

## **Credit -1. Fundamentals of Disaster Management**

### **Disaster: Concept and Meaning:**

A disaster is a consequence of a sudden disastrous event which seriously disrupts the normal function of the society or the community to the extent that it cannot subsist without outside help.

A disaster is not just the occurrence of an event such as an earthquake, flood, conflict, health epidemic or an industrial accident; a disaster occurs if that event/process negatively impacts human populations.

Disasters combine two elements: hazard, and the vulnerability of affected people. "A disaster occurs when a hazard exposes the vulnerability of individuals and communities in such a way that their lives are directly threatened or sufficient harm has been done to their community's economic and social structure to undermine their ability to survive.

A disaster can be defined as any tragic event stemming from events such as earthquakes, floods, catastrophic accidents, fires, or explosions. It is a phenomenon that disasters can cause damage to life, property and destroy the economic, social and cultural life of people.

Disaster is the exposure of a group of people to a hazard, leading to a serious disruption of the functioning of a society and causing human, material, economic environmental losses which exceed the ability of the affected community or society to cope. A disaster results from a combination of hazards and vulnerability that exceeds the capacity of a society to reduce the potential negative consequences of risk.

Hazard is an extreme event, natural or man-made, with a destructive potential to social, economic and human assets. These may include future threats, and may be "natural" (geological, hydro meteorological and biological) or "man-made" (Conflict, environmental degradation and technological hazards).

Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

A disaster is a calamitous, distressing, or ruinous effect of a disastrous event which seriously affects or disrupts (or threaten to disrupt) the critical functions of a community, society or system, for a period long enough to significantly harm it or cause its failure. It is beyond the capability of the local community to overcome it. The stricken community needs extraordinary efforts to cope with it, often with outside help or international aid.

It is a situation resulting from an environmental phenomenon or armed conflict that produce stress, personal injury, physical damage, and economic disruption of great magnitude.

The World Health Organisation (WHO) defines Disaster as "any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services, on a scale sufficient to warrant an extraordinary response from outside the affected community or area."

### **Types of disasters**

Disasters are broadly divided into two types:

- 1) Natural
- 2) Man-made disasters.

### **Natural disasters**

Natural disasters occur as the result of action of the natural forces and tend to be accepted as unfortunate, but inevitable. They include:

- Famines
- Droughts
- Tornadoes,
- Hurricanes,
- Floods / Sea Surges / Tsunamis
- Volcanoes
- Snow storms,
- Earthquakes

### **Man-made disasters**

- explosions,
- fires,
- release of toxic chemicals or radioactive materials(industrial accidents),
- dam failures
- nuclear reactor accidents
- wars

### **Hazard: Concept and Meaning:**

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Hazard is a physical event, phenomenon or activity that has the potential to cause the loss of life or injury, property damage, social and economic disruption or environmental degradation e.g. earthquake, flood, drought, tsunami, cyclone etc. Each hazard is characterized by its location, intensity, frequency and probability. Hazard is a dangerous condition or event that threatens or has the potential for causing injury to life or damage to property or the environment.

Hazards can be categorized in various ways but, based on the origin; hazards worldwide are basically grouped in two broad headings:

1. **Natural Hazards:** (hazards with meteorological, geological or even biological origin)

Natural hazards are further classified into following types:

**a. Terrestrial hazards:** Those hazards which originate inside the earth or its atmosphere are called terrestrial hazards. Terrestrial hazards can be:

**i. Endogenic Hazards:** Hazards which originate inside the surface of the earth are termed as endogenic hazards. E.g. Volcanic, Earthquake

**ii. Exo-genic Hazards:** Hazards which originate above the surface of the earth (in the atmosphere) are called exogenic hazards. These can be further sub-divided into the following categories:

**A. Atmospheric Hazards:** Natural hazards that originate in the atmosphere of the earth are called atmospheric hazards. These include: cyclones, tornadoes, droughts, thunderstorms etc. Drought, Rainfall, Snowfall, Winds, Hailstorm

**B. Hydrosphere Hazards:** Those natural hazards that are related to water in the atmosphere are termed as hydrospheric hazards. Wave Currents, Tsunamis, Floods

**C. Lithospheric Hazards:** Lithospheric hazards are those natural hazards that occur near to the surface of the earth. It includes the following hazards: Landslides, weathering, erosion, shifting, avalanches, sink Holes. Calcium carbonate inside the surface of the earth is dissolved by the underground running

water and taken away with it, creating holes. This causes the earth to become hollow and eventually the earth above it settles down under load.

**iii. Biotic Hazards:** The types of hazards that originate through plants, animals or humans.

**A. Floral Hazards (Plants):** The type of hazards that originate from plant life.

**B. Faunal hazards (Animals)**

**2. Anthropogenic Hazards (Man Induced)**

**1. Physical:** Earthquake, Landslide, Erosion

**2. Chemical:** Release of Toxic Chemical, Nuclear Explosion

**3. Biological:** Eutrophication, Population Explosion

**b. Extra-Terrestrial hazards:** The kinds of hazards which originate outside the earth and its atmosphere are called extra-terrestrial hazards e.g; meteorites.

**Unnatural Hazards:** (hazards with human-caused or technological origin)

**Status of a hazard:**

Hazards are sometimes classified into three modes or statuses:

- **Dormant**—The situation environment is currently affected. For instance, a hillside may be unstable, with the potential for a landslide, but there is nothing below or on the hillside that could be affected.
- **Armed**—People, property, or environment are in potential harm's way.
- **Active**—A harmful incident involving the hazard has actually occurred. Often this is referred to not as an "active hazard" but as an accident, emergency, incident, or disaster.

**Disaster Management Cycle or continuum:**

Disaster management aims to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. The Disaster management cycle illustrates the on-going process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle. The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.

It is an on-going process by which governments, civil (and military) society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. There are

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variations to the cycle but the most common version is the 4 phases of disaster cycle:

**Mitigation:** Measures that prevent or reduce the impact of disasters.

**Preparedness:** Planning, training, & educational activities for things that can't be mitigated.

**Response:** The immediate aftermath of a disaster, when business is not as usual.

**Recovery:** The long-term aftermath of a disaster, when restoration efforts are in addition to regular services.

Management (or disaster management) is the discipline dealing of with and avoiding risks. It is a discipline that involves preparing, supporting, and rebuilding society when natural or human-made disasters occur.

In general, any Emergency management is the continuous process by which all individuals, groups, and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from the hazards.

