus, concentrate on creating disaster resilient structures and communities. For example, in India, cyclones are a common phenomenon that occurs and warnings are generally given beforehand. If preparatory activities can be undertaken well in advance, then it becomes easy to prevent huge losses in terms of lives and property, in the aftermath phase.

During-disaster: Response and Relief are the important activities in the during-disaster stage. It will start in the aftermath of a disaster. It includes immediate

activities like search, rescue and evacuation, identification of and management of dead bodies and debris management, provision of first-aid, food, water, shelter, safety and security, health care and sanitation, restoration of basic facilities, etc. For example, when the Indian Ocean Tsunami struck in 2004, one can reflect that all these measures were undertaken immediately.

Post-disaster: The major activities in the post-disaster phase include: Rehabilitation, Reconstruction and Recovery. These activities will ensure that the disaster affected community becomes resilient and return back to normalcy. Generally, this phase takes a long time, as the efforts are made to restore all essential facilities to pre-disaster status. The major focus of this phase is on the measures that could pave way for long-term recovery of social, economic and physical structures, as well as processes in such a way that future disasters are unable to impact severely and irreversibly.

As discussed earlier, the activities undertaken in all the three phases are not an isolated one and hence proper preparedness and mitigation measures are essential for an effective response and recovery of the society. Further insights on the different stages of a disaster have been made here to provide better understanding (IGNOU-NDMA, 2012):

Prevention	Prevention activities aim at totally avoiding the adverse impact of hazards and providing means to minimise environmental, technological and biological disasters. Depending on social and technical feasibility and cost-benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters.
Mitigation	Mitigation means any action taken to minimise the extent of a disaster or potential disaster. Mitigation can take place before, during or after a disaster, but the term is most often used proactively to refer to actions against potential disasters. Mitigation measures are physical and both structural and non-structural. Structural measures are measures that can be easily seen or perceived such as strengthening of buildings, disaster-resistant construction, and erection of infrastructure. The non-structural measures are intangible in nature. These cannot be easily quantified, but are very important such as generation of awareness, education and training, adherence to the rules and byelaws.
Preparedness	Preparedness entails activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings, preparation of emergency plans, maintenance of inventories, at-risk planning and temporary evacuation of people and property from threatened locations. It involves measures that enable governments, community and individuals to respond rapidly to disaster situations and effectively cope with them. The following are the important components of disaster preparedness, that is, evacuation plans, incident response

	set-up, logistics management, standardisation of relief procedures, land-use planning, disaster insurance, awareness on vulnerability of women, elderly, children and disadvantaged sections of society, pertinence of disaster task force, role of traditional wisdom and community based disaster management.
Response/Relief	Relief can be of an immediate, short-term, or protracted duration. For example, search and rescue of the affected people and provision of food, temporary shelter and medical care to the persons affected by the disaster are some common areas of intervention after a disaster. Relief involves strategies and ways that can help to reduce the level of suffering and mitigate the distress, so as to bring out the affected people from the shock and trauma of suddenly losing their means of livelihood. Further, the main objective of relief is to assist the affected persons to start their normal activities again. The following are important components of disaster response, that is, role of search and rescue, health assessment, epidemiological survey, standard operation procedures, emergency operations centre, emergency health care, geographical information system and remote sensing, community radio and internet, communication and alarm systems and evacuation plans (See Unit 7 for more information).
Rehabilitation	Rehabilitation process includes all operations and decisions taken after a disaster with a view to restoring an affected community to its former living conditions, by encouraging and facilitating the necessary adjustments to the changes caused by the disaster (See Unit 9 for more information).
Reconstruction	Process of Reconstruction includes the actions taken to re-establish a community, following rehabilitation after a disaster. These actions generally include construction of permanent housing, complete restoration of all services and physical infrastructure to the pre disaster state (See Unit 9 for more information).
Recovery	Recovery refers to decisions and actions related to rehabilitation and reconstruction taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the affected community. At the same time, it also focuses on encouraging and facilitating necessary adjustments to reduce disaster risk. Recovery activities make use of disaster risk reduction measures to improve the situation in affected areas. The aim is to also develop the areas in a way that vulnerability and risk to disasters are minimised. All development programmes in the area need to be mainstreamed with recovery programmes in order to treat disasters as development opportunities (See Unit 9 for more information).

***Source*:** Adapted from IGNOU-NDMA, 2012.

6.4 DISASTER PREVENTION

As we know, disasters are inevitable and unavoidable. But appropriate preventive measures will help in reducing the impact of a disaster. The High Powered Committee (HPC) Report on Disaster Management (2001) considers "development of a culture of prevention as an essential component of an integrated approach to disaster reduction". The Committee also pointed out that the 'culture of prevention' should be developed among the people, government and other community based organisations. In recent times, the system of disaster management has undergone a major change and importance has been given to disaster prevention too. The National Policy on Disaster Management (2009) considers it essential to put in place "appropriate institutional framework, management systems, and allocation of resources for efficient prevention and handling of disasters". Developing early warning systems and developmental planning are the key measures towards disaster prevention. For achieving long-term development or sustainable development, the country should include the disaster preventive components in the policies, plans and the projects. Ideally, these preventive measures will be helpful during the stages of preparedness, response, recovery and rehabilitation. Following are some of the measures towards disaster prevention:

6.4.1 Measures towards Disaster Prevention

HPC has listed the following measures towards disaster prevention.

- Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies.
- Disaster prevention should focus on reducing the need for disaster relief.
- Disaster prevention should be an integral part of the developmental policy and planning at national, regional, bilateral, multilateral and international stage.
- Early warning of impending disasters and their effective dissemination using telecommunication are the key factors to successful prevention.
- Preventive measures should involve participation at all levels, from the local community to national level to the regional and international level, to ensure effectiveness.
- Application of proper design and patterns of development focused on target groups through appropriate education and training is essential for the reduction of vulnerability.
- There should be acceptance on the part of the international community to share necessary technology to prevent disasters, which should be made freely available and done in a timely manner as an integral part of technical cooperation.
- Each country bears the primary responsibility of protecting its people, infrastructure and other national assets from the impact of natural disasters. The international community should demonstrate strong political determination required to mobilise adequate resources and make efficient use of existing resources, including financial, scientific and technological means (HPC, 2001).

Thus, the focus of preventive measures is to give thrust to vulnerability reduction and risk reduction. Proper preventive measures can reduce the need of the disaster relief and response. Though disasters cannot be completely prevented, paying

heed to early warning systems and communication strategies can help in reducing the impact of the disasters. The preventive measures cannot be implemented without the coordination of the community and the government. The following Table (adapted from Coppola, 2015) shows the difference between response and recovery based efforts and prevention and risk reduction based efforts.

Response and Recovery-based Efforts	Prevention and Risk-reduction based Efforts
Primary focus on disaster events	Focus on vulnerability and risk areas
Single, event based scenarios	Dynamic, multiple risk issues and development scenarios
Basic responsibility to respond to an event	Fundamental need to assess, monitor and update exposure to changing conditions
Often fixed, location-specific conditions	Extended, changing, shared or regional, local variations
Responsibility in single authority or agency	Involves multiple authorities, interests, actors
Command and control, directed operations	Situation-specific functions, free and open association and participation
Established hierarchical relationships	Shifting, fluid, and tangential relationships
Often focused on hardware and equipment	Dependent on related practices, abilities, and knowledge base
Dependent on specialised expertise	Focused on aligning specialised expertise and public views and priorities
Urgent, immediate, and short time frames in outlook, planning, attention and returns	Moderate and long time-frames in outlook, planning, values and returns
Rapidly changing, dynamic information usage, which is often conflicting or sensitive in nature	Accumulated, historical, layered, updated or comparative use of information
Primary, authorised, or singular information sources, need for definitive facts	Open or public information, multiple, diverse, or changing sources, differing perspectives and points of view
In-out or vertical flows of information	Dispersed, lateral flows of information
Related to matters of public security, safety	Matters of public interest, investment and money

***Source*:** Terry, 2001.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss Disaster Management Cycle and its stages.

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2) Explain Disaster Prevention.

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3) Bring out the difference between response and recovery based efforts, as well as prevention and risk reduction based efforts.

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6.5 DISASTER PREPAREDNESS

Disaster preparedness is defined as "actions taken in advance of a disaster to ensure adequate response to its impacts, and the relief and recovery from its consequences – is performed to eliminate the need for any last-minute actions" (Coppola, 2015). United Nations' International Strategy for Disaster Reduction (UNISDR) has referred to preparedness as "the knowledge and capacities developed by governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions". Disaster preparedness, as per IFRC (2005), is a "continuous and integrated process involving a wide range of activities and resources from multi-sectoral sources". The United Nations Disaster Relief Office (UNDRO, 1982) defines disaster preparedness as "measures designed to organise and facilitate timely and effective rescue, relief, rehabilitation operations in case of disaster. Measures of preparedness include among others, setting up of disaster relief machinery, formulation of emergency relief plans, training of specific groups (and vulnerable communities) to undertake rescue and relief, stock piling supplies and earmarking funds for relief operations". Thus, preparedness includes formulation of emergency plans, development of warning system, and training of personnel to handle the emergency. It also includes planning of evacuation measures and preparation for rescue measures. Preparedness helps in minimising loss of life, disruption of critical services and damages on the occurrence of a disaster (Kanal, 2013).

Disaster preparedness is not an easy task and is a complex process. No one knows about the aftermath of the disasters. It needs prior planning, proper institutional settings and coordination among various stakeholders. In this process of preparedness, the role of community is very important. Preparedness has to be the core requirement for communities, if they have to survive the aftermath of different catastrophes. There is an urgent need to build the capacity and capability of the local communities by empowering them with coping capacities and increasing their self-confidence

through recognition and increasing their knowledge, practices and values so that this falls in line with the developmental activities. The role of community participation in disaster preparedness is discussed at length in Unit 13.

6.5.1 Key Components of Disaster Preparedness Framework

Disaster preparedness framework has to encompass various measures. Following are some of the key components of disaster preparedness:

- Strengthening of policy, technical and institutional capacities in regional, national and local disaster management, including those related to technology, training, as well as human and material resources.
- Promoting and supporting dialogue, exchange of information and coordination, with the aim of fostering a holistic approach towards disaster risk reduction.
- Strengthening and developing coordinated regional approaches, to prepare or review and periodically update disaster preparedness plans and policies at all levels, with a particular focus on the most vulnerable areas and groups.
- Promoting the establishment of emergency funds, wherever needed, to support preparedness measures.
- Developing specific mechanisms to engage the active participation and ownership of relevant stakeholders including the communities, with the spirit of volunteerism.

6.5.2 Types of Preparedness

The preparedness activities can be divided into three types, namely 1) Target-oriented Preparedness; 2) Task-oriented Preparedness; and 3) Disaster-oriented Preparedness, which are discussed as follows:

6.5.2.1 Target-oriented Preparedness

Preparedness plans are target specific and for instance, the focus is laid on making different types of planning for the vulnerable groups viz., women, children, elderly and disabled. It also focuses on animals. Livestock would need a specific preparedness plan. Apart from that there could be health preparedness plans, risk reduction preparedness plans and awareness generation plans, some of which have been discussed in the succeeding text.

- ***Livestock Preparedness Plan*** – this may include preparatory work on database that provides information with regard to hazards, community profile, livestock profile and animals at risk; Assessment of resources including veterinary personnel, drugs and equipment, mobile veterinary units, veterinary hospitals; and General awareness amongst the community, and volunteers about the livestock management aspects including their recovery, rehabilitation, and control of diseases.
- ***Composite, Long-term Disaster Health Preparedness Plan*** – a composite plan for mitigation of medical and health related problems arising out of any natural disaster should include community profile, Plan of Action, Resource Planning, Training Plan, Allied Planning, Periodical Practice, Evaluation of Plan and its consequent modification; collaboration and coordination with allied agencies and neighbourhood areas.

- ***Community Based Disaster Management (CBDM) Plan –*** The preparatory work for CBDM plans to safeguard lives, livelihood and property and in this context, involvement of community or people is integral to disaster preparedness. It contains Risk Assessment Vulnerability Analysis; Resource Analysis and Mobilisation; Warning System and its dissemination; Community Response Mechanisms; Construction and Maintenance of Shelters; Mock Drills; Strengthening of Community Self-help capacities; Formation of Disaster Management committees and teams; Making of Seasonal Calendars; and Creating Hazard, Vulnerability, Risk and Capacity Analysis, etc.

- ***Coordination Plan –*** It is pertinent that coordination between all the institutions/ agencies (Governmental and Non-Governmental) takes place systematically. Even though, coordination has to be established between the central, state and local levels, the majority of disaster information for the purpose of coordination is processed at the state level, depending on the intensity and scale of disaster event.

6.5.2.2 Task-oriented Preparedness

Task-oriented preparedness planning, focuses on carving out various tasks, which include the following:

- Mapping
- Planning
- Forming Disaster Task Forces
- Training of members of Task Force and other Volunteers
- Creating Structures for Coordination
- Promoting Awareness Campaigns
- Operationalising Disaster Management
- Recruiting Personnel for Relief and Distribution Tasks

6.5.2.3 Disaster-oriented Preparedness

Sometimes the disaster preparedness is oriented towards the particular type of disaster, for which the planning can be both structural and non-structural:

- ***Structural Preparedness Measures*** are proactive and reactive measures. These are used to arrest the adverse impact of disasters. These measures would vary from disaster to disaster.

- ***Non-structural Preparedness Measures*** include: Administrative and Regulatory Legislation; Insurance Schemes; Information, Education and Training; Community Participation, Community Action Groups; Responding to Warning Systems; Institution Building; Provision of Incentives; and Creations of Public Awareness (IGNOU-NDMA, 2012).

6.6 DISASTER MITIGATION

Disaster mitigation involves measures to reduce the effects of disaster causing phenomena. It includes all actions to reduce the impact of a disaster that can be taken prior to its occurrence including preparedness and long-term risk reduction measures. According to Coppola (2015), "The components of disaster management cycle, that is, preparedness, response and recovery are performed either in reaction

to hazards or in anticipation of their consequences and mitigation measures seek to reduce the likelihood or consequences of hazard risk before a disaster ever occurs". The DM Act, 2005, defines Mitigation as "measures aimed at reducing the risk, impact, or effects of a disaster or threatening disaster situation". Like preparedness and preventive measures, mitigation measures are also essential to deal with disaster. Thus, a sustainable development model towards disaster management has to focus on mitigation too.

6.6.1 Disaster Mitigation Approaches

The disaster mitigation can be divided into two approaches viz., Structural Approach and Non-structural Approach .

6.6.1.1 Structural Approach

Structural approach is divided into engineered structures and non-engineered structures. Engineered structure is about the structure that is constructed by architects and engineers. This approach involves various activities like planning and designing of bridges, dams, buildings, roads, etc. The building codes are available to construct various structures in disaster prone areas. Though engineered structures are expensive it helps in disaster resistance. On the other hand, non-engineered structure is something which is constructed by local people with the available local knowledge and skills. Mostly it is constructed by locally available masons, carpenters, etc. The materials which are used for this are mostly from locally available raw material. The cost of the construction is less expensive; however, it is not disaster resistant. The structural approach is also called as a "man-controlling nature".

6.6.1.2 Non-structural Approach

Non-structural approach of the disaster mitigation is human behaviour oriented, which does not focus on the engineered structures. It is called as a "man adapts nature". The following are the key components of Non-structural approach of mitigation, that is, Legislation, Insurance, Information, education and training, Community participation, Community action groups, Responding to warning systems, Institution building, Incentives and Public awareness.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Explain Disaster Preparedness and its key components.

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2) Discuss the various types of Disaster Preparedness.

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3) Examine Disaster Mitigation Approaches.

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6.7 CONCLUSION

Day by day, disasters are leading to huge economic losses and developmental setbacks to the country. Incorporating proper preventive, preparedness and mitigation strategies in the development planning will reduce the impact of the disaster, discussed in this Unit. Towards effective disaster management, it is pertinent that various measures as pointed in disaster management cycle in all three phases of disaster are incorporated at the international and national level to ensure effective disaster management.

6.8 GLOSSARY

Disaster Management Act, 2005 : The Disaster Management Act, 2005 was enacted from 23rd December 2005. This Act provides for the effective management of disasters and for matters connected there with or incidental thereto.

National Policy on Disaster Management, 2009 : National Policy on Disaster Management (NPDM) was approved by the then Union Cabinet on 22nd October, 2009 with the vision "To built 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.

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6.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - Disaster Management Cycle integrates various isolated activities, attempts and different actors.
   - Pre-disaster, During-disaster and Post-disaster.

2) Your answer should include the following points:
   - Prevention activities aim at totally avoiding the adverse impact of hazards and providing means to minimise environmental, technological and biological disasters.
   - Measures towards Disaster Prevention.

3) Your answer should include the following points:
   - Response and Recovery-based Efforts.
   - Prevention and Risk-reduction based Efforts.

Check Your Progress 2

1) Your answer should include the following points:

   - Preparedness includes formulation of emergency plans, development of warning system, and training of personnel to handle the emergency.
   - Key Components.

2) Your answer should include the following points:

   - Target-oriented Preparedness.
   - Task-oriented Preparedness.

3) Your answer should include the following points:

   - Structural Approach.
   - Non-structural Approach.

UNIT 7 DISASTER RELIEF AND RESPONSE*

Structure

7.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand the concepts of disaster relief and response;
- Examine disaster relief measures and methodologies;
- Assess response mechanism; and
- Understand the role of Government and Non-government bodies involved in the process of disaster response and relief.

7.1 INTRODUCTION

A disaster is an event that occurs, in most cases, suddenly and unexpectedly, causing severe disturbance to people and objects of environment, resulting in loss of life, property and health of the population. Such a situation causes disruption in the normal pattern of life, generating misfortune, helplessness and suffering and affecting the socio-economic structure of a region or country or continent to such an extent that there is a need for assistance or immediate external intervention from within the country or outside.

Disasters threaten sustainability of economy worldwide. In the past twenty years, earthquakes, landslides, floods, tropical storms, tsunamis and other calamities have killed around three million people, inflicted injury, disease, homelessness and misery on about one billion others, and caused damage worth billions of rupees. Developing countries, especially the most densely populated regions suffer the brunt of natural disasters. Between 1990 and 2015, more than 97 per cent of all natural disaster related deaths were in developing countries. The world's worst natural disasters have claimed many lives and have caused damage to property in millions. Poverty and unsystematic development amplify the adverse effects of natural disasters. Developing countries are particularly vulnerable because they have limited capacity of preventing and absorbing these effects.

* Contributed by Dr. Kamla Bora, Assistant Professor, Govt. P.G. College, Rudrapur, Uttarakhand.

Disasters destroy decades of human effort and investment, thereby forcing demand on society for reconstruction and rehabilitation. However, the impact of disasters in terms of loss of life and property, and damage to the environment can be minimised by appropriate mitigation and preparedness plans, commensurate with level of resources and technologies available. India is one of the most disaster prone countries in the world. A major disaster occurs in India almost in every 2-3 years and 50 million people are affected annually from these disasters. On an annual basis, around 1 million houses are damaged along with human, social, economic and other losses.

In the aftermath of a disaster, the immediate need is that of relief to be provided to the victims. This falls within broad parameters of response that gets into being after the disaster has caused enormous devastation. The response is ensured so that at the immediate instance some relief is made possible.

Relief work is about the bottom line of ensuring basic minimal necessities that relief must secure. Basic relief attempts to secure survival by ensuring that people have access to four things:

- Sufficient drinking water and sanitation
- Sufficient food
- Basic medical care; and
- Shelter from extreme weather conditions.

7.2 DISASTER RELIEF MEASURES AND METHODOLOGIES

Disaster relief is a systematic effort carried out through a number of actions. These are discussed here under.

Evacuation

In the event of the impending disaster the first step towards relief to be provided in the area concerned is through evacuation. It is carried out for the purpose of ensuring safety of people. Thus, it involves shifting of population from the risk areas of the concerned disaster to safer place, which could be a cyclone shelter, a concrete building, and higher altitude for a temporary shelter.

Evacuation is of different types namely:

- Preventive (done much before the disaster actually strikes);
- Protective (done as a precautionary measure to guard against spread of diseases or an impending disaster);
- Rescue-oriented (focusing on rescue operation whereby in the aftermath of disaster the inhabitants are to be moved to identified places in safe areas).

For evacuation to be effective, there is requirement of timely and accurate warning, clearly identified escape routes, arrangement for transportation, cooperation of the people of affected area and coordination amongst various stakeholders involved in the process. Evacuation could be of great relevance, if carried out effectively. It gets proved by the example of cyclone Phailin wherein large scale evacuation was carried out leading to a minimum death toll, though the region suffered damage,

worth million of dollars and affected the livelihood of 13 million in October, 2013 (World Bank, 2013).

Past experiences and lessons learnt from the past also play a substantive role in making evacuation a success. It gets proved from the view expressed by an official in Odisha, "zero causality became the war cry of the state government. We took cyclone 1999 as a benchmark to develop policies to reduce risk, and the reference to 1999 was used to persuade people to evacuate. We knew from 1999 that one of the main reasons the cyclone killed so many people was that few people evacuated. (Interview with high-level official in charge of district of Ganjam, Bhubaneswar, November 2014)" (Walch, 2018). Evacuation process comprises number of steps each leading to required action as shown in the Table 7.1 below:

Table 7.1: **Steps in Evacuation Process**

STEP	ACTION
Determine the need	Determine whether there is need for total or partial evacuation.
Identify a relocation area	Select an area that is free of hazards and easily accessible.
Communicate	Communicate to everyone involved about the need to evacuate and update them on the locations of shelters.
Pre-designate routes	Designate routes from the area to be evacuated to be the area of location. Consider alternatives.
Verify routes periodically	Make sure that the evacuation is proceeding smoothly, and that during evacuation, no bottlenecks are created along the evacuation route.
Report the evacuation	Be sure to inform governmental emergency management personnel about the evacuation to avoid unnecessary duplication of efforts and risks.

***Source*:** IGNOU-NDMA, 2012.

Search and Rescue (SAR)

Search and Rescue (commonly known as SAR) is of utmost importance in ensuring People's safety. The process needs to be carried out after the disasters strike an area. It is carried out by the locals, who are the first responders; NGOs; voluntary organisations and the emergency agencies. Search and Rescue operations are meant to save as many trapped people as possible. It aims at survival of the maximum number of affected persons. It is normally and preferably carried out with the help of people as they are familiar with the area concerned and also have the assessment of the trapped victims. Primarily Search and Rescue operations are undertaken by trained personnel who normally follow the following three key principles:

- LOOK: See physically the incidents and make a thorough visual perception.
- LISTEN: Listen to all sources of information from the community and government records etc. Assess the community data regarding people in danger.
- FEEL: Feel convinced regarding the facts, the gravity of the dangers involved and one's own capacity to respond (IGNOU-NDMA, 2012).

The Search and Rescue kits, ideally available in central location of vulnerable areas, contain required tools. A typical SAR kit comprises the following.

- Evacuation map of the building or area
- Hammer
- Screw driver (6" flat)
- Axe
- 24" Crow bar
- Spade
- Pickaxe
- 50-foot rope
- Torch
- Spare battery cells
- Hard shoes or Gum Boots
- Helmet
- Hand gloves
- Dust Mask

There are number of techniques and ways of rescuing affected individuals and carrying victims. These could be listed as:

i) One-Person Arm Carry

ii) One-Person Pack-Strap Carry

iii) Two-Person Lift

iv) Chair Carry

v) Blanket Carry

vi) Improvised Stretchers

vii) Drag

viii) Ropes, Knots and Techniques

ix) Double Sheet-Bend

x) Chair Knot

xi) Lashings (Tie something firmly to something else)

- Square Lashing
- Diagonal Lashing
- Figure of Eight Lashings
- Round Lashing

xii) Improvised Swimming and Floating Aids

- Raft
- Breast-Line (Life-Lines)
- Rules of Breast-Line-Throwing

Shelter

Disasters like, Earthquake, Landslide, Cyclone, Flood cause destruction and serious damage to buildings and infrastructure. Besides, in case of cyclones or floods, people are asked to move out of the dwelling units to earmarked shelters.

Shelter is also one of the relief measures as it provides place for people in the event of either impending disaster or in the post-disaster situation. Thus, it means interim housing to meet basic immediate needs of disaster victims. The prime purpose of a temporary or designated shelter is to safeguard peoples' lives from exposure and further suffering. Temporary shelters are either in the form of tents or specifically assembled structures made of variety of material including wood, plastic, tin, etc.

A 10 point guideline for temporary shelter provisions prepared in the aftermath of Kashmir Earthquake of 2005 by Ian Davis is as follows (IGNOU, 2006).

1) **Monitor what is going on**

Use this disaster to inform the coordination agencies about what goes on in this sector, at micro and macro levels, such as, who is deciding on shelter approaches; where is the expertise; what the popular wisdom on shelter is; what are the dilemmas and conflicts? etc.

2) **Tents**

The likelihood is that a wide variety of tents, with varied specifications will arrive, some very appropriate, while others are hopelessly unsuited for the climate or cultural conditions. Who adopts what specifications and, is there any quality control or standardised specification? If families tear their allocated tent to use the canvas in creative ways this can be highly effective, yet in some contexts, some 'tidy minded' officials have been known to ban this adaptive process.

3) **Standards**

Minimum standards of shelter provision are given under the Sphere Project, and are accepted around the world. These should be adhered to, and adapted where there is a need for modifications. The basic principles of the standards should be ensured in all temporary shelter programmes.

