

Jaipur Engineering College & Research Centre

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Disaster

Management

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Definition of Disaster

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

Definition of Disaster

As per DM Act, 2005

Disaster means a catastrophe, mishap, calamity or grave occurrence affecting any area from natural and 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 and magnitude as to be beyond the capacity of the community of the affected areas.

Elements of a Disaster

- ❑ A phenomenon or event which constitutes a trauma for a population/environment.
- ❑ A vulnerable point/area that will bear the brunt of the traumatizing event.
- ❑ The failure of local & surrounding resources to cope with the problems created by the phenomenon.

Disaster Types

- ❑ Natural
- ❑ Man-Made

Terminology

- ❑ **Disaster Risk:** The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period.
- ❑ **Disaster Risk Management:** The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.
- ❑ **Disaster Risk Reduction:** The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened ...

... vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

- ❑ **Risk:** The combination of the probability of an event and its negative consequences.
- ❑ **Risk Assessment:** A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
- ❑ **Risk Management:** The systematic approach and practice of managing uncertainty to minimize potential harm and loss.

- **Risk 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 other party.
- **Adaptation:** The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
- **Capacity:** The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.

- ❑ **Capacity Development:** The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions.
- ❑ **Climate Change:** A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use”.

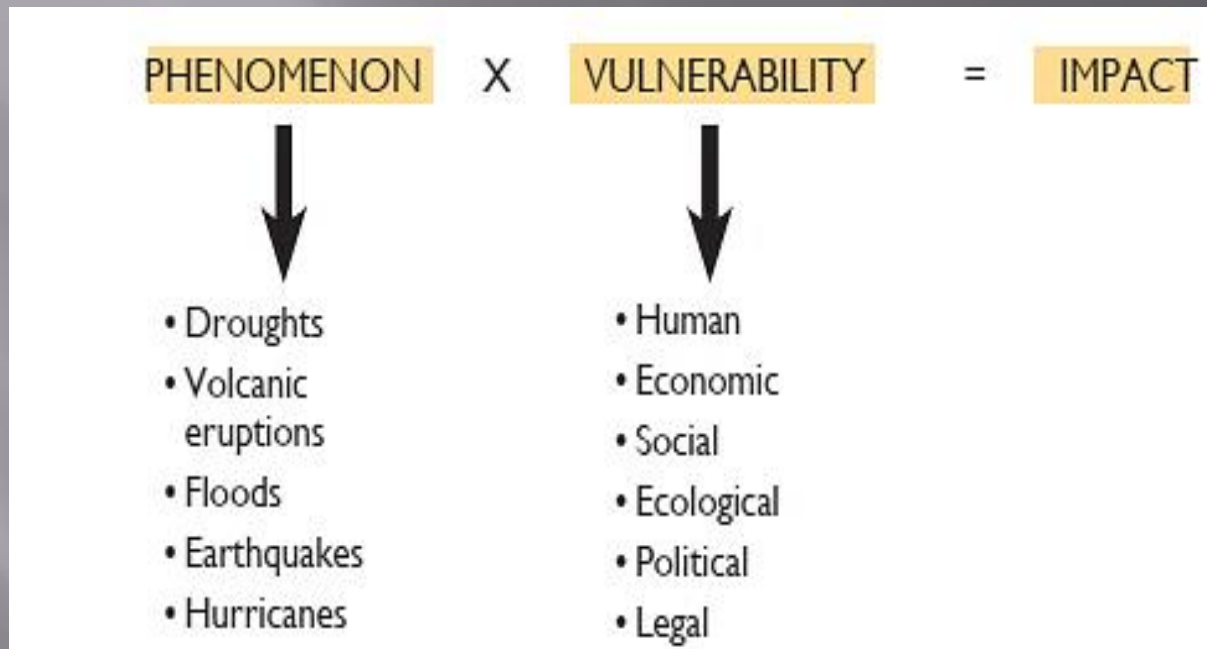
- ❑ **Contingency Planning:** A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.
- ❑ **Coping Capacity:** The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
- ❑ **Emergency Management:** The organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps.

- ❑ **Hazard:** A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
- ❑ **Mitigation:** The lessening or limitation of the adverse impacts of hazards and related disasters.
- ❑ **Preparedness:** The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
- ❑ **Prevention:** The outright avoidance of adverse impacts of hazards and related disasters.