Actions taken depend in part on perceptions of risk of those exposed. Effective emergency management relies on thorough integration of emergency plans at all levels of government and non-government involvement. Activities at each level (individual, group, community) affect the other levels. It is common to place the responsibility for governmental emergency management with the institutions for civil defence or within the conventional structure of the emergency services. In the private sector, emergency management is sometimes referred to as business continuity management.



**MITIGATION:**

Mitigation efforts attempt to prevent hazards from developing into disasters altogether, or to reduce the effects of disasters when they occur. The mitigation phase differs from the other phases because it focuses on long-term measures for reducing or eliminating risk. Personal mitigation is mainly about knowing and avoiding unnecessary risks. This includes an assessment of possible risks to personal/family health and to personal property.

An example of personal non-structural mitigation would be to avoid buying property that is exposed to hazards, e.g. in a flood plain, in areas of subsidence or landslides. Homeowners may not be aware of their home being exposed to a hazard until it strikes. Real estate agents may not come forward with such information. However, specialists can be hired to conduct riskassessment surveys. Insurance covering the most prominent identified risks are a common measure.

Personal structural mitigation in earthquake prone areas include installation of an Earthquake Valve to instantly shut off the natural gas supply to your property, seismic retrofits of property and the securing of items inside the building to enhance household seismic safety such as the mounting of furniture, refrigerators, water heaters and breakables to the walls, and the addition of cabinet latches. In flood prone areas houses can be built on poles, like in much of southern Asia. In areas prone to prolonged electricity black-outs a generator

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would be an example of an optimal structural mitigation measure. The construction of storm cellars and fallout shelters are further examples of personal mitigative actions.

### **PREPAREDNESS:**

In the preparedness phase, emergency managers develop plans of action for when the disaster strikes. Common preparedness measures include:

- The Communication plans with easily understood terminology and chain of command
- Development and practice of multi-agency coordination and incident command
- Proper maintenance and training of emergency services Development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans
- Stockpiling, inventory, and maintenance of supplies and equipment

An efficient preparedness measure is an emergency operations centre (EOC) combined with a practiced region-wide doctrine for managing emergencies. Another preparedness measure is to develop a volunteer response capability among civilian populations. Since, volunteer response is not always as predictable and plan-able as professional response; volunteers are often deployed on the periphery of an emergency unless they are a proven and established volunteer organization with standards and training.

On the contrary to mitigation activities which are aimed at preventing a disaster from occurring, personal preparedness are targeted on preparing activities to be taken when a disaster occurs, i.e. planning. Preparedness measures can take many forms. Examples include the construction of shelters, warning devices, back-up life-line services (e.g. power, water, sewage), and rehearsing an evacuation plan. Two simple measures prepare you for either sitting out the event or evacuating. For evacuation, a disaster supplies kit should be prepared and for sheltering purposes a stockpile of supplies.

### **RESPONSE:**

The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area. This is likely to include a first

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wave of core emergency services, such as fire-fighters, police and ambulance crews. They may be supported by a number of secondary emergency services, such as specialist rescue teams.

We work in all Phases of Disaster management and through our supported teams we respond in moments after a disaster hits as well as the other phases to try to reduce the chance of it happening in the first place or to reduce the impact of a disaster. We can respond worldwide to LEDCs (Less Economically Developed Countries) as well as MEDCs (More Economically Developed Countries).

In addition volunteers and other non-governmental organizations (NGOs) such as the local Red Cross branch or St. John Ambulance may provide immediate practical assistance, from first aid provision to providing tea and coffee. A well-rehearsed emergency plan developed as part of the preparedness phase enables efficient coordination of rescue efforts. Emergency plan rehearsal is essential to achieve optimal output with limited resources. In the response phase, medical assets will be used in accordance with the appropriate triage of the affected victims.

### **RECOVERY:**

The aim of the recovery phase is to restore the affected area to its previous state. It differs from the response phase in its focus; recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed. Recovery efforts are primarily concerned with actions that involve rebuilding destroyed property, re-employment, and the repair of other essential infrastructure.

An important aspect of effective recovery efforts is taking advantage of a 'window of opportunity' for the implementation of mitigative measures that might otherwise be unpopular. Citizens of the affected area are more likely to accept more mitigative changes when a recent disaster is in fresh memory. The recovery phase starts when the immediate threat to human life has subsided. In the reconstruction it is recommended to reconsider the location or construction material of the property.

In long term disasters the most extreme home confinement scenarios like war, famine and severe epidemics last up to a year. In this situation the recovery will take place inside the home.



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Planners for these events usually buy bulk foods and appropriate storage and preparation equipment, and eat the food as part of normal life. A simple balanced diet can be constructed from vitamin pills, whole-meal wheat, beans, dried milk, corn, and cooking oil. One should add vegetables, fruits, spices and meats, both prepared and fresh-gardened, when possible.

#### 4 R'S OF RESCUE, RELIEF, REHABILITATION AND RECONSTRUCTION

The standard time frame of rescue, relief and rehabilitation are usually defined as approximately 7 days, 3 months and 5 years respectively. (This is an approximate rule.)

The rescue operation starts with the local residents, immediately after the earthquake / disaster. It is usually supported by the trained and skilled staffs from the (Urban) Search and Rescue (SAR) departments of the governments. These activities can be complemented by the non-government organizations (NGO).

international Relief Teams arrive in the later stage, usually after 24 hours, depending on the accessibility, and political relation with the country.

#### **RESCUE PHASE**

Rescue phase usually lasts for the first 48 to 72 hours after a disaster when the rate of survival of trapped victims is high. Rescue operations continue for much longer duration, however, after the first 2 to 3 day, the resources allocated for rescue are comparatively low since other priorities take over. Initially Rescue may be 'self-rescue' or the rescue by bystanders or witnesses.

#### **RELIEF PHASE:**

Relief phase followed immediately after the Rescue phase. During the relief phase, the focus is to provide basic necessities to victims of the earthquake and to restore social equilibrium. Detailed assessment of human and other losses is also usually carried out during the relief phase, which helps in optimal allocation of resources.

Relief phase may last between 1 to 3 months depending on the severity of the earthquake and the resources of the government. Community, supported by government is usually the central point. Added resources of the NGOs and the international organization substantiate this effort.

**REHABILITATION/ RECONSTRUCTION PHASE AIMS:** Rehabilitation/reconstruction phase aims to restore the communities to the pre-earthquake status. During this phase, the social and other infrastructure is restored and economy revitalized.

The rehabilitation/reconstruction phase typically starts at the end of relief phase and may last for several years.