4) **Location of Tents**

Where possible, families should be allowed to take a tent and put it near their house rather than on a centralised campsite. Reasons for this are obvious; it would provide for better care of domestic animals in rural settings, protection of household belongings that may remain within their ruined dwellings and maintenance or recovery of livelihoods that may be linked to the home.

5) **Shelter Materials**

Probably, one of the best policies is to distribute shelter materials, such as blankets,

roofing, sheeting, plastic sheeting, lengths of planed timber, building tools, wire, rope, nails, etc. Where possible, these can be sold where people have money to avoid dependency, but where people do not have resources, they can be donated. If the materials for roofing, sheeting, etc., can come with expertise and the support of skilled volunteers to assist in building, this will enhance the process.

6) **Shelter for Families with Damaged Dwellings**

Aftershocks can bring down damaged, but standing houses. Therefore, such families need to be advised to sleep outside their homes in tents or improvised shelters even if they spend time in the day in their homes. The risks are very high when they are lying flat, sleeping and a damaged structure collapses. Rapid damage surveys need to check on this issue as a vital measure to avoid further losses of lives from aftershocks.

7) **Local Advice Centres**

Repairs begin immediately, regardless of whether or not the government seeks to stop the process until structural safety surveys have been undertaken. Small teams can be assembled, comprising volunteer engineers/ architects/ builders who can be assigned different areas to offer advice concerning shelters and repair and rebuilding options.

8) **Transition Housing**

An effective strategy is to seek to help families to create a transitional dwelling that will eventually develop into a permanent dwelling. This is a preferable approach to providing expensive rehabs that will later be replaced by another permanent home (In effect this a wasteful double reconstruction approach). The aim is to use the sheltering process to accomplish three things: provide shelter, strengthen local livelihoods and aid the psychosocial recovery process.

9) **Debris**

In many disaster situations there is often large-scale destruction of building debris during the clearing and recovery process. Vital timber and masonry debris is destroyed in the process. It is essential to collect useful building debris for recycling purposes.

10) **Shelter Units**

Each disaster will attract a community of intrepid inventors or commercial opportunists who seek to convince officials to place big orders for their novel creations made of cardboard, plastic, polyurethane, etc. Such designs are essentially innovative answers seeking a problem. They often cost far more than tents and shelter materials; they can be culturally and climatically inappropriate and can take ages to deliver. There are better alternatives available as noted above.

It is not only human beings but also livestock which get affected by disasters. In fact the causality among livestock is very high because at time of disaster, they are left tide to their stakes leaving no means of escape. Thus, there is need for provision of shelter for livestock as well with focuses on the following, availability of fodder; maintenance of hygiene; and assistance of veterinary staff.

Distribution of Food, Water and Fodder

Number of agencies, Government and Non-government, do take steps for the distribution of food, water, medicine and fodder, etc., to the victims after the disaster. However, the community needs to have its own stock of the said items

for the purpose of its consumption in between the time of disaster occurrence and arrival of the relief distribution teams at the affected places. Community is also to be prepared for assisting the relief distribution teams as they are working in the community interest. Nevertheless, the distribution teams should not take this act as that of charity or obligation and should ensure that the consumables are provided to as many as possible and in the shortest possible time.

Clearance of Debris

Debris of collapsed buildings, bridges and other structures, as well as uprooted trees, hoardings, etc., are the biggest hindrance to search, rescue and relief operations, as they lead to the disruption of communication service and transportation. As such, debris clearance is the first step towards re-establishment of transport and communication networks and setting up of a system to enable effective search, rescue and relief efforts.

Debris clearance in a post-disaster scenario is a complex task, not only due to high volumes and hampered accessibility, but because the nature of debris is also unique. It may comprise rubble from damaged buildings, bridges and other structures, uprooted trees, poles and hoardings, damaged vehicles, goods and even accumulated solid waste, which may be of biodegradable or non-biodegradable nature.

During debris clearance operations, care has to be taken so as not to cause further problems endangering lives or property. There is need to safeguard survivors trapped underneath debris and attention is also required not to tamper with any infrastructure and service networks in the process of debris clearance. Survivors can be first searched. Local community can help in carrying out this operation.

Movement of Injured to Hospitals

The Local People, NGOs, elected members of the Gram Panchayat, local officials need to help the rescue team to prioritise the victims who have sustained more injuries for their transportation to the nearby hospitals. The serious cases must be given precedence over the less serious ones and accordingly injured should be moved to the hospitals for proper treatment.

Disposal of Dead Humans

Quick disposal of dead bodies is very important for containing the spread of diseases due to their quick decay. Besides, decomposing human dead bodies on the site with fast spreading stench, present a very unpleasant environment for the rescue workers as well as surviving victims. This could have a telling effect on their mental health.

However, human dead bodies need to be disposed off with great care because sentimental values are attached to the dead and human dignity is to be respected even after death. As such, the means, process and the manner of their disposal are of great importance to their kith and kin. The first step in this regard has to be the identification of the dead bodies. This is also required for compliance with police formalities. Once the ethnic background of the victims has been identified, then the bodies should be suitably disposed in accordance with their religious and cultural practices.

Resources such as fuel need to be mobilised for cremation purposes. Whose ethnic background prescribes burial have to be buried accordingly. If the families of the dead are at hand and are willing to take charge of the bodies for individual

disposal, this may be done. In case where there are no claimants or where bodies cannot be recognised, they should be collectively disposed through mass burial or cremation. In certain cases, where formalities and legalities, such as post-mortem medical reports and filling up of forms are required, assistance is needed to be provided to the relatives of the dead for completion of these formalities.

Disposal of Dead Animals

In most natural disasters, particularly in rural areas, the number of animal deaths are very high in residential areas, due to the fact that most domesticated animals are kept tied up, and in event of a disaster while the people flee urgently, the animals are left tied up; they have no chance of voluntary escape and thus, often perish.

Disposal of dead animals is as important as that of humans because decaying dead bodies can be a potential health and environment threat. Still, this aspect is usually accorded lower priority, more so in case of stray animals. The rescuers are not willing to handle animals' carcasses. Yet, this must be done expeditiously by local volunteers till the authorities take charge and get the carcasses disposed off. Disposal is best done by burial, at some place outside the habitated area. Till such times, nobody should be allowed to hold on to the dead bodies for extraction of hides or bones or any other recoverable material, because the risk of disease and infection is very high, and quickest disposal of the dead bodies is desirable.

Sympathetic Attitude towards Victims

When people suffer from disaster, they undergo certain psychological problems. The psychological stress is seen in the form of:

i) Shock

ii) Anger

iii) Fear

iv) Helplessness

v) Anxiety

vi) Depression

vii) Sadness

There is a need for proper psychological support to the victims. Listening to distressed persons and offering empathy and understanding enable them not to feel alone and come to terms with the reality. However, it is required of the supporting persons to be objective and non-judgemental and refrain from giving advice or commenting on their emotions. None else than the local people are more suitable for this task as they already know about the victim, the family, the socio-economic conditions of the family, etc.

Assisting Rescue Teams

Once the disaster strikes and the news reach the Government and NGOs concerned, these organisations gear up to rescue the victims. Large number of rescue teams attempts to reach the disaster site. It becomes imperative for the community to provide all kinds of physical assistance by way of information and help to the rescue teams so that they can efficiently and effectively perform the tasks undertaken by them.

Property Security

In the event of disaster like cyclone and floods, people are supposed to move to the safer places like cyclone shelters, concrete shelters, etc. It is being observed that many people refuse to leave their dwelling units for fear of thefts and misplacement of their belongings. The locals with the help of the elected members of the local body, local officials, etc., must ensure safety of property of the people who have moved to the safer structures. This will not only save the assets but will also help in managing the migrants to the safer structures to keep cool and have balance of mind as they will not be worried for their belongings and property.

Information Dissemination and Checking of Rumours

The area, which has been struck by the disaster, has people whose relatives may be staying at far of places. Furthermore, there is a need for exact information to be passed on to the block and district authorities about the severity of disaster, likelihood of the damage, loss of human lives, loss of livestock, number of injured human beings and livestock so that proper rescue operation could be planned and carried out. Community could play a vital role in checking the spread of rumours as this proves to be counterproductive and may stall the relief and response measures initiated by the response teams.

Immediate Damage Assessment

Damage assessment is a pre-requisite of all disaster management practices. Rapid damage assessment is required for emergency relief measures. This would lead to the amount of medical relief and food stocks to reach the disaster area. Rapid damage assessment needs to include area affected in Sq. Kms.; number of people affected in the village, number of households partially and fully damaged, number of injured persons and livestock, etc.

Filing of Claims

The process of filling the claims must start as early as possible. The local officials, NGOs, community could assist the affected people to file the claims.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) What do you understand by disaster relief and response?

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2) List out the major steps initiated under disaster relief.

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7.3 RESPONSE MECHANISM

The National Emergency Operations Centre (NEOC) acts as the communication and coordination hub during this phase and it maintains constant touch with early warning agencies for updated inputs. It informs State Emergency Operations Centre (SEOC) and District Emergency Operations Centre (DEOC) through all available communication channels and mechanisms. The Disaster Management Division (DM Division) of the Ministry of Home Affairs (MHA) communicates and coordinates with designated early warning agencies, various nodal Ministries, and State Governments. It mobilises reinforcements from the National Disaster Response Force (NDRF), Armed Forces and the Central Armed Police Forces (CAPFs) and puts together transportation plans for moving resources. The National Disaster Management Authority (NDMA) supports the overall coordination of response as per needs of MHA. The NDMA provides general guidance, and takes decisions for the deployment of the NDRF. The NDRF is deployed as required depending on the request from State Government. They keep the force in operational readiness at all times.

At the national level, the Central Government has assigned nodal responsibilities to specific Ministries for coordinating disaster-specific responses. The National Executive Committee (NEC) coordinates response in the event of any threatening disaster situation or disaster. The State Government activates the Incident Response Teams (IRTs) at State, District, or block level and ensures coordination with the State Emergency Operation Centers (SEOC). The State Disaster Management Authority (SDMA) provides the technical support needed to strengthen the response system. It is essential that the first responders and relief reach the affected areas in the shortest possible time. Often, there are inordinate delays due to real constraints imposed by the location, nature of disaster and, most regrettably, due to inadequate preparedness. In many situations, even a delay of six to twelve hours proves to be too late or unacceptable. To make matters worse, relief tends to arrive in a highly fragmented or uncoordinated form with multiple organisations acting independently of each other without a cohesive plan, without mechanisms to avoid overlaps and without proper prioritisation of different aspects of relief such as shelter, clothing, food, or medicine. From an operational perspective, the challenges are similar across most hazards. The NDMA has formulated Incident Response System (IRS) Guidelines for the effective, efficient, and comprehensive management of disasters. The implementation of NDMA's IRS Guidelines by the States will help National Disaster Management Authority in standardisation of operations; bring clarity to the roles of various departments and other agencies, which are common to most disaster response situations. Disaster Ministries at the National level are assigned with the role of coordinating response for different disasters. The Table 7.2 below points out the designated ministries' role.

Table 7.2: Central Ministries for Coordination of Response at National Level

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

***Source*:** Government of India, 2016.

"The state and district administration identify sites for establishment of various facilities as mentioned in the IRS guidelines such as Incident Command Post, camp, base, staging area, camp, and helipad, for providing various services during the response. The state and local administration must widely disseminate and publicise information about these arrangements as mandated in the State Disaster Management Plan (SDMP) and District Disaster Management Plan (DDMP). Since disaster response operations are multifaceted, time sensitive, extremely fast-moving, and mostly unpredictable, it requires rapid assessment, close coordination among several departments, quick decision-making, fast deployment of human resources and machinery as well as close monitoring. In order to prevent delays and to eliminate ambiguities with regard to chain of command, the SDMP and DDMP must clearly spell out the response organisation as per IRS. These plans must clearly identify the personnel to be deputed for various responsibilities in the IRT at various levels of administration along with proper responsibility and accountability framework. Provision for implementation of unified command in case of involvement of multiple agencies such as Army, NDRF, CAPF, and International Urban Teams Search and Rescue must be spelt out in the SDMP. From time to time, the DM plan must be tested and rehearsed by carrying out mock exercises" (Adopted from NDMP, Government of India, 2016).

Catastrophic disasters like earthquakes, floods, cyclones and tsunami result in a large number of casualties and inflict tremendous damage on property and infrastructure. The Government of India has established a flexible response mechanism

for a prompt and effective delivery of essential services as well as resources to assist a State Government or Union Territory severely hit by a disaster. Disaster management is considered as the responsibility of the State Governments, and hence the primary responsibility for undertaking rescue, relief and rehabilitation measures during a disaster lies with the State Governments. The Central Government supplements their efforts through logistic and financial support during severe disasters as requested by the State Governments. Responding to such emergencies stretches the resources of district and State administration to the utmost and they may require and seek the assistance of Central Ministries/ Departments and agencies like the NDRF, Armed Forces, CAPF, and Specialised Ministries/ Agencies.

At times, the impact of disasters occurring in one state may spread over to the areas of other states. Similarly, preventive measures in respect of certain disasters, such as floods, etc. may be required to be taken in one state, as the impact of their occurrence may affect another. The administrative hierarchy of the Country is organised in to National, State and District level administration. This presents challenges in respect of disasters impacting more than one state. Management of such situations calls for a coordinated approach, which can respond to a range of issues quite different from those that normally present themselves – before, during and after the event. The National Crisis Management Committee (NCMC) plays a major role in handing such multi-state disasters. The NDMA will encourage identification of such situations and promote the establishment of mechanisms for coordinated strategies for dealing with them by the states and Central Ministries, departments and other relevant agencies.

While there are disaster-specific aspects to the post-disaster response, the emergency functions are broadly common to all disasters and there are specific ministries, departments, or agencies that can provide that emergency response. Besides, very often, there are multiple hazards and secondary disasters that follow a major disaster. Hence, response intrinsically follows a multi-hazard approach. Therefore, all the response activities have been summarised in a single matrix applicable to all types of disasters. The response responsibility matrix specifies the major theme of response. All agencies responsible for response should follow the NDMA's IRS guidelines, which will help in ensuring proper accountability and division of responsibilities. Different ministries and departments have to provide specialised emergency support to the response effort. Certain agencies of Central Government will play a lead role, while others will be in a supporting role. The SDMA, Commissioner of Relief (CoR), or the Dept. of Revenue is the nodal agency at the state level for coordination of response. The DDMA is the nodal agency for coordination of response at District level. Various central ministries, departments, agencies, and state governments have to prepare their own hazard specific response plans as per guidelines of the NDMA and in line with the NDMP. They need to ensure preparedness for response at all times and must carry out regular mock drills and conduct tests of readiness periodically, and the ministries/ departments must report the status to the NDMA (Government of India, 2016). The major tasks of response given in the responsibility matrix are:

1) Early Warning, Maps, Satellite inputs, Information Dissemination
2) Evacuation of People and Animals
3) Search and Rescue of People and Animals
4) Medical care

5) Drinking Water / Dewatering Pumps / Sanitation Facilities / Public Health
6) Food and Essential Supplies
7) Communication
8) Housing and Temporary Shelters
9) Power
10) Fuel
11) Transportation
12) Relief Logistics and Supply Chain Management
13) Disposal of animal carcasses
14) Fodder for livestock in scarcity-hit areas
15) Rehabilitation and Ensuring Safety of Livestock and other Animals, Veterinary Care
16) Data Collection and Management
17) Relief Employment
18) Media Relations

Planning and building capacity for responding to disasters has shown many positive effects. This begins with ensuring strong and standardised data collection capabilities at local and regional levels – in order to have access to up-to-date and accurate information during emergencies, to deploy aid efforts and assess losses. In addition, it is essential to assess risk levels and vulnerabilities of regions and populations towards a disaster as well as its aftermath.

These activities require continued and formalised local and community participation, and rely on non-government organisations and citizen groups to support government and defense organisations.

Emergency planning and preparedness also involves community-level preparedness – for which local, government, defence and private organisations must be provided training and resources. This can range from general safety procedures, guidelines for DOs and DON'Ts, chain of communication, guidelines on controlling emergency scenes, and evacuation and response drills.

With the involvement of multiple groups and at multiple levels of authority and expertise, it is also essential to establish a management mechanism to ensure all efforts and make it sure that communications are streamlined, and disaster assessments (in terms of damage occurred or medical assistance required) are accurate and timely. In the absence of such a mechanism, an emergency site can be overcome by chaos and confusion, further adding to risk and damage to life and property, causing wastage of relief materials and resources, and causing delays in response efforts.

It is thus, extremely critical to enable coordination among all parties involved at various levels of disaster relief and assign clearly defined and documented roles and responsibilities as well as reporting structures.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the institutional structure for disaster response in India.

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2) What is the role of Emergency Operation Centre in disaster response?

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7.4 CONCLUSION

In the post-disaster phase, the foremost relief operations which are undertaken are search and rescue. The untraced disaster victims are searched and rescued with the help of local communities. In accordance with Disaster Management Act, 2005, NDRF has been setup by the Government of India to ensure specialised response during disaster incidences. There is detailed discussion on various measures and methods of relief and response in the Unit. The disaster response is the actual implementation of the disaster plan. Disaster response is the organisation of activities used to respond to the events in post-disaster situation. The response phase includes the mobilisation of the necessary emergency services and first responders in the disaster areas. The mechanism of response is the activation of different components of response in accordance with the standardised emergency management procedures and protocols.

7.5 GLOSSARY

Search and Rescue (SAR) : Search and Rescue or SAR, as it is called, is a technical activity rendered by a group of specially trained personnel, who rescue and attend to the causalities under adverse conditions, where life is under threat. Search and Rescue is organised in close cooperation with the community with a team orientation. It is a procedure carried out immediately after a disaster to look for survivors and dead ones.

Emergency Operations Centre (EOC) : EOC is an off-site facility, which will be functioning from the State/District head quarters, and which is actually an augmented control room having communication facilities and space to accommodate the various officers.

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7.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- Disaster relief is the financial aid or services made available to individuals and communities that have experienced losses due to disasters such as floods, hurricanes, earthquakes, drought, tornadoes, and sociological terms as a major disruption of the social patterns of individuals and groups.
- It is about the "bottom line" of ensuring basic minimal necessities to keep people alive.
- Disaster response is the organised activities which are used to respond to the post disaster.

2) Your answer should include the following points:

- Search and Rescue.
- Evacuation.
- Distribution of Food and Water.

Check Your Progress 2

1) Your answer should include the following:

- National Disaster Response Force and State Disaster Response Force
- Armed Forces and Para Military Forces.
- Nodal Ministries/Departments.

2) Your answer should include the following:

- EOC is an off-site facility, which will be functioning from the State/District head quarters, and which is actually an augmented control room having communication facilities and space to accommodate the various officers.

UNIT 8 DAMAGE ASSESSMENT*

Structure

8.0 OBJECTIVES

After reading this Unit, you should be able to understand:

- Major elements of Damage Assessment;
- Various Dimensions of Damage Assessment; and
- Framework and methods of Damage Assessment.

8.1 INTRODUCTION

Damage assessment is an important tool for retrospective and prospective analysis of disasters to assimilate the extent of impact of a disaster. This forms the basis for future disaster preparedness and preventive planning. It is essential in determining: What happened? What the effects were? Which areas were hardest hit? What situations must be given priority and what types of assistance are needed, for example, Local, State, or Union? Emergency response could be more effective; equipment and personnel could be better used; and help could be provided quicker, if a thorough damage assessment is performed beforehand. The basic objectives of damage assessment could be summarised as follows:

- To make a rapid assessment of areas affected to know the extent of impact for purpose of immediate rescue and relief operations;

* Contributed by Dr. Kamla Bora, Assistant Professor, Govt. P.G. College, Rudrapur, Uttarakhand.

- To prepare estimates for the amount of relief to be provided and the mode of relief, be it food, clothing, medicines, shelter or other essential commodities;
- To make a detailed assessment regarding requirements for long-term relief and rehabilitation planning; and
- To identify focus areas for the purpose of 'retrofitting' actions in similar future situations.

Damage assessment is, therefore, a prerequisite for effective disaster response effort. For effective decisions, officials responsible for organising post-disaster relief operations should be properly informed of the damage/possible damage should the event repeat itself sometime in the future, so that they can know the needs, current, as well as prospective, in precise terms. They must have appropriate and timely information about: what happened, what needs to be done, and what resources are available? Their decisions can save lives; minimise injury, damage and loss; prevent any further escalation; prevent secondary hazards; and inform people who need to know. Well-organised response will also help in building confidence and enhancing the credibility of the administration. Relief operations are essentially about the management of information and resources, which is based on assessments and reports carried out from time to time. Information is needed at all levels of administration, but the nature of the information required varies from one level to another. In sum, disaster damage assessment is a vital tool to assimilate the extent of impact of a disaster, both short-term and long-term, and forms the basis for any disaster management and mitigation process and action plan. In the phase of recovery, the first step is damage assessment.

Damage assessment is to make an initial and preliminary onsite evaluation of damage or loss that has been caused by an accident or disaster. Through damage assessment exercise an attempt is made to put on record the amount and degree of damage and also to point out what can be replaced, restored or salvaged. Such an exercise brings to fore the likely required time for repair, replacement and recovery. Thus, damage assessment "is an integral part of facilitating effective and efficient response by government agencies and other organizations" (ODPM).

8.2 ELEMENTS OF DAMAGE ASSESSMENT

The following are the very important elements of damage assessment:

1) Identification of type of information needed and sources of data collection.
2) Data collection through primary and secondary sources.
3) Analysis of data.
4) Data interpretation.
5) Report writing
6) Drawing conclusion
7) Making Forecasts
8) Recommendation and measures suggested for decision makers, planners, implementers, community groups, NGOs, etc.

Definitely a detailed damage assessment needs to include much more, such as, verification of number of losses of human life and injured persons, losses of cattle lives, agricultural damage in hectares, building damage, losses of public works, business, utilities, total financial loss, etc.

Basic data generated from the flow is bottom up:

- Impact, which a hazard has had on the affected area;
- Needs and priorities for immediate emergency measures to save and sustain lives of survivors;
- Resources available for use;
- Possibilities for facilitating and expediting longer-term recovery and development;
- Directory information: Various line departments contact details;
- Habitation (Village/hamlet/ward) details;
- Village wise different types of disasters along with degree of risk (Vulnerability details);
- Historical records of past events with damage details and details of relief expenditure;
- Census data sets- Agriculture and population census, building and various structure details.

8.3 DIMENSIONS OF DAMAGE ASSESSMENT

Damage assessment is also a multi-disciplinary exercise involving officials from a cross section of experts and administrators from revenue, health, engineering, public works, social scientists, non-profit organisations, community, etc., to get a comprehensive account of losses for adequate future mitigation planning. Some of the data required are already available in the form of baseline data (maps, population statistics, etc.). However, it must be supplemented by real time information regarding the extent/nature of ongoing damage during a disaster event, from the damage site (through information report from various sources) as pre-disaster estimates, however accurate, may not provide sufficient information.

Information to be primarily compiled can be broadly segregated in the following categories:

1) Nature of the disaster, that is, the date, time, exact location;
2) Details of the occurrence of the disaster;
3) Regular reports regarding progress of damage assessment work;
4) Expected date and time of restoration or completion of a particular activity or mission.

Damage assessment is done through data collection and information assimilation and dissemination. It is useful to distinguish between the terms “data” and “information”, as data are simply units of information including perceptions, numbers, observations, facts or figures. Data sometimes conflict with one another, for example, when two individuals report widely differing perceptions of the same event. Information, on the other hand, is “useful data”. Data could become information when it can be translated into meaningful, relevant and understandable language, especially particular people at a particular time and place, for a particular purpose (IGNOU-NDMA, 2012).

Data collection, which is an on-going activity, depends on:

- Expertise and advice of survey specialists;
- Use of sample surveys;
- Cultural attitudes; and
- Personal preferences.

Concerned Department and Support Group

Administration and nodal department concerned are to collect all the available disaster related information and compile it at the earliest, through the concerned officials of the department. Support group coordination is a very important part of damage assessment. They provide a forum with which those affected can share their experiences. The group is both a source of information and a means of communication. Support groups can exploit the intense media interest in disaster by campaigning for public injuries by lobbying for better levels of compensation and safety change. The concerned Minister/Secretary, Department of Disaster Management and District Magistrate are only competent persons to interact with press and electronic media. These persons should ensure that only factually correct and confirmed information is shared with media. At the same time, no exaggerated version of any event or any criticism or one's personal opinion or views about the occurrence of disaster at any point of time should be made public.

Damage assessment is required at two basic levels of intervention. Firstly, it is required for emergency relief measures in which quick assessment of damage is the basis for the amount of relief material and food stocks that reach the disaster area. This type of an assessment is called Rapid Damage Assessment. The second level would be a detailed technical analysis of damage for long-term restoration and rehabilitation works. From a long-term perspective, damage assessment scrutinises the mechanisms of failure that took place during the disaster. It is called Detailed Damage Assessment. These studies are very useful for all prevention and mitigation efforts for disasters in the future.

Rapid Damage Assessment

The official agency for reporting estimates of damage is usually the Revenue and Relief Department of the State Government, as they are also the authority for distributing relief to affected persons. As usual, there is a hierarchy of officials who report from the lowest level of Villages/*Panchayats* through Blocks/Revenue Circles, *Tehsils/ Talukas*, and Sub-divisions and finally to the districts and then to the State headquarters. However, relief agencies including NGOs also have their own damage assessment systems and teams to carry out the assessments. The basic items covered in rapid assessment are:

- Name of the place
- The causative factors
- Date and time of disaster occurence
- Area affected
- Total number of villages or neighborhoods affected
- Total population

The estimate of a disaster's effects can be characterised as a scenario of possible losses and needs. Estimates can then be created that anticipate the resources that are required to respond to the loss. The estimates include commodities of food, medicines, manpower, and machinery and money requirements for getting relief to the potential victims.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) What do you mean by damage assessment?