- **Recovery:** The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
- **Resilience:** The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
- **Response:** The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

- ❑ **Retrofitting:** Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards.
- ❑ **Structural Measures:** Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems.
- ❑ **Non-structural Measures:** Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.
- ❑ **Sustainable Development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

- **Vulnerability:** The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.



DISASTER CLASSIFICATION

Natural disasters

- Hurricanes or cyclones
- Tornadoes
- Floods
- Avalanches and mud slides
- Tsunamis
- Hailstorms
- Droughts
- Forest fires
- Earthquakes
- Epidemics

Man-provoked disasters

Technological/industrial disasters

- Leaks of hazardous materials
- Accidental explosions
- Bridge or road collapses, or vehicle collisions
- Power cuts

Terrorism/International violence

- Bombs or explosions
- Release of chemical materials
- Release of biological agents
- Release of radioactive agents
- Multiple or massive shootings
- Mutinies
- Intentional fires

Complex emergencies

- Conflicts or wars
- Genocide

NATURAL DISASTERS

Natural disasters are caused by natural forces, such as earthquakes, volcanic eruptions, hurricanes, fires, tornados, and extreme temperatures.

They can be classified as Rapid-Onset Disasters such as Earthquakes or Tsunamis, and those with Progressive-Onset, such as Droughts that lead to Famine.

Natural disaster category is divided into six groups:

1. Biological
2. Geophysical
3. Meteorological
4. Hydrological
5. Climatological
6. Extra-Terrestrial

Each group covers different disaster main types, each having different disaster sub-types.

DISASTER SUB-GROUP CLASSIFICATION & DEFINITION

Disaster Subgroup	Definition	Disaster Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede

GEOPHYSICAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural Disaster	Geophysical	Earthquake	Ground shaking	
			Tsunami	
		Volcano	Volcanic eruption	
		Mass movement (dry)	Rockfall	
			Avalanche	Snow avalanche
				Debris avalanche
			Landslide	Mudslide Lahar Debris flow
			Subsidence	Sudden subsidence
				Long-lasting subsidence

METEOROLOGICAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural Disaster	Meteorological	Storm	Tropical storm	
			Extra-tropical cyclone (Winter storm)	
			Local/Convective storm	Thunderstorm/ Lightning
				Snowstorm/Blizzard
				Sandstorm/Duststorm
				Generic (severe) storm
				Tornado
				Orographic storm (strong winds)

HYDROLOGICAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Hydrological	Flood	General (river) flood	
			Flash flood	
			Storm surge/coastal flood	
		Mass movement (wet)	Rockfall	
			Landslide	Debris flow
			Avalanche	Snow avalanche
				Debris avalanche
			Subsidence	Sudden subsidence
				Long-lasting subsidence

CLIMATOLOGICAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type			
Natural disaster	Climatological	Extreme temperature	Heat wave				
			Cold wave	Frost			
				Extreme winter conditions	Snow pressure		
				Icing			
				Freezing rain			
		Drought	Drought	Drought	Debris avalanche		
					Wild fire	Forest fire	
							Land fires (grass, scrub, bush, etc. ...)

BIOLOGICAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Biological	Epidemic	Viral Infectious Diseases	
			Bacterial Infectious Diseases	
			Parasitic Infectious Diseases	
			Fungal Infectious Diseases	
			Prion Infectious Diseases	
		Insect infestation	Grasshoper/Locust/Worms	
		Animal stampede		

EXTRA-TERRESTRIAL DISASTERS

Disaster Generic Group	Disaster Group	Disaster Main-Type	Disaster Sub-Type	Disaster Sub-sub Type
Natural disaster	Extra-terrestrial	Meteorit/Asteorit		

MAN-MADE DISASTERS

Disasters caused by man are those in which major direct causes are identifiable intentional or non-intentional human actions.

They can be subdivided into three main categories:

1. Technological disasters
2. Terrorism/Violence
3. Complex humanitarian emergencies

Technological Disasters : Unregulated industrialization and inadequate safety standards increase the risk for industrial disasters.

Terrorism/Violence : The threat of terrorism has also increased due to the spread of technologies involving nuclear, biological, and chemical agents used to develop weapons of mass destruction.

