

## **UNIT 2**

# **Inter-relationship between Disasters & Development**

### **Learning outcomes:**

- Recognize the positive and negative nexus between disaster & development.
- Understand factors that affect vulnerability.
- Impact of developmental projects on disaster management & vice versa.
- Understanding the relevance of Indigenous Knowledge and its impact on disaster risk management.
- Climate change and its impact.
- Understanding the role of Sustainable Development & its impact on disaster management
- Role of governmental bodies, local governance on disaster management.

### **2.0 Introduction**

Development and disasters are having a close nexus. Disasters are two-sided coins i.e. "*They can destroy developmental activities or pave way for new opportunities*". Disasters have positive and negative impacts on vulnerability. In ancient days, 'Disasters', were assumed to be act of God and was beyond human control. But over the years with growing awareness, scientific research, and various initiatives by the government it has been realized that humans can intervene and reduce the severity and

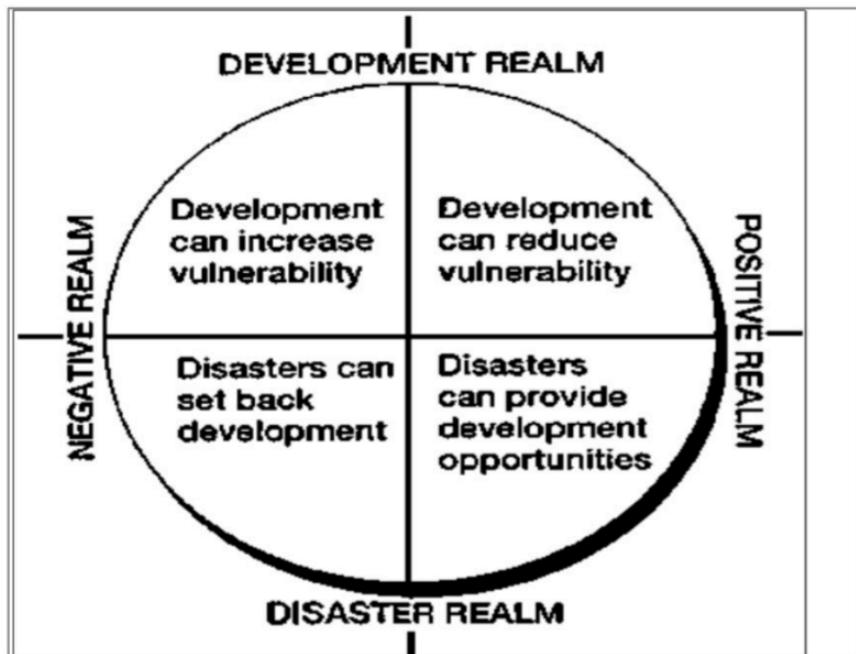


impact of a hazard. The entire unit focuses on the interrelationship between development and disaster and their corresponding impact on each other.

## 2.1 The Interrelationship between Disaster & Development:

A growing body of knowledge on the relationships between disasters and development indicates four basic themes as follows:

- Disasters can set back years of developmental activities
- Disasters provide significant opportunities to initiate development programs.
- Development programs can raise the vulnerability and susceptibility of an area to disasters.
- Development programs can decrease Vulnerability.



### Figure 2.1: Relationship between Disaster & Development

Understanding the relationship that exists between disaster and development based on the above four classifications is important. They involve two positive realms and two negative realms.

- **Disasters can set back development (Negative Realm):**

Disasters can ruin decades of development activities that have taken place over a period. For example, the tsunami had a major impact on numerous countries. The cost of reconstruction of water and sanitation, telecommunication, roads, and railways cost millions. The constant drain of resources because of disasters will have a cascading impact on future developmental plans. Disasters also harm the working population, as there would be a reduction in human capital and hence work gets stagnant. It also has an impact on investments and the growth of place gets restricted. Besides, additional pressure may be imposed on the finances of the government through investments in relief and rehabilitation work.

- **Disasters can provide development opportunities (Positive Realm):**

The Post Disaster period often gives stimulus to growth & development. Numerous Socio development activities & reconstruction shall be taken up during this period. House improvement with special attention to building codes, infrastructure development as a contingency requirement, health care centers, reconstruction of an economic base, land reform policies, and social forestry would be the activities that would be emphasized. New sustainable goals would be adapted to see that people are better equipped to face future hazards. With an emphasis on sustainability, the development would be the outcome as they would focus on poverty elimination, social development, gender parity, and protection of the environment.

- Development can increase vulnerability (Negative Realm):

Social and economic development can increase the vulnerability of the community to disaster risks. In the recent past, we have witnessed an increase in disaster risk owing to economic development. Deforestation in hilly regions, for example, has led to an increase in landslides. The uncontrolled use of fire by the farmers to increase the agriculture area in the hilly terrains has led to numerous forest fires. Many man-made disasters are sheer examples of the fallout of developmental activities. Waterlogging, false floods, acid rain falls are examples of indiscriminate urbanization. Urbanization is a major contributor to environmental degradation and over-exploitation of natural resources. It also has been instrumental in social destitution through an increase in poverty. The vulnerability of the region and people also increases due to lack of necessities, which is invariably an outcome of overpopulation and mass urbanization. Over the period most of the countries are witnessing an increase in unsustainable development leading to exposure to natural hazards. Overexploitation of space has been a major concern, and evasion of building codes with substandard construction especially in highly vulnerable areas has resulted in an increased risk of disasters. Globalisation too has contributed to an increase in vulnerability. People with more disposable income travel for recreational purposes and hence become susceptible to unforeseen catastrophes. The tourist hotspots are usually prone to natural calamities like floods, cyclones avalanches, or volcanoes, thus it leads to an increase in vulnerability.

