UNIT - I

DISASTER MANAGEMENT

Disaster management is a collective term encompassing all aspects of planning for and responding to emergencies and disasters, including both pre- and post-event activities. It refers to the management of both the risk and the consequences of an event. In essence, disaster management is more than just response and relief; it is a systematic process aimed at reducing the negative impact and/or consequences of adverse events.

Goals of disaster management

- Proactive plans to mitigate various business risks
- Minimizing loss via more effective preparedness and response
- Creating more effective and durable recovery

DISASTER

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses that exceed the ability of the affected community or society to cope using its own resources. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk

Any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected community or area

Levels of disaster.

Disasters are categorized into three Levels namely; minor, major and catastrophic disasters. The distinctions between disaster levels are described below:

1. **Minor Disaster:** Any disaster that falls within the response capabilities of Local Government and requires minimal State or Federal assistance.

2. **Major Disaster:** Any disaster that exceeds the local government capabilities and requires a broad range of State and Federal assistance.

3. **Catastrophic Disaster:** Any disaster that require massive State and Federal assistance, including immediate military involvement. Potential Federal assistance will involve response as well as recovery measures.

Approaches to Disaster Analysis

(a) Sociological Approach

(b) Anthropological Approach

(c) Development Studies Approach

(d) Disaster Medicine and Epidemiology Approach

(e) Geographical Approach

(f) Technical Approach

A Sociological Approach

Over the years Sociologists have agreed on the definition of disaster. They have "interpreted disasters as special types of social phenomena, in part because they are dramatic historical happenings (events), and also because they compel collective reactions (social catalysts)". The sociologists study a range of different types of events. They are natural hazards (tornadoes, floods, hurricanes, earthquakes, volcanic eruptions), accidents (air disasters, explosions, large scale fires, breaking of dams). Not lots of sociological disaster studies have been done on famines, epidemics, economic depressions, political revolutions and wars

An Anthropological Approach

According to the Anthropologist "Disaster is seen as a process leading to an event that involves a combination of a potentially destructive agent from the natural or technological sphere and a population in a socially produced condition of vulnerability” (Oliver-Smith and Hoffman, 1999). Henry (2005) has given an anthropological contribution to the complete life cycle of disaster, from