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2) Discuss elements of damage assessment?

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8.4 FRAMEWORK AND METHODS

The framework for damage assessment can be broadly divided in two parts:

1) Initial Situation overview

2) Needs Analysis

The first part is meant to bring to attention the amount of damage done by the disaster in the area concerned. Normally, it is a time bound activity and required to be put forth in the first 8 hours of the happening of the event. The major focus is on issues like casualties, displacement of the population and damage to lifelines and critical facilities. It is mostly through the observations of the key organisations and officials. "The ISO (Initial Situation Overview) often involves observation from an aircraft, sometime satellite photographs, and various other reports. The information from the ISO allows national/local officials to determine immediate action necessary to respond to the effects of the hazard" (ODPM).

The second part tries to articulate level and type of assistance required for the affected population. The damage assessment covers the nature and extent of a disaster, priority need of the affected community, particularly the vulnerable people. It must provide the extent and type of damage and identify secondary threats,

resource availability and the capacity of local response. Finally, the assessment process should make actions, interventions and resources needed to formulate long term rehabilitation or development strategies.

The post-disaster assessment completely highlights the damage and its impact on various aspects of life. Damage assessment plan for various critical sectors are as follows:

8.4.1 Assessing Loss and Damage to Human Life

The loss of human lives affects many other aspects for the lives of survivors which are critical for a dignified living. The first information regarding this loss is to determine the baseline data related to the number of families residing in the affected area where the damage assessment is being undertaken.

For such assessment, it is useful to have data regarding-deaths, permanent disabilities, major injuries, minor injuries and missing people. Data should be segregated on the bases of gender, age or occupations, to develop deeper understanding. Details of occupation also provide a hint of economic status of families and enable to determine number of earning members and dependents within the family.

It is important to pay attention to certain special groups of people who tend to get left out in the enumeration process. Migrant workers, tourists, and travelers or unregistered informal sectors workers may be difficult to be estimated because of the lack of such record. All this information helps in effective targeting of the humanitarian response.

It is essential to have an assessment methodology that uses the community information and is credible for the humanitarian response planners. Collecting information from secondary sources is also important. Loss of life is estimated by community institutions, media and the government and many a time they come up with different figures. It is important that the damage assessment report mentions all the figures published under different reports.

8.4.2 Assessing Damage to Housing

The catastrophic event can cause varying degrees of damage to houses depending on various factors. The quality of construction, materials used, construction technology, type of dwelling, location, etc., contribute to the vulnerability of built structures and affect the extent of damage.

The geographic location of the settlement is the first information needed, including information regarding proximity to natural features such as lakes, rivers or sea. The assessment should further elaborate, in terms of urban or rural, size, typology on the basis of design and structural system, types of ownership and functional usage, etc.

First thing that must be done in the affected area is a transect walk. Transect walk through the disaster struck village and its varied locations and habitations is very useful for the purpose of reconnaissance and gives an overview of the extent and type of damage. Following are parts of good assessment for housing damage:

i) Area transect;

ii) Habitat mapping (information such as house type, damage category, vulnerable category);

iii) Photographic documentation;

iv) Household level survey.

8.4.3 Assessing Damage to Community Infrastructure

Infrastructure damage includes not only damage to basic services (like drinking water, roads, electricity, etc.), but also to public buildings essential for providing education, health care or those serving other social functions. For the assessment of damage to infrastructure after a disaster, it is must for a good assessment to have following components:

i) Infrastructure mapping: It gives an overview of the services and infrastructure available in the area. These are shown on maps prepared by community members. This helps in determining the geographic extent of damage and the affected stakeholders;

ii) Area level survey: It is conducted for each public building, basic services and community owned infrastructure to understand the extent of damage. Steps needed for changes should also be included;

iii) Photographic documentation: The decision making regarding infrastructure may take a long time and may be done at a distant site: photographic documentation, therefore, helps in making the correct decision about repair or replacement.

8.4.4 Assessing Damage to Environment

It is essential to understand and assess the impact of natural disasters on environment as the state of environment has an important effect on the quality of life of the people living. The loss of many environmental resources like soil, trees, etc., can be assessed directly. However, some damages are indirect, particularly those to the environmental services such as reduction of pollution, carbon sequestration, provision of wild life habitat, etc.

In post-disaster situation, following changes need to be looked into as they may affect the goods (food, fodder, water, timber and other non-timber products) and services (oxygen emission, pollinators, etc.) provided by the ecosystem:

i) Unique/unusual land form changes;

ii) Changes in natural drainage;

iii) Soil degradation;

iv) Destruction of trees;

v) Water contamination;

vi) Loss of plants and animals or their natural habitat.

The methods used for environmental damage assessment are:

i) Resource mapping: It shows various elements of the ecosystem in which the settlement exists like types of plantation, forest, natural water resources etc.

ii) Area transect

8.4.5 Assessing Loss of Livelihood

Disasters have significant impact on the socio-economic well being of the community. Different occupations experience varying extents of vulnerability to different disasters.

For example, farmers may be more affected in droughts, fisher-folk in tsunamis, industrial workforce and artisans in earthquake, etc.

Loss of economic assets, employment; reduction in income, critical consumption of food and expenditure on education and health care need to be assessed to understand the impact of the disasters. The assessment of economic loss of disaster is important for future planning.

Economic losses can be divided into two categories:

i) Direct damages

ii) Indirect damages

Direct damage assessment includes losses in agriculture, fisheries, local trade and production of goods. Indirect damage assessment includes losses in terms of likely production, future employment, income etc due to direct damage caused by the disaster.

8.4.6 Assessing Impact on Health

The impact assessment on health may be required as part of the overall assessment to identify the possible fallouts of the disaster. Because of disaster's negative impacts on health, health risks, due to worsening living conditions, are aggravated after disaster. Therefore, it is necessary to observe the victims, particularly the families with infants, pregnant/lactating mothers, old aged, disabled, chronically ill, HIV positive members, etc. Health hazards may arise due to site conditions such as water stagnation, mosquito breeding, high population density, etc. The assessment on water, lack of safe sanitation, light and ventilation in shelters, nutrition and food is important. Another important aspect that needs assessment for humanitarian response planners is the extent of the healthcare services required.

Surveillance reveals the type, magnitude, pattern and trends of health problems through periodic and systematic collection of health related data. Mobility map for health services are of great importance because they indicate the distance, frequency of availability and the types of services available. This can also help in identifying vector breeding sites and developing control mechanisms.

8.4.7 Assessing the Psycho-social Impact of Disasters

Disaster affects not only physical and material life of the community, but also affects them psychologically. It is reflected in their emotional reactions and increase in incidents like, anger, irritability, panic attacks, sleeplessness, withdrawal from activities, increased anxiety, nightmares in children, etc. These are some of the universal responses amongst people who experience events beyond their coping capacities. The other important aspect relates to need for psycho-social care for all disaster affected people. For understanding the psycho-social trauma that one may be experiencing, observation and listening is the most essential methodology to understand the type of trauma and its extent. Psychologically it is only through informal community discussion, meeting and personal contact with the households that one can observe these symptoms. Severe traumatic conditions can be identified through the above processes and detailed case cards may have to be prepared. A case card is like a case history and it is important to record the symptoms, personal and family background associated with such reactions. This helps in engaging psycho-social experts.

8.4.8 Assessing the Impact of Disasters on Women

A clear gender framework helps in capturing the important aspects of vulnerabilities in the damage assessment. Therefore, assessment for women groups is of wider significance because gender analysis is useful to understand activities and extent of their role in decision making regarding various aspects that govern daily life and may have been affected in the disaster. Thus, these are all concepts of vulnerability reduction, social inclusion, community participation and gender perspective forming the very important process of damage assessment.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Explain the framework of damage assessment.

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2) Write a note on Environment Damage Assessment.

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3) List out the impact of damage assessment in the area of health and women.

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8.5 CONCLUSION

Damage assessment is an important aspect in the field of disaster management. In this Unit, we have covered various elements, assessments, frameworks and methods of damage assessment. Increasing the efficiency, effectiveness of post-disaster damage assessment will lead to effective rehabilitation, reconstruction and recovery and also bring backs the resilience of the society. Some of the major elements of damage assessment are identification of types of information needed and sources of data collection as level of primary and secondary sources, data analysis and interpretation then report writing and forecasting, recommendation and measures suggested for decision makers, planners and community group.

8.6 GLOSSARY

Rapid Damage Assessment (RDA) : Rapid Damage Assessment (RDA) emphasizes on a rapid appraisal of the situation and extent of damage to provide resources for effective relief and resource. RDA is to be conducted by the planning section of the Incident Response Team (IRT), responsible for response management. The planning section of the IRT may require support of the local community.

Detailed Damage Assessment (DDA) : Detailed Damage Assessment is supposed to be done at the district level during the recovery stage involving skilled personnel from various line departments. The aim of this assessment is to estimate the economical and financial aspects of damage, the detailed building damage, agricultural damage, and property damage. It also aims at retrofitting or strengthening of houses, roads, bridges, hospitals, school, warehouses, railway tracks and other infrastructure.

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8.8 ANSWER TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- Damage assessment is an important process to assimilate the extent of impact of a disaster both short term and long term and forms the basis for any disaster management and mitigation process and action plan.
- Damage assessment is essential for effective rehabilitation and reconstruction.

2) Your answer should include the following points:

- Identification of type of information needed and sources of data collection; data collection through primary and secondary sources; analysis of data.; data interpretation; report writing; drawing conclusion; making Forecasts; recommendation and measures suggested for decision makers, planners, implementers, community groups, NGOs etc.

Check Your Progress 2

1) Your answer should include the following points:

- The framework can be divided into two types, that is, Initial situation overview and Needs analysis.
- Initial situation overview is carried out to obtain a broad picture of the extent of damage caused by disaster.
- Needs analysis is tries to articulate level and type of assistance required for the affected population.

2) Your answer should include the following points:

- Unique/unusual land form changes; changes in natural drainage; soil degradation; destruction of trees; water contamination and loss of plants and animals or their natural habitat.
- Resource mapping and Area transect are the methods of environment damage assessment.

3) Your answer should include the following points:

- It is very necessary to observe the situation during disaster particularly the families with infants, pregnant women, old aged, disabled, chronically ill, HIV positive members etc. Health hazards may arise due to site conditions such as water stagnation, mosquito breeding, high population density etc.
- The assessment of water, lack of safe sanitation, light and ventilation in shelters, nutrition and food is important. Other very important aspect that needs assessment for humanitarian response planners is the extent of the health care services required.
- Gender framework helps in capturing the important aspects of vulnerabilities in the damage assessment.

UNIT 9 REHABILITATION, RECONSTRUCTION AND RECOVERY*

Structure

9.0 OBJECTIVES

After reading this Unit, you should be able to:

- Discuss the scope of rehabilitation;
- Explain the need of rehabilitation;
- Understand the scope of reconstruction;
- Explain the requirements of reconstruction and its significance; and
- Describe the relevance of recovery.

9.1 INTRODUCTION

Rehabilitation, reconstruction and recovery are three essential facets in post-disaster phase. These are in direct consonance with the nature of the disaster, location of disaster, proportion of damage, direct and indirect losses, availability of human resource with local capacities, available material resources along with institutional capacities. For example, when an earthquake occurs, it leads to damage of infrastructure and buildings, therefore, the planning for rehabilitation and reconstruction

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should be related to buildings and infrastructure. In the previous Unit, we have learnt about damage assessment and in this Unit, we will discuss rehabilitation, its types; reconstruction, requirements of reconstruction; and relevance of recovery as well as problems in recovery.

9.2 REHABILITATION

Rehabilitation means to take necessary actions after the disaster to resume the basic services, help the victim, to compensate the physical damage done to the surroundings and to start again economic actions to provide psychological support, social security and comfort to the victim. It functions to capacitate the affected people to restart regular functions of life. It may be considered as a dovetailing between present time relief and long-term development. Thus, the main aim of rehabilitation is to revive the victim to the normal life. Rehabilitation is classified as:

- Physical Rehabilitation
- Social Rehabilitation
- Economic Rehabilitation
- Psychological Rehabilitation

9.2.1 Physical Rehabilitation

Physical rehabilitation is an important component of rehabilitation. In this step, the focus is on the reconstruction of physical amenities such as houses, buildings, railways, roads, water supply, communication network, electricity, etc. It also includes strategies towards environment protection, employment generation, job creation, watershed management, alternative cropping techniques, canal irrigation. Rehabilitation of animal husbandry, agriculture, farm implements, flood plain zoning, land-use planning, retrofitting of undamaged houses are some other related activities of physical rehabilitation.

9.2.2 Social Rehabilitation

Social rehabilitation has its own significance. It aims at providing social support to sufferers. It could be through:

- Establishing educational committees that provide regular counselling to sufferers.
- Finding persons who could conduct educational activities and provide books and writing material to children.
- Running various programmes related to physical and mental health, stress management, nutrition and hygiene etc.
- Providing day care and old age homes to the sufferers for a limited time period.
- Setting up multi-purpose community centre and promote self help group.
- Finding native surroundings to sufferers like old age persons, women & children.

9.2.3 Economic Rehabilitation

It plays an important role to compensate the economic loss occurred due to the disaster, it involves providing compensation to the victim based on:

- Broad investigation of actual and future hazard and compulsion of troubled group; and
- Investigation of current livelihood planning and business.

9.2.4 Psychological Rehabilitation

One of the most important steps of rehabilitation is psychological rehabilitation. It is a very sensitive issue. Shock of disaster is directly connected with victims' psychology. The victims generally experience many types of physical and psychological strains.

A disaster victim goes through specific types of emotional stages. Psychological rehabilitation focuses on treating victims to cope up with the emotional imbalance. The psychological rehabilitation helps the victims to lead a normal life. Counsellors help the affected in leading a happy and healthy life.

9.3 RECONSTRUCTION

Reconstruction means to repair or to re-establish all services like buildings, infrastructure, replacement of damaged structures, reintegration of economic sectors (industries & agriculture), and the creation of cultural, social and environmental settings. Reconstruction is a long-term development plan to mitigate or reduce future disaster risk by incorporating appropriate measures. Damaged structure may not be necessarily being restored to their previous form. It may include temporary arrangements. Reconstruction aims to build the rehabilitated system to safer standards so that the future risks could be reduced.

The reconstruction efforts aim at restoring the affected structures to a condition equal to or better than what existed before the disaster. It also aims at constructing permanent housing besides restoring the basic amenities.

Reconstruction should pay attention to certain specific activities for speedy recovery in disaster hit areas. Every disaster results in a different type of damage, for example, when an earthquake occurs, it damages the infrastructure and buildings of that area, therefore, the planning for reconstruction should focus on mentioned thrust areas.

The major steps of reconstruction are:

9.3.1 Development of Physical and Economic Infrastructure

Infrastructure is classified as:

- Physical Infrastructure: Physical infrastructure includes roads, water, drainage, electricity.
- Service Infrastructure: In service infrastructure, transportation, health and education are included.
- Social Infrastructure: In social infrastructure, social sector services, primary healthcare, old age homes and community centres are the main components.
- Environmental Infrastructure: In environmental infrastructure, creation of necessary environmental conditions to reduce the risk of disaster is the thrust area.

When we talk about the physical infrastructure in relation to disaster, we refer to the nature of houses. In case of earthquake, it needs to be ensured that the houses

are earthquake resistant. In the case of flood, it needs to be ensured that the houses are constructed away from the flood prone area. In case of landslides, it needs to be ensured that the houses are constructed away from the area prone to landslides. Housing infrastructure needs to be planned according to the environmental conditions of the region.

Example of post-earthquake rehabilitation in Gujarat is useful at this point. The agenda in the reconstruction programme, propagated by United Nations Development Programme (UNDP), has not been just to build houses, but also construct them in a demonstrative manner to transfer the technologies to the villagers. These houses have served as model houses, incorporating disaster resistant technologies.

The UNDP's shelter programme aimed to:

- Build local capacities (training of semi- skilled construction workers and masons in hazard resistant construction)
- Support the environment (use of alternative technologies)
- Involve local communities
- Help rebuild lost livelihoods

9.3.2 Funding Arrangements for Reconstruction

It is very important to have proper knowledge about the policies available for providing funds for reconstruction in a disaster hit area. Central and state governments have specific schemes/ strategies for providing funds for disaster management activities like reconstruction and rehabilitation. Some of the funding arrangements are as follows:

9.3.2.1 National Disaster Response Fund (NDRF)

The NDRF (earlier known by the nomenclature NCCF) is a Fund constituted under Section 46 of Disaster Management Act, 2005. It covers calamities of cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloud burst and pest attack. NDRF is operated by the Government of India (GoI) for the purpose of providing immediate relief to people affected by the calamities of severe nature, under non-plan expenditure. NDRF is classified in the Public Account in Sub-section(b) Reserve Funds not bearing interest of the Government of India under the National Disaster Response Fund major head 8235 – 'General and other Reserve Funds' – 119. Funds are to be credited into NDRF in accordance with the provisions of DM Act. Let us have a look at some of these provisions (IGNOU-NDMA, 2012):

- Upon a request made by a state not having adequate balance in its State Disaster Response Fund (SDRF), Ministry of Home Affairs (MHA) or Ministry of Agriculture, as the case may be, will assess whether a case for additional assistance from NDRF is made out under the guidelines and the approved items and norms of assistance under NDRF/SDRF.
- MHA shall oversee the utilisation of releases from NDRF for the purposes for which funds have been released and monitor compliance with guidelines of NDRF.
- Upon the approval of High Level Committee (HLC), constituted with members from Ministry of Finance, Ministry of Agriculture, Ministry of Home Affairs, Deputy Chairman Planning Commission, the assistance shall be released by the Ministry of Finance from NDRF to states.

- The actual expenditure out of NDRF should be booked under respective minor heads within major head.
- The Pay and Accounts Office, Ministry of Finance shall release payments to the state governments. The detailed accounts of the Fund shall be maintained by the Controller General of Accounts through the Chief Controller of Accounts, Ministry of Finance.
- The State Executive Committee shall be responsible for ensuring that the expenditure incurred out of funds received under NDRF is in accordance with the items and norms of expenditure of NDRF/SDRF.
- The accounts of NDRF shall be maintained and audited by the Comptroller and Auditor General (CAG) annually. Its report will be submitted to Ministry of Finance and Ministry of Home Affairs.

9.3.2.2 State Disaster Response Fund (SDRF)

SDRF (which has replaced the earlier Calamity Relief Fund (CRF)) is a Fund constituted under Section 48 (1a) of Disaster Management Act. The SDRF shall be used only for meeting the expenditure for providing immediate relief to the victims of Disasters, as identified for NDRF grant. The SDRF is constituted in Public Account under the Reserve Fund bearing Interest in the Major Head: 8121. The provisions include (IGNOU-NDMA, 2012):

- Of the total contribution indicated by the Thirteenth Finance Commission, Government of India will contribute 75 per cent for general category states and 90 per cent for special category states, of the total yearly allocation in the form of a non-plan grant. The balance 25 per cent in case of general category states and 10 per cent in case of special category states will be contributed by the state government concerned.
- The share of Government of India to SDRF shall be paid as Grant-in-aid and accounted for in the Government of India accounts under the Major Head "3601-Grants-in-aid to state governments – 01 Non-Plan Grants – 109 Grants towards contribution to SDRF".
- The Annual Report shall, inter-alia, furnish details of expenditure incurred by the state government on each of calamities, for each type of expenditure allowed as per the items and norms of expenditure of SDRF/NDRF so fixed by MHA with the concurrence of Ministry of Finance.
- The State's SDRF account would distinctly show the receipt of assistance from NDRF apart from the remaining four sources of receipts into the Fund, namely (i) Centre's share of SDRF, (ii) State's share of Disaster Response Fund, (iii) Returns on investments, and (iv) Redemption of investments.
- The State government will constitute a State Executive Committee (SEC) according to DM Act and entrust it with responsibility to decide on all matters connected with the financing of relief expenditure of immediate relief from SDRF.
- The accounts of SDRF and investment shall be maintained by Accountant General in charge of accounts of the State. CAG would cause audit of SDRF annually.
- The share of the Central government in SDRF shall be remitted to State governments in two instalments in each financial year. The State governments

shall furnish a certificate to MHA and Ministry of Finance indicating that the amount received earlier has been credited to SDRF along with State's share of contribution, accompanied by a statement giving the up-to-date expenditure and balance amount available in the SDRF.

9.3.2.3 National Disaster Mitigation Fund

As per Section 47 of the DM Act, 2005, Central Government may constitute a National Disaster Mitigation Fund for projects exclusively for the purpose of mitigation. This Section has not been notified by the Government so far. As mentioned earlier, the FC-XIV restricted its recommendation to existing arrangements on the financing of the already constituted funds (National Disaster Response Fund and State Disaster Response Fund) only, as per its terms of reference. The FC-XIV did not make any specific recommendation for a mitigation fund (Government of India, 2016).

9.3.2.4 Recommendations of the Fourteenth Finance Commission

In regard to grants for disaster management, Fourteenth Finance Commission (FC-XIV) has adopted the procedure of the XIII FC and used past expenditures on disaster relief to determine the State Disaster Response Fund corpus. While making recommendations, XIV FC have taken note of the additional responsibility cast on States and their district administrations under the Disaster Management Act. XIV FC has also taken note of the location-specific natural disasters not mentioned in the notified list, which are unique to some States (ibid).

9.3.2.5 District Level Funds

District Relief Fund at the district level is based on the principles of CRF so that they are readily availability for immediate requirements. The District Level Relief Committee under the chairmanship of the District Collector/ Magistrate would evolve the guidelines and norms for expenditure to be made from the funds allotted for rehabilitation at the district level. At least fifty percent of the contribution to the funds could come from the public. DDRF is proposed to be created at the District Level as mandated by Section 48 of the DM Act. The disaster response funds at the district level would be used by the DDMA towards meeting expenses for emergency response, relief, rehabilitation in accordance with the guidelines and norms laid down by the Government of India and the State Government (DDMP, 2012).

9.3.2.6 Members of Parliament Local Area Development Scheme

Another funding arrangement, called as Members of Parliament Local Area Development Scheme (MPLADS), was started in December 1993. Under this scheme, Members of Parliament (MPs) are allotted funds, annually, to pursue developmental work in their constituencies. Each MP gives a choice of works, to be undertaken in his/her constituency to the concerned District Heads, who get them implemented by the established procedures laid down in the guidelines for the improvement of their districts under MPLADS.

9.3.2.7 Prime Minister's National Relief Fund

The Prime Minister's National Relief Fund, created shortly after independence, provides immediate relief to people in distress. The fund depends entirely on voluntary donations received from the public. The fund renders assistance to individuals facing disaster. Its resources are utilised for the provision of immediate relief to the families of those killed in natural calamities like floods, cyclones and earthquake.

9.3.2.8 Insurance Schemes

Insurance is an important risk transfer technique. Insurance is very helpful to counter the losses caused by the disaster. The insurance cover, however, cannot be regarded as a funding arrangement for disaster. We need an insurance system that common people, especially the rural poor could afford. Some insurance schemes are:

- **Pradhan Mantri Fasal Bima Yojna –** PMFBY provides a comprehensive insurance cover against failure of the crop thus helping in stabilising the income of the farmers. The scheme covers all Food & Oilseeds crops and Annual Commercial/Horticultural Crops for which past yield data is available and for which requisite number of Crop Cutting Experiments (CCEs) are conducted being under General Crop Estimation Survey (GCES) (www.financialservices.gov.in).
- **Restructured Weather-based Crop Insurance Scheme –** RWBCIS aims to mitigate the hardship of the insured farmers against the likelihood of financial loss on account of anticipated crop loss resulting from adverse weather conditions relating to rainfall, temperature, wind, humidity etc. WBCIS uses weather parameters as "proxy for crop yields in compensating the cultivators for deemed crop losses. Pay-out structures are developed to the extent of losses deemed to have been suffered using the weather triggers (www.financialservices.gov.in).
- **Seed Crop Insurance –** is to provide financial security & income stability to the breeder/seed growers in the event of failure of seed crop. The salient feature of the scheme is to cover the risk involved in seed production at field stage, loss in expected raw seed yield, loss of seed crop after harvest so that more number of the breeder /institutions /organisations /seed growers would take up and come forward in seed production (RKMP, 2011).
- **Kisan Credit Card –** was introduced in 1998 for issue of KCC to farmers so that farmers may use them to readily purchase agriculture inputs such as seeds, fertilizers, pesticides etc. and draw cash for their production needs. The KCC scheme has since been simplified and provides for issue of ATM enabled RuPay Debit Card, inter alia, with facilities of one-time documentation, built-in cost escalation in the limit, and any number of drawals within the limit, etc (PIB, 2018).

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the concept and types of Rehabilitation.

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2) What do you mean by Reconstruction?

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3) Discuss the financial arrangements for Reconstruction.