- Development can reduce vulnerability (Positive Realm):

If development can act as an agent for increasing the vulnerability of the community; it can also sometimes reduce the vulnerability of the people. For economic development to proceed without increasing disaster risk, development planning needs to *reconcile some potentially conflicting drivers for development*. **First**, is the generation of wealth, which can raise the basic level of human development, and **second**, is the distribution of wealth, which can enable the poorest to overcome human vulnerability. The



main task of any government would be to develop an existing economic plan in such a way that it minimizes the risks associated with disaster management. Apart from economic development, thrust also must be laid on social development. Social development plays a key role in reducing the vulnerability of a given population. To decrease vulnerability, assistance must be provided to the needy in terms of welfare measures education, and health-associated measures. A well-educated population (including women and children) has better dexterity to cope with disasters. They would be in a better position to respond to the warning and more resilient in handling a disaster. Hence, a defensible socio-economic plan can reduce the vulnerability of a given population.

Keeping the link that exists between disaster and development, policymakers give a lot of impetus to the same. The current genre projects have been designed to include disaster management with recovery programs.

## **2.2 Factors affecting vulnerabilities**

Vulnerability refers to the propensity of exposed elements such as human beings, their livelihood, and assets to suffer when impacted by a hazard. It is a set of conditions that increase the susceptibility of a community to the effect of a hazard. In earlier days the word 'Vulnerability', was restricted to the physical elements of engineering structures, but now it is inclusive of social and environmental variables and taps on factors like the impact of climate changes, lack of resilience, or inability to deal with extreme situations.

Vulnerability can be seen as a situation-specific hazard. Vulnerability to a financial crisis, may not interfere with vulnerability to natural hazards or climatic changes. Similarly, a population might be vulnerable to hurricanes, but not to landslides or floods. The future vulnerability of an area also depends on the present underlying conditions related to climate change and may either pave the way or even restrict the vulnerability. Thus, it depends on the situation that is manifested in the area under study. From

a climatic change perspective, the future holds a greater degree of risk in many areas, which currently seem to be in low-risk zones of hazards.

While the vulnerability is in general hazard-specific, certain factors, such as poverty, and the lack of social networks and social support mechanisms, will aggravate or affect vulnerability levels irrespective of the type of hazard. These types of generic factors are different from the hazards specific factors and assume a different position in the intervention actions and the nature of risk management and adaptation processes. These factors hence necessitate the understanding of the relationship between socio-cultural variables & environmental processes that impact the vulnerability of a human settlement. Due to this the degree of vulnerability that undermines a society depends on its interaction with the changing physical world, the risk depends on the transformation that is taking place in the society. This notion underscores that society, in its interaction with the changing physical world, constructs disaster risk by transforming physical events into hazards of different intensities or magnitudes through social processes that increase the exposure and vulnerability of population groups, their livelihoods, production, support infrastructure, and services. The questions that one needs to address while inspecting the vulnerability is:

- What is the influence of human actions on levels of exposure and vulnerability?
- How human intervention leads to the creation of new hazards or damage?
- How human understanding and awareness can lead to resilience and better decision-making?

To manage disaster risk, it is important to understand how the vulnerability is generated, how it increases or decreases. There are many underlying causes of vulnerability including socio-economic variables like high birth rate, availability of drinking water, inadequate sanitization, lack of economic opportunities, etc. the vulnerability of a group is based on a set of complex interwoven set of drivers and conditions. The factors identified

as the constituents of vulnerability include can be segregated to political, physical, social, economic, and environmental factors for ease of understanding. These factors are described in the following sections:

- **Political factor**

The level of vulnerability that a community is susceptible to is linked directly to the political will and commitment to developmental concerns. Any community that doesn't have accessibility to quality education, employment opportunities, basic services, and information are likely to be very vulnerable.

- **Physical factor**

Physical vulnerability, according to UNISDR (2002), is the susceptibility of individuals, households, and communities to loss due to the physical environment in which they find themselves. The level of population density, the accessibility of settlements, availability of infrastructure facilities, materials used for construction, etc determine physical vulnerabilities. Physical vulnerability includes factors related to geographical proximity to a source of hazards like coastal belts, hilly terrains, and snow-clad mountains. These areas are more susceptible to disasters than areas that are at a distance from sources of hazard-prone zones. In urban areas, physical vulnerability is also related to difficulty in accessing hospitals, water resources, fire brigades, and even transport connectivity and food security. Furthermore, the lack of proper construction based on building codes falls under physical vulnerability.