The short term plans of the recovery process are clearance of debris, building housing units, restoration of the lifelines and infrastructures, while the long-term objective is to build a safer and sustainable livelihood. Past experiences show that the efforts are sustainable only with community / government partnership, while NGOs and international organizations role is reduced after a certain period.

### **Vulnerability**

Vulnerability is the potential for loss or the extent to which an individual, community or place can be affected because of a disaster. It is caused by geographical as well as social conditions. Vulnerability is most often associated with poverty, but it can also arise when people are isolated, insecure and defenseless in the face of risk, shock or stress.

### **Causes of vulnerability**

Following are the main causes of vulnerability in a community.

- Poverty and poor living conditions.
- Lack of information
- Inadequate living conditions
- Inadequate safety measures and precautions
- Improperly maintained equipment.

Vulnerabilities when come before disasters and hazards, add to their severity, obstruct disaster response and may continue to remain long after a disaster has hit. Therefore, it is the vulnerability and hazard that changes the condition into a risk.

### **Examples of vulnerable groups**

Examples of potentially vulnerable groups are as follows:

- Displaced populations who leave their habitual residence in collectives, usually due to a sudden impact of disaster, such as earthquake or a tsunami, threat or conflict, as a coping mechanism and with the intent to return.
- Migrants who leave or flee their habitual residence to go to the new places, usually abroad to seek better and safer perspectives.
- Returnees- former migrants or displaced people returning their homes.
- Specific groups within the local population, such as marginalized, excluded or destitute people.
- Young children, pregnant and nursing women, unaccompanied children, widows, fisher folks, elderly people without family support and disabled

persons.

### **Types of vulnerability**

**1. Physical vulnerability** relates to buildings, infrastructure, and agriculture. The major focus of this appendix is on physical assets but the loss potential of crops, trees, livestock, and fisheries should be recognized as well. e.g. Wooden homes are less likely to collapse in an earthquake, but are more vulnerable to fire.

**2. Social vulnerability** refers to the inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of wellbeing of individuals, communities and societies. Records from the past disasters suggest that the following groups of people are particularly at risk and require special attention.

- Single parent families.
- Women, particularly when pregnant or lactating.
- Mentally and physically handicapped people.
- Children and the elderly.

**3. Economic vulnerability:** The level of vulnerability is highly dependent upon the economic status of individuals, communities and nations. The poor are usually more vulnerable to disasters because they lack the resources to build structures and put engineering measures in place to protect themselves from being negatively impacted by disasters.

### **Factors of vulnerability**

Vulnerability is dependent on the following factors.

- Location of the area
- Social and economic backwardness of people.
- Age and sex
- Disabilities
- Improper planning for disaster management.
- Lack of proper training to prevent or mitigate disaster.
- Unchecked growth of population.
- Unplanned urbanization

### **Concept of Exposure**

The presence and number of people, property, livelihoods, systems or other elements in hazard areas (and so thereby subject to potential losses) is known as exposure (UNISDR, 2009 and IPCC, 2012).

The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas and are subjected to losses is known as exposure. Exposure is one of the defining components of disaster risk.

$$\text{RISK} = \text{HAZARD} \times \text{EXPOSURE} \times \text{VULNERABILITY}$$

### **Why does it matter?**

If a hazard occurs in an area of no exposure, then there is no risk. Take the example of typhoons (tropical cyclones that occur in the Pacific Ocean). In October 2013 a Category 5 super typhoon (known as Lekima) hit the North West Pacific Ocean. Its winds reached peaks of around 240 kilometres per hour, but caused no impact on people or assets. In November 2013 another Category 5 Super Typhoon Haiyan (Yolanda) hit the region, with winds peaking at 315 kilometres per hour. Haiyan affected 11 million people, causing more than 6000 casualties and the loss of more than 1.5 billion US dollars. The difference in impact was because there were no people or property in the path of Lekima; in other words, there was no exposure.

The extent to which exposed people or economic assets are actually at risk is generally determined by how vulnerable they are (UNISDR, 2009), as it is possible to be exposed but not vulnerable (IPCC, 2012).

However, increasing evidence suggests that the case of extreme hazards the degree of disaster risk is a consequence of exposure more than it is a result of vulnerability (UNISDR, 2015). For instance, in the case of the 26 December 2004 Indian Ocean tsunami all those exposed to tsunamis were at risk, no matter their income, ethnicity or social class (UNISDR, 2011).

### **What drives exposure?**

People and economic assets become concentrated in areas exposed to hazards through processes such as population growth, migration, urbanization and economic development. Previous disasters can drive exposure by forcing people from their lands and to increasingly unsafe areas. Consequently, exposure changes over time and from place to place.

Many hazard prone areas, such as coastlines, volcanic slopes and flood plains, attract economic and urban development, offer significant economic benefits or are of cultural or religious significance to the people who live there. As more people and assets are exposed, risk in these areas becomes more concentrated. At the same time, risk also spreads as cities expand and as economic and urban development transform previously sparsely populated areas.

Large volumes of capital continue to flow into hazard-prone areas, leading to significant increases in the value of exposed economic assets. If global exposure continues to trend upwards, it may increase disaster risk to dangerous levels.

### **How do we reduce exposure?**

Economic exposure in high-hazard areas is trending upwards. If we do not reverse this trend, disaster risk is set to increase. We need to act now to reduce exposure and build capacity and resilience in these areas of growing exposure.

When it is not possible to avoid exposure to events, land use planning and location decisions must be accompanied by other structural or non-structural methods for preventing or mitigating risk. In the case of the Boxing Day 2004 Indian Ocean tsunami, for instance, the only possible strategy to save lives would have been to reduce exposure through timely evacuation, which depends on the existence of reliable early warning systems and effective preparedness planning, and then to compensate for loss through insurance or other risk financing instruments.

### **Concept of Capacity**

Capacity refers to all the strengths, attributes and resources available within a community, organization or society to manage and reduce disaster risks and strengthen resilience. A capable and accountable state, supported by an effective civil society and engaged private sector, is indispensable for the sustainable reduction of disaster risk. Some examples of capacity are permanent houses, ownership of land, adequate food and income sources, family and community support in times of crisis, local knowledge, good leadership etc. Like vulnerability it can be described using different terms.

**Coping capacity** is the ability of people, organizations and systems, to use available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during crises or adverse conditions. It contributes to the reduction of disaster risks.

**Capacity assessment** is the process by which the capacity of a group is reviewed against desired goals, where existing capacities are identified for maintenance or strengthening and capacity gaps are identified for further action.