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9.4 RECOVERY

Recovery is the process by which society and the nation are supported in turning back to their appropriate level of working, ensuing disaster. The recovery process is a time taking process which takes almost 5 to 10 years or even more. The recovery process includes activities like re-establishing the necessary services, reconstruction of repairable homes and also other buildings, accommodate alternate housing, measures to facilitate the physical and psychological rehabilitation of persons who have gone through the disaster and also long term measures of reconstruction, including the restoration of buildings and infrastructure that have been devastated by the disaster. Post-disaster analysis should also be involved as part of the recovery process. The recovery process is, therefore, complex and extensive; it can lead to a multiplicity of problems, some of which will necessitate changes to original plans as recovery proceeds. Thus, decision makers should be prepared to take a flexible attitude toward policy implementation to produce the best results. Also, it is important to bear in mind that recovery from disaster offers opportunities for improvement and development.

9.4.1 The Ground for Recovery Activity

The ground for earliest recovery activity depends on following pillars:

- Identification of various necessary aspects of the recovery mode;
- Defining an overall strategy for recovery, with suitable proposed and potential national development;
- Decision of distinct recovery programmes within the overall strategy;
- Implementation of the individual programmes within the overall strategy; and
- Fulfilment of individual programmes and projects on a well supervised and coordinated basis.

9.4.2 Problems in Recovery Areas

Major problems in the area of recovery are necessary to be outlined. These are:

- Recovery programmes formulation has been always delayed because the description and administration of recovery programmes have not been sufficiently considered in overall counter-disaster planning;
- Severe and extensive damage may be so destructive that difficulties can take considerable time to formulate and assess recovery programmes;
- Information for the formulation of recovery programme is inadequate. Resurveys can be necessary in some cases in order to establish more accurately the post-disaster effect;
- Recovery programme may impose additional load on government system and even functioning output of government departments may slow down whereby the whole recovery process becomes unsatisfactory;
- Resources from recovery programmes and fund may divert due to the occurrence of another major disaster;
- Problems relating to ministerial responsibilities may arise because recovery requirements overlap from one department to another;
- Formulation of recovery programmes may hinder due to inavailability of required finance and restrictions;
- Sometimes political problems can arise when some areas are not receiving the same priority of attention as in regard to other recovery programmes;

The above do not necessarily reflect all the problems which might affect recovery programmes, but they illustrate the kind of difficulties with which disaster management officials may have to deal. There is much felt need for the Government to initiate steps towards long-term recovery. With the massive Kerala Floods, 2018, in view, it has been stated that the "Government has to come forward and accept the challenges and immediately initiate extraordinary efforts for quick recovery. People are in distress and complete disarray. State should stand behind them and get back to the business of innovative planning for faster recovery. Country has faced such problems in the past too. It took time but they could recover well. Maharashtra (1993), Andhra Pradesh (1997, 2001) Orissa (1999), Gujarat (2001), Tamil Nadu (2005, 2015) , Andman & Nicobar (2004), Jammu & Kashmir (2005, 2015), Bihar (2008) Utarrakhand (2015) and few more states have gone through the process of long-term recovery earlier. Few states have taken partial recovery with few sectors approach and some have gone for full recovery with all sectors approach with significant recovery. Prioritising recovery need is the immediate requirement for the state" (Kumar, 2018).

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Define Recovery.

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2) Write a note on problems in Recovery Areas.

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9.5 CONCLUSION

In this Unit, the issues of Rehabilitation, Reconstruction and Recovery have been discussed. Various types of rehabilitation namely physical, social, economic and psychological have been explained. Besides describing the concept of Reconstruction, its major steps have been explained. Further detailed analysis on funding arrangements for reconstruction has been made. Towards the end, the discussion is on the problems in recovery areas.

9.6 GLOSSARY

Rehabilitation : To return to a good, healthy, or normal condition after a disaster.

Reconstruction : Reconstruction is the process of rebuilding something.

Recovery : To become successful or normal again after being damaged or having problems.

NGO : A non-profit organisation or an NGO is an organisation that operates independently of any government, typically one whose purpose is to address a social or political issue.

Economic infrastructure : Economic infrastructure promotes economic activity, such as roads, highways, railroads, airports, sea ports, electricity, telecommunications, and water supply.

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9.8 ANSWER TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

   - Rehabilitation means to take necessary actions after the disaster to resume the basic services, help the diseased, to compensate the physical damage done to the surroundings and to start again economic actions to provide psychological support, social security and comfort to the diseased.
   - Physical rehabilitation; Social rehabilitation; Economic rehabilitation and Psychological rehabilitation.

2) Your answer should include the following points:

   - Reconstruction means to repair or reestablishment of physical infrastructure, service infrastructure and Environmental infrastructures.
   - It aims to build the rehabilitated system to safer standard so that the future risks would be reduced.
   - The reconstruction efforts aim at restoring the affected structures to a condition equal to or better than what existed before the disaster.

3) Your answer should include the following points:

   - National Disaster Response Fund (NDRF)
   - State Disaster Response Fund (SDRF)
   - National Disaster Mitigation Fund

- Recommendations of the Fourteenth Finance Commission
- District Level Funds
- Members of Parliament Local Area Development Scheme
- Prime Minister's National Relief Fund
- Insurance Schemes.

Check Your Progress 2

1) Your answer should include the following points:

   - The recovery process includes activities like re-establishing the necessary services, reconstruction of repairable homes and also other buildings, accommodate alternate housing, measures to facilitate the physical and psychological rehabilitation of persons who have gone through the disaster and also long term measures of reconstruction, including the restoration of buildings and infrastructure that have been devastated by the disaster.

2) Your answer should include the following:

   - Major points discussed in the Sub-section 9.4.2.

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BLOCK 3

INTERRELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

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UNIT 10 CLIMATE CHANGE*

Structure

10.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand the concepts of Weather and Climate;
- Explain Climate Change; and
- Describe Climate Change Adaptation.

10.1 INTRODUCTION

Climate change is a major global environmental and developmental problem. Though all the possible consequence of climate change are yet to be understood, it is now established that adverse impacts are likely from an increased frequency of extreme weather, floods and droughts, submergence of coastal areas due to sea level rise and extreme climate variability. The poor, women, the aged and the very young, especially in underdeveloped or developing area contexts, are relatively more vulnerable due to their greater dependence on climate-sensitive sectors such as agriculture, fisheries and forestry for their livelihoods or their limited adaptive capacity. The poor status of infrastructure and essential services in most of the poverty-affected areas also limits their ability to cope with adverse impacts of climate change. According to the IPCC 5th Assessment Report (2014), human influence has been detected in warming of the atmosphere and the ocean, in changes in global water cycle, in reductions in snow and ice, in global mean sea level rise and in changes in some climate extremes.

* Contributed by Dr. Bhagwati Joshi, Assistant Professor, Govt. P.G. College, Rudrapur, Uttarakhand

The atmospheric concentrations of the greenhouse gases carbon dioxide (co_2), Methane (CH_4) and nitrous oxide (N_20) have all increased since 1750 due to human activity. The deep interconnection between the vulnerability of natural and human systems to climate change calls for expeditious coping strategies and response measures. Climate proofing of vulnerable sectors, programmers, natural systems and interventions are increasingly becoming an integral part of the development/ environment lexicon and action worldwide (IPCC, 2015).

10.2 UNDERSTANDING WEATHER AND CLIMATE

10.2.1 Weather

Weather is the day-to-day state of the atmosphere and is a chaotic non-linear dynamical system. Fundamentally, weather is caused by the sun, which heats the air at the planet's bulling equatorial regions more than at either pole. Combine the heat of the sun rotation of a planet covered mostly in water, and the product is what we call weather. Weather means the day-to-day change in the quality of atmosphere near the surface of the earth. Because hotter air rise and cooler air falls, the difference in temperature across the planet causes masses of air to begin to move. It is felt that the movement to the air becomes even more dynamic because of earth's rotation, while the steady evaporation of surface water leads to the formation of clouds and eventually precipitation.

10.2.2 Climate

The term 'climate' has a very wide variety of meanings. To many of us, 'climate' often first suggests temperature, although rainfall and humidity may also come to mind. When we think of climatic change, it is often in the time frame of glacial periods. More recently, however, there has been considerable public concern over the possible shorter-term impact upon the climate of increasing atmospheric carbon dioxide and other greenhouse gases. Climate includes the average temperature, amount of precipitation, days of sunlight, and other variables that might be measured at any given site. However, there are also changes within the earth's environment that can affect the climate.

Climate is determined by large scale pattern and force, beginning with the position with the position of the earth 93 million miles from the sun close enough to receive a life –sustaining amount of solar radiation. Since earth tilts on its axis, much of the sun's heat falls on the tropical areas around the equator. The resulting uneven distribution of sun light –and of temperature in the atmosphere and throughout the world's oceans- establishes under lying sea current and wind patterns that, in turn, influence climate.

10.3 UNDERSTANDING CLIMATE CHANGE

10.3.1 Climate Change

Climate change refers to a change in the state of the climate that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. UN 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 that is in addition to natural climate variability observed over comparable time periods (IPCC, 2007).

Climate change refers to change conditions such as weather pattern of temperature that can be observed for a long period of time. In the usage of the Intergovernmental Panel on Climate Change (IPCC), climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity.

10.3.2 Climate Change Impact on the Globe

Over the last 50 years, human activities – particularly the burning of fossil fuels – have released sufficient quantities of carbon dioxide and other greenhouse gases that are trapping additional heat in the lower atmosphere and affect the global climate (UNDP, 2006; IPCC, 2013). In the last 130 years, the world has warmed by approximately 0.85°C. Each of the last 3 decades has been successively warmer than any preceding decade since 1850 (IPCC, 2014). Sea levels are rising, glaciers are melting, precipitation patterns are changing, and extreme weather events are becoming more intense and frequent. Human health has always been influenced by climate and weather (IPCC, 2014; WHO, 2005 and 2014). Changes in climate and climate variability, particularly changes in weather extremes, affect the environment that provides us with clean air, food, water, shelter, and security. Climate change, together with other natural and human-made health stressors, threatens human health and well-being in numerous ways (Balbus et al., 2016). Some of these health impacts are already being experienced in all parts of the world including the Himalayan Mountains (WHO, 2005; ICIMOD, 2007). Given that the impacts of climate change are projected to increase over the next century, certain existing health threats will intensify and new health threats may emerge (IPCC, 2013 and 2014). These are the global major impacts on the earth planet.

10.3.2.1 Global Warming

About 75% of the solar energy reaching the earth is absorbed by the earth's surface, which increases its temperature. The rest of the heat radiates back to the atmosphere. Some of the heat is trapped by greenhouse gases (GHGS), mostly carbon dioxide is released by various human activates, it is rapidly increasing. This is causing global warming is causing global warming (Cline, 2008).

A human activity during the last few decades of industrialisation and population growth have polluted the atmosphere to the extent that is has begun to seriously affect the climate. The carbon dioxide in the atmosphere has increased by 31% since pre-industrial times, causing more heat to be trapped in the lower atmosphere. There is evidence to show that carbon dioxide levels are still increasing. Many countries have signed a convention to reduce GHGS under the United Nations framework convention on climate change (UNFCC). However, the current international agreement is not still effective enough to prevent the significant changes in climate and in sea levels (www.unfccc.int).

10.3.2.2 Acid Rain

On burning fossil fuel such as coal, oil and natural gas; chemicals, sulfur dioxide and nitrogen oxides are produced. These chemicals react with water and other chemicals in the air to form sulfuric acid, nitric acid and other harmful pollutants like sulfates and nitrates. These acid pollutants spread upwards into the atmosphere, and are carried by air currents, to finally return to the ground in the form of acid

rain, fog or snow. The corrosive nature of acid rain cause many forms of environmental damage. Acid pollutants also occur as dry particles and gases, when washed from the ground by rain, add to the acid in the rain to form an even more corrosive solution. This is called acid depositions.

10.3.2.3 Ozone Layer Depletion

Ozone is formed by the action of sunlight on oxygen. It forms a layer 20 to 50 km above the surface of the earth. This action takes place naturally in the atmosphere, but is very slow. Ozone is a highly poisonous gas with a strong odor. It is a form of oxygen that has three atoms in each molecule. It is considered pollution at ground level and constitutes a health hazard by causing respiratory ailments like asthma and bronchitis. It also causes harm to vegetation and lands to deteriorate further. Ozone in the upper atmosphere, however, is vital to all forms of life as it protects the earth from the sun's harmful UV radiation. This ozone layer in the upper atmosphere absorbs the sun's UV radiation, preventing it from reaching the earth's surface.

10.3.2.4 Nuclear Accidents and Nuclear Holocaust

Nuclear energy was researched and developed as an alternate source of clean cheap energy compound to fossil fuels. Although this did happen, along with the benefits of nuclear energy came its downfalls. In the short history of nuclear energy, there have been a number of accidents that have surpassed any natural calamities or other energy sources extractions in their impacts. A single nuclear accident causes loss of life, long-term illness and destruction of property on a large scale and for a long period of time. Radioactivity and its fallout lead to cancer, genetic disorders and death in the affected area for decades after, thus affecting all forms of life generations to come.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss about Weather and Climate.

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2) What is Climate Change?

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3) Explain the impacts on Climate Change.

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10.4 CLIMATE CHANGE VULNERABILITY

Climate change is a major issue in the current perspective, and the impact of climate is affecting both natural eco-system and society directly as well as indirectly. Water being the most fundamental and critical natural resource is highly sensitive to climate change. It has been observed that rapid changes in climatic phenomena has modified global hydrological cycle; and has profound impact on the quantity as well as on the quality of both surface and groundwater across the planet. These changes are affecting the availability of water resources for drinking, food production, manufacturing and sanitation; and increasing the vulnerability of large population particularly in developing and low income countries to water, food, and livelihood and health insecurity.

Vulnerability

IPCC Fifth Assessment Report (2007) has defined "vulnerability to climate change broadly as the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt"**.** Thus, vulnerability in regard to climate change refers to the inability to cope with changes in climate conditions. As changes become more extreme, people might not have the capacity to adapt to them. It is these people who are considered as vulnerable to climate change. According to the IPCC' Vulnerability is "the degree, to which a system is susceptible to and unable to cope with, adverse effects of climate change, including climate variability and extremes.... Vulnerability is a function of the character, Magnitude, and rate of climate change and carination to which a system is exposed, the sensitivity and adaptive capacity of that system" (IPCC, 2007). The climate change is not a speculative concern, but is based on the works of hundreds of scientists under the aegis of IPCC. The UNEP and the WMO established IPCC which was endorsed by the United Nation General Assembly in 1988. Climate change is recognized by IPCC as a significant man made global environmental challenge. International efforts to address climate change began with the adoption of the united now the IPCC has published fifth rounds of assessment reports and the sixth will be submitted in 2019.

The National Context

Climate change is expected to manifest quite significantly in India. India is much affected by climate change, not only because of high physical exposure to climate-related disasters (65% of India is drought-prone, 12% food-prone and 8 % susceptible to cyclones), but also because of the dependency of its economy and majority of population on climate-sensitive sectors (for example, agriculture, forest, tourism, animal husbandry and fisheries). India is one of the most vulnerable countries to climate change (Beernaert & Malone 2005). The Government of India is serious

on this issue as evident from the statement of the Ministry of Environment and Forests that no country in the world is as vulnerable, on so many dimensions to climate as India. Whether it is our long coast line of 7000 km; our Himalayas with their vast glaciers; our almost 70 million hectors of forest which incidentally house almost all of our key minerals reserve; we are exposed to climate on multiple fronts. Rigorous science based assessment are therefore critical in designing our adaptation strategies (INCCA, 2012).

Climate Change Vulnerability: Hotspots

The identification of hotspots of climate change vulnerability depends upon exiting knowledge on the subject, which is having growth in recent years (Anthony-Smith, 2009) According to the Asian Development Bank (2009), low-lying coastal area, deltaic regions and semi-arid areas are the hotspots vulnerable to climate change. Hotspots are defined as specific areas or regions that may be at relatively high risk of adverse impact of one or more natural hazards as a result of climate change. The west coast, the Ganga- Brahmaputra Delta, the delta of Mahanadi, Krishna and Godavari in the east coast and arid area of Rajasthan are the hotspots. On the other hand, INCCA (2012) considered only four regions namely, coastal areas, Western Ghats, north-east and the Himalayas as hotspots of climate change vulnerability based on biodiversity, and left the western dry land which is an important biophysical entity of India. Foresight Group (2011) identified dry lands, mountainous region and low elevation coastal zones as areas of hotspots. It is worthwhile to note that the climate change models are still ratchet imperfect representations of reality, and differ considerably in identifying the zone of vulnerability and hotspots (Ericksen et al., 2011).

The Indian Himalayan Region (IHR)

It stretches across states in the western and eastern Himalaya and provides critical ecosystem services for communities in mountains and downstream planes. The IHR covers vast areas, with about 17% of the region being under permanent snow cover and glaciers and about 30-40 % under seasonal snow cover, forming a unique water reservoir. This feeds important perennial rivers that provide water for dirking, irrigation and hydropower. Every year about 1, 00,000 million m^3 of water flows from Himalayan rivers. The IHR is home to nearly 4 % of the country's population and provides directly or indirectly for livelihoods. The average land holdings are very small and less than a hectare per family. Most agriculture is of subsistence type and depends on suitable weather for good yields. Economically vulnerable groups including the scheduled tribes and castes have high dependence on the forest resources' including collection of fodder, medicinal plants and firewood these ecosystem services are highly sensitive and the regional economy vulnerable (Government of Uttarakhand, 2012).

Himalaya constituting headwaters of major rivers of south Asia is highly vulnerable to climate change (ICIMOD, 2007). Owing to constraints of terrain, subsistence agriculture constitutes main source of food and livelihood even though the availability of arable land is severely limited and agricultural productivity is low (Tiwari & Joshi 2012). During recent past, a variety of changes have emerged in traditional resource use structure mainly in response to population growth, improved access, growing market economy, rapid urbanisation, growth of tourism and resultant exploitation of natural resources in Himalaya. These changes have exerted sharply accentuated pressures on primary ecosystem services through disrupting hydrological

regimes of headwaters, eroding biodiversity and undermining livelihood and food security both in mountains and adjoining lowlands. Moreover, climate change has stressed traditional agricultural system through higher mean annual temperature, fast melting of snow and glaciers, erratic rainfall and increased frequency and severity of extreme weather events (ICIMOD, 2007). During recent years, Indian monsoon has shown sweeping changes over the region resulting into decreased annual rainfall and reduced number of rainy-days affecting adversely the availability of and access to water resources (Bandyopadhyay et al., 2002). These changes are exacerbating region's limited capacity to cope with projected decrease in availability of water for drinking and food production. Consequently, agricultural productivity is declining thereby increasing vulnerability of local population to food insecurity and a variety of health risks (IPCC, 2014). It is, therefore, highly imperative to analyse micro-regional variability in precipitation pattern, and assess its impacts on key sectors, such as agriculture, food and community health, and evolve an effective adaptation framework to strengthen traditional adaptation mechanism and coping strategies.

10.5 CLIMATE CHANGE ADAPTATION

Adaptation is defined by IPCC (2014) as "in human system, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities" In natural systems, it is the process of adjustment to actual climate and its effects; human Intervention may facilitate adjustment to expected climate". In human system, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects. According to UNFCCC, adaptation is defined as practical *steps to protest countries and communities from the likely disruption and damage that will result from effects of climate change.*

Stages of Adaptation Process

The basics towards adaptation, as mentioned below, will remain same when adaptation is planned at national, state, district, block or panchayat level.

- Identifying adaptation needs
- Identifying adaptation options
- Appraising adaptation options
- Planning and implementing
- Monitoring and evaluation

Adaptation to Climate Change in IHR

IHR is highly vulnerable to climate change and there is an urgent need to respond to the current and future risks by enhancing the preparedness of the communities and natural systems. Current scientific evidence suggests instability in the Himalayan ecosystems result of climate change in composition and distribution of natural resources such as water, Forest and agro bio diversity. Thus, adaptation is imperative for responding to current and future climate change risks in IHR and enhancing preparedness (Government of India, 2010). According to IPCC (2014), adaptation needs arise when the anticipated risks or experienced impacts of climate change require action to ensure safety of population and security of assets including ecosystem and their services.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Write a note on climate change vulnerability.

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2) Describe Climate Change Adaptation.

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10.6 CONCLUSION

Global Warming is perhaps the biggest challenge that the humankind is facing presently. Man has the onus of protecting not only himself but also other life forms on this planet. Globally, all nations are working on their strategies to combat climate change.

India has engaged actively in multilateral negotiations in the United Nations Framework Convention on climate change (UNFCCC). India's immense geographic diversity adds to the complexity of developing and implementing sectors, locations and populations, there can be no 'one size-fits-all' climate change strategy. Approaches will need to be fit specific sub-national context and conditions. India's National Action Plan on Climate Change, 2008 (NAPCC), with its eight national missions, is designed to achieve sustainable development as a co-benefit of addressing climate change. These 8 missions are: National Solar Mission; National Mission for Enhanced Energy Efficiency; National Mission on Sustainable Habitat; National Water Mission; National Mission for Sustaining the Himalayan Ecosystem; National Mission for Green India; National Mission for Sustainable Agriculture; and National Mission for Strategic Knowledge for Climate Change.

The climate change is the biggest environmental emergency that the earth faces today. This inevitable disaster has a multitude of serious implications for both environment and human society. In accordance with it, the Unit discusses various aspects of climatic change.

10.7 GLOSSARY

Climate Change : Climate change refers to a change in the state of the climate that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. UN 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.

Impacts : Effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as *consequences* and *outcomes*. The impacts of climate change on geophysical systems, including floods, droughts, and sea-level rise, are a subset of impacts called physical impacts.

Adaptation : The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Resilience : The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.

Transformation : A change in the fundamental attributes of natural and human systems. Within this summary, transformation could reflect strengthened, altered, or aligned paradigms, goals, or values towards promoting adaptation for sustainable development, including poverty reduction.

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10.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - Weather is the day-to-day state of the atmosphere and is a chaotic non-linear dynamical system.
   - Humidity, atmospheric pressure, clouds and rain storm.
   - Climate is determined by large scale pattern and force, beginning with the position with the position of the earth 93 million miles from the sun close enough to receive a life –sustaining amount of solar radiation

2) Your answer should include the following points:
   - Change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere.
   - Change conditions such as weather pattern of temperature that can be observed for a long period of time.

3) Your answer should include the following points:
   - Global Warming
   - Acid Rain
   - Ozone Layer Depletion
   - Nuclear accidents and nuclear holocaust

Check Your Progress 2

1) Your answer should include the following points:
   - Vulnerability in Indian Context.
   - Climate Change Hotspots.

2) Your answer should include the following points:
   - The process of adjustment to actual or expected climate and its effects.
   - Adaptation seeks to moderate harm or exploit beneficial opportunities.

UNIT 11 DISASTERS AND DEVELOPMENT*

Structure

11.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand the relationship between disasters and development;
- Examine the way disasters can impact development programmes and development programmes can increase vulnerability; and
- Discuss the ways for designing development programmes for decreasing vulnerability.

11.1 INTRODUCTION

In this Unit, we shall attempt to understand the relationship between disasters and development and shall also study about the primary remedial measures to be taken immediately after the disaster occurs. Besides, the possibilities of long-term development concerning the creation of job opportunities and livelihood options will be discussed. While disasters result in considerable disruption of normal life, enormous suffering, loss of lives and property, global efforts consider the recovery, rehabilitation and reconstruction phase as an opportunity to build back better integrating disaster risk reduction into development measures, and making communities resilient to disasters (Government of India, 2016). There is a close link between disasters and development as disasters create destruction obstructing development initiatives; on the other hand, they give rise to development opportunities. Hence, we can say that the development schemes can both increase and decrease vulnerability.

* Contributed by Dr. Ranju Joshi Pandey, Academic Associate, Uttarakhand Open University, Haldwani, Uttarakhand

11.2 RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

There is a close relation between disasters and development. Initiatives of development get destroyed by disasters and at the same time it produces opportunities for development. Vulnerability may both be increased and decreased by strategies of development. Traditional approach to disasters referred to the 'natural disasters as an act of God and beyond human control; causing death and damage to property and revenue losses. In the past, most of the development plans were designed without considering the impact of disasters and without taking community viewpoints and plans into consideration. In the event of a disaster, the focus used to be on emergency needs. In keeping with mainstreaming disaster risk reduction and sustainable development, it is felt that a package of resilience-building plans would yield better results and minimise, if not completely avoid, losses. (Hallegatte,S. et al. 2017). Thus, the focus now is on reducing the impact of disasters in the wake of relationship between disaster and development indicating following basic themes:

- Vulnerability may increase due to development initiatives;
- Development initiatives may decrease vulnerability; and
- For development initiatives, disasters is as an opportunity.

Thus, the policy makers cannot ignore the relationship between the disasters and development. Projects are, thus, being designed incorporating the disaster recovery programmes and long-term development needs in mind. Disasters can significantly impede the effectiveness of development resource allocation.

11.2.1 Development Programmes can Increase Vulnerability

Population without developmental initiatives is more exposed to natural hazards and other calamities. At the same time, however, the development process, itself, might increase vulnerability for the same disasters. There is a close link between poverty, marginalisation, over-population and vulnerability. By and large, poverty gives rise to vulnerability. Poverty stricken people are more likely to live in vulnerable areas, such as, on slopes prone to landslides; in flood-prone areas to marginal agricultural land. Poorer countries mostly are more likely to have a dangerous building stock, often as a result of insufficient resources to enforce appropriate building codes, structural design and quality control due to lack of education and public awareness.