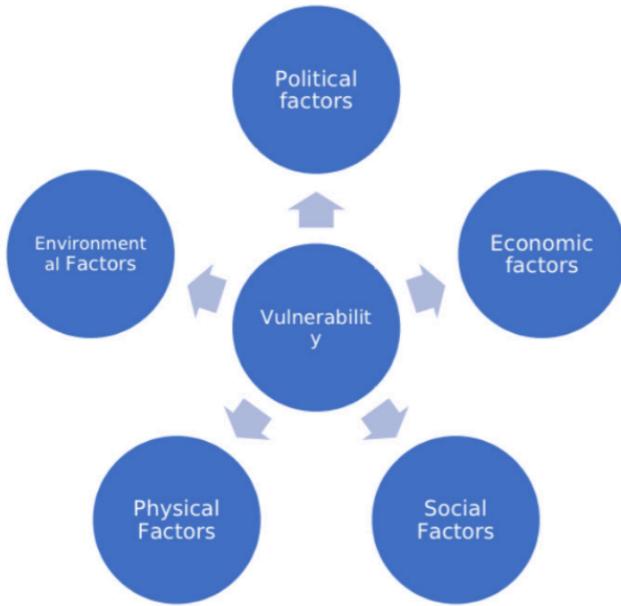


Figure 2.2: Factors influencing vulnerability

- **Economic factors**

The economic status of a population is a crucial factor in dealing with vulnerabilities. One of the most important vulnerabilities faced by people in developing countries is poverty. Eradication of poverty is such an indispensable factor in the reduction of vulnerabilities in such countries. Economic status, in addition to exposing communities to vulnerabilities, also negatively impacts their capacity to cope with and recover from adverse fallouts of disasters. Wealthy communities survive post-hazards without many adverse effects. They also recover quickly from the adverse fallouts and the impacts of the disasters. The vice versa holds good with poverty struck the community.

- **Social factors**

Social well-being has a direct impact on the level of vulnerability to hazards. There is a definite need for a well-organized and cohesive civil society. Such a society will be capable of bringing in social well-being through higher levels of education, literacy, and training; better safety, security, and human rights; equity and awareness; adherence to strong cultural and traditional beliefs and values, good governance. In addition to social wellbeing, social factors bring in physical, mental, and psychological health. This would help in reducing vulnerability, which is never equally distributed. For instance, the aged, orphaned, women, children, disabled, minority groups, etc. are susceptible to more vulnerable than the others.

- **Environmental factor**

A close examination of the innumerable disasters that we are experiencing around the globe is exacerbated due to environmental degradation. Environmental degradation is a major contributor to an increase in vulnerability. Recurring floods are an example of anthropocentric interventions.

There are numerous frameworks for classifications of vulnerability. Based on several studies and a review of literature the above-given factors have been identified. The basic objective of any disaster management program is reducing vulnerability and vulnerability refers to lack of capacity. Hence, increasing the capacity leads to reduced vulnerability. The promotion of resilient and adaptive societies requires a shift in focus from natural hazards and extreme weather conditions to proper identification, assessment, and ranking of vulnerability. Therefore, a proper understanding of vulnerability becomes the prerequisite for risk reduction and adaptation to extreme climatic changes.

### **2.3 Differential Impacts:**

Differential impacts can be defined as the discriminatory impacts experienced by different individuals, groups, or communities when they are faced with an event with damaging consequences. Concerning disaster

management, to understand the differential impacts, classification is done as follows:

- **Gender**
  - o Women, Children, widows, destitute and adolescent girls are most vulnerable at the time of a disaster. They are subjected to sexual violence and neglect in most situations
- **Age**
  - o The youngest and the oldest members of the population are the most vulnerable to natural disasters, mainly due lack of physical dexterity.
- **Income**
  - o The economical poor segment of the society is the most vulnerable to disasters. Poverty is therefore a major factor in increasing disaster risk, by increasing vulnerability to disasters and reducing existing coping capacities. There is another point of view that says that an increase in luxuries might contribute to vulnerability, as people are unfamiliar with hardships and hence may scumble to a disaster quicker compared to the people of the lower-income segment.
- **Caste**
  - o Caste here refers to how marginalized people get lower access to resilient measures and hence suffer high order of vulnerability. People belonging to the marginalized segment are having poor access to education, health facilities and are poverty struck. Hence, when a natural calamity strikes the area that they live in, they are more vulnerable than the remaining classes of the population.
- **Location**
  - o People living in low-land areas, and coastal belts are most prone to be affected by disasters such as cyclones, floods, tsunamis, and hurricanes. Whereas the population living in Zone V would be susceptible to earthquakes. Geographical

location has a tremendous differential impact on disaster management.

## **2.4 Impacts of development projects such as dams, embankments & changes in land use on disasters.**

Disasters have a cascading impact on the development of any nation, irrespective of whether it is in a well-developed nation or a third-world country. However, the underdeveloped nations are more vulnerable to disasters comparatively. As per the reports of the United Nations, the estimated economic loss due to natural hazards is approximately US \$ 2 trillion and has devastated the lives of more than 4 billion people in the past two decades, with a million lives lost alongside. Apart from the economic loss and death, disasters also leave a long trail of psychological impact that harms the growth of the region affected. Through growing research and scientific development, mankind has been able to mitigate the risk associated with disasters. Ironically, indispensable developmental activities have on the other hand paved way for many man-made disasters and led to an increase in natural disasters. The study of the impact of these developmental projects on nature and vice versa is of prime importance in all countries. The interwoven relationship between disaster and development has been a topic of debate and is difficult to prioritize between nature and developmental activities. The impact of disasters on some of the developmental projects have been listed below:

- Impact on dams**

Dams and embankments have been developed as an intervention strategy to tout against natural calamities like floods. These developmental projects along with hydroelectric projects come with their own set of pros and cons. Completed dams have been an integral part of disaster management in India, apart from generating power and aiding agriculture. In the case of a development project involved in the construction of dams, the disasters like



flash floods, earthquakes, and landslides can delay the project and adversely affect the finances allocated to the project. The destruction of the RishiGanga dam in Uttarakhand due to Glacial Lake Outburst, which further breached the Tapovan Hydropower plant is a recent example of the impact of disasters on dams. The government had to incur additional expenditure for clearing the debris, redesigning the project, and disposal of the incomplete structure. The natural disasters, push back the progress of the project and the project are delayed considerably.