**Capacity development** is the process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals. It is a concept that extends the term of capacity -building to encompass all aspects of creating and sustaining capacity growth over time. It involves learning and various types of training, but also continuous efforts to

develop institutions, political awareness, financial resources, technology systems and the wider enabling environment.

### **Why does capacity matter?**

Capacity (or the lack of it) is central to reducing disaster risk and therefore critical to meeting development objectives.

Enhancing capacity offers vulnerable communities the opportunity to reduce their disaster risk, develop and adapt to climate change.

### **How do we enhance capacity?**

Capacity development activities include;

- Anticipate (e.g. awareness raising of risk, education, participating in and implementing risk assessments, etc.);
- Cope (e.g. training in first aid, securing home, learning to swim, etc.);
- Resist (e.g. preparedness measures including establishing early warning systems, designing evacuation strategies, stock piling emergency equipment, etc.) and
- Recover (e.g. alternative means of income, i.e. diverse livelihoods, networks, social protection, etc.)

### **Types of capacities**

1. **Physical capacity** of a community or an area includes the equipment available, means of communication, infrastructure available in the area like bridges, roads, hospitals, schools, drainage etc. Availability of new water sources for drinking, irrigation and other purposes can also be counted in physical capacity. Indigenous engineering and construction skills to build and repair infrastructure are also a part of physical capacity.
2. **Social capacity** includes the social interaction, community organization, social and community work etc. e.g. In some areas during or after a disaster communities have organized themselves on street-level or village level and have built small organizations for help in case of disasters or carrying out other welfare activities in the area on volunteering basis e.g. CSO, youth organizations, CBOs etc
3. **Economic capacity** comprises of the income of the community or an area, their savings, earnings, production, business activities and availability of jobs and livelihoods. This capacity also includes employable skills like mining, weaving, etc. GDP/ GNP of an area describe its economic capacity.
4. **Attitudinal capacity** includes the capacity of People to fight and resist against plans and strategies that are not in line with their culture, ideology or religion and this can limit their capacity and increase their vulnerability to disasters.

## **Disaster Risk Reduction (DRR)**

DRR – disaster risk reduction – is the process of protecting the livelihoods and assets of communities and individuals from the impact of hazards. The hazards can be natural or human derived, and include earthquakes, floods, cyclones, droughts, price spikes, conflict and contagious diseases. DRR limits the negative impacts of these events by working to reduce their size, strength or how often they occur, and building the capacity of the people exposed to these hazards to anticipate, survive, and recover from them.

### **What does it look like?**

Disasters come in all shapes and sizes, and so the tools we use to reduce risk are just as varied. DRR can include:

- Infrastructure designed to reduce risk (like retaining walls, check dams, embankments and terraces).
- natural resource management (for example, reforestation)
- Agricultural interventions (introducing crop varieties).
- Behavior change (e.g., peace building processes and addressing some of the inequalities that make some people more vulnerable than others).
- Evacuation procedures and safe shelters.
- Early warning systems and preparedness planning for improving response to these events when they happen.

### **We need to manage risks?**

We need to manage risks to;

- avoid the construction of new risks
- address pre-existing risks
- share and spread risk to prevent disaster losses being absorbed by other development outcomes and creating additional poverty

## **How do we reduce risk? Or Disaster Risk Management**

Disaster risk management involves activities related to:

**Prevention:** Activities and measures to avoid existing and new disaster risks (often less costly than disaster relief and response). For instance, relocating exposed people and assets away from a hazard area.

**Mitigation:** The lessening or limitation of the adverse impacts of hazards and related disasters. For instance, constructing flood defenses, planting trees to stabilize slopes and implementing strict land use and building construction codes.

**Transfer:** The process of formally or informally shifting the financial consequences of particular risks from one party to another whereby a household, community, enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that of other party. For instance insurance.

**Preparedness:** The knowledge and capacities of governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent or current hazard events or conditions. For instance, installing early warning systems, identifying evacuation routes and preparing emergency supplies.

## **Disaster Management Act, 2005**

The Disaster Management Act, 2005, (23 December 2005) No. 53 of 2005, was passed by the Rajya Sabha, the upper house of the Parliament of India on 28 November, and by the Lok Sabha, the lower house of the Parliament, on 12 December 2005. It received the assent of The President of India on 9 January 2006. The Disaster Management Act, 2005 has 11 chapters and 79 sections. The Act extends to the whole of India. The Act provides for "the effective management of disasters and for matters connected there with or incidental thereto.



**Silent features of the Act are as follows;**

**Chapter I –Definition:** Section 2 of the Act defines;

**‘Disaster’** as a catastrophe, mishap, calamity or grave occurrence in any area, arising from either natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering, or damage to and destruction of property or damage to or degradation of environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

**‘Disaster Management’** is defined as a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient to prevent danger or threat of any disaster, mitigation or reduce the risk or severity or consequences of any disaster, capacity-building and preparedness to deal with any disaster, prompt response to any threatening disaster situation or disaster, assessing the severity or magnitude of effects of any disaster, evacuation, rescue and relief, rehabilitation and reconstruction.

### **Chapter II- National disaster management authority**

- The Act empowers the Central Government to appoint the National Disaster Management Authority with the Prime Minister of India as the Chairperson and such number of other members, not exceeding nine.
- The Central Government is to provide the National Authority with such officers, consultants and employees, as it considers necessary for carrying out the functions of the National Authority.
- The National Authority has the responsibility to lay down, approve the policies, plans and guidelines for disaster management prepared by various departments of Government of India to ensure timely and effective response

to disaster.

- Further the chapter also details about the meetings, executive committee and plans.

### **Chapter III - State Disaster Management Authorities**

- Similar to National Authority at the Centre, the State Government is to establish a State Disaster Management Authority for the State.
- The State Authority is to be headed by the Chief Minister of the State as the Chairperson and such number of other members, not exceeding nine.
- The State Authority is empowered as and when it considers necessary to constitute an advisory committee, consisting of experts in the field of disaster management.
- The State Authority is supposed to lay down the State disaster management policy, approve the State Plan in accordance with the guidelines laid down by the National Authority.
- Chapter III also specifies on meetings, state executive committee and plans.

**Chapter IV- District Disaster Management Authorities.** Every State Government, in turn is to establish a District Disaster Management Authority for every district in the State with the Collector or District Collector or Deputy Commissioner as the Chairperson and such number of other members, not exceeding seven. The District Authority is to act as the district planning, coordinating and implementing body for disaster management and takes all measures for the purposes of disaster management in the district in accordance with the guidelines laid down by the National Authority and the State Authority.