Lack of knowledge leads to lack of awareness and poor education with lack of awareness results into absence of consciousness which often increases vulnerability-people may be simply unaware of the options available to them for vulnerability reduction due to lack of awareness and education programmes. Poverty stricken people have fewer assets to invest in resources, which increases their vulnerability. Poor people are less likely to be in a position to organise together to reduce risks. Moreover, after a disaster, its aftermath gives rise to starvation and chronic sickness leading to newer risks for the people.

Even though in larger terms, development will usually contribute to decrease vulnerability to natural disasters, however, development activity within an area might largely increase certain types of vulnerability as mentioned below:

- Urban development usually leads to an inflow of comparably low-income groups, with large- scale settlements on marginal land or in high density, poor quality housing. Buildings could also be sited on earthquake faults, in flash- flood zones, or on slopes at risk of landslides;
- Marine and coastal zone development leads to population consolidation, exposed to potential high winds, storm-surge, landslide risks and flash-flood. Tourist development can increase potential vulnerability substantially when low lying beach areas are a mark for infrastructure and basic investments. Tsunami and tropical storms quickly destroy these improvements also placing tourists and staff at serious risk to injury and death;
- Transport and other construction activities without awareness about environment often result in deforestation and increased risks of landslides;
- Water resource projects, such as dams and irrigation schemes, increase risk of floods, slope instability or dam failure;
- Investment in poorly managed hazardous industries might result in concentration of population around the high risk zone of plant, exposing the unaware population to high hazardous chemicals or other industrial disasters;
- Livestock development projects result in extensive loss of the vegetation cover, leading to desertification;
- Agricultural projects promoting cash crops might reduce production of essential foods.

All the above mentioned examples clearly specify the linkages between development and disasters. However, it should be made clear here that sustainable development cannot be disastrous, only ill-conceived planning and mismanagement make development process quite disastrous.

11.2.2 Development Programmes can Decrease Vulnerability

Mitigation is extensively used as a measure to reduce the impact of any disaster. Mitigation, on the bases of their approach to problem and methodology, may be considered in two distinctive ways:

i) Structural mitigation measures are used to decrease the economic and social impact of hazards and involve programmes of construction; particularly dams, terracing, windbreaks and hazard resistant buildings.

ii) Non-structural mitigation is mostly concerned with policies and practices, as well as land-use policies, zoning, crop diversification, building codes and methods for prediction and warning. In a wider context, non-structural mitigation may also include awareness, education, environmental understanding, community organisation, and employment strategies.

It has been experienced that mitigation is best effective as a part of a long-run development programme having hazard-reduction measures into regular investment projects. The risk is evaluated analytically and notably within the scenario of planning and investment programme reviews. The cost-effectiveness of specific emergency preparedness measures and hazard reduction activities should be evaluated. There are opportunities to make links between government and international organisations

concerned with relief, recovery and support opportunities for investment institutions to assist governments to gain access to new developments in hazard-reduction technologies. In regular investment projects, attention is given to early warning systems and alternative components of emergency preparedness through financial or technical help.

These steps of development programmes to decrease vulnerability are integrated into each level of programme and project development and review at regular intervals. A structured review action would require that the remedial measures taken to counter the loses occurred due to the recent disaster and the project reports specifying the same should particularly be taken into consideration.

There are a wide range of choices for incorporating mitigation measures into regular development programmes. The examples suggest various ways to secure population and critical economic assets against hazards and also to take measures to reduce the overall impact of disasters.

Strengthening of urban utility systems and industrial support infrastructure is an objective of most of the development projects. This is achieved through a variety of external inputs, including loans, technical assistance, and institution development support. So called "lifeline systems"- water, electric power, transport links and communications can be made more persuasive and more selectively resistant to specific hazards.

Investment in transport and communications also improve a country's ability to respond to, and recover from, a major emergency. For example, improvements in road capacity will usually make evacuation easier; Better communication would lead to improved early warning and more effective preparedness and response measures; Investments in airports and bridges can help speed up the delivery of relief resources, etc..

11.2.3 Disasters as Opportunities for Development Initiatives

Disasters can be a carrier of effective development programmes. The political impact of damage and disruption can act as a real incentive for change. Disaster inspired development initiatives are influenced in a number of ways, but the following two aspects are especially important:

- Disasters can highlight particular areas of vulnerability, for example, areas where huge losses of life have occurred, or where the economic damage is disproportionate to the strength of the impact. The outcome of this is usually to highlight the general level of underdevelopment; and
- For a few weeks or months, the political environment may favour a much higher rate of economic and social change than before, in areas such as land reform, housing improvements, new job training, and restructuring the economic base.

The value of direct international assistance given after disasters may partially compensate for economic losses, as the amounts are usually smaller in relation to the total loss. The initial value of the aid rarely constitutes more than ten percent of the overall losses, and is usually considerably less. In the following months and years, there may be additional longer term development aid, which would otherwise not have been made available.

The extent, to which development opportunities can be followed up after a disaster, is usually constrained or influenced by donor investment policy for emergency loans. It is mandatory to review the current World Bank criteria for emergency lending for post disaster investment. According to the World Bank:

1) The operation must be directed towards the restoration of the assets or productivity in a long- term development perspective not temporary relief;
2) The prospective economic returns should be high;
3) The effects of the emergency should be significant;
4) The event triggering the emergency should have a low probability of happening again soon;
5) The need for an urgent response should be evident;
6) Emergency lending is limited to cases where effective action can be felt in two to three years;
7) There should be some prospect for future reduction in the hazards.

It is often felt that development opportunities are often missed or compromised because of an excessive focus on relief assistance. Relief assistance may introduce substantial flows of resources into small communities: resources which could be purchased locally. The method of incorporating of these resources- often involving free distribution through inappropriately chosen local structures- may discourage independence and entrepreneurism. The scale and variety of external relief sources in some disasters make this a difficult problem to contain and highlights the need for governments and international agencies to continually emphasise the development framework of the disaster response.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the relationship between disasters and development.

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2) 'Development programmes can increase vulnerability'. Discuss.

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3) 'Disasters are opportunities for development initiatives'. Comment.

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11.3 DEVELOPMENT OF INFRASTRUCTURE

Infrastructure means the basic structure or foundation. It means the structure for communication and services within an institution. In the context of development, infrastructure connotes buildings, means of transportation and communication as well as other necessary basic utilities and facilities, for example, schools, hospitals, etc.

11.3.1 Different Types of Infrastructure

Infrastructure can be classified as:

- Physical infrastructure – roads, water, drainage, electricity, etc.
- Service infrastructure – transportation, health, education, etc.
- Social infrastructure – social sector services, primary healthcare, old age homes and community centers, etc.
- Environmental infrastructure – creation of necessary environmental conditions to reduce the risk of disaster.

It becomes utmost important to understand the appropriate context of the developing nations in any discussion on infrastructure. Limited resources in these nations often imply that infrastructure is undeveloped or underdeveloped. Lack of basic amenities like, water and electricity is a common problem in a developing country. Even in the case of healthcare facilities; secondary level schools; and other services in the social sector, the infrastructure parameters change according to socio-economic conditions. At the time of disaster, these limited infrastructure facilities are damaged and destroyed making it difficult for the administration to cater to the needs of the people.

11.3.2 Development of Physical and Economic Infrastructure

With reference to appropriate physical infrastructure particularly in relation to disasters, the nature, type and quality of housing are of relevance. Housing infrastructure needs to be planned for the particular environmental conditions of the area. There may be an area that is flood-prone or a mountainous region prone to landslides and so on. Housing has to be in accordance with the requirements of that area. The peculiar requirements of the urban areas need to be kept in mind. Earthquake safety measures in high-rise buildings in urban areas are a case in point.

The shelterless population, which is already vulnerable even in normal times, is affected the most at the time of any disaster. Studies reveal that a homeless child is twice as likely to have learning disabilities and six times more likely to have stunted growth than a child in a stable environment. The example of post-earthquake rehabilitation in Gujarat is worth emulating. The agenda in the reconstruction programme, propagated by United Nations Development Programme (UNDP), has not been just to build houses, but also to construct them in a manner so as to impart technological skill to the villagers. These houses have served as model houses, incorporating disaster resistant technologies (corner vertical bars, header stones, reinforced cement concrete (RCC) bands at different sections of the structure, etc.). This has created a multiplier effect in the surrounding areas.

11.3.3 Development of Environmental Infrastructure

Any discussion on physical and economic infrastructural development is incomplete without satisfactory emphasis on building environment support system. There is a close link between environmental conservation and disaster mitigation. Inappropriately, human induced activities act as catalysts, positive or negative, to the natural environment. There are thousands of lakes, ponds, lagoons, estuaries, marshes, backwaters and mangrove swamps that are the lifeline of a country's wetlands, fresh water needs and biodiversity. Absence of a National Wetlands Act in India demands a proactive environmental infrastructure development. However, few success stories may still be quoted.

In India, cases such as rebirth of Sukhna Lake in Chandigarh and greening of Alwar District reveal that water harvesting wisdom needs to be appropriately touched to build infrastructure, especially environmental infrastructure. An example of Community Supported Agriculture (CSA) from the state of Minnesota, United States of America, also specifies that agriculture is more than just source of food and timber; it also provides various other environmental and social benefits. The struggle necessitates changing the implication of the term 'maximizing productivity'. Some of the methods that help environmental and social benefits include increased users to select production methods.

At their most basic level, the CSA farms provide a weekly delivery of organically grown produce to users during the growing season. Those users, in turn, pay a consent fee. However, having involvement with CSA operations forever means sharing the benefits as well as the risks of farming. By linking together through CSA operations, farmers and users alike can benefit from an agriculture that gives lavish nutritious food while conserve the ecological and social base necessary for the future generations.

Attempts to build sustainable environment infrastructure are being made by national as well as international agencies all over the world. The aim is to decrease transmission of greenhouse gases and maintain the global commons (atmosphere) for the long run. A number of the major environmental agreements are listed below:

1) **CITES (Convention on International Trade in Endangered Species)**

This convention was signed in 1975. More than one hundred twenty five countries are its members. CITES creates worldwide controls on the International trade of unsafe species of animals and plants. Within the case of species unsafe with dying out, CITES ban all commercial trade in wild specimens.

2) **Basel Convention on Trans-boundary Movement of Hazardous Wastes**

Basel Convention on the Management of Trans- boundary Movements of Hazardous Waste and their Disposal was approved in 1989. It came into force in May 1992. This world environmental contract strictly manages the trans-boundary movement of hazardous wastes and necessitates its members to ensure that such wastes are managed and disposed off in an environmentally sound manner.

3) **Convention on Biological Diversity**

The Convention on Biological Diversity was signed by over one hundred fifty governments at the Rio "Earth Summit" in 1992. It became the centerpiece of international efforts to conserve the planet's biological diversity, assuring the continuous use of its components, and facilitating fair and honest sharing of the information about the usage of genetic resources.

4) **Convention on Climate Change**

In June 1992, one hundred fifty States signed the U N Framework Convention on Climate Change at the Rio "Earth Summit". The Convention provides a "framework" within which governments can work together to carry out new policies and programs.

5) **Kyoto Protocol to the United Nations Framework Convention on Climate Change**

The Document consists of the final authentic text of the Kyoto Protocol to the United Nations Framework Convention on Global Climate Change. The Protocol has come into force with an objective of protecting the environment of the world from further deterioration. Around one hundred eighty countries have signed the Kyoto Protocol.

6) **Convention to Combat Desertification**

The Convention to Combat Desertification helps a new path to controlling, dry land ecosystems and therefore the flow of aid for development in drought affected countries especially in Africa. Their Website contains Official Documents for the International Negotiating Committee (INDC), as well as public information material.

7) **Convention on the Law of the Sea**

The United Nations Convention on the Law of the Sea systematises the principles by which nations use the oceans of the world. The links between the nations are controlled by the independent counsel on Ocean Law, which is a broad collection of documents regarding the Law, as well as links to the text of the Convention.

8) **Montreal Protocol on Substances that Deplete the Ozone Layer**

The Montreal Protocol is that the primary international agreement for the management of the production and consumption of Ozone depleting substances like choloro-fluoro-carbons (CFCs), halons and methyl bromide, etc. As of November 2003, one hundred eighty three governments have become parties to the Protocol, including virtually all major industrialised countries and most developing countries.

Sustainable Community Development

Every physical space, which can be entitled as a community, needs to sustain sufficient resources within it for fulfilling certain capacity. When we talk in context of India, strengthening of *anganwadis* and *balwadis,* and other similar institutions will go a long way in building sustainable communities. Rural and urban communities in India should have community centers, female-children homes, old age homes and daycare homes. These institutions fulfill the functions of taking care of needs of special groups in the community such as the children, women, old and disabled. The social chain build through the functioning of healthcare centers and community centers are strong points for any society. In cases where these networks function well, they justify their significance in post-disaster situations.

A sustainable society meets its present needs without sacrificing the requirement of future generations. It is engaged in developing attitudes and actions that strengthen its economic, environmental and social infrastructure. Sustainable community development is easily achieved when it comes from within an existing community. The benefits of this type of development include more livable communities, lower costs of living and safer environment for future generations. Some of the outstanding ways of developing a sustainable society are to:

1) Create awareness and education on sustainability;
2) Conserve green space;
3) Conserve our water resources;
4) Support sustainable agriculture;
5) Recycle the building materials; and
6) Conserve energy and support renewable energy initiatives.

11.4 CREATION OF LONG-TERM JOB OPPORTUNITIES AND LIVELIHOOD OPTIONS

Whereas livelihood and the accessible means of employment opportunities are significant issues even in normal times, but these turn into more compelling needs after natural or man-made disasters. The meaning of livelihood is presence of employment, work opportunities or occupation as a means of hold. This type of support refers to physical sustenance of individuals' families and households. The livelihood approach is especially linked with the formation of sustainable environment. In its importance on multi-sectoral coordination, the livelihood approach advocates an increase in economic opportunities of work without degrading the natural environment.

The changing nature of economies and the new trends in globalisation present some distinctive features in the case of livelihood opportunities in the developing countries. Some of the contributing factors like irregular process of industrialisation, non-availability of fertile land for cultivation and process of environmental degradation create a complex scenario with regard to the linkages between rural and urban economies, as well as amongst the available livelihoods.

11.4.1 International Approaches to Livelihood

The operationalisation of sustainable livelihood is broadly exhibited in two ways.

1) As an analytical tool, applying a sustainable livelihood lens as a part of policy formulation and/or as programme planning process. This ensures that efforts, say to reduce poverty or promote environmental conservation, recognise the linkages between development and environment; and the effect of such linkages on the livelihood of the poor.

2) The manner in which the approach of sustainable livelihood is used for the design and implementation of sustainable livelihood programmes. In this situation, sustainable livelihood initiatives aim to strengthen one or more aspects of a household's livelihood through distinct programme interventions (for example, provision of micro-finance), but does so in a consistent manner within an overall sustainable livelihood framework. As an essence, a sustainable livelihood programme acts merely as a demonstration of the approach. It is imperative to understand that this approach is adopted, modified and tailored to the individual country's context.

The United Nations Development Programme (UNDP) has been at the forefront of employing the sustainable livelihood approach. Different government ministries have come together to discuss the pros and cons of using a sustainable livelihood

lens for poverty reduction. Substantive interactions mean actions at the local levels (for example, district, community) and better coordination and implementation. Moreover, by using a sustainable livelihood approach, UNDP has managed to bring together a diverse set of actors (for example, government, civil society, donors and community-based organisations) that have traditionally operated in isolation from each other. Many other premier agencies are also striving to have a well-rounded approach to development.

11.5 STATUTORY PROVISIONS FOR MAINSTREAMING DISASTER RISK REDUCTION

The following are the statutory provisions incorporated in the Disaster Management Act, 2005, for mainstreaming Disaster Risk Reduction or DRR:

- Section 6 (i) provides that the NDMA may take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;
- Section 18 (2) (g) provides that the SDMA may review the development plans of the different departments of the State and ensure that prevention and mitigation measures are integrated therein;
- Section 22 (2)(b) provides that the SEC may examine the vulnerability of different parts of the State to different forms of disasters and specify measures to be taken for their prevention or mitigation;
- Section 23 (4) (b) provides that the State Plan shall include measures to be adopted for prevention and mitigation of disasters;
- Section 23 (4) (c) provides that the State Plan shall include the manner in which the mitigation measures shall be integrated with the development plans and projects;
- Section 23 (4) (d) provides that the State Plan shall include, capacity-building and preparedness measures to be taken;
- Section 30 (2) (iv) provides that the District Authority may ensure that the guidelines for prevention of disasters, mitigation of its effects, preparedness and response measures as laid down by the National Authority and the State Authority are followed by all departments of the Government at the district level and the local authorities in the district;
- Section 30 (2) (xiii) provides that the District Authority may facilitate community training and awareness programmes for prevention of disaster or mitigation with the support of local authorities, governmental and non-governmental organisations;
- Section 30 (xiv) provides that the District Authority may set up, maintain, review and upgrade the mechanism for early warnings and dissemination of proper information to public;
- Section 31 (3) (b) provides that the District Plan shall include the measures to be taken, for prevention and mitigation of disaster, by the Departments of the Government at the district level and local authorities in the district;

- Section 32 (a) provides that every office at the district level shall prepare a Plan setting out:
  - provisions for prevention and mitigation measures as provided for in the District Plan and as is assigned to the department or relevant agency;
  - provisions for taking measures relating to capacity-building and preparedness as laid down in the District Plan;
  - the response plans and procedures, in the event of, any threatening disaster situation or disaster;
- Section 35(2) (b) provides that the central government may ensure the integration of measures for prevention of disasters and mitigation by Ministries or Departments of the Government of India into their development plans and projects;
- Section 36 (b) provides that every Ministry/ Department of Government of India shall integrate into its development plans and projects, the measures for prevention or mitigation of disasters in accordance with the guidelines laid down by the National Authority;
- Section 37 (1) (a) mandates all the Ministries and Departments of Government of India to prepare a disaster management plan inter alia specifying:
  - the measures to be taken by it for prevention and mitigation of disasters in accordance with the National Plan;
  - the specifications regarding integration of mitigation measures in its development plans in accordance with the guidelines of the National Authority and the National Executive Committee;
- Section 38 (2) (e) provides that the State Government may ensure integration of measures for prevention of disaster or mitigation by the departments of the Government of the State in their development plans and projects;
- Section 38 (2) (f) provides that the State Government may integrate in the State development plan, measures to reduce or mitigate the vulnerability of different parts of the State to different disasters;
- Section 39 provides that the departments of State Government shall integrate into its development plans and projects, the measures for prevention of disaster and mitigation;
- Section 40 (1) (a) (ii) mandates all department of the State to prepare a disaster management plan that shall integrate strategies for the prevention of disaster or the mitigation of its effects or both with the development plans and programmes by the department

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the different types of infrastructure?

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2) List out the major International Level Agreements on Environment.

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3) Explain sustainable community development.

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11.6 CONCLUSION

The effective planning and incorporation of basic remedial measures is an important part of disaster management. In this Unit, we have discussed all the basic concepts concerning all important physical, monetary and environmental aspects relating to the minimisation of the occurrence of disaster. This Unit also clearly shows the relationship between disasters and development. Disasters can hold up development by loss of resources; shifting of resources to emergency response; depressing the investment climate; affecting the non-formal sector, etc. Development can increase vulnerability through dense urban settlement; development of hazardous sites; environmental degradation; technological failures or accidents; imbalance of pre-existing natural or social systems, etc. Development programmes can reduce vulnerability through, strengthening of urban utility systems, hazard resistant building techniques, institution building and capacitating of local authorities, agriculture and forestry programmes, etc. Disasters can provide development opportunities by creating a social and political atmosphere of acceptance to change, highlighting the general level of underdevelopment that causes the disaster, focusing international attention and aid on the disaster area.

11.7 GLOSSARY

Disaster : Sudden event that causes a lot of damage.

Development : The act or process of creating something over a period of time.

Infrastructure : The basic physical and organisational structures and facilities needed for the operation of a society or enterprise.

Vulnerability : Susceptibility to physical attack.

Recovery : Process of returning to a normal state after a period of difficulty.

Livelihood : Securing the necessities of life.

Support : Approval and encouragement given to someone or something.

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11.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- Vulnerability may increase through development programmes.
- Development programmes can decrease vulnerability.
- For development initiatives disaster is as an opportunity.

2) Your answer should include the following points:

- Large- scale settlements on marginal land or in high density, poor quality housing.
- Tourist development can increase potential vulnerability substantially when low lying beach areas are marked for infrastructure and basic investments.
- Water resource management projects, as well as dams and irrigation schemes, increase risk for the masses.

- Investment in poorly controlled hazardous industries.
- Livestock development projects and agricultural projects promoting cash crops might reduce production of essential foods.

3) Your answer should include the following points:

- Disaster can be a vehicle for effective development programs.
- International aid and development programs.
- World Bank criteria for post disaster investment.

Check Your Progress 2

1) Your answer should include the following points:

- Physical infrastructure
- Social infrastructure
- Economic infrastructure
- Environmental infrastructure.

2) Your answer should include the following points:

- CITES (Convention on International Trade in Endangered Species)
- Basel Convention on Trans-boundary Movement of Hazardous Wastes
- Convention on Biological Diversity
- Convention on Climate Change
- Kyoto Protocol to the United Nations Framework Convention on Climate Change
- Convention to Combat Desertification
- Convention on the Law of the Sea
- Montreal Protocol on Substances that Deplete the Ozone Layer.

3) Your answer should include the following points:

- A sustainable society meets its present needs without sacrificing the requirement of future generations. It is engaged in developing attitudes and actions that strengthen its economic, environmental and social infrastructure.
- Criteria for developing a sustainable society.

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BLOCK 4

DISASTER MANAGEMENT: CROSS-CUTTING ISSUES

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UNIT 12 RELEVANCE OF INDIGENOUS KNOWLEDGE*

Structure

12.0 OBJECTIVES

After reading this Unit, you should be able to:

- Understand the concept of traditional knowledge;
- Relate indigenous knowledge with Disaster Risk Reduction (DRR); and
- Understand the coping strategies during cyclones.

12.1 INTRODUCTION

In recent times, there has been constant occurrence of natural disasters around the globe, mainly due to ill-conceived development efforts and unprecedented climate change. For instance, disasters such as unforeseen floods, heavy rain and drought are the results of climate change. Such climatic variations, not only lead to natural catastrophe, but also cause a huge impact on the lives of the local community. Though the occurrence of such disasters is sometime unavoidable, the repercussions of such disasters can be avoided when participation of community members is given due recognition in disaster reduction activities. Further, accomplishment of targeted goals and sustainability of risk reduction interventions also depend upon the involvement of local populace, their knowledge, culture and traditional practices. Thus, increasing the adaptive capacity of the communities helps in bringing back the resilience and also in reducing the levels of vulnerability. The adaptive capacity could be increased by laying emphasis on the traditional knowledge of the local communities. In this Unit, the discussion is on the concept of traditional knowledge and the interrelationship between traditional knowledge and disaster risk reduction. It also documents some of the existing traditional

* Contributed by Dr. A. Senthamizh Kanal, Consultant, Faculty of Public Administration, SOSS, IGNOU, New Delhi.

practices that were adopted in dealing with disaster situations like, cyclones and droughts.

12.2 UNDERSTANDING TRADITIONAL KNOWLEDGE

Traditional Knowledge is "the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men, indigenous to a particular geographic area" (Grenier, 1998). The world 'traditional knowledge' is derived on the belief that the local communities have knowledge about the history of their locality based on the past experiences. Berkes (2007) defines traditional knowledge as "a body of cumulative knowledge, practice and belief, evolving by adoptive process, and handed down through generations by cultural transmission about the relationship of living being (including humans) with one another and the environment". The traditional knowledge can be also called as 'Indigenous Knowledge' or 'Local Knowledge'. UNESCO (2002) describes traditional knowledge as a "cumulative body of knowledge, know-how, practices and representation, maintained and developed by peoples with extended histories of interaction with the natural environment, while indigenous as attached to place and indigenous people".

As per the World Bank Report (2005), "Indigenous knowledge also referred to as traditional or local knowledge refers to the large body of knowledge and skill that has been developed outside the formal education system. Indigenous knowledge is embedded in culture and is unique to a given location or society. Indigenous knowledge is an important part of the lives of the poor. It is the basis for decision making of communities in food security, human and animal health, education and natural resource management". Flavier also states that the "traditional knowledge is the information base for a society, which facilitates communication and decision-making. Indigenous information systems are dynamic and are continually influenced by internal creativity and experimentation as well as by contact with external systems". Based on the above definitions on indigenous knowledge, it can be concluded that indigenous knowledge is not only about the past experiences of the community, but also helps a community to make a decision on what to do and what not to do. According to IIRR, indigenous knowledge is "the knowledge that people in a given community has developed over time, and continues to develop. It is based on experience, often tested over centuries of use, adapted to local culture and environment, dynamic and changing".

Rajib Shaw (2010) characterised indigenous knowledge as: "Locally bound, indigenous to a specific area and communities; culture and context specific; non-formal knowledge; orally transmitted, and generally not documented; Dynamic and based on innovation adaptation, and experimentation; and closely related to survival and subsistence for many people worldwide".

12.3 INDIGENOUS KNOWLEDGE AND DISASTER RISK REDUCTION

This section discusses how the traditional knowledge helps to reduce the disaster risk. It is always obvious that the local people know their land and environment thoroughly well. They have a unique ability, through traditional wisdom, to get and store the information on natural disasters that their land is exposed to. Hence, focus should be laid on the local people, to make their situation better. The Sendai

Framework for Disaster Risk Reduction (SFDRR) 2015-2030 stated that to achieve the disaster risk reduction at the global and regional level it "requires a multi-hazard approach and inclusive risk-informed decision-making based on the open exchange and dissemination of disaggregated data, including by sex, age and disability, as well as on easily accessible, up-to-date, comprehensible, science-based, non-sensitive risk information, complemented by traditional knowledge."