Dams have always been subjected to debate, regarding their pros and cons. The opening of the Dam gates in Idukki, Kerala, the incident of Rishi Ganga Dam in Uttarakhand made people think of the negative consequences of the dam. Though dams were meant to mitigate the risk of flood, in the recent past they have been seen to trigger floods especially when the dam gates are opened due to heavy rainfalls. Besides, the unscientific construction of dams has led to erosion of the ecological balance in the vicinity around the dams. Besides their detrimental impact on aquatic life, the capture of silt deposits leads to loss of soil fertility. They have also been known for an increase in greenhouse gas emissions. The above-given facts underline that development and disasters are closely linked and due diligence needs to be taken care of when new developmental projects are undertaken.

- **Impact on embankment**

Embankments are commonly seen structures in the coastal belts and are used to mitigate the impact of floods and help control erosion of soil. Many natural disasters may disrupt these structures and destabilize them. Floods, Earthquakes majorly affect the embankments. The floods may lead to water absorption by the bricks on the embankment which would cause it to collapse. The floodwater might even weaken the bonds between the bricks and stones used for the construction of the embankment and may result in damage and cracks on the structure. Earthquakes will shake the entire



edifice of embankments leading to partial or complete damage. The landslides too have their impact on embankments and may cause severe damage. Though the impact of natural disasters on embankments is largely uncontrollable, over the period the government has spent a large part of the resources in reconstructing embankments as a method to mitigate the risk of floods.

The review of literature on the impact of using embankments says that over the years with increasing intensity of floods has made embankments largely ineffective and no proper cost-benefit analysis has been taken at the national level. Besides, the embankments have also been criticized for their counter-effective impact of intensifying floods and causing floods over a larger area. Ecologists are also of the opinion that embankments can be safe areas for people to live in, but an unwarranted dam breach may result in increased vulnerability of people living in these areas. River flow alongside the embankments can also lead to a build-up of silt, gravel, etc., and increase the mean height of river water resulting in catastrophic breaches.

- **Impact of changes in land use:**

The utilization of land for socio-economic purposes such as cultivation & urbanization is referred to as land use. The change in land use and land cover (LULC) might result in a change in the natural hydrological processes of the region. The ever-increasing demands of mankind due to mass urbanization & overpopulation pose a threat to the environment as these activities result in over-exploitation of natural resources especially the land. Natural land such as forests, grasslands, and wetlands have been converted into cities, industrial estates, and agro land. This change has made the ecology go fragile and caused an imbalance in the earth's surface. the result has been increased frequency of natural disasters such as floods, land erosion, and increased salinity of the soil. The dramatic reduction in grasslands, forests has led to a depletion of natural resources that regulated the climate, water resources, and maintained fertility of the soil.



Although development is inevitable, people need to adopt more resilient measures to avoid the increase in disasters and make people aware of the thin thread of bonds that exists between disaster risk and land-use changes.

Land-use change has been the most common factor in recent natural disasters. Listed below are some examples

- The Mangrove ecosystem was destroyed because of unscientific construction in Mumbai. Sewage and garbage dump also destroyed the mangroves. The Mumbai floods during the year 2005 is a classic example of modifying land-use contributing to a major disaster where more than 1000 lives were lost.
- Floods in Chennai and Bengaluru are examples of waterlogging due to haphazard change in land use has become a major source of disasters.
- Uttarakhand floods in 2014 are also an example of change in land use and an example of how unplanned development has led to large-scale disasters.

The collapse of the hydroelectric power project increased the degree of devastation in valleys. This mainly was because of deviation of the course of rivers which were blocked due to accumulation of debris and lead to an overflow.

## 2.5 Climate Change Adaption

Changes in the surface temperature of the earth have exacerbated climate hazards and have amplified weather-related disasters. Disaster risk is magnified by climatic changes as it leads to an increase in the frequency and intensity of hazards and simultaneously eroding the resilience of households and communities. *"Climate Change", refers to a change in the climate that is consistent for a decade or longer due to human-induced activities or natural causes.* The year 2021, joined the list of the warmest years on record as per the UN weather report and it was regrettable to note that global temperature has been more than 1 ° Celsius above the pre-



industrial levels, edging closer to the max limits set by the Paris agreement on climatic changes. Climate change has increased sea level, thus leading to more tropical cyclones, which further trigger natural disasters such as floods and landslides, leading to an increase in the vulnerability of many low-lying areas, deltas, and coastal belts across the globe. The earth witnessed more heatwaves, droughts, and forest fires in the last 50 years.

The impact of climate change can be listed as below:

- Rising sea levels across the world
- Increased frequency of weather extreme events like hurricanes and cyclones
- Decrease in agricultural yield
- Severe and frequent extreme precipitation events
- Water scarcity and droughts
- Declining biodiversity
- Frequent Forest fires
- Human migration due to changing weather
- Lower resilience in case of underdeveloped countries to manage disaster risk

“Climate change adaptation”, refers to actions taken to reduce the negative impact of climate change and to mitigate the risk of the greenhouse effect. It technically refers to the way humans respond to climatic changes with moderated risk. Adaptation & mitigation are two strategies that can be banked on to deal with climate change.

### **2.5.1 Adaption:**

Adapting refers to adjusting to the actual or expected future changes in climate. The agenda behind adaptation is to reduce the vulnerability to the catastrophic impacts of climatic extremes. It also is inclusive of taking advantage of drawing a potential benefit through climate changes like growing crops round the year in certain regions.