**Chapter V - Measures by the Government and International Agencies for Disaster Management:** The Central Government is empowered to take measures

as it deems necessary or expedient for the purpose of disaster management like deployment of naval, military and air forces, other armed forces of the Union or any other civilian personnel as may be required for the purposes of this Act, coordination with the United Nations agencies, international organizations and governments of foreign countries for the purposes of this Act and establish institutions for research, training and developmental programmes in the field of disaster management. It is also empowered to deal with all such other matters as it deems necessary or expedient for the purpose of securing effective implementation of the provisions of the Act.

**Chapter VI - Local Authorities:** Subject to the directions of the District Authority, the local authorities shall ensure that the officers and employees are trained; resources are so maintained as to be readily available, carry out relief rehabilitation and reconstruction activities in the affected areas and may take such other measures as may be necessary for the disaster management.

**Chapter VII - National Institute of Disaster Management:** The Central Government is empowered to constitute an institute to be called the National Institute of Disaster Management. The institute functions within the broad policies and guidelines laid down by the National Authority and is responsible for planning and promoting training and research in the area of disaster management, documentation and development of national level information base relating to disaster management policies, prevention mechanisms and mitigation measures.

#### **Chapter VIII - National Disaster Response Force**

- A National Disaster Response Force for the purpose of specialist response to a threatening disaster situation or disaster is to be constituted.

- The general superintendence, direction and control of the Force shall be vested and exercised by the National Authority and the command and supervision of the Force shall vest in an officer to be appointed by the Central Government as the Director General of the National Disaster Response Force.

**Chapter IX - Finance, Accounts and Audits:** The Central Government is empowered to constitute a fund to be called as the National disaster Response fund for meeting any threatening disaster situation or disaster and there shall be credited thereto an amount which Central Government may, after due appropriation made by parliament by law in this behalf provide any grants that may be made by any person or institution for the purpose of disaster management.

**Chapter X -Offences and Penalties:** The Act imposes punishments to persons/companies for contravening the provisions of this Act, 2005 such as obstructing or abandoning, refusing to comply with any of the provisions of this Act, making false claims, misappropriation of money or materials or false warning, etc. The punishment in such cases could be imprisonment or fine or both.

**Chapter XI-Miscellaneous:** The National Authority, the State Authority, or a District Authority is empowered to recommend the Government to give direction to any authority or person in control of any audio or audiovisual media or such other means of communication as may be available to carry any warning or advisories regarding any threatening disaster situation or disaster, and the said means of communication and media as designated shall comply with such direction.

**Recent Initiatives:** Coordinated mock drills under simulated situations like terror attack, earthquake, bomb blast, fire breakouts, flyover collapse etc., are being

organized by the National, State & District Management Authorities from time to time.

### **Jammu and Kashmir State Disaster Management Plan**

This plan will be known as the '**Jammu and Kashmir State Disaster Management Plan**' and will be applicable in the State of Jammu and Kashmir, India.

The silent features of the plan are as follows;

#### **Vision:**

**"TO BUILD SAFE AND DISASTER RESILIENT JAMMU AND KASHMIR"**

#### **Theme:**

The plan document envisages the accurate assessment of risk and vulnerability to disasters in the State of Jammu and Kashmir. A significant thematic component will be the mainstreaming of disaster management concerns in development plans/projects/ and programmes. The plan proposes to achieve its stated goals by enhancing capacities and designing preparedness measures that are rooted in socio-cultural, economic, ecological and technological determinants of risks and uncertainties, which affect diverse populations of the State. This plan outlines strategies for proper coordination and allocation of roles and responsibilities of each government department and other stakeholders involved. The plan also has provisions of reviewing and updating plan annually.

#### **Objectives:**

- To protect the lives of people in Jammu and Kashmir from any kind of natural disasters.
- To minimize the suffering of vulnerable population and the loss of property/infrastructure in the State due to disasters.
- To achieve maximum efficiency in reducing vulnerability of people to disasters in the State.
- To promote a culture of disaster resilience in the State.
- To design appropriate prevention and mitigation strategies across various levels of stakeholders in the State.
- To enhance the capacities of all relevant stakeholders in disaster risk reduction.
- To mainstream disaster risk reduction as integrated component of development planning in the State.
- To nurture and establish efficient disaster response/relief mechanism in the State.

- To provide clarity on roles and responsibilities for all stakeholders concerned with disaster response and recovery.
- To ensure co-ordination and promoting constructive partnership with all other agencies related to disaster management.

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## **Credit -2 Natural and Anthropogenic Hazards**

### **Natural Disasters**

#### **1. Earthquakes:**

In simple words sudden shaking or trembling of the earth surface is an earthquake. Most earthquakes are a minor tremor. Larger earthquakes usually begin with slight tremors but suddenly they turn into violent shocks and after that the intensity of shocks diminishes. Tremors or shocks are felt for a few seconds only.

Earthquake is a hazard that strikes suddenly. A hindi poet described the earthquake in these words. "Earthquakes strikes without pre information but the breathing stops without informing the man."

Earthquake can occur at any time of the year, day or night. Its impact is very sudden. There are no warning signs of earthquakes. Extensive and sincere research has been conducted but success has eluded humans in the forecast or prediction of earthquake.

Extensive research has been conducted in recent decades but there is no accepted method of earthquake prediction as on date.

#### **ELEMENTS AT RISK**

Several key factors that contribute to vulnerability of human populations to earthquakes:

- Location of settlements in an earthquake prone area, especially on soft ground, on area prone to landslides or along fault lines.
- Dense collection of weak buildings with high occupancy.
- Non-engineered buildings constructed by earth, rubble, buildings with heavy roofs (more vulnerable than light weight structures), poor quality and maintenance of buildings
- Weak or flexible storey intending for parking purposes.

#### **INDIAN EARTHQUAKES:**

The Indian subcontinent lies upon the Indian Plate. This plate is moving northward at about 5 centimetres per year and in doing so, collides with the Eurasian Plate. Upon the Eurasian Plate lie the Tibet plateau & Central Asia. Due to this collision, the Himalayas are thrust higher and very many earthquakes are generated in the process. This is the cause of earthquakes from the Himalayas to the Arakan Yoma. The same process, results in earthquakes in the Andaman

& Nicobar Islands. Sometimes earthquakes of different magnitudes occur within the Indian Plate, in the peninsula and in adjoining parts of the Arabian Sea or the Bay of Bengal. These arise due to localized systems of forces in the crust sometimes associated with ancient geological structures such as in the Rann of Kachchh. All earthquakes in peninsula India falls within this category.