Combining the traditional knowledge with scientific expertise is more relevant in the current context. Knowing and documenting the traditional knowledge is not effective unless it is included in the disaster risk reduction activities. It is the entry point of people's participation at the grassroot levels. The SFDRR report suggests that to understand the disaster risk at national and local level, it is important to "ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to complement scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors, with a cross-sectoral approach, which should be tailored to localities and to the context."

To this effect, Pan American Health Organisation (2015) suggested the following points to be included in the Disaster Risk Reduction (DRR) planning:

- Securing the input of indigenous peoples and their cultural and environmental knowledge in the development and implementation of government disaster risk reduction plans;
- Integrating an indigenous perspective into government disaster plans that reflects how climate change is contributing to increased disaster risk;
- Considering how infrastructure development and climate change impact the disaster vulnerability of indigenous people;
- Collaborating indigenous people in the design and implementation of early warning systems in order to ensure their linguistic and cultural relevance;
- Encouraging indigenous groups to develop, with the participation of entire community, their own community-level preparedness and risk reduction plans and strategies that include actionable contingency plans to protect lives, livelihoods and critical infrastructure.

Types of Indigenous Knowledge

The indigenous knowledge can be divided into three types, that is, Technological Knowledge, Economic Knowledge and Environmental Knowledge.

1) Technological Knowledge

The indigenous people use their technical knowledge, gained over the years to address some of the concerns related to disaster risk reduction. For instance, the traditional practices of the community are still in existence; with respect to construction of house and infrastructure in the flood inundate areas, coastal regions and the mountain regions. For example, during the Uttarkashi earthquake of 1991, though the damage was visible, most of the traditional structured houses still could survive even after the disaster. Similarly, Kashmir region is also known for its earthquake resistant construction practices, that is, *Taq* System and *Dhajji Dewari* System. These types of houses could survive during 2005 Kashmir Earthquakes. Incorporating such local technical knowledge and encouraging participation of community members in the disaster preparedness improves the sustainability.

2) **Economic Knowledge**

The other type of indigenous knowledge is the economic knowledge used by the community at times of crisis. People come up with economic ideas to address the issues on a temporary basis. For instance, the construction of temporary/permanent shelter by the community with the locally available resources, in both 'during and post-disaster' phases is an apt example. Thus, low cost strategy is planned using local resources by the community. Similarly, the community also adapt themselves to alternative livelihood to overcome the crisis situation.

3) **Environmental Knowledge**

Environmental knowledge is something which is sensed by the community, even based on the minor or minute inference which they get from the environment or surrounding. For example, it is the knowledge which is based upon the experiences during cyclones or floods. On the basis of the colour of the water or clouds, people used to predict and warn the community members. It used to help the community members to take preparedness measure like storing food, firewood, saving drinking water and fodder for cattle.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Define Traditional Knowledge.

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2) Bring out the relationship between indigenous knowledge and Disaster Risk Reduction.

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3) Discuss the types of Indigenous Knowledge.

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12.4 INDIGENOUS KNOWLEDGE AND EARLY WARNING SYSTEM

To reduce risk and prepare for effective response, early warning system plays a major role in DRR. In olden times, people used to sense the cyclones through certain indicators. Precautionary measures were taken by the community based on the indications they receive from the nature through their traditional knowledge.

However, in recent times we tend to ignore native intelligence. Mostly, the indigenous early warning indicators prove to be true and paying heed to such warnings could save the community from great disasters. The following table indicates the indigenous early warning indicators of cyclones.

Indigenous early warning indicators of cyclone

Weather Patterns	Sky turns gloomy and overcast# Black rolls of cloud and change in colour of cloud – indication for flood $ Weather unusually hot and humid/hot spells after rain# Strong wind blows from the south/south-east # East wind blows in full noon – indication of cyclone If clouds move north wards, it is indication of flood $ Wind changing from east to south & gets cooler– indication of the change of direction of cyclone
Sea/River Patterns	Big waves/dark rolls of water '*Goroom goroom'* noise in the river Smokey or cloudy shapes in the sea Pond and river water becomes hot*
Animal Behaviour	Cattle become restless and stop eating grass***# Cattle/dogs wail continuously/at night***# Barking of dogs in day time – indication of cyclone $ Dogs scratch the ground continuously $ Ants climb trees with eggs on their backs# Bees move around in clusters *Kurpals* (type of gull) fly high and cry Flocking of large number of birds from north to south – indication of cyclone Birds fly without destination Increased number of flies and mosquitoes# Insects attack cattle** Fish jump in the rivers and ponds Crows/cockerels call/fly at night Frogs call constantly Foxes bark during the day Crabs come into the house and courtyard****
Other	Bending trees Water hyacinth in the canal Leaves of the mandar and cotton tree turn upside down New leaves of trees fall to the ground Muddy smell on the wind* Particular kind of fish catch by fishermen – indication of cyclone $
* - up to one day before; ** - 1-2 days before; # - most commonly mentioned across all four chars; *** - 3-7 days before; **** - 10-12 days before. Source: Adopted from Howel, 2003.	

12.5 INDIGENOUS KNOWLEDGE AND COPING STRATEGIES

12.5.1 Cyclones and Floods

Traditional knowledge of the community has always been the guiding force for the community members to develop their own coping mechanism for different disasters faced by them. For instance, people living in cyclone prone areas, areas of frequent earthquakes, landslides, etc., are used to such events as it happens on a regular basis. Based on the inference drawn from the nature, they resort to coping strategies. For example, people living in coastal areas are aware of the time of rising tides and hence avoid fishing in that season or go to high mounts in that time. Though useful and very intelligent strategies are evolved by the community members, there is hardly any documentation on the community's traditional knowledge, wisdom, and coping mechanism strategies. It is important to document such strategies, supplement the same with scientific facts and thus pass it on to larger community for adherence. Such documentation of the traditional knowledge and coping strategies of indigenous community can be beneficial, as it can help in minimising the loss of life or property, when a disaster strikes.

Some of the coping strategies that are adopted to deal with cyclones have been discussed here:

- People wrap all available seeds, rice and paddy and bury it under ground when they move for safer places.
- Some families wrap all their important papers, documents and other valuables and bury it under ground before leaving their houses.
- Houses are constructed on higher plinth whereby the water cannot enter the house.
- If the clouds move towards north, there is an indication that there will be floods in three or four days.
- Some people while looking at the colour of the clouds and their formation can predict about floods.
- People grow banana trees around the houses as the banana stems are used for floating. Something similar to a boat is made out of banana stems and is also used as barge.
- Banana leaves are used as fodder during cyclones and floods.
- People identify nearby villages and inform them before hand for their temporary migration and shelter in those villages in case of floods.
- People store foodstuff, dry food, coconut, pumpkins, etc. to be used immediately after the disaster.
- Beating of drums for dissemination of warning.
- Continuous blowing of wind from east indicates that the cyclone is approaching, more so if within two hours the wind starts becoming hot; indication is that the intensity of cyclone will be more.
- If the wind changes its direction from east to south and gets cooler, it indicates that the cyclone has changed its direction.

- Barking of village dogs without any provocation during the daytime is indicative of an unusual event like cyclone approaching in the immediate future.
- The dogs start scratching the ground.
- Fishermen get substantive catch of a particular fish prior to the cyclone which normally they are unable to get.
- The fishermen nets catch particular small plankton which they never get otherwise. This also indicates that a cyclone is approaching.
- A strange and rather thundering sound from sea for two-three days indicate that a cyclone is about to strike.
- If the clouds move fast from north to south, then there is a likelihood of cyclone.
- Birds in large quantity flock together and fly from north to south, give the indication to the community about an approaching cyclone.
- People don't plant big trees near their house so that these may not fall on them when the cyclone approaches.

12.5.2 Droughts

Droughts are not flood, earthquake, landslide and tsunami like disasters. But they create pressure on the society in the name of malnutrition, food shortages and ill-health. The reason behind drought is low rainfall and high soil moisture stress. Sometimes prolonged droughts will lead to famines and the situation gets worsened further. The recent intervention by government agencies in the maintenance and up gradation of water harvesting structures e.g. ponds, *taankas*, *naadis* and *khadeens* have also led to other avoidable complications. In this context, it is important to resort to indigenous measures taken by the community for managing situations like drought. Some of the indigenous measures adopted for dealing with drought have been discussed as below:

- The nomadic *Maldharis* of Gujarat construct 'Virdas', which serve as a means for water harvesting. They also dig shallow wells in low depressions, which are called 'Jheels' to collect water.
- The 'Kundis' of Rajasthan are unique structures that look like huge concrete sauces on the landscape. They are used for collecting rainwater to meet the needs of the local people and animals.
- The 'Kuis' were found in Bikaner and Jaisalmer. These were *kuchcha* structures dug near tanks to collect seepage and were usually covered with planks of wood.
- Rajasthan also had 'Rapats' and 'Tobas' which were effective water harvesting techniques.
- The Spiti area of Himachal Pradesh has been dependent on diversion channels called 'Khuls' for irrigation for a long time. They have carried water from glaciers to village.
- The 'Khasis' used to practice a 'Bamboo Drip' irrigation system. Maharashtra had a 'Phad' system and Bihar had 'Ahar' and 'Pynes'.
- 'Palliyals' or stream diversions were common in Kerala.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Bring out the indigenous early warning indicators during cyclones.

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2) Discuss the indigenous coping strategies.

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12.6 CONCLUSION

Indigenous knowledge or the traditional knowledge of a community is laden with rich values and information on a potential disaster which is about to happen. Indigenous knowledge, as discussed in this Unit, is the ability of the community to sense possible disasters for which the inference is drawn from nature through various indications, which is passed on to generations through experiences. Attention to the voices and experiences of indigenous community is very important, if we are to safeguard the people from disasters. Indigenous knowledge not only gives indications of early warnings about a disaster, but is also helpful to know the coping strategies adopted to deal with disaster situation. Accordingly, in this Unit, examples related to cyclones and droughts have been discussed.

12.7 GLOSSARY

Taq System : "In the Taq system, large pieces of wood or timber are used as horizontal runners embedded into the masonry walls. These runners are located at floor level and at the top of windows. These runners tie together all of the elements of the building or house and keep the entire structure in concert, thus preventing spreading and cracking of masonry. The runners are joined together with small pieces of timber, giving the shape of a ladder laid over a wall covering two exterior faces of the wall" (UNECSO, 2002).

Dhajji-Dewari System : "In the Dhajji-Dewari system, timber frames for confining masonry in small parcels are used. The timber frames, not only have vertical elements, but also have cross members, which divides the masonry infill into various small panels. The most important characteristic of this type of construction is the use of lean mud mortar. A common practice in the region is to use the Dhajji-Dewari system in the upper story walls, especially for the gable portion of the wall" (UNECSO, 2002).

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12.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

   - Traditional knowledge is not only about the past experiences of the community, but also helps a community to make a decision on what to do and what not to do.
   - It is a locally bound, indigenous to a specific area and communities; culture and context specific; non-formal knowledge; orally transmitted, and generally not documented; Dynamic and based on innovation adaptation, and experimentation; and closely related to survival and subsistence for many people worldwide.

2) Your answer should include the following points:

   - Integrating the traditional knowledge with scientific expertise is more relevant in the modern times. Knowing and documenting the traditional knowledge is not effective unless it is included in the disaster risk reduction activities.
   - SFDRR Framework.

3) Your answer should include the following points:

   - Technical Knowledge

- Environmental Knowledge
- Economic Knowledge

Check Your Progress 2

1) Your answer should include the following:
   - Weather patterns
   - Sea/River patterns
   - Animal behaviour and others

2) Your answer should include the following points:
   - Science time immemorial, traditional knowledge of the community has been guiding the community members to develop their own coping mechanism for the different disasters faced.
   - Documentation of the traditional knowledge and coping strategies of indigenous community can be beneficial to the people, as it can help in minimising the loss of life or property, when a disaster strikes.
   - Adopted coping strategies.

UNIT 13 COMMUNITY BASED DISASTER MANAGEMENT*

Structure

13.0 OBJECTIVES

After reading this Unit, you should be able to:

- Explain the concept of Community Based Disaster Management (CBDM);
- Discuss the issues related to Community Based Disaster Risk Assessment;
- Differentiate between the traditional approach and the CBDM approach;
- Describe the institutional framework of CBDM; and
- Discuss CBDM plans that are to be addressed in the pre, during and post disaster phases.

13.1 INTRODUCTION

Community Based Disaster Management (CBDM) is the bottom-up approach in dealing with a disaster situation. In the initial years, top down approach was resorted to, in dealing with a disaster situation, which mostly attempted 'command' and 'control' measures and neglected the participation of affected population both in policy making and implementation. Such approach made the disaster response

* Contributed by Dr. A. Senthamizh Kanal, Consultant, Faculty of Public Administration, SOSS, IGNOU, New Delhi.

and rehabilitation measures ineffective and unsustainable. However, in the last few decades, there has been the adoption of bottom-up approach, where a person at the ground level, that is, the community is regarded as the key player. Any effort that involves the community can help in achieving sustainability, particularly in disaster risk reduction activities. The concept of Community Based Disaster Management (CBDM) brings together the community and involves them in the various phases of disaster risk reduction activities, viz., prevention, preparedness, mitigation, response, recovery, rehabilitation and reconstruction. It creates opportunities for the community to appraise local conditions and situation through their past experiences. In this approach, local communities are part of making plans, arriving at decisions and implementing the same. It can thus be stated that the sustainability of any risk reduction programme completely depends upon the community involvement and their active participation.

In this Unit, you will be introduced to the concept of Community Based Disaster Management (CBDM) and community based risk assessment (CBRA), which covers aspects such as hazard, vulnerability, risk and capacity assessment. It also highlights the principles of CBDM and enumerates the differences between the traditional approach and the CBDM approach. The Unit also covers the institutional framework related to CBDM besides emphasising on the planning measures that are to be considered in the pre, during and post-disaster phase.

13.2 COMMUNITY BASED DISASTER MANAGEMENT (CBDM): KEY ASPECTS

13.2.1 Community and Community Based Organisations

As per Cambridge dictionary, a community is "the people living in one particular area or people who are considered as a unit because of their common interests, social groups or nationality". They are the group of individuals and households residing in a similar location. In the context of disaster risk reduction (DRR), community is a set of people who are exposed to the same hazard. Communities can identify their own vulnerability and they also make best decisions for their well-being. However, as observed by the United Nations International Strategy for Disaster Reduction (UNISDR), "in every community, knowledge, professional abilities, and experience fashioned from adversity can be found, but seldom are these resources called upon or fully utilised". Thus, community has a major role to play in managing the disasters and its role in disaster management becomes pertinent because of the following reasons:

- The community comprising the people at the local level are the direct sufferers of a disaster, irrespective of the fact that whether a disaster is severe or mild; when a disaster strikes, they are the main stakeholders and they have more to lose in the aftermath of a disaster;
- Community members are the first set of people to become vulnerable;
- The community has a lot to lose if they do not address their own vulnerability; At the same time, they gain the most by reducing the impact of disasters on their community.

In handling disasters, the community is thus put at the forefront, which has led to the emergence of community based disaster management. Community can handle a disaster situation in a better way, if they are organised as a group and they have

various advantages, when their efforts are mobilised together. Organised effort of a community is more beneficial because of various reasons, which include:

- Immense volunteering capacity of a community;
- Innate ability of the community to understand local needs;
- Increased awareness on the most vulnerable sections of their community;
- Built-in credibility with the local members;
- Access to remote social groups that generally do not have interaction with government officials;
- Power of persuasion and community influence; and
- Ability to make decision outside the government processes.

As a result of all these reasons, community based organisations are effective instruments to handle disaster situation. To put it in simple terms, Community Based Organisations (CBOs) are organisations that are created by the people within the local community which operates, monitors, and controls their own activities. These organisations work without the interference of the government and private institutions. It includes community members, elected *Panchayati Raj* representatives, village administrative/ development officer, women and youth collectives, *Gram Sewak*, *Anganwadi* workers and self-help group members. As discussed earlier, they have tremendous potential, not only in handling a disaster situation, but also in making disaster risk assessment, which is discussed later in this Unit.

13.2.2 Definitions of CBDM

Asian Disaster Preparedness Centre (2004) defines Community Based Disaster Management (CBDM), as an approach that "seeks to actively engage at-risk communities in the identification, analysis, implementation, monitoring and evacuation of disaster risks in order to reduce their vulnerabilities and enhance their capacities". In the Indian context, the National Disaster Management Authority (NDMA) (2014) states "where communities are equipped and prepared, disasters clearly have much lesser impact, especially in terms of the loss of lives". Further it regards CBDM as an approach to "build the capacity of communities to assess their vulnerability to both human induced and natural hazards and develop strategies and resources necessary to prevent and/or mitigate the impact of identified hazards as well as respond, rehabilitate, and reconstruct following its onset". The International Institute for Disaster Risk Management (IIDRM) views CBDM as "an approach that involves direct participation of the people most likely to be exposed to hazards, in planning, decision-making, and operational activities at all levels of disaster management responsibility".

The above definitions highlight the importance of communities in planning and implementation of disaster risk management. Apparently the definitions also clarify that it is important to enhance community capabilities, which will help in reducing the vulnerabilities at grass root level. The knowledge, skills and attitude towards a disaster situation at the local level will help the communities during disasters and also increase the preparedness level.

13.2.3 Principles of CBDM

The following are the basic principles of CBDM:

- *Active participation:* Active participation of the community is very important

for reducing disaster risk. When disaster risk reduction measures are community-centric, the local champions take ownership in planning, implementation and management of disaster reduction activities.

- *Use of local resources and capacities:* Interventions begin from locally available and accessible resources, capacities and networks/partnerships. Utilisation of all these aspects at the local level is an important principle to deal with a disaster.
- *Own choice and decision:* Community should consider their choices and decisions while engaging in disaster risk reduction.
- *Capacitating community:* DRR programmes should be community specific and focus on increasing the capacity of the local level people.
- *Attention to vulnerable groups:* Special focus should be given to vulnerable groups, so that their wellness and needs are taken care of in the pre, during and post-disaster phases.

13.2.4 Difference between Traditional and CBDM Approach

With the introduction of CBDM practices, disaster management activities have become effective, as the attention is towards people and addressing their vulnerabilities. The traditional approach was mostly insensitive to local needs and it did not help much in reducing disaster impacts. The following are the major differences between traditional and CBDM approach.

S.No	Traditional Approach	CBDM Approach
1	It's a victim or receiver oriented approach	It is an active participatory approach
2.	People are considered as helpless victims	People are active participants in rebuilding their lives and livelihoods.
3.	People are recipient and totally dependent on external aid	People's capacities are built and developed through their active participation. It maintains the sustainability of the development programmes.
4.	Need and damage assessment done by external people/experts	Need and damage assessment done with community participation. It provides the realistic picture of the assessment.
5.	It focuses on technical solution and material aid	It focuses on assisting communities to address their vulnerabilities so that the short-term aid get replaced by long-term development.
6.	Focus on individual household	Focuses on strengthening community and their structure. It enhances the sustainability of the DRR measures and also integrates the society and its resources
7.	Disaster management is considered as a relief provided to the community	Disaster management is considered as community awareness and sensitisation, community participation and mainstreaming DRR into socio-economic, political and development initiatives.

***Source*:** ADPC, 2014.

13.3 COMMUNITY BASED DISASTER RISK ASSESSMENT (CBDRA)

Community Based Disaster Risk Assessment (CBDRA) is a systematic way to identify and assess the hazard, vulnerability and capacity at the local level. According to ADPC, "community risk assessment is a participatory process of determining the nature, scope and magnitude of negative effects (due to hazards), which can be anticipated during a specified period and be reduced by employing local capacities". The nature of a disaster is unique and distinct and each disaster makes different impact on the society. For instance, earthquakes damage lives, houses and critical infrastructure; whereas cyclone affects houses, livelihood and other related matters. Hence, assessment of the hazard, risk, vulnerability and capacity (HRVC) of the village with the help of community will increase the coping capacity of the local people and also augment the local resources. In the following section, we will discuss about the key issues of community based disaster risk assessment.

13.3.1 Hazard Assessment

Hazard assessment makes an evaluation of the nature of the hazard at the community level. This analysis is done by the community members to identify potential risks and hazards in their villages and identify the appropriate measures to bring resilience to the society. In general, this kind of assessment tries to find answers to the following:

- What is the nature and intensity of hazards present in a specific area?
- What are the elements at risk?
- What can be the possible extent of loss caused by these hazards?
- What is the duration of these hazards and how can they interact with each other to pose compound threat?

The major tools of the hazard assessment are village hazard maps, historical profile of the place and the seasonal calendar. In this exercise, the communities assess the existing hazards, its nature and frequency in their area and identify the most vulnerable place or group in that village.

13.3.2 Vulnerability Assessment

Most of the hazards turn disastrous because of the vulnerability of the community and the unpreparedness of the community. Vulnerability assessment measures the extent to which people are or infrastructure is likely to get affected from hazards. In other words, it is "the analysis of the vulnerability of various sectors that are exposed to the natural hazards identified in the hazard analysis exercises. The sectors include social, livelihood, economic, physical assets, agriculture, political and administration" (DMTP, 1994). It is a process to determine what elements are at risk and analyse the factors behind why these elements are at risk? This assessment is not at all possible without the active participation of the people because they are the ones, who know their field very well. The following are the two stage consequence of vulnerability assessment to hazards (IGNOU, MPA 007):

1) Making inventory of what element is at risk:

Once the hazard is identified in the particular village it is necessary to find out the

possibility of damage that can be caused by the hazard. The data on the following elements are required during the vulnerability assessment.

- Population: Age, gender and health
- Livelihoods: Types and locations
- Local economy
- Agriculture and fishery
- Buildings and infrastructure
- Cultural assets (Library, museums and heritage buildings)
- Local institutions.

2) Assessing the vulnerability of elements at risk:

Once the required information has been collected, it is necessary to identify how the elements will be affected by hazards to make accurate assessments of the risk. The analysis of the socio-vulnerability factors will provide the coping mechanism to the community members.

13.3.3 Capacity Assessment

As per UNISDR, "Capacity is the combination of all the strengths and resources available within a community, society or organisation that can reduce the level of risk or the effects of a disaster". ADPC states that "Capacity assessment is the process to determine what people do in times of crisis to reduce the damaging effects of the hazard, and to secure the sustainability of their livelihood by: understanding people's previous experiences with hazards that enables them to develop coping strategies; analysing which resources are available and used by the community to reduce risk; and assessing who has access to these resources and who control them". The Capacity can be classified into the following categories: economic capacity, physical capacity, social capacity and natural and climatic resources.

13.3.4 Tools for Community Based Disaster Risk Assessment

Participatory Risk Assessment tools are used to collect information from the community about the existing risk status of the village. For such an assessment, it is not necessary to have a particular, technical expertise, but what is needed is only the local knowledge of the community. This approach helps to conduct the base line survey of the village, which would help in resolving the conflict resolution through more interaction. The following are the Participatory Risk Assessment (PRA) Tools:

- Historical profiling
- Risk mapping
- Seasonal calendar
- Transect walk
- Institutional analysis
- Gender mapping
- Livelihood and existing coping strategies
- Disaster ranking

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Define Community and Community Based Organisations.

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2) List the major principles of Community Based Disaster Management.

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3) Discuss Community Based Disaster Risk Assessment.

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4) Bring out the difference between Traditional and CBDM Approaches.

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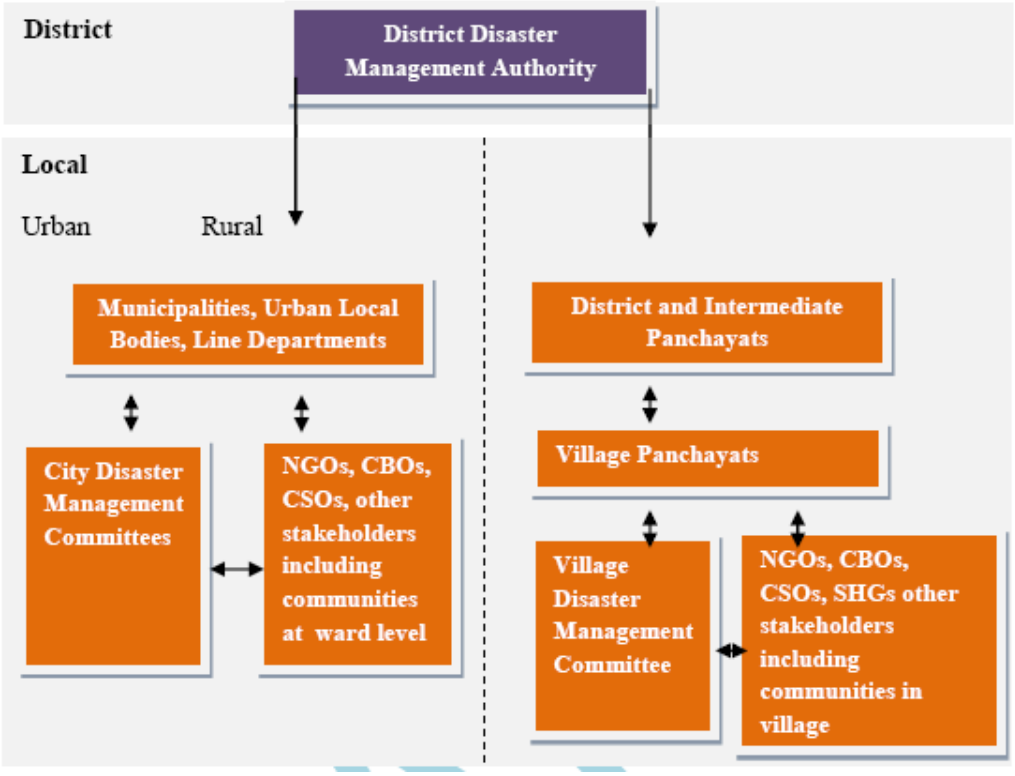
13.4 COMMUNITY BASED DISASTER MANAGEMENT: INSTITUTIONAL FRAMEWORK

Community involvement in disaster management has been stressed both by the Disaster Management Act and the National Disaster Management Authority, which state that only when community initiatives are integrated with the local institutions, state policies and practices, the CBDM measures can be effectively implemented. The NDMA in 2014 came up with the CBDM guidelines discussing the CBDM institutional framework. It observes that the institutional framework of CBDM should be grounded on the principles of participation, social inclusion, equity and decentralised governance. In general, CBDM institutional framework is important for various reasons:

- Firstly, the CBDM institutional framework helps in having clarity on the nature and forms of institutions that exist at the ground level;
- Secondly, it creates linkage between community and government institutions, which helps in better coordination and action;
- Thirdly, the framework would help the government and civil society to facilitate the formation and functioning of community organisations; and
- Finally, the framework serves as a mechanism to monitor and evaluate the functioning of community based institutions and processes.