Adaptive actions can be either

- **Incremental** (actions where the central aim is to maintain the essence and integrity of a system)

- **Transformative** (actions that change the fundamental attributes of a system in response to climate change and its impacts).

The need for adaptation depends on the vulnerability of the region and is very diverse across the globe. The adaption strategy is important for underdeveloped and developing countries, as they have insufficient resources and techniques to manage climatic changes. Adaptive capacity is directly proportional to the socio-economic development and political will of the nations. The developing countries are generally not well equipped to face a new hazard or adapt to a new change at the pace of a developed nation like the USA. Poverty also is a major contributor to the low resilience of these countries. Though Climate change is a global phenomenon, it must be dealt with locally also. Communities at the local level should build their defense mechanisms to deal with climatic changes. This is when they can adopt indigenous knowledge and appropriate technology to adapt to environmental changes.

### 2.5.2 Mitigation

Mitigation refers to the reduction in the impact of climate change by preventing or reducing the emission of greenhouse gases in the atmosphere. Mitigation means making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. The target of the mitigation strategy is to avoid anthropogenic climate changes. It aims at “stabilizing greenhouse gas levels”, such that the ecosystems can adapt naturally to climate change. It tries to ensure food security and tries to enhance economic development sustainably. Mitigation can be achieved through:

- Use of renewable sources of energy like solar, wind power, geothermal energy, biopower, etc.
- Introduce energy standards for consumer appliance and equipment's
- Introduce better building codes
- Investments in clean energy.

- Promote the use of sustainable transport like buses fuelled by electricity
- Afforestation.

The UNO's, the environment-related program estimates the cost of development activities related to adaptation & coping with climate changes to range between \$ 140-300 billion per year by 2030. Though climate-related weather extremes will affect all the countries, the developing nations and poor nations will bear the brunt of the enhanced risk. Despite being the least responsible for climatic changes the poverty-stricken nations are likely to suffer four times more than the richer countries. This warrants the need to act at the earliest to save the earth from drastic climatic changes.

## **2.6 Relevance of Indigenous knowledge, Appropriate technology, and local resources**

Indigenous knowledge refers to the knowledge that has been developed by societies/ communities before the advent of the modern scientific system. Indigenous knowledge is, "*Culture-specific and represents people's lifestyle*". This knowledge has been instrumental in Disaster Risk Reduction (DRR) at the community's level when faced with natural hazards like floods, droughts, cyclones & Tsunamis. These skills and philosophies developed by the communities represent a blend of their lifestyle, daily practices, rituals, language and are directly related to their relationship with their natural surroundings. This knowledge has been instrumental in the people's struggle with Natural Disasters and has been passed from one generation to another. Even before we came up with high technology-based early warning systems or standard operating procedures for the response, numerous local communities worldwide have prepared, operated, acted, and responded to natural disasters using indigenous methods passed by their forefathers.



The local communities have an advanced understanding of the surrounding environment, which was based on generations of habitation in the same area. This distinguished knowledge differs from modern science and has been informally disseminated across the population. Many of these indigenous techniques are collectively owned, adapted, and embedded in a community's way of life as a means of survival. A few examples of the use of indigenous knowledge to manage or mitigate the effects of disasters are listed below:

- **Dhajji Dewari:**

In Kashmir, earthquake-safe construction is used and is referred to as "**Taq'** and "**Dhajji Dewari**". Dhajji technology has proven to be more resilient towards earthquakes and the damage is minimal compared to the buildings which are constructed using concrete.

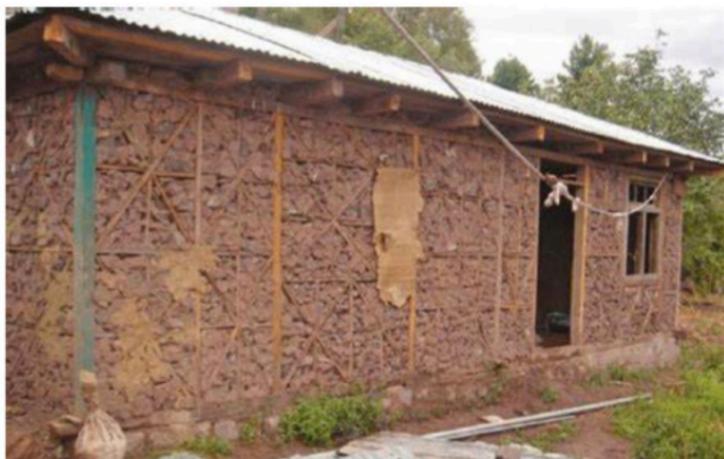


Figure 2.3: Dhajji Dewar of Kashmir

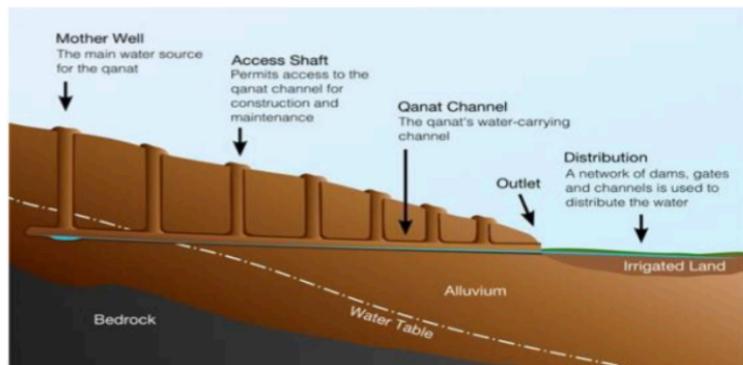
The earthquake resistance of a dhajji building is developed in the following ways:

- The mortar, masonry infill panels quickly crack in-plane thereby absorbing seismic energy through friction against the timber framing, and between the cracks in the fill material. Thus, distributing the earthquake energy evenly.
- The timber frame and closely spaced bracing, which essentially remains elastic, prevent large cracks from propagating through the infill walls. Thus, the possibility of an out-of-plane collapse of masonry panels is reduced considerably.
- The masonry walls are kept relatively thin. This helps to reduce the mass of the building and therefore the inertial forces that must be resisted during an earthquake.