Complex Humanitarian Emergencies : This describes the humanitarian emergency resulting from an International or civil war. In such situations, large numbers of people are displaced from their homes due to the lack of personal safety and the disruption of basic infrastructure including food distribution, water, electricity, and sanitation, or communities are left stranded and isolated in their own homes unable to access assistance.

GENERAL EFFECTS OF DISASTER

- ❑ Loss of Life
- ❑ Injury
- ❑ Damage to and Destruction of Property
- ❑ Damage to and Destruction of Production
- ❑ Disruption of Lifestyle
- ❑ Loss of Livelihood
- ❑ Disruption to Essential Services
- ❑ Damage to National Infrastructure
- ❑ Disruption to Governmental Systems
- ❑ National Economic Loss
- ❑ Sociological and Psychological After-Effect

DISASTER MANAGEMENT

“An applied science which seeks, by the systematic observation and analysis of disasters, to improve measures relating to prevention, mitigation, preparedness, emergency response and recovery.”

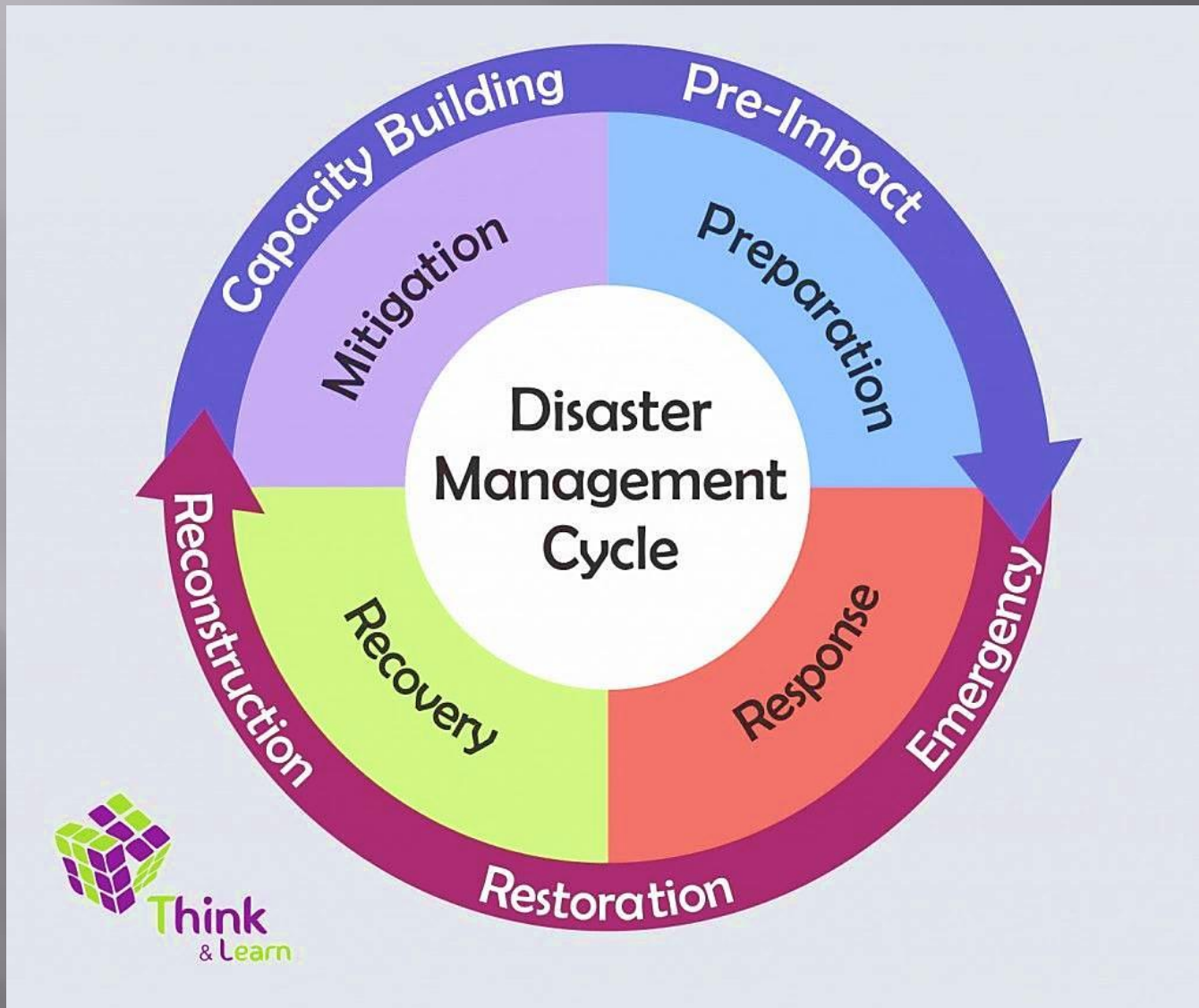
Disaster Management means a coordination and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for:

- ❑ Prevention of danger or threat of any disaster
- ❑ Mitigation or reduction of risk of any disaster or its severity or its consequences

Contd.

- ❑ Capacity Building
- ❑ 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

Disaster Management Cycle



PREPAREDNESS

Preparedness is usually regarded as comprising measures which enable governments, organizations, communities and individuals to respond rapidly and effectively to disaster situations. It includes all the activities and actions taken in advance of a disaster.

Examples of Preparedness measures are :

- Formulation & Maintenance of valid, up-to-date Counter-Disaster plans which include
 - ✓ Frequency of occurrence of event
 - ✓ Anticipated magnitude of effect
 - ✓ Characteristics of the populations most likely to be affected

Contd..

PREPAREDNESS

Contd.

- ✓ Amount and types of resources available within the community or organizational structure
- ✓ Ability to function independently without additional outside resources for periods of time
- Special provisions for Emergency action
- Provisions of Warning systems
- Emergency communications
- Public Education and Awareness
- Training programs, including Exercises and Tests

RESPONSE

This is the Emergency Phase. It comprises all the activities and actions taken immediately during and immediately following Disaster Impact.

Typical measures include :

- Notification of the organizations involved in Disaster Response
- Setting up of Initial Communication Networks
- Activation of the Counter-Disaster System
- Search and Rescue
- Provision of Emergency food, shelter, medical assistance, etc.
- Survey and Assessment
- Rescue and Evacuation Measures

RECOVERY

Recovery is the process by which communities and the nation are assisted in returning to their proper level of functioning following a disaster.

Three main categories of activity are normally regarded as coming within the recovery segment:

- Restoration
- Reconstruction
- Rehabilitation

PREVENTION & MITIGATION

PREVENTION comprises of Actions which are designed to impede or obstruct the occurrence of a disaster event and/or prevent such an occurrence having harmful effects on communities or key installations.

This phase usually occurs when conditions are returning to their pre-disaster state. In this, all aspects of emergency management are scrutinized for “lessons learned” which are then applied in an effort to prevent the recurrence of the disaster or to lessen the effects of subsequent events.

PREVENTION & MITIGATION

MITIGATION includes preventive and precautionary measures after a Disaster. Action within this segment usually takes the form of specific programs intended to reduce the effects of disaster on a nation or community such as:

- Changing building codes and practices
- Redesigning public utilities and services
- Reviewing mandatory evacuation practices
- Warning policies, and educating members of the community

some countries regard the development and application of building codes (which can reduce damage and loss in the event of earthquakes and cyclones) as being in the category of mitigation.

Principles of Disaster Management

- ❑ Risk & Hazard Assessment
- ❑ Planning
- ❑ Organization
- ❑ Resource Utilization
- ❑ Need for Specialists
- ❑ Training

RISK AND HAZARD ASSESSMENT

Disaster risk will be a combination of the likelihood of the event and the vulnerability of a place to that event.

The hazard assessment will aim to deliver accurate disaster information about individual locations.

The combination of hazard and vulnerability assessments will result in formulating total risk assessment.

RISK AND HAZARD ASSESSMENT

Vulnerability to a particular hazard will include :

- Critical products, services, records and operations.
- Hazardous materials
- Potential effects of damage on stakeholders.
- Likely financial costs.
- Resources personnel and time available to make preparations.
- Level of insurance cover.