### ***Measuring Earthquakes***

The *severity* of an earthquake can be expressed in several ways. The *magnitude* of an earthquake, as expressed by the Richter scale, is a measure of the amplitude (total range of fluctuation) of the seismic waves. Magnitude is related to the amount of energy released— an amount that can be estimated from seismograph recordings. The *intensity*, as expressed by the modified Mercalli scale, is a subjective measure that describes how severe a shock was felt at a particular location. Damage or loss of life and property is another, and ultimately the most important, measure of an earthquake's severity.

The Richter scale is the best known scale for measuring the magnitude of earthquakes. The scale is logarithmic so that a recording of 7, for example, indicates a disturbance with ground motion 10 times as large as a recording of 6. A quake of magnitude 2 is the smallest quake normally felt by humans. Earthquakes with a Richter value of 6 or more are commonly considered major in magnitude.

### **Effects of Earthquakes**

#### ***Primary Effects***

*The initial effect of an earthquake is the violent ground motion. Additionally the ground often fissures or cracks, and there can be large permanent displacements horizontally—sometimes as much as 10-15 meters (30-50 feet)*

The San Francisco earthquake of April 18, 1906, occurred along the San Andreas Fault over a length of 470 kilometres (300 miles), displacing the lips by a few centimetres up to one meter and causing a slip between the sides varying from 25 centimetres to seven meters.

Another primary effect is known as liquefaction. Loose sandy soils with a high moisture content separate when shaken by an earthquake. The water moves upward, giving the surface a consistency much like that of quicksand. Heavy structures resting on these soils slowly sink into the ground.



## ***Secondary Effects***

Often as destructive as the earthquake itself are the resulting secondary effects such as landslides, fires, tsunamis, and floods. Landslides are especially damaging and often account for the majority of lives lost. During the 1970 earthquake in Peru a very large portion of those killed were swept away by a landslide that covered the town of Yungay. Similarly, in the Guatemala earthquake of 1976, most deaths that occurred in Guatemala City were caused by the collapse of the unstabilized hillsides where thousands of urban squatters had settled.

## **Pre-disaster Activities**

Fortunately, a great deal can be done to prevent earthquakes from becoming disasters. First, the general public as well as engineers, planners, politicians and others need to understand the nature of earthquakes.

There are many ways to reduce earthquake damage. Possible actions include:

- Developing construction techniques that are seismic resistant;
- Conducting a program to introduce improved construction techniques to the building industry and the general public;
- Analysing soil type and geological structure to determine which sites are safe for construction;
- Instituting incentives to remove unsafe buildings and buildings on unsafe sites or, more probable, to upgrade their level of safety;
- Instituting incentives to encourage future development on safer sites and safer methods of construction through:
  - Land-use control (zoning);
  - building codes and standards and means of enforcing them;
  - Favourable taxation, loans or subsidies to qualifying and building methods sites;
  - land development incentives.
- Reducing possible damage from secondary effects by:
  - identifying potential landslide sites and restricting construction in those areas;
  - installing devices that will keep breakages in electrical lines and gas mains from producing fires;
  - verifying the capability of dams to resist earthquake forces, and upgrading as necessary.

## **Post-disaster Activities**

### ***Earthquake Response***

The immediate impact of an earthquake affects virtually all sectors of the community. Initial response by local authorities should include implementing the activities identified in the preparedness stage. Initial emphasis will be on *search and rescue* of the victims, attempting as far as feasible to account for all members of the affected population.

Second, *provide emergency medical assistance*. There will be a high incidence of surgical needs during the first 72 hours; additional medical needs will fall off sharply after that time.

Contrary to myth, there are no actual immediate epidemiological threats or patterns of disease resulting directly from an earthquake.

Third, *conduct damage and needs assessment*. The local government as well as international donors need to know as quickly as possible the scale of the disaster and what sort of assistance (and how) is needed.

Fourth, *provide relief* to the survivors. Response can take several forms. Of the greatest value is cash, allowing survivors and local agencies discretion to focus resources where the most urgent needs are. International donors can assist in reopening roads, re-establishing communications, making contact with remote areas, conducting disaster assessment, and providing building materials for reconstruction. The popularly known forms of foreign relief such as food, blankets and clothes are totally inappropriate.

### ***Earthquake Rehabilitation, Reconstruction and Recovery***

At the end of the emergency period, a transition to long-term recovery occurs. Local authorities should concentrate their assistance in the following areas:

- repair and reconstruction of “lifelines,” i.e. water, sewer, electrical services and roads;
- technical, material and financial assistance for the repair and reconstruction of housing and public buildings;
- economic programs that create jobs to help rejuvenate the economy;
- financial assistance to survivors, including lines of credit and assistance to businesses, enabling them to participate in recovery efforts.

## 2. Floods

Floods are one of the most common disasters which have impacted human civilization from time in memorial. Every flood is of different nature. They can occur suddenly and recede quickly, or may take days or even months to build and then discharge. They occur at irregular intervals and many decades can pass between significant floods can occur again but there are examples of floods occurring within short period of time.

“Floods are the temporary inundation of large regions as a result of rivers overflowing their banks”. OR “A Flood is an overflow of water that submerges land that is usually dry.”

**Causes of flood:** Floods are natural phenomena caused by natural forces but human interference with nature increased its impact. Some of the major causes of floods are:

- (1) Heavy rains
- (2) Cyclones
- (3) Storm surge along coasts
- (4) Tsunami
- (5) Cloud burst
- (6) Damage to river dams and chocking of river channel
- (7) Rapid snow melts

### **Effects of floods:**

- (a) Casualty to lives due to drowning.
- (b) Damage to roads, buildings, drains and sewerages.
- (c) Contamination of drinking water supplies.
- (d) Spread of water borne diseases.
- (e) Damage to crops and storage of food.
- (f) Loss of vegetation due to submergence.

**Major Floods in India:** Floods are common in India about 12% of total land area of the country is prone to floods. Some of the major floods in recent times in India are listed below.