These structures are environmentally friendly and traditionally would not have incorporated any toxic products in their construction, apart from the natural fungal and insect resistant chemicals in the timber itself. They represent an excellent blend of social & Environmental sustainability goals.

- **Karez Technology for Drought Disaster**

A traditional irrigation system called Karez is used to make use of groundwater efficiently. Its origin can be traced back to China. It is constructed as a series of well-shaped vertical shafts, which are further connected by sloping tunnels, that tap the subterranean water and deliver a large quantity of water to the surface level by gravity without using the pumping technology. Karez is composed of four primary components: vertical wells, underground canals, a surface canal, and small reservoirs. The Karez technology is used for water supply for irrigation & domestic purposes in many other countries like India, Pakistan, the Middle East & North Africa besides China. At present, modern technology has been integrated into the traditional Karez system to further reinforce the successful traditional practice.



Source: <https://www.asiaculturaltravel.co.uk/the-turpan-karez-water-system/>

Figure 2.4: Karez Technology for Drought Disaster Reduction

- **Soil and Water Conservation through Bamboo Plantation (Assam):**

Bamboo plantation along canal bunds by the local people of Nandeswar Village, Assam in India, in many ways has benefited their village. With plantation of bamboo, one of Assam's most prevalent vegetation, canal bunds (embankments) are kept from being breached and soil is kept from further erosion. Although floods occur every year in Assam, this technique

has maintained and protected embankments and has kept bridges and roads from damage during heavy rains.



Source: [https://www.researchgate.net/figure/Bamboo-planted-along-the-river-in-Assam\\_fig2\\_260639713](https://www.researchgate.net/figure/Bamboo-planted-along-the-river-in-Assam_fig2_260639713)

**Figure 2.5: Soil and Water Conservation through Bamboo Plantation (Assam)**

- o **Living with Floods in Singas, Papua New Guinea**

The lifestyle and experience of members of the Singas village, Papua New Guinea (PNG), illustrate how indigenous knowledge can contribute to disaster risk reduction. The Village is situated along the banks of the river Markham and is affected by floods yearly, due to heavy rainfalls during the rainy season. This village is a striking example of how indigenous knowledge has been used as it shows how a man can coexist with a potential source of hazard. The livelihood of these people is largely based on the river and hence they are very proactive in mitigating the consequences of the flood. Their indigenous knowledge particularly stands out in five areas, namely building methods, social linkages, land use

planning, food strategies, and environmental strategies. The community has proved to the world that prolonged habitation in the same area provides the community with dexterity to deal with natural calamities and they master the art of mitigating the risk of a regular flood. The images below give the idea of their construction and how it assists them to make a livelihood living alongside a river.



Source:<https://pim.cgiar.org/2019/04/15/new-data-offers-insights-into-rural-poverty-and-undernutrition-in-papua-new-guinea/>

Figure 2.6: Indigenous construction used to adapt to floods in Papua New Guinea

Indigenous knowledge is culture-specific and represents people's lifestyles in a small domicile. Thus, the dissemination and wider practices of the knowledge is often a challenging issue. The principles of indigenous knowledge can apply to different locations, which needs local cultural calibration. Hence 2030, Sustainable development Goals has emphasized dissemination of this knowledge universally.

## 2.6.1 Appropriate Knowledge & Local Resources:

Appropriate Technology (AT) is defined as a sustainable technology, which requires fewer natural resources, and is environmentally friendly. It is designed to be appropriate to the context of its use. Appropriate technology is a movement encompassing technological choice and application that is small-scale, affordable by locals, decentralized, labor-intensive, energy-efficient, environmentally sound, and locally autonomous. The appropriate technology is a very well-adapted method in underdeveloped and developing nations which have lesser resources to spend on capital-intensive projects. The AT depends on local skills and materials and hence is affordable and paves the way to be environmentally friendly. The definition of "Appropriate Technology" changes with each situation. It's not appropriate to install solar modules in a place with very little sun, a wind generator in a place with little or no wind. What's appropriate in a large urban location is very different from what's appropriate in a remote, isolated environment. One quality that remains the same, however, is taking care of things. In each situation, the essence of AT remains appreciating, helping, caring. Planned obsolescence, throw-away products, poor quality all go against intelligent decision-making and the true spirit of appropriate technology.