PLANNING

- To have a clear and logical approach to dealing with disasters.
- To provide common reference for all departments and authorities with roles.
- To assist with information for sitting-up a multi-functional organizational structure.
- To form a basis for coordinated action.
- To provide clear allocation of responsibilities.
- To form a basis for reviewing and evaluating current and future disaster management requirements.
- To give a focus for disaster related training

ORGANIZATION

- The nature of National Disaster Management Authority (NDMA)
- Utilization of total governmental structures/ resources i.e. National, State & Local level.
- Co-ordination of non governmental resources
- Community involvement
- Clear lines of Authority and unity of command
- Special system requirements.

ORGANIZATION

- Special system requirements.
 - ✓ Emergency Operation Centre/Control Centre
 - ✓ Direction & Coordinating Authority
 - ✓ Communications
 - ✓ Warning Systems
 - ✓ Survey & Assessments
 - ✓ Information Management
 - ✓ Emergency Logistics

RESOURCE UTILIZATION

- Identification of resources
- Assessment of resources with relation to their capability & availability
- Allocation of appropriate tasks
- Level of skill in handling allotted tasks and experience
- Activation time for deployment/availability
- Co-ordination with line authorities of resource organizations
- Coalition of accurate information for effective deployment of resources

NEED FOR SPECIALISTS

- Search & Rescue
- Survey & Damage Assessment
- First Aid & Triage
- Mobile Medical & Health Team
- Evacuation
- Animal Husbandry/Veterinary
- Emergency Welfare
- Emergency Shelter
- Emergency Logistics

NEED FOR SPECIALISTS

- Staff for EOC (Emergency Operating Center)
- Information Management including public information needs.
- Specialists from field of disaster studies and research (Geologists, Meteorologists, etc.)

TRAINING

- Identification of Training needs.
- Scope of Training programs.
- Training policy.
- Implementation of training

Design of training shall be compatible to support tasks required to be performed after a Disaster at three levels.

- Foundational Training
- Team Training
- Combined Organizational Training

HAZARD, VULNERABILITY, AND RISK

Hazard: The term Hazard means a possible source of a potentially dangerous event which may cause a disaster. It depends on the probability of occurrence of an event, its location, and the strike time.

Vulnerability: The term Vulnerability refers to the level of susceptibility or degree of exposure to hazard risks.

Hazards turn disasters only when our vulnerability level is high and our degree of preparedness is low.

HAZARD, VULNERABILITY, AND RISK

Risk: The term Risk conveys the consequence of a hazard usually specified in terms of economic worth of loss. For determining risk involved in a disaster, we need to know the level of hazard, the elements at risk, and the associated vulnerability.

When hazard is H and vulnerability is V , the risk involved will be the product of the two.

Where there is no hazard, we fear no disaster or risk. Higher the hazard level more is the likelihood of risk for a given vulnerability. Higher the risk, the higher will be the losses.

TYPES OF VULNERABILITY

Type	Example
Physical Vulnerability	People living in unsafe buildings in earthquake-prone areas are physically vulnerable.
Economic Vulnerability	People without financial and material resources are economically handicapped and therefore more vulnerable than the rich.
Social Vulnerability	People without social connectivity and support are socially vulnerable.
Ecological Vulnerability	Communities and people unprotected from the on-going ecological degradation are ecologically vulnerable.
Organizational Vulnerability	Communities without capacity and organizational support are organizationally vulnerable.
Communicational Vulnerability	Communities without access to information and telecommunication facilities suffer from communicational vulnerability.
Attitudinal Vulnerability	Communities without behavioral training, education, and awareness suffer from attitudinal vulnerability.
Political Vulnerability	Locations without political patronage suffers from political vulnerability.

TYPES OF NATURAL DISASTERS

Disaster Name	Description
Hurricanes	<p>Hurricanes are also known as cyclones or typhoons depending on the area of the world. They consist of an area of calm at the core, known as the eye of the storm, which is surrounded by a swirling, fast-moving vortex of wind and rain storms. Hurricanes occur when groups of thunderstorms drift over warm oceans. The warm air from the storm and air at the surface of the ocean begin to rise. As the air rises, it creates an area of low pressure at the surface of the ocean. The air pulls cooler air downwards, towards the ocean. The storm moves across the ocean as this process continues and the wind speeds increase.</p>
Tornadoes	<p>Tornadoes are also known as twisters, whirlwinds, or cyclones. They are a funnel of rapidly moving air that is in contact with the surface of the earth. They occur when humid air is heated and starts to rise. As this moist air meets cold air, it can form thunder clouds. The upward movement of air combined with winds from other directions can cause the air to rotate, sometimes causing the visible 'twister' funnel form out of the bottom of the cloud. They can last a just a few seconds or it can be up to over an hour before they dissipate. On average, the United States has the most tornadoes each year, but they can be found all over the world.</p>

