



BLOCK 3

**INTERRELATIONSHIP BETWEEN
DISASTERS AND DEVELOPMENT**

UNIT 10 CLIMATE CHANGE*

Structure

- 10.0 Objectives
- 10.1 Introduction
- 10.2 Understanding Weather and Climate
 - 10.2.1 Weather
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- 10.4 Climate Change Vulnerability
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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 (CO₂), Methane (CH₄) and nitrous oxide (N₂O) 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, programmes, 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 bulging 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 rises 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 of 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 underlying 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 activities, it is rapidly increasing. This 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 it 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 (UNFCCC). 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

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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 hectares 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 (Eriksen 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 drinking, irrigation and hydropower. Every year about 1, 00,000 million m³ 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 protect 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
- 11.1 Introduction
- 11.2 Relationship between Disasters and Development
 - 11.2.1 Development Programmes can Increase Vulnerability
 - 11.2.2 Development Programmes can Decrease Vulnerability
 - 11.2.3 Disasters as Opportunities for Development Initiatives
- 11.3 Development of Infrastructure
 - 11.3.1 Different Types of Infrastructure
 - 11.3.2 Development of Physical and Economic Infrastructure
 - 11.3.3 Development of Environmental Infrastructure
- 11.4 Creation of Long-Term Job Opportunities and Livelihood Options
- 11.5 Statutory Provisions for Mainstreaming Disaster Risk Reduction
- 11.6 Conclusion
- 11.7 Glossary
- 11.8 References
- 11.9 Answers to Check Your Progress Exercises

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:

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- 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 losses 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.

Interrelationship Between Disasters and Development

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 entrepreneurship. 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 chloro-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;

Interrelationship Between Disasters and Development

- 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.