The NDMA's CBDM guidelines also enumerated the principles of community based disaster management institutional framework, which are as follows:

- The CBDM institutional framework must consider the local communities as active actors, rather than passive victims;
- Community should be considered the centre of all disaster management activities, right from planning, disaster response, disaster mitigation, etc.;
- CBDM institutional framework should be sensitive to the needs of different communities viz., people belonging to different social groups, disabled, women, elderly and other marginalised, etc., as they are at greater risk;
- The CBDM institutional framework should analyse the local risk patterns and trends, as disaster is not an isolated event, but stems from the concerns related to development, environment management and human behaviour;
- The CBDM institutional framework has to work in coordination with external supportive and facilitative institutions without losing its autonomy and thus shall function on the spirit of voluntarism and collaboration.



***Source*:** NDMA, 2014.

The CBDM institutional framework emphasises decentralised planning and management at the district, sub-district and village level and insists that there should be both horizontal and vertical links at all levels. Thus, disaster risk reduction strategies and issues could be mainstreamed in the development planning process, if there are proper linkages with all institutions at all levels, as depicted in the diagram, both at the rural and urban level.

13.5 COMMUNITY BASED DISASTER MANAGEMENT PLAN

It is important to plan well ahead for managing disasters, as it is helpful to prevent major losses in terms of life, livelihood, property, etc. Further, CBDM plans are also helpful as it contains details on the vulnerabilities, potential hazards that can hit a place, mechanism that are in place to deal with a disaster immediately. The following section discusses about the community based disaster management plan, which can be made in various phases of a disaster, viz., pre, during and post-disaster.

CBDM Plan in Pre-disaster Phase

The planning process in the pre-disaster phase can cover the following:

- *Community orientation:* The plan can have measures towards community orientation, wherein the community can be briefed on the nature and effect of a disaster and their vulnerabilities;
- *Stock-taking of resources:* Stock-taking of the resources within their village or locality is important in the pre-disaster phase. Such stock-taking of the condition of schools, health centres, cyclone shelters, communication facilities, conditions of roads and infrastructure, etc., can help the community to take quick decisions when a disaster actually strikes;
- *Risk and vulnerability assessment:* Assessing the risks and vulnerabilities of the community is another important aspect of planning in the pre-disaster phase. It is important to take stock of the elements at risk, viz., area, physical structures, economic assets, etc. and people at risk, viz., children, women, disabled, elderly, etc., so that preparedness measures are appropriately planned;
- *Formulation of preparedness plan:* Formulating preparedness plan at the community level is very crucial in the pre-disaster phase. This takes into cognisance the community needs; clarifies measures to be taken by the community before, during and after the disaster strikes; gives idea of resources available at various places; specifies the roles and responsibilities of concerned officials, departments, *Panchayati Raj* Institutions, NGOs, CBOs, etc. A properly prepared plan facilitates the community to effectively execute the plan.

During Disaster

Following measures are to be taken into consideration, while planning for this phase of disaster management:

- *Organising search, rescue and evacuation activities:* This includes identifying the disaster victims, bringing them to safer places, providing first-aid, distributing relief, adhering to evacuation plan, etc.
- *Providing shelter to people and livestock*: While the place of shelter for

people and livestock is pre-planned, plan should be made for other arrangements to be taken care of in the shelter, which include water supply, sanitation, kitchens, fodder for animals, medical services, first-aid, etc.

- *Debris clearance and dead body identification:* Clearing of debris from collapsed buildings, bridges, trees, other structures, etc., and disposing of dead humans and livestock is a major concern in the ' during disaster phase', which has be to planned appropriately, if the spread of disease and further health and environmental impact is to be contained.
- *Damage assessment:* Assessing damages immediately on the occurrence of disaster facilitates quick emergency relief. This is to be done with reference to the number of households, population, livestock, area affected, etc.

Post-disaster Phase

The CBDM plan in the post-disaster phase covers the following:

- *Detailed damage assessment:* Undertaking a detailed damage assessment is very important in the post disaster phase, as this is helpful to know the magnitude of loss both in terms of lives and other damages like infrastructure, damage to crops and the estimated value.
- *Preparation of rehabilitation plan:* Drawing up a comprehensive economic rehabilitation plan is necessary, which can include measures for restoration of agricultural activity through necessary inputs, rehabilitation of artisans, marginal, small scale and business people, those pursuing other occupations, replacement of cattle, agricultural and other equipment, boats, fishing nets etc.
- *Social rehabilitation:* The post-disaster plan should ensure social rehabilitation through strengthening of existing health centres, schools, *anganwadis*, community centres, vocational training centres, psychological counselling to the affected to enable them get back to their normal routine.
- *Monitoring of CBDM:* It is important to build an appropriate monitoring and evaluation mechanism in community-based disaster management programme. This is needed to facilitate proper utilisation and implementation of resources.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss the Institutional Framework of CBDM.

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2) Write a short note on the Post-Disaster Phase of CBDM.

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13.6 CONCLUSION

In this Unit, we have covered an important topic, that is, community based disaster management. As discussed earlier, the role of the community is very vital especially in dealing with a disaster situation, as the community members are the first set of people, who would get affected when a disaster strikes and who is immediately available for help and whose help matters a lot in preventing huge loss of life and property. Understanding the importance of the critical role of the community, both at the national and international forum, CBDM has been highlighted as crucial measure to bring resilience in a community. The Unit also introduced the principles of CBDM, apart from highlighting the difference between the traditional and CBDM approach, where there was the shift from the top-down to the bottom up approach. Institutional framework and planning for CBDM was also covered in this Unit, which discussed the importance of integrating different stakeholders at the local level and the need to consider various disaster related aspects in the pre, during and post-disaster phase.

13.7 GLOSSARY

Disaster Risk : The UN defines it as "the conceptual framework of elements considered with the possibilities to minimise vulnerabilities and disaster risks throughout a society, to avoid (prevention), or to limit (mitigation and preparedness) the adverse impact of hazards, within the broad context of sustainable development.

Participatory Rural Appraisal (PRA) : PRA originally stood for Participatory Rural Appraisal, but its applications are in many other contexts besides rural and good practice is far more than just appraisal. It enables others to do their own appraisal, analysis, planning and action, to own the outcome and to share the knowledge. The target group could be local; rural or urban concerning people, women, men or old, or members of an organisation or group.

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13.9 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:

- Community comprises of the people at the local level and they are the first set of people to become vulnerable;
- The community comprising of the people at the local level are the direct sufferers of a disaster, irrespective of the fact that whether a disaster is severe or mild. When a disaster strikes, they are the main stakeholders and they have more to lose in the aftermath of a disaster.
- Community Based Organisations are organisations that are created by the people within the local community which operates, monitors and controls their own activities.

- These organisations works without the interference of the government and private institutions. It includes community members, elected *Panchayati Raj* Representatives, village administrative/development officer, women and youth collectives, *gram sewak, anganwadi* workers and self help group members.

2) Your answer should include the following points:
   - Active participation
   - Use of local resources and capacities
   - Own choice and decision
   - Capacitating community
   - Attention to vulnerable groups

3) Your answer should include the following points:
   - Community Based Risk Assessment (CBRA) helps to collect the base line survey of the village, which would help in resolving the conflict resolution through more interaction.
   - Participatory Risk Assessment Tools: Historical Profiling ; Risk Mapping; Seasonal Calendar; Transect Walk; Institutional Analysis; Gender Mapping; Livelihood and existing coping strategies; and Disaster Ranking .

4) Your Answer should include the following points:
   - Traditional approach was mostly insensitive to local needs and it did not help much in reducing disaster impacts.
   - CBDM approach focuses on assisting communities to address their vulnerabilities. So that the short term aid replaced by long term development.

Check Your Progress 2

1) Your answer should include the following:
   - CBDM institutional framework helps in having clarity on the nature and forms of institutions that exist at the ground level.
   - Linkage of community with government institutions, which helps in better coordination and action.
   - It would help the government and civil society to facilitate the formation and functioning of community organisations; and
   - It serves as a mechanism to monitor and evaluate the functioning of community based institutions and processes.
   - NDMA's CBDM framework.

2) Your answer should include the following:
   - Detailed Damage Assessment
   - Preparing Rehabilitation Plan
   - Social rehabilitation
   - Monitoring of CBDM.

UNIT 14 DISASTER MANAGEMENT STRATEGIES*

Structure

14.0 OBJECTIVES

After reading this Unit, you should be able to:

- Discuss the problems involved in management of a disaster situation;
- Understand the scholarly perspectives of the disaster management strategies; and
- Explain the disaster management strategies adopted at the international and National levels.

14.1 INTRODUCTION

As discussed in the previous Units, disasters have been of wider repercussions on the society leading to huge losses and damages and this scenario is a global phenomenon. Across the borders, the disaster impact has been increasing day-by-day. Extreme weather conditions, population growth, unplanned urbanisation, demographic changes and increasing pressure on natural resources are the major factors for the disaster losses. As reported by the Centre for Research on the Epidemiology of Disasters (CRED) and the United Nations International Strategy for Disaster Reduction (UNISDR), the disaster losses in India has been enormous in the last 20 years, which is around 20 billion US dollars (CRED & UNISDR, 2018). In such a scenario, where the disasters are making huge setback on development, it is important to reflect on whether disasters can be avoided or

* Contributed by Dr. A. Senthamizh Kanal, Consultant, Faculty of Public Administration, SOSS, IGNOU, New Delhi.

not? With the adoption of the International Decade for Natural Disaster Reduction (IDNDR) convention since the 1990s, the way disaster has been looked at has changed worldwide. The relief-oriented approach changed into risk-reduction approach. With the change in approach, the focus was more towards adopting strategies that can help in disaster reduction. Thus, disaster management strategies focused on various components like improving the capacities of community, adopting prevention, preparedness and mitigation measures, etc.

While the previous Units acquainted you with the basic concepts and components of disaster management, this Unit introduces you to some of the international strategies and frameworks related to disaster management. Some of the key disaster management strategies discussed in this Unit include Yokohoma strategy, IDNDR framework and Sendai Framework for Disaster Risk Reduction 2015-2030. It also discusses the scholarly views on disaster management strategies besides elaborating the strategies for disaster management adopted in India.

14.2 EVOLVING DISASTER MANAGEMENT STRATEGIES: IDENTIFYING THE PROBLEMS

Before the disaster management strategies could be evolved, it is important to reflect on the problems that the strategies are trying to address. Thus, clarity is needed on the kind of challenges or problems that has to be addressed, as the disaster management measures cannot remain too confused, because it involves large number of lives and huge amount of property. Some of the challenges that are to be focused upon include the following:

- *Gaps in Policies and Practice:* Though disaster management strategies and measures are formulated by emergency managers or government, there exists a huge gap between the policy formulated and policy implemented. Hence, it is important to address policy failures. Guidelines should be formulated in a more realistic and responsible manner. Further, gaps that exist in implementation due to administrative failure should also be rectified, which would otherwise lead to negative effects in the mitigation of disasters. In addition, McConnell and Drennan (2006) identify the following tensions between the ideals and practices of disaster management:
    - High potential impact of crisis *vs.* the low priority of emergency management;
    - Need for planning and order *vs.* the chaotic uncertainty and the inherent disorder of crisis events;
    - Need for an integrated approach *vs*. the reality of institutional fragmentation; and
    - Need for active planning and genuine readiness *vs.* symbolic readiness.
- *Corrupt Practices:* One of the major problems faced in disaster management is the high level of corruption involved in the phase of relief and recovery, which needs to be addressed, while planning the strategies. As highlighted by Grist (2007), there is certain element in the community which always attempts to profit from the misfortune of others or the outpouring of assistance from relief organisations. Hence, the strategies for disaster management should also ensure that such corrupt practices are prevented.

- *Lack of Situational Awareness and Analysis:* Another major problem faced is the lack of situational awareness and analysis. Without having proper understanding of the implications of a particular disaster situation, different approaches are followed which lead to delay in the process of disaster resilience. Hence, the disaster strategies should be based on a thorough knowledge of disaster situation and suggest relevant measures for different disasters.

- *Centralised Approach:* One of the crucial problems is that the emergency management measures have become more response-oriented and less collaborative, besides being more centralised. Centralised decision processes cause delays in approving and dispatching disaster assistance and greatly complicate communication between and among various stakeholders in disaster management. This creates serious communication problems between and among local, state, and federal officials, apart from creating communication gap among the emergency responders (Waugh 2006). The disaster strategy, thus, has to adopt flexible measures in terms of having decentralised measures, wherever possible, apart from ensuring coordination among various levels.

- *Lack of Coordination:* Even if collaborative arrangements are established, there remains lack of coordination among the players and various governmental, non-governmental and local agencies. All these players become much rigid in their own perspective. Thus, the strategies adopted by them become piece-meal measures, rather than following an integrated approach. Grist (2007) suggests that the elected representatives of the community should be encouraged to assume the role of integrators and preservers of the vision of the common good.

All such problems referred to above are only the tip of the ice berg. Such understanding of the problems involved in disaster management helps in evolving effective strategies and arriving at a comprehensive mechanism for dealing with it.

14.3 SCHOLARLY PERSPECTIVES ON DISASTER MANAGEMENT STRATEGIES

In dealing with a disaster situation, different strategies are suggested by different scholars and at different forums at the international level. A comprehensive definition of disaster management has been given by the United Nations International Strategy for Disaster Reduction (UNISDR, 2009), by referring to *disaster risk management* as a "systematic process of using administrative decisions, organisation, operational skills, and capacities to implement policies, strategies, and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters". However, a comprehensive strategy at the global level may not be an umbrella framework suitable for all regions. The local knowledge and indigenous thoughts should be pooled in, to design a region specific disaster management strategy.

Canton's strategy in dealing with emergencies is the response methodology and presence of principal agent. Canton's formulation of crisis hierarchy model suggests usage of Multi-Agency Coordination System as a response methodology and State and local governments as Principal Agents (Canton, 2007).

According to Kapucu and Van Mart (2006), 'innovative problem solving, horizontal adaptation, collaboration, relationships based on trust, better public sector leadership, decentralised decision making and intensive human interaction are critical for the

success of disaster responses'. To this effect, it is of greater help to refer to the general strategies identified by Multidisciplinary Center for Earthquake Engineering Research (MCEER). It comprises four such general strategies that can be applied in handling any kind of disaster. These are (Kapucu, 2005):

i) Robustness – ability to withstand the forces generated by a hazard agent without loss or significant deterioration of function;

ii) Resourcefulness – capacity to apply material, information, and human resources to remedy disruptions when they occur;

iii) Redundancy – the extent to which elements, systems, or other units of analysis exist that are capable of satisfying the performance requirements of a social unit in the event of loss or disruption that threaten functionality; and

iv) Rapidity – the ability to contain losses and restore system or other units in a timely manner.

The Federal Emergency Management Agency (FEMA, 2003) of the United States has also identified few strategies in managing emergencies that include, concentrating on the core set of functions to be performed at the time of disasters; besides, other aspects in general to be taken care of. The set of core functions that is to be provided by emergency management personnel at the time of disasters includes the following:

- Direction and control;
- Communications;
- Warning;
- Emergency public information;
- Evacuation or in-place sheltering;
- Mass care;
- Health and medical; and
- Resource management.

Apart from this, FEMA has also provided a set of aspects that are required to be followed by emergency managers. These are: Hazard identification and risk assessment; Hazard mitigation; Resource management; Planning; Direction and control; Communication and warning; Operations and procedures; Logistics and facilities; Training; Exercises, evaluations, and corrective actions; Public education and information; and Finance and administration.

Kris Teutsch (2010) highlights the need for looking into the following capabilities and benefits, in planning disaster strategies:

- *Optimised Situational Awareness:* Real time communication, data management and data transmission helps in presenting a full picture of the disaster situation;
- *Interoperable, Collaborative Environment:* Information flow across all levels and all types of boundaries can help the responders to save more lives and deal with disasters in a better manner;
- *Support for Mobile and Web-based Access*: In a digital world, which is

driven by technology, all components and people are connected in fixed and field location though different digital devices. Hence, mobile and web-based access in handling disaster situation can help in handling disaster situation. For instance, during the Kerala floods of 2018, through the mobile and web-based access and portals, support was offered both in terms of mobilising fund for relief and also in identifying the victims who are in need of relief measures.

Thus, though the strategies to deal with disasters can have a comprehensive outlook, it should also have flexibility to make necessary changes based on the local context and challenges faced.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Highlight the problems involved in disaster management.

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2) Discuss the scholarly perspectives on disaster management strategies.

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14.4 INTERNATIONAL AND NATIONAL STRATEGIES FOR DISASTER MANAGEMENT

14.4.1 Disaster Management Strategies: International Measures

At the international level, various strategies and guidelines were given to deal with disaster situations. Some of the key strategies right from the IDNDR of the 1990s to the recently initiated Sendai framework have been discussed here.

14.4.1.1 International Decade for Natural Disaster Reduction (IDNDR)

To prevent the adverse effects and impacts of natural disasters, 1990s was declared as the 'International Decade for Natural Disaster Reduction', by the United Nations General Assembly on December 11, 1987. The United Nations adopted a resolution on 22nd day of December 1989 that stated "to reduce through concerted international

action, the loss of life and disruption caused by natural disasters". Thus, the United Nations set up a decade's goal with focus on improving the capacity of the developing countries to mitigate the effects of natural disasters. The resolution also sought the developing nations to design guidelines and strategies for applying existing scientific and technical knowledge (United Nations, 1989).

Some of the key strategies that were suggested by the IDNDR for the participating nations and member countries included the following:

- Planning and implementation of disaster management measures at the national level;
- Integration of disaster prevention policies with the development programmes;
- Laying emphasis on community preparedness by way of education and training on the significance of preparedness, prevention, relief and recovery;
- Emphasising the developing nations to pay substantial attention to the social and economic infrastructure and concentrate on providing human shelters and proper health care facilities to mitigate the vulnerabilities at the time of disasters (Ibid.).

14.4.1.2 Yokohama Strategy for Disaster Reduction

In order to undertake a mid-term review of the resolution of International Decade for Natural Disaster Reduction (IDNDR), a World Conference on Natural Disaster Reduction was held in May 1994, at Yokohama, Japan. In this conference, the Yokohama Strategy and Plan of Action for a Safer World was adopted. In general, this Strategy played a significant role in motivating the developing countries in changing its relief oriented approach to the one based on mitigation and prevention.

Each member country in the Conference agreed to work towards protecting its people, infrastructure, and other national assets from the impact of natural disasters. The member countries thus agreed to adhere to the principles or strategies enumerated by the conference, which included the following (UNISDR, 1994):

- come to an agreement that, Risk assessment is the major step for adoption of successful disaster reduction policies and measures and disaster prevention and preparedness are of primary importance in reducing the need for disaster relief;
- consider disaster preparedness and prevention as an integral aspect in planning the development policies at the international, national, regional, bilateral and multilateral levels;
- consider development and strengthening of capacity to prevent, reduce and mitigate disasters as a top priority;
- consider early warning of impending disasters and the dissemination of information using telecommunication and other broadcasting services as a key factor for successful disaster prevention and preparedness;
- promote participation at all levels, from the local, regional, national and international for the preventive measures and reduce vulnerability by the application of proper designs and planning by focusing on target groups by way of education and training;
- provide free access to necessary technology to prevent and mitigate disasters

and promote the acceptance of international community to use it in a timely manner as an integral part of technical cooperation;

- consider environmental protection in consistent with poverty alleviation as an important component in preventing and mitigating natural disasters.

Thus, through risk reduction strategies, the varying impact of disasters can be considerably reduced, if not eliminated. Though these were emphasised upon by the Yokohama Strategy, yet these could not be taken up as sufficient to cope up with the multiplying challenges of disasters. An analysis of the Yokohama Strategy reveals gaps and challenges in the domains of governance, risk identification, assessment and monitoring, knowledge management, reduction of risk factors and preparedness for effective response and recovery (UNISDR, 2005).

14.4.1.3 Hyogo Framework for Disaster Reduction

The gaps identified in the Yokohama Strategy were addressed in the World Conference on Disaster Reduction held in Kobe, Hyogo, Japan in 2005 (it is popularly referred to as Hyogo Framework for Disaster Reduction). It was held on the hypothesis that a more comprehensive approach is needed for proper management of disasters. The Hyogo Framework of Action and Hyogo Declaration set out a result-oriented plan of action or strategy for the next decade from 2005-2015, which included the following:

- Effective integration of disaster risk considerations into sustainable development policies, planning and programming at all levels with emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction;
- Strengthening of institutions, and capacities at all levels, especially at the community level;
- In the context of increasing global interdependence, concerted international cooperation and an enabling international environment are required to stimulate and contribute to developing the knowledge, capacities and motivation needed for disaster risk reduction at all levels;
- A gender perspective should be integrated into all disaster risk management policies, plans and decision-making processes, including those related to risk assessment, early warning, information management, and education and training;
- Disaster-prone developing countries, especially least developed countries and small island developing States, should be given particular attention in view of their higher vulnerability and risk levels, which often greatly exceed their capacity to respond to and recover from disasters;
- There is also a need for proactive measures, bearing in mind that the phases of relief, rehabilitation and reconstruction following a disaster are windows of opportunity for the rebuilding of livelihoods and for the planning and reconstruction of physical and socio-economic structures, in a way that will build community resilience and reduce vulnerability to future disaster risks;
- An integrated, multi-hazard approach to disaster risk reduction should be factored into policies, planning and programming related to sustainable development, relief, rehabilitation, and recovery activities in post-disaster and post-conflict situations in disaster-prone countries (UNISDR, 2005).

Though the Hyogo Framework provided new measures to deal with disaster management, it lacked innovation in it. It seemed to be an old wine in a new bottle. Repeatedly the issues of prevention, preparedness, mitigation and recovery, occupy the central theme in all the three frameworks, viz., IDNDR, Yokohama Strategy and the Hyogo Framework. Nevertheless, the three frameworks are landmark initiatives at the international level, reinforcing the developing countries for favourable response, towards a disaster free world.

14.4.1.4 Sendai Framework for Disaster Risk Reduction

During the Third United Nations World Conference on Disaster Risk Reduction held in Sendai, Japan, in June 2015, the "Sendai Framework for Disaster Risk Reduction" was adopted. It was the first major agreement of the post-2015 development agenda, with four priorities of action and seven targets.

The four priorities for action under the Sendai Framework include:

Priority 1: Understanding disaster risk – Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.

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

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

Priority 4. Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction – The growth of disaster risk means there is a need to strengthen disaster preparedness for response, take action in anticipation of events, and ensure capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures (UNISDR, 2015).

The strategy adopted by the Sendai Framework is to focus on the seven "global targets", which include:

1) Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020–2030 compared to the period 2005– 2015;

2) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020–2030 compared to the period 2005–2015;

3) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030;

4) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030;

5) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020;

6) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the present Framework by 2030;

7) Substantially increase the availability of and access to multi-hazard early warning system and disaster risk information and assessments to people by 2030 (ibid).

However, in spite of all such strategies, frameworks and their guidance, managing a disaster does not appear to be an easy task, because of multiple issues and complexities involved in it. Most of the time, the mismanagement of disaster is mainly due to the poor handling of disaster events by the disaster managers or the government or sometimes the victims themselves, who pay least attention to the warnings issued.

14.4.2 Disaster Management Strategies: Indian Context

Evolving disaster management strategies in the Indian context has been in practice since age old times, as disasters have been a regular phenomenon (For more details on Disaster Management in India, refer Unit-5). In earlier times, adoption of systematic strategy to deal with disasters, has been found in Arthashashtra written by Kautilya in the period of 321 to 296 BC. This treatise on Statecraft is a book of rules, which could be enforced by law by the king and along with other rules, rules for dealing with disaster situation have been specified.