Earthquakes	<p>Earthquakes are caused by sudden jolts in tectonic plates. The Earth's crust is broken up into pieces that rest on a semi-molten layer called the mantle. Uneven heating in the mantle causes convection currents which cause the tectonic plates to move. Thousands of earthquakes happen every day, but most of them are too small for humans to notice and they are only detected by a sensitive scientific instrument known as a seismometer. When they are large enough, earthquakes can destroy whole cities, but they mainly occur around fault lines.</p>
Tsunami	<p>Tsunamis can occur from earthquakes, volcanic eruptions, or explosions under the ocean. The seismic waves can jolt the seabed, which displaces huge amounts of water in the ocean. This causes large waves to spread from the Epicentre. In deep water, the waves move quickly; when they reach shallow coastal areas, they slow down but their height increases. These waves can cause huge destruction when they reach land.</p>
Avalanche	<p>An avalanche occurs when a large amount of snow and ice rapidly slides down a slope. This can be caused as snow and ice starts to build up and there are weaker layers underneath. The fast moving snow will bury whatever or whoever is in its path. Sometimes small avalanches are triggered on purpose in a controlled way to make some mountainous areas safer. This is done when the build-up of snow is small, so as not to cause damage or injury.</p>

Volcanoes	<p>Most volcanoes only become dangerous during a volcanic eruption. There are hundreds of potentially active volcanoes around the world, most of which are found along the fault lines of the earth. The molten rock is known as magma when it is under the earth, and lava when it reaches the surface. Volcanoes erupt when the pressure in the magma chamber is so great that it can break through the rock at the top of the volcano. As it erupts, large rocks are thrown into the air along with a hot cloud of rock and ash. This cloud of ash, known as a pyroclastic flow, moves quickly, engulfs everything in its path.</p>
Heat Wave	<p>A Heatwave is a period of excessively high temperatures, often with high humidity. High temperatures can have negative effects on people's health and can even cause death. Heatwaves can also cause mass power outages because many people turn up their air conditioning.</p>
Drought	<p>A drought is characterized when the rainfall in an area is less than average to the point where there is a negative effect on the water supply. This can have a large impact on agriculture because crops cannot grow without water and potentially leads to famine, as farmers can't produce enough food for everyone. A lack of water often leads to a mass migration of people and animals as they go in search of areas with more water.</p>

<p>Landslide</p>	<p>Landslides, also known as landslips, can vary massively in their size and destruction, but they always involve the movement of land. Landslides occur when the ground on a slope becomes less stable. This could happen due to a number of reasons including erosion, groundwater flow, and deforestation. The triggers for landslide include any seismic activity from earthquakes or volcanoes, or vibrations from heavy machinery.</p>
<p>Wildfire</p>	<p>Wildfires or forest fires can be started by natural causes, like lightning, or by humans. Sometimes humans start them intentionally to clear brush, but wildfires also start accidentally. Wildfires have been caused by cigarettes, grills that haven't been extinguished, and campfires that haven't been managed properly. They can be extremely difficult to stop once they have started and can destroy large areas of forestland. Often, Firefighters will use 'Waterbombers', or aircraft that can spray water over large areas of forest.</p>
<p>Blizzard</p>	<p>Blizzards are a type of dangerous snowstorm where there are powerful winds with a minimum speed of 56 kph (35 mph). These storms typically last a number of hours and reduce visibility, making driving very dangerous. Blizzards are associated with very low temperatures and snowdrifts which can shut down whole towns and cities and cause danger to life.</p>

Flood

Floods can occur for a number of different reasons at many times throughout the year. A flood is when land is covered by water when it normally isn't covered by water. This can occur whenever there is a large amount of precipitation or melting ice that causes a lake, river, or ponds to overflow. Often with heavy rain, the rivers and natural drainage cannot cope with the rate of water flow. The moving water can cause debris to block drains, making it even more difficult for the water to move freely. Floods can cause extensive damage to property and can also cause loss of life.

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