Examples of Appropriate technology used locally, which are an addition to sustainable Development:

- o Solar Cookers
- o Hand-pumps
- o Pot in pot refrigerators
- o Malian Peanut Sheller
- o A Human-powered vehicle like a bicycle
- o Animal powered vehicles like bullock carts

## 2.7 Sustainable development and its role in disaster mitigation



The core task of sustainable development is disaster risk reduction. The edifice of the concept of sustainable development is based on economic development, environmental protection, social equality, and growth & political stability. The concept was first explained in the Brundtland Commission report in the year 1987 as, "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The definition highlights two concepts:

- The concept of "need" – with specific reference to the needs of the poor people of the world, which should be prioritized.
  - The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.
- 
- **Pillars of sustainability:**



Figure 2.7: Pillars of sustainability

- **Environmental Sustainability:**

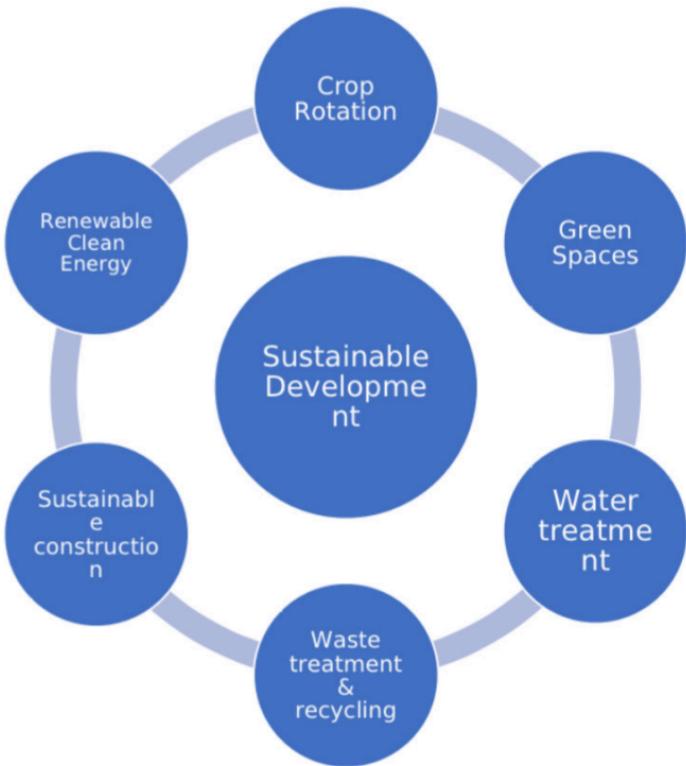
At this level, sustainability focuses on the protection of the environment from exploitation, use of renewable energy, saving water, facilitating sustainable mobility, and environmentally friendly constructions and architecture. With proper focus on environmental sustainability, man-made disasters would be mitigated, and the frequency of natural hazards also can be reduced if not avoided.

- **Social Sustainability:**

The thrust at the social level is the fair distribution of healthcare and education across the globe. Another aspect included in social sustainability apart from improvement in quality of life is gender parity. Social Sustainability reduced the social vulnerability of people and hence helps in disaster risk mitigation. People are more prepared and aware of the risk of hazards as the education level rises.

### **Economic Sustainability**

Here sustainability emphasizes on equal distribution of economic resources to all. Economic growth, better investment prospects, and development with minimum harm to the environment is the focus area. Economic sustainability aims at poverty elimination, which would directly help in Disaster mitigation. Poverty is both cause & consequence of Disaster Risk. Economic sustainability aims at bringing down the vicious trap of poverty during the post-disaster phase, consequently acting as a mitigation strategy.



Source: <https://resource.temarry.com/blog/examples-of-sustainable-development-in-the-us>

**Figure 2.8: Examples of Sustainability**

For a sustainable future, Disaster Risk Reduction (DRR) is a mandate and DRR is an integral part of the socio-economic development of any country. This was recognized by several global documents related to Sustainable development and DRR and the first major international framework – the Yokohama strategy & plan of action for a safer world (1994). Ever since then, the close interrelationship between sustainable development and DRR has been on the agenda of every global agreement & summit. The international community has placed DRR at the heart of Sustainable Development. The urgent need for reduction of Disaster Risks and building resilience is the main theme of the 2030 Agenda for sustainable development. The 2030 Agenda features 17 interwoven goals referred to as Sustainable Development Goals (SDGs) and 169 targets to be achieved by the year 2030.



The SDGs focus on three aspects, social, environmental & economic sustainability. If there is proper socio-economic development, with environmental vigilance the disaster risk gets mitigated naturally. Therefore, governments across the globe are focusing on the achievement of the SDG by the year 2030.

## **2.8 Roles and responsibilities of community, panchayat raj institutions/urban local bodies, state, center, and other stakeholders in Disaster Mitigation**

India has been vulnerable to many devastating natural and man-made disasters. 40 million hectares of land is prone to flood, 7516 km is prone to cyclones and tsunami, 58.6% of the land is prone to various degrees of earthquakes and 68% of cultivable are vulnerable to drought, not to mention the landslide and avalanches that are seen frequently in the hilly areas. Furthermore, man-induced disaster in the form of nuclear and chemical disasters has seen a substantial increase in the last two decades. Therefore, there was a need to mitigate the risk that posed the country with an effective Disaster management strategy.

The first step towards articulating a systematic and holistic approach was done at the National level, by setting an HPC- High Power Committee in the year 1999. The HPC prepared comprehensive model plans for Disaster Management at various levels viz. the national, state, and district levels. After the Gujarat Earthquake, National Committee on Disaster Management (NCDM) was set up, under the Chairmanship of the Prime Minister and with representatives of national and state-level political parties. The NCDM was meant for catalyzing and enabling the preparation of Disaster management plans and to implement various mitigation strategies. In the year 2005, the Government of India enacted the Disaster Management Act. Section 23 of the Disaster Management Act 2005 provided a plan for every State – SDMA (State Disaster Management Act). It outlines the broad coverage of the plan as well as the requirements of consultation in the preparation of the state



plans. The state plans shall be prepared by the SEC in conformity with the guidelines to be issued on related matters by the SDMA having regard to the guidelines laid down in this regard by the NDMA, and after such consultation with local and district authorities and the people's representatives as the SEC may deem fit.

The levels of disasters have already been categorized and disseminated as:

Level	Activities
L0	Denotes the planning stage. Activities like training on search, rescue, rehearsal evaluation & inventory updating
L1	Specifies disaster that can be managed at District
L2	Disasters that require assistance & resource mobilization from the State level
L3	Large scale disaster where intervention from Centre is required.

Source: <https://cdn.s3waas.gov.in/s38d7d8ee069cb0cbbf816bbb65d56947e/uploads/2018/02/2018022462.pdf>

Figure 2.9: Classification of different levels of Disaster

## NATIONAL LEVEL

Cabinet Committee on Management of Natural Calamities (CCMNC)  
High level Committee (HLC)  
National Crisis Management Committee  
National Disaster Management Authority (NDMA)  
National Disaster Response Force(NDRF)

## STATE LEVEL

State Disaster Management Authority  
State Executive Committee(SEC)  
State Advisory Committee(SAC)

## DISTRICT LEVEL

District Disaster Management Authority (DDMA)  
District Crisis Group  
District Disaster Management Committee & Task Forces

Source: <https://cdn.s3waas.gov.in/s38d7d8ee069cb0cbbf816bbb65d56947e/uploads/2018/02/2018022462.pdf>

Figure 2.8: Disaster Management Agencies at various levels

Though the responsibility of Disaster Management is vested with the Central and State governments, it is difficult for them to deal effectively with all the aspects of disaster management according to the needs of the affected people. In many cases, where the disaster-affected area and population is large, the reach of the government bodies is inadequate and due to lack of timely response, there is considerable loss of life and massive collateral damage. In states like Andhra Pradesh, Uttarakhand, Kerala it was experienced that during major natural disasters the role played by the local communities & local government in providing rescue, relief, and rehabilitation, resulted in the efficient management of the situation. It was also noticed that the reachability of the welfare measure is better if there is active involvement at the community level. Keeping these things in view, the High-Powered Committee on Disaster Management has, therefore, in its draft policy, stated the importance of the Community Based Disaster Management and the involvement of the local governments, Municipalities, and the Panchayati Raj Institutions.



The roles of the Panchayati Raj Institutions (PRIs) and urban local institutions in both disaster risk reduction and the management of a post-disaster situation have been well recognized.

### Significance of PRIs in Disaster Management

- ② **Handling Disasters at Grass-root Level:** The decentralization of power and responsibilities to the panchayats will result in flexible and committed response at the grass-root level in the case of natural calamities. The Panchayath Raj can work in harmony with the government and help in more preparedness which is possible through early warning systems.
- ② **Ensuring Better Relief Operations:** since the local governing bodies are in close vicinity of the disaster-struck areas, they are better equipped to provide timely relief and with familiarity with the surroundings, they can have a better understanding of the local people's needs.
- ② **Spreading Awareness and Gaining Cooperation:** Local government institutions have grass-root level contact with people, and they can help effectively in spreading awareness and ensuring people's participation in fighting the crisis. They are also ideal channels for NGOs and other agencies' participation in the rescue and relief operations.

### Components of Community based Disaster Management

- Disaster Management Committee
- Review and analysis of past disasters
- Seasonality Calendar of disasters
- Mapping exercises
- Disaster Mitigation teams (DMTs)
- Mock Drill
- Identification of Hazard Specific Mitigation Activities
- Community Contingency Fund



Unfortunately, these institutions have not been fully operationalized for the handling of disasters either during the preparatory stages or during disaster and post-disaster operations. This has been the major area of improvement in most states, and they are working towards setting the hassles right. The participation of all citizens in every country is essential for the mitigation of disasters, which are largely based on Natural environmental phenomena. Social interactions between the governing institutions, agencies, NGOs, and people are edifice for an efficient Disaster Management strategy. Disaster Mitigation is more a collective effort of all the stakeholders from the grassroots level to the national level. Ample coordination, interaction, exchange of resources is mandated at every stage of Disaster management to reduce the vulnerability and unanimously the country can overcome the risks faced by hazards.

### Review Questions

1. Explain with examples how development activities increase the vulnerability of the community towards natural hazards.
2. Do you think disaster-resistant features need to be added in all the development activities carried out by the Government? Discuss.
3. Discuss the impact of urbanization and population explosion on disasters.
4. How have disasters set back decades of development? Explain this with suitable examples
5. Discuss the implications of climate change on the environment. List any 5 human activities that contribute to climate changes
6. Illustrate the relevance of indigenous knowledge and local resources in disaster management. Cite suitable examples for the same.
7. "Adaptation is the principal way to deal with impacts of changing climate". Comment
8. What are differential impacts? Using appropriate examples discuss the concept in the light of disaster management.
9. Enumerate the various factors that increase the vulnerability of a region.

10. Differentiate between adaptive and mitigation strategies of climate change adaptation.
11. Discuss the role of sustainable development in Disaster Risk Reduction.
12. What is Sustainable Development? Enumerate on the pillars of Sustainability.
13. Discuss the role of Panchayat Raj Institution in disaster risk mitigation.
14. Discuss the role of the government in Disaster Management.
15. "Disaster Management to be effective, work has to start at the grass-root level" -Comment

## References

The content has been composed referring to various online and offline resources. Major sources of reference are listed below. Copyright exists with the respective organizations. Contents have been adapted for educational purposes only. No commercial benefits are derived.

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