In contemporary times, the strategy adopted by India to deal with disaster was mostly reactive rather than being proactive. In recent times, with repeated emphasis by International forums, the strategy of India has changed. Thus, there has been a widespread awareness about the impact of disasters and India has started taking proactive measures to mitigate disasters. The Declaration of International Decade for Natural Disaster Reduction in 1989, made the country to realise the importance of disaster management. However, the efforts of India towards disaster management were proceeding at a slow pace. With the Yokohama Strategy of 1994, the disaster management efforts picked up momentum and after the Hyogo framework of 2005, India has engaged in full-fledged measures to mitigate disaster.

Apart from such international efforts, the disasters that happened continuously at the national level since 1993; the Latur Earthquake (1993), Malpa Landslide (1994), the Orissa Super Cyclone (1999), Bhuj Earthquake (2001), Indian Ocean Tsunami (2004), Kosi Floods (2008), Uttrakhand Floods (2013), Cyclones and Floods in Chennai and Kerala (2018) etc., were responsible for the quick reaction of India. The High Powered Committee on Disaster Management was constituted in August 1999, under the chairmanship of Shri J.C.Pant, Secretary, Ministry of Agriculture, Government of India. This was a first attempt in India towards framing a systematic, comprehensive and holistic approach towards disasters. After that India had enacted the Disaster Management Act in 2005 and also established the National Disaster Management Authority in the same year, that is, 2005. In addition, the Disaster Management Policy was formulated in 2009. It was followed by the formulation

of the National Disaster Management Plan in 2016. The State Governments are also in the process of setting up State and District Disaster Management Authorities. The provisions of the Act relevant to the States/UTs have been brought into force with effect from 1st August 2007. Almost all States are reported to have constituted the State Disaster Management Authority (SDMA) (Kanal, 2013).

The National Disaster Management Plan 2016 has been created based on the goals and priorities set out by the Sendai framework. The vision of the document is to "*Make India disaster resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets – economic, physical, social, cultural, and environmental – by maximising the ability to cope with disasters at all levels of administration as well as among communities*" (Government of India, 2016).

Thus, in the Indian context, it can be stated that the strategy adopted mostly aims at setting the institutional structure and enumerating the provisions for dealing with disaster situation. However, in terms of implementation, India still needs to adopt firm strategies. However, it cannot be denied that the institutional structure of the disaster management in India has been strengthened. Further, the focus also has shifted to risk reduction and capacity enhancement.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Discuss various features of Yokohama Strategy and Hyogo Framework.

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2) List out the priorities and global targets of Sendai framework.

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14.5 CONCLUSION

On the whole, the attempt has been made in this Unit to sensitise you about the disaster management strategies. It summarised the challenges that are to be identified and acted upon even before framing the strategies. In addition, the Unit also brought forth the scholarly views on disaster management strategies as put forward by different scholars and also international forums. Various disaster management strategies, both at the international level and in the Indian context, have also been highlighted, whereby it can be observed that there has been shift in focus from managing disasters to dealing with disaster risks. Thus, the shift from reactive to proactive approach that was seen in various forums such as UNISDR, Yokohama strategy, Hyogo and Sendai Framework, etc., was discussed, besides referring to the strategies adopted in India.

14.6 GLOSSARY

Principal-Agent : The principal–agent problem, in political science and economics, occurs when one person or entity is able to make decisions and/or take actions on behalf of, or that impact, another person or entity: the "principal" (Wikipedia).

FEMA : It is called as a Federal Emergency Management Agency in USA. FEMA (Federal Emergency Management Agency) mission is to support the citizens and first responders to promote that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards (www.fema.gov).

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14.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - Gaps in Policies and Practice
   - Corrupt Practices
   - Lack of Situational Awareness and Analysis
   - Centralised Approach
   - Lack of Coordination

2) Your answer should include the following points:
   - Multi-agency coordinating system
   - Four general strategies
   - FEMA four core functions.

Check Your Progress 2

1) Your answer should include the following points:
   - Yokohama Strategy for Disaster Reduction
   - Hyogo Framework for Disaster Reduction

2) Your answer should include the following points:
   - Understanding disaster risk
   - Strengthening disaster risk governance to manage disaster risk
   - Investing in disaster risk reduction for resilience
   - Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction
   - Seven Global Targets

UNIT 15 DISASTER MANAGEMENT: CASE STUDIES*

Structure

15.0 OBJECTIVES

After reading this Unit, you should be able to:

- Discuss a few case studies related to disaster management in the Indian context;
- Understand the impact of Odisha Super Cyclone and the establishment of OSDMA thereafter;
- Explain the impact of Bhuj Earthquake;
- Discuss the impact of Indian Ocean Tsunami and the resultant measures in terms of enactment of disaster related legislation and policy; and
- Examine the situation of Uttarakhand Floods and Cyclone Phailin.

15.1 INTRODUCTION

Lura Tcuk, the World Bank Vice-President for Sustainable Development, pointed out that "with significantly increased levels of population, urbanisation and built infrastructure, our cities and communities are more exposed to disaster risk. Looking at past disasters helps us to plan for a more resilient future". Thus, as rightly pointed out by William Faulker, "the past is never dead. It's not even the past". Always the past disasters teach us on how to act and react to a disaster situation and in this context, case studies on past disasters serve as an important instrument to understand a disaster and also examine the measures taken in to deal with it and later reflect on the usefulness of such measures. Case studies of past disasters, thus, help us to learn from the past experiences and help us plan for a disaster resilient future (GFDRR, 2018).

* Contributed by Dr. A. Senthamizh Kanal, Consultant, Faculty of Public Administration, SOSS, IGNOU, New Delhi.

India has faced about 300 disasters which have claimed about 76,031 lives (Raj, 2017) in the last 17 years. Due to the geographical location of the country, India constantly gets hit by various disasters and it is a regular phenomenon. There was no proper institutional mechanism and policies for handling disasters. It was only after the Orissa cyclone in 1999 (since the name of Orissa has been changed to 'Odisha' in 2011, hereafter 'Orissa' is termed as 'Odisha'), Gujarat earthquake in 2001 and Indian Ocean tsunami in 2004, etc., significant measures in terms of policies and institution mechanisms were created in India for handling disasters. In this Unit, you are given insights on some of the landmark disaster events that had shaken India in the last two decades, which later helped India in framing useful legislation, policy, institutions and frameworks for disaster management.

15.2 ODISHA SUPER CYCLONE, 1999

Odisha is one of the most disaster prone states in India and disasters such as cyclones and floods are constant phenomena in this state. Odisha is divided into 30 districts, 314 blocks, 6799 Gram Panchayats and 50,972 revenue villages (http://odisha.gov.in/content/dist). It has 1,55,707 square kilometres total area. About 87 per cent of the people live in rural areas and they depend on agriculture for their livelihood. On 29th October, 1999, a severe cyclone struck the coastal districts of Odisha. The life span of the cyclone was around six days. It had a wind speed of 300km/hour, with the tidal waves reaching a height of 7-10 metres which came into inlands 0-15kms and there was incessant rain for 48 hours. It affected about 97 blocks, 12 districts, causing devastation in about 1,200 kilometres. The super cyclone severely affected life and property. About 14,000 villages/ wards and 16, 50,086 households were severely affected. More than 15 million people (about one third of state's population) got affected and it took a toll of 9,885 human lives and more than 0.4 million livestock and let another 7,507 persons injured. As per the estimate made by state government, about 7,000 lives were lost due to tidal surge; about 2,000 lives due to cyclonic flood and the rest falling objects and or being blown away due to high speed winds. Out of the human lives lost, 8,119 were from Jagatsinghpur district alone. A total of 3.7 million children were affected and 1,500 were orphaned (UNDMT, 1999).

The immediate response of the Odisha Government to the super cyclone was the provision of relief to the affected and prevention of epidemic in the affected area. The government began the urgent task of clearing the roads of debris so that the army, state government and NGOs could deliver relief material by trucks to thousands of affected villages. With corpses and animal carcasses laying all around and water sources being contaminated, the threat of diarrhea, dysentery and malarial fever was quite strong. Several NGOs and the army were engaged in the task of disposing the corpses and animal carcasses. They were also involved in the distribution of relief materials that included food, fresh drinking water and water purifying tablets, clothes and blankets, polythene rolls, medicine and first aid kits. The army also assisted in setting up community kitchens and rural hospitals, where medical personnel were brought in from national and international NGOs.

While there were measures taken immediately in the aftermath of the cyclone, there were also some long-term measures taken by the state. On one side, rehabilitation measures were taken to make the community return back to normalcy and on the other side, stringent measures were taken by the Odisha government by way of setting up the institutional structures so that future catastrophes can be handled in

an effective manner. One such measure was the constitution of the state disaster management authority.

Odisha State Disaster Management Authority (OSDMA)

The Government of Odisha constituted the Orissa State Disaster Mitigation Authority under the Societies Registration Act, 1860. OSDMA was a Government owned autonomous body established in 1999, to have a systematic and planned approach to disaster management in the state with the objective of making the people of the state more disaster resilient. OSDMA was the first state level disaster management authority that was established in India. Chief Secretary is the chairman of the OSDMA. Later in 2000, the name of the authority was changed from Orissa State Disaster Mitigation Authority to Orissa State Disaster Management Authority.

The major task of OSDMA is to concentrate on disaster preparedness, management and social issues related to disaster management such as capacity building, awareness raising and public education, apart from promoting inter-organisational coordination. During normal time, 90% of its activities go for preparedness and 10% of its activities go for reconstruction. But if any disaster occurs, 90% of its activities go for reconstruction. OSDMA, thus, coordinates various activities of disaster mitigation in the state including capacity building of the community and disaster managers and strengthening of infrastructure, improvement in communication system, etc.

15.3 BHUJ EARTHQUAKE, 2001

Gujarat is the one of the highly industrialised states in India. As per 2011 census, Gujarat has been divided into 33 districts and the actual population of the state is 60,383,628. Due to its geographic profile, the state is more vulnerable to all kinds of major disasters and it falls under Zone V. Gujarat witnessed a powerful earthquke with a magnitude of 6.9 on Ritcher Scale at Bhuj (Kutch Region) at 8.46 a.m. on 26th January, 2001. This earthquake was the most devastating in the past 50 years. Its impact was huge in terms of loss of lives and properties. Out of 33 districts, 21 districts got affected by this earthquake and around 16.04 million people suffered terrible loss. It made a large scale devastation in 18 towns, 182 talukas and 7,904 villages in the State. About 20,086 persons were killed and more than 20,717 were seriously injured. Majority people were killed due to the collapse of the buildings. Around 3, 70,000 houses were completely destroyed and over 1.2 million houses suffered extensive damage.

The earhtquake spread upto 300km from the epicentre. Kutch district was one of the worst affected districts. The sadest part was around 450 villages were totally devasted and destroyed. Eventually it affected the districts of Rajkot, Jamnagar, Surendranagar, Patan and Ahmedabad. Ganhidham, Morvi, Rajkot and Jamnagar witnessed a major devastation due to its major structures, infrastructures and industrial facilities. Not only industries, but majority of the public buildings also collapsed during the earthquake. These included hospitals, monuments and museums. Bridges, roads and railways also faced minor damages and structural changes. Due to the severity of the earthquake, the entire network of the telecommunications was affected. Power and water supply services also got severely affected.

After the disaster, immediately the Union Cabinet as well as the National Crisis Management Committee (NCMC) under the chairmanship of the Cabinet Secretary held urgent meetings on 26th January itself for relief measures. An Empowered

Group of Ministers (EGoM), under the chairmanship of the Home Minister, was set up and the EGoM along with NCMC started monitoring the situation round-the-clock.

Immediately the restoration of communication services was undertaken on a war-footing and satellite phones, hotlines, HAM radios and mobile phones were pressed into service. The Government of India also provided immediate assistance from the NCCF (National Calamity Contingency Fund) and the PM's Relief Fund. The state government started the rescue and relief operations with the help of armed and Para-military forces. Apart from rescue measures, the state also focused on providing immediate relief to the survivors. Teams of officials were sent to the severely affected areas for a quick assessment of the requirements and for coordinating arrangements for ensuring food, shelter and health related supplies. The presence of some well-organised NGOs, which began operating community kitchens, was of considerable assistance. Apart from the central government and the NGOs, the state also received support from the corporate organisations and the international community (Sharma, 2001).

In the aftermath of the severe earthquake, on 8th February, 2001, the state had established the Gujarat State Disaster Management Authority under the Societies Registration Act and the Bombay Public Trust Act. The initial mandate of this institution was to implement and coordinate the recovery, rehabilitation and reconstruction activities in the earthquake affected areas. It also acted as a nodal agency for pre-disaster preparedness and mitigation activities. At the national level, Gujarat was the first state to formulate the state level disaster management policy in September 2002.

Check Your Progress 1

Note: i) Use the space given below for your answers.

ii) Check your answers with those given at the end of the Unit.

1) Write a note on Odisha Super Cyclone and highlight the role of OSDMA.

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2) Discuss the immediate relief measures after Bhuj Earthquake.

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15.4 THE INDIAN OCEAN TSUNAMI (TAMIL NADU), 2004

On 26th December, 2004, India experienced the devastating effects of tsunami, caused by a series of earthquakes in the Bay of Bengal, which originated from the West Coast of Northern Sumatra in Indonesia. The magnitude and intensity of the huge and strongest marine earthquake was 9.0 on the Richter scale. First it was recorded around 6.29 AM IST in Indonesia and after three hours it attacked the west of Pulo Kunji Great Nicobar, India (7.3 on Richter scale). The earthquake set off giant tsunami tidal waves of 3 to 10 meters high that penetrated inland up to 3 kms (ADB, UN and WB, 2005). The Indian Ocean Tsunami of 2004 had caused devastating damages to the lives and property of many countries and it caused irreparable damages to the Indian coast as well. More than 20 countries experienced major causalities and damages and a total of about 2.2 million people got affected.

The Indian Ocean Tsunami had affected nearly 2,260 kilometres of the coastal areas, of India, which covered States namely Tamil Nadu, Kerala, Andhra Pradesh and the Union Territories of Puducherry, and the Andaman and Nicobar Islands. As per the Government of India Report, 12,405 people lost their lives; 6,913 people were injured and 6,47,59 people were displaced from their dwellings. About 100,000 houses were estimated to be damaged or destroyed. Approximately 2,000 kilometers of the Indian coastline was submerged up to a distance of two kilometers.

The Indian Ocean Tsunami had caused huge devastating impact on the 13 coastal districts of Tamil Nadu viz. Chennai, Tiruvallur, Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Tiruvarur, Thanjavur, Pudukottai, Ramanathapuram, Thoothukudi, Tirunelveli and Kanyakumari. Three districts viz. Nagapattinam, Kanyakumari and Cuddalore were the worst affected of all districts, with a death toll of 6,065, 828 and 617 respectively (State Planning Commission, 2005). However, the response to the tsunami was swift and comprehensive and it included a combined effort of government bodies, non-governmental organisations (NGOs), and local community.

After the tsunami had struck, it was the local community members who came for immediate rescue, even before the government, NGOs and other players could provide response. Only in the subsequent phase of Tsunami, the Government and NGOs had rendered support. The Government provided relief material and coordinated the relief and rehabilitation programmes. The voluntary organisations and other NGOs were involved in the intervention programmes initiated, in the mitigation, response and recovery activities. In addition to this, even the global communities responded quickly to the tsunami by way of mobilising the resources, required in the disaster response efforts.

The relief measures were undertaken immediately which included search, rescue and evacuation; first aid; shelter; resumption of critical infrastructure; restoring transportation routes; communication lines and electricity; ensuring food and clean water distribution.

After the disaster, the Ministry of Home Affairs, Government of India, was nominated as the nodal agency at the national level for undertaking and co-ordinating relief measures in the affected states and the union territories. It was followed by the establishment of the National Crisis Management Committee (NCMC) in 2005 under the chairmanship of the Cabinet Secretary. The relief efforts were reviewed by the Cabinet Committee of Ministers under the chairmanship of the Prime Minister

together with secretaries of the relevant ministries/departments and chiefs of the armed forces. From the National Calamity Contingency Fund (NCCF), equivalent of US$112 million was allocated to the disaster affected states and union territories. The Planning Commission played an important role in the phases of recovery and rehabilitation and the State Governments took the responsibility for implementation of recovery programmes (UN Country Team, 2005).

The Government of Tamil Nadu announced a relief amount of Rs. 4,000/- to each tsunami-affected household, followed by monthly allowance of Rs. 1,000/- per household for three months. Besides, as per the provisions of Government Order, each household was provided 60 kgs of rice, edible oil, 3 litres of kerosene, spices, etc., worth Rs. 2,000/- per household, in addition to germicidal spray three times a day. A relief assistance of Rs.1,00,000/- was provided for every death caused by the tsunami by the Central Government and Rs. 1,00,000/- by the State Government.

The collapsed structures everywhere had created hindrances in the search, rescue and relief operations. The Public Works Department with the help of local people removed the debris of collapsed buildings, roads, bridges and other structures, as well as uprooted trees, hoardings, etc. The resource persons from Tamil Nadu Agricultural University visited the agricultural lands and cleared the sea water and started the land reclamation process.

Damage assessment is a pre-requisite for all disaster management practices. Rapid damage assessment is required for emergency relief measures. For this purpose, the NGOs initiated Village Information Centres (VICs) in order to make an assessment of the damages. VICs coordinated with the government officials and community members and collected the information like severity of disaster, likelihood of the damages, loss of life and property damages and it passed on the information to the block and district authorities and people also approached the VICs to register their complaints or grievances.

The NGOs started the community kitchen in the shelter area. Some of the International Non-Governmental Organisations (INGOs) started the mineral water plant for the victims to distribute drinking water. The sanitation was very poor and people resorted to open defecation. Later, the NGOs, with the support of UNICEF, installed Eco sanitation toilets.

Coordination was the vital and immediate component needed in the response phase. A number of agencies at the local, regional, national and international level mushroomed up in the villages to provide various services to the victims. However, coordination and cooperation of various agencies became a challenging task in the initial phase. Later, the district administration had established coordination centre among the various stakeholders.

After witnessing the impact of tsunami in 2004, the Disaster Management Act was enacted in 2005 and later the National Disaster Management Policy also was formulated in 2009 (Kanal, 2013).

15.5 UTTARAKHAND FLOODS, 2013

The state of Uttarakhand and the adjoining areas received heavy rainfall during 14th to 17th June, 2013, which was about 375 percent more than the benchmark rainfall in a normal monsoon. Out of 13 districts, 5 districts namely Bageshwar, Chamoli, Pithoragarh, Rudraprayag and Uttarkashi were affected badly due to

flash floods. The major reason for the flash flood was extreme rainfall, melting of Chorabari Glacier and eruption of the Mandakini River. As per the Indian Meteorological Department (IMD), the rainfall in the State between 15 June and 18 June, 2013, was measured at 385.1 mm, against the normal rainfall of 71.3 mm, which was in excess by 440 per cent. As per state government, a total of 169 people died and 4021 people were reported missing (presumed to be dead) (NIDM, 2014).

The heavy rains, flash floods and massive landslides on 16 June, 2013, due to over flow of Gandhi sarovar (also known as Chourabari lake) just above Kedarnath temple caused washing away of area around Kedarnath temple, pilgrims shelters there and enroute, foot tracks and entire villages and settlements of Gaurikund and Ram Bada; the transition points to Kedarnath. The market of small town of Sonprayag also suffered heavy damage and loss of lives. Pilgrimage centres in the regions of Gangotri, Yamunotri, Kedarnath and Badrinath, the holy Hindu Chardham (four sites), Hemkund Sahib a pilgrimage centre for the Sikh community and its roadhead transit point at the Govindghat gurudwara are visited by thousands of devotees during May to October every year. Hence, it was the peak time of pilgrimage, when disaster had struck. Over 125,000 people were stuck up in various regions because of damaged or blocked roads. National Highway 58, an important artery connecting the region, was washed away near Joshimath and many other places. For more than three days, stranded pilgrims and tourists were without rations or survived on little food. The roads were seriously damaged at more than 450 places, resulting in huge traffic jams. The floods caused washing away of many cars and other vehicles. On June 18, more than 12,000 pilgrims were stranded at Badrinath, the popular pilgrimage centre located on the banks of the river Alaknanda. Rescuers at Haridwar on the river Ganga recovered bodies of 40 victims washed down by the flooded rivers as of June 21, 2013. Bodies of people washed away in Uttarakhand were found at distant places like Bijnor, Allahabad and Bulandshahr in Uttar Pradesh. Search for bodies of those who lost their lives during the extreme natural fury of June in Kedar valley continued for several months. Even as late as September 2013, about 166 bodies were found in highly decomposed state during fourth round of search operation. In a massive evacuation-cum-rescue operation, the Indo-Tibetan Border Police (ITBP), Air Force, Army, NDRF, and state administration evacuated more than 125,000 people from the flood ravaged area. The ITBP was the first to respond and to launch rescue and relief operation immediately after the disaster. About 1600 ITBP personnel were involved in rescue and relief operations in Uttarakhand (Eapen, 2016).

The following are the “major lessons learnt from this disaster:

- The need to have strict implementation of the Flood Plain Zoning Act which can regulate the constructions within the flood plain of a river.
- For clearance of all hydro-power and other mega projects in ecologically sensitive regions like Uttarakhand, the Disaster Impact Assessment (DIA) should also be made compulsory besides Environmental Impact Assessment (EIA).
- Landslide risk zonation mapping be completed on priority. Development and enforcement of guidelines, regulations and codes for landslides is critical.
- Effective stabilisation of slopes in shear and weak zones be undertaken using scientific techniques available at national/international levels.

- Blasting for developmental activities be avoided as it may destabilise the weak rocks in mountainous regions.
- The existing emergency communication system be reviewed regularly to ensure last mile connectivity during disasters.
- Investments in infrastructure development related to weather, glacial lakes, river flow monitoring, etc. are fundamental for improving the accuracy of risk mapping, thereby allowing more lead-time for warnings provided by IMD, CWC, GSI, NRSC, etc.
- Tourism related development should not be allowed along the river banks.
- An effective pilgrim control and regulatory body should be constituted for control and management of pilgrims/tourists" (NIDM, 2014).

15.6 CYCLONE PHAILIN, 2013

As we already discussed in section 15.2, Odisha suffers frequent cyclones and floods. The Cyclone Phailin had crossed the coastline of Barhampur, Odisha, on 12th October, 2013. Due to the cyclone, the state faced continuous rainfall. Though the cyclone caused extensive damage on the infrastructure, fewer casualties were reported. As per Government of Odisha, the cyclone had affected the lives of 13 million people; 2,56,633 houses got damaged and extensively the crops also got severly affected. Surprisingly 45 people got killed. Here the significant factor is that compared to earlier cyclones, the loss of lives was very small.

During the period of cyclone, resources were deployed from Odisha Rapid Action Force (ODRAF), Andhra Pradesh State Disaster Response Force (APSDRF), National Disaster Response Force (NDRF), Indian Army, Indian Air Force, Fire Services and DG of Police for search and rescue operations. Mock drills were also conducted at the cyclone shelters to prepare the community in facing the situation. The Ministry of Home Affairs (MHA) and the National Disaster Management Authority (NDMA) were also requested to make necessary arrangements for deployment of the NDRF and IAF helicopters on short notice. The Government of Odisha was, thus, proactive and well prepared. The OSDMA had done a wide range of preparatory activities to face the furious cyclone with a zero casualty approach. Even the community members were equally prepared to face the disaster. Before the landfall of the cyclone, one million people were evacuated in 36 hours. It was one of the largest evacuation operations in the history of disaster management in India. It was possible because of the Odisha Disaster Rapid Action Force (ODRAF), National Disaster Response Force (NDRF), Central Reserve Police Force (CRPF), Odisha State Armed Police (OSAP) and the Indian Air Force (IAF). Proper coordination and the effective response action plan had reduced the human causalities (NIDM, 2014). Thus, cyclone Phailin was handled in an effective manner by almost all the stakeholders, including the community members, which contributed a great deal in reducing the vulnerability of people.

Check Your Progress 2

Note: i) Use the space given below for your answers.

ii) Check your answers with that given at the end of the Unit.

1) Discuss the post-disaster institutional measures after Indian Ocean Tsunami.

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2) Highlight the major lessons learnt from Uttarakhand floods and Cyclone Phailin.

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15.7 CONCLUSION

The Unit has discussed the case studies of some of the major disasters that made huge impacts in different parts of the country. There has been substantial loss of life and property in the last two decades. These disasters were also responsible for the creation of Disaster Management Act, National Disaster management Policy, institutional structure and framework, both at the national and state level. The case study of disasters such as Odisha Super Cyclone, 1999; Bhuj Earthquake, 2001; Indian Ocean Tsunami, 2004; Uttrakhand Floods, 2013; Cyclone Phailin, 2013; etc. have thus been briefly discussed in this Unit, to provide you a picture of how the disasters were handled in the during-disaster and post-disaster phases.

15.8 GLOSSARY

Richer Scale : The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included in the magnitude formula to compensate for the variation in the distance between the various seismographs and the epicentre of the earthquakes (https://pubs.usgs.gov).

Glacier : A slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains or near the poles (https://en.oxforddictionaries.com).

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15.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress 1

1) Your answer should include the following points:
   - Effects of Odisha super cyclone
   - Odisha State Disaster Management Authority

2) Your answer should include the following points:
   - National Crisis Management Committee
   - Empowered Group of Ministers
   - Various immediate relief measures

Check Your Progress 2

1) Your answer should include the following points:
   - National Crisis Management Committee
   - Cabinet Committee of Ministers
   - State Government Measures
   - NGOs and INGOs initiatives

2) Your answer should include the following points:

- Flood Plain Zoning Act
- Landslide risk zonation mapping
- Emergency communication system
- OSDMA measures

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