S.no	YEAR	REGION	IMPACT
1.	1987	Bihar	1399 human deaths
2.	2013	Uttarakhand	More than 5700 people dead
3.	2014	Kashmir	257 human deaths
4.	2016	Assam	Affecting 1.8 million people
5.	2017	Gujarat	200 human deaths
6.	2018	Kerala	445 human deaths

### **Mitigation of Floods:**

Flood mitigation involves the management and control of flood water movement. Some of the steps to reduce the impact of floods are listed below:

- (a) **Embankments/Flood walls:** it is the oldest and most common method of construction of artificial high river banks.
- (b) **Storage reservoirs:** Cleaning of natural water storages should be done regularly. Encroachments should be stopped around rivers, lakes and ponds.
- (c) **Construction on higher areas:** The construction of any kind (houses, buildings, shops etc) should be done on elevated areas in flood plain areas.
- (d) **Retention Basins:** construction of dams which can be used for storing of water can reduce chances of floods.
- (e) **Flood zonation mapping:** mapping of flood prone areas.
- (f) **Land use planning:** No major development or construction should be allowed in flood prone areas. This will minimize loss of life and property.

### **3. Landslides:**

The slipping of masses of rocks, earth or debris downwards on the mountain slopes or banks of the rivers is called a landslide. The occurrence of landslides in mountainous areas is increasing day by day. The impact of landslides on the people in the mountains is clearly visible.

#### **Landslide prone areas:**

The landslides are a common feature in Himalaya, Western ghats and in river valleys. The state of Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and all the seven states of North East India, are most vulnerable to landslide. In

southern India Maharashtra, Karnataka, Tamil Nadu and Kerala bear the brunt of landslides.

### **Causes of landslides:**

**1. Heavy rain:** Heavy rain is the main cause of landslides.

**2. Deforestation:** Deforestation is another major cause of landslides. Tree, bushes and grasses keep the soil particles compact. Mountain slope loses their protective cover by felling of trees. The rain water flows on such slopes with unimpeded speed.

**3. Earthquakes and volcanic explosions:** Earthquake is a common feature in the Himalaya. Tremors destabilize the mountains and the rocks tumble downwards. Volcanic explosions also trigger landslides in the mountainous areas.

**4. Building of roads:** Roads are built in mountainous areas for development. During the process of the construction of road, a large amount of rocks and debris has to be removed. This process dislodges the rock structure and changes the angle of slopes. Consequently landslides are triggered.

**4. Shifting agriculture:** In the North Eastern part of India, the number and frequency of landslides has increased due to the practice of shifting agriculture.

**5. Construction of houses and other buildings:** For giving shelter to the ever-increasing population and promotion of tourism more and more house and hotels are being built. In building processes large amount of debris is created. This causes the landslides.

### **Impact of landslides:**

**(i) Degrading of environment:** Landslides are degrading the environment of mountains. Natural beauty is diminishing slowly and slowly.

(ii) Sources of water are drying up.

(iii) Flooding in rivers is increasing.

(iv) Roads are blocked.

(v) Life and property are lost

### **Measures to control landslides and to mitigate their impact**

(i) Afforestation: Trees and bushes help in binding the soil particles.

(ii) New technology in road construction: Roads should be constructed in such a way, that lesser amount of debris's are generated.

(iii) Ban on quarrying of stones and mining of minerals

(iv) Instead of exploitation of forests, they should be used scientifically.

(v) Permanent crops like orchards of fruits should replace the seasonal or annual crops.

(vi) By controlling the surface flow of water, seepage of water should be minimized.

(vii) Retaining walls can be built on mountain slopes to stop land from slipping.

(viii) Hazard mapping should be done to locate areas commonly prone to landslides. Building and construction activities may be banned in such areas.

#### **4. Cyclone**

Coastal areas are prone to many disasters. One of the most common disaster that affects these regions especially in tropical and sub tropical region is a Cyclone.

“Cyclone is a large scale air mass that rotates around a strong center of low atmospheric pressure”.

##### **Formation of Cyclone:**

The formation of a cyclone depends upon various conditions; these are:

- (1) A warm sea ( a temperature in excess of 26 degree Celsius to a depth of 60 m) with abundant and turbulent transfer of water vapour to overlying atmosphere by evaporation.
- (2) Atmospheric instability encouraging formation of massive vertical clouds due to convection with condensation of rising air above ocean surface.

##### **Impact of cyclones:**

Cyclones are destructive weather system accompanied by torrential rains, high speed winds and coastal flooding. This can lead to destruction of buildings, crops and infrastructure and loss of human life.

##### **Cyclones in India:**

India having a long coast line (7500km) is vulnerable to cyclones. About 8% of land in India is affected by cyclones. India experience two or three cyclones of varying intensity every year. Cyclonic activities are severe on east coast than on west coast. Some of the major cyclones that have struck India are:

- (1) In 1970 Bhola cyclone struck India and Bangladesh killing about 500000 people.
- (2) In 1999 cyclone 05-B struck Orissa killing about 9803 people.
- (3) Cyclone Nargis struck India and many neighboring countries causing huge destruction to life and property.

## **Mitigation of cyclones:**

### **(1) Structural measures:**

- Cyclone walls
- Increasing river dike height.
- Cyclone shelters (safe places to flee)
- Evacuation routes identification.

### **(2) Non structural measures:**

- Coastal Regulation zone act (CRZ) –strict implementation ( no development within 500m of the high tide line with elevation of less than 10m above mean sea level).
- Maintaining natural sand dunes.
- Early warning system.
- Land use zoning according with CRZ.

## **5.Drought:**

Drought has long been recognized as one of the most insidious causes of human misery. It has today the unfortunate distinction of being the natural disaster that annually claims the most victims. Its ability to cause widespread misery is actually increasing.

While generally associated with semiarid climates, drought can occur in areas that normally enjoy adequate rainfall and moisture levels. In the broadest sense, any lack of water for the normal needs of agriculture, livestock, industry, or human population may be termed a drought.

The cause may be lack of supply, contamination of supply, inadequate storage or conveyance facilities, or abnormal demand. Drought, as commonly understood, is a condition of climatic dryness that is severe enough to reduce soil moisture and water below the minimums necessary for sustaining plant, animal, and human life. Drought is usually accompanied by hot, dry winds and may be followed by damaging floods. More socially relevant than technically correct is the definition used by Ari Toubou Eibrahim, the minister of agriculture in Niger, who has said that a drought is “Not as much water as the people need.”

### **Geographical Distribution:**

Droughts occur in all of the world’s continents. In recent decades the most severe and devastating to human populations have been in Africa, perhaps

giving the impression that droughts are principally an African problem. In fact devastating droughts have occurred in virtually all of the major semiarid regions of the world as well as in many zones that are normally temperate climates with significant annual rainfalls.

### **Impact of Droughts on Built and Natural Environments:**

The effects of droughts can be divided according to the primary or immediate effects, and the secondary or resulting effects.

#### ***Primary Effects***

Primary effects of drought result from a lack of water. As a dry period progresses and water supplies dwindle, existing water supplies are overtaxed and finally dry up. The primary losses are loss of crops, loss of livestock and other animals, and loss of water for hygienic use and drinking.

#### ***Secondary Effects of Drought***

The secondary effects of drought follow and result from the primary effects. As water supplies dwindle and crops and fodder are depleted, families begin to migrate in search of better grazing lands for their herds or move to the cities to seek jobs and alternative sources of income. If the dwindling supplies of food are not replaced, famine can occur, further accelerating the migration out of the stricken areas to less affected zones. The migration may, in itself, contribute to spreading the scope of the disaster, especially if grazing animals are moved with the people.

If drought is long term, it may result in permanent changes of settlement, social, and living patterns. For example, before the 1968 drought, 65 percent of Mauritania's population were nomads. By 1976 that figure was down to 36 percent. The town of Nouakchott grew from 12,300 in 1964 to approximately 135,000 20 years later.

### **Emergency Response:**

Once a drought has commenced, the emergency response must be swift and comprehensive.

If action is quickly taken, the following activities normally occur in the affected area:

- distribution of supplementary food for vulnerable population groups in the affected zones
- distribution of fodder for animals in the affected zones



- Provision of water supplies to the communities (water supplies must be constant and people must be sure of this constant supply; otherwise they will leave the area.)

- distribution of seeds for alternative crops.

If desertification is accelerated during a drought, several activities are normally taken to reclaim the land and develop water resources. These are discussed in the chapter on desertification.

If emergency measures are not immediately instituted at the beginning of a drought, large populations will inevitably begin migrating from the drought-stricken area. Once this has happened, the emergency response becomes a famine response, and emergency relief measures must be initiated.

### **6.Snow avalanches**

An avalanche is a rapid flow of snow down a hill or mountainside. Although avalanches can occur on any slope given the right condition, certain time of year and certain locations are naturally more dangerous than others. Wintertime particularly from December to April is when most avalanches tend to happen. However, deaths due to avalanches have been recorded throughout the year.

#### **Causes of snow avalanches:**

- Weather condition.
- Slope steepness.
- Slope direction.
- Wind direction.
- Vegetation covers of the region.
- Snowpack condition.

#### **Impact of avalanches:**

- Destruction of infrastructure (buildings, dams, roads).
- Destruction of vegetation cover.
- Loss of human and animal life.

#### **Snow avalanche at Valtengu Nad Jammu and Kashmir (2005):**

On 18<sup>th</sup> February 2005 an avalanche hit Jammu and Kashmir valtengu Nad in Anantnag district affecting 128 families. During the incident 175 persons lost their lives. Besides this 550 animals (goats, sheep, and cows) were killed.

**Mitigation:**

- Controlled avalanches are intentionally triggered avalanches. They are caused by explosive or by ski cutting.
- Development of Snow sheds.
- Deflecting wall to divert the direction of snow.
- Barrier fences to slow the movement of snow.
- Avalanche warning.

**7.Wildfires**

A wildfire or wild land fire is a fire in an area of combustible vegetation occurring in rural areas. Depending on the type of vegetation present, a wildfire can also be classified more specifically as brush fire, forest fire, and grass fire.

**Causes of wildfire:**

Natural causes:

- Dry climate.
- Lightning.
- Volcanic eruption.

Human cause:

- Arson.
- Discarded cigarettes.
- Power line arcs and sparks from equipment.
- Slash and burning for clearing forest land for cultivation.

**Prevention of wildfire:**

Unlike many natural disasters most of the wildfires are caused by humans and can be prevented by people. Here are some tips how to prevent wildfires:

- Never leave a fire unattended near a forest.
- Do not discard cigarettes, matches, and smoking materials from moving vehicles. Be certain to completely extinguish cigarettes before disposing of them.
- Follow local ordinances when burning yard waste.
- Avoid backyard burning in windy conditions.

## **8. Tsunami**

Tsunami is a natural disaster that affects the coastal areas. Tsunami is a Japanese term which is translated as harbor wave. They are also called seismic sea waves. Tsunami may be defined as “a large wave on the ocean, usually caused by an undersea earthquake, a volcanic eruption, or coastal landslide.”

A tsunami can travel hundreds of miles over the open sea and cause extensive damage when encounters land. Tsunami can have height up to 30 m (98ft) and reaches speed of 950 Km (589mi)/hour.

### **Tsunami in India:**

India having a long coastline is vulnerable to tsunami related natural disasters.

On 26<sup>th</sup> December 2004 Indian Ocean region was hit by a tsunami triggered by an earthquake 9.1 magnitude with epicenter near the west coast of Sumatra Island in Indonesia which affected 14 countries. It is one of the deadliest disasters in recorded history killing 230000 people and destroying property in several billion dollars. In India 10136 people were killed.

### **Impact of Tsunami:**

Tsunami can cause major damage to life and property in coastal region. Some of the impacts of Tsunami are listed below:

- Destruction of humans and animal life.
- Damage to buildings, infrastructure near coastal regions.
- Tsunami can cause damage to ports, Harbors and ships.
- Damage to mangrove vegetation and other coastal vegetation.
- Flooding of coastal regions.

### **Mitigation steps:**

- We can avoid impact of tsunami by building on high grounds away from sea shores.
- Slowing the tsunami waves by frictional techniques- forests, ditches, slopes, and berms.
- Deflecting the tsunami away by using angled walls.
- Development of early warning systems for tsunami.
- Awareness about evacuation areas and routes.

## **9. Volcano**

A volcano is an opening in the earth's crust that allows molten material; gases and debris escape from inside the earth's crust to surface of earth. A volcanic eruption may involve lava and other debris that can flow up to 100 mph, destroying everything in their path. Volcanic ash can travel 100's of miles and can cause severe health problems.

### **Impact of Volcanic eruption:**

- Contaminate water supplies.
- Damage machinery, vehicle, and even airplanes.
- Reduce visibility through smog and harmful gases that may threat low lying areas.
- Makes hard to breath and irritates the skin, eyes, nose and throat.

### **Mitigation:**

- Work with public officials.
- Provide information of possible hazard.
- Plan with local agencies prior to an eruption, inform of possible hazard in the region.
- Communication with media for hazard information of general public and possible excavation.
- Create hazard maps to show extend of possible impact.
- Beside this volcano are cause of earthquakes so people living in these regions should know how to safe guard from shaking of ground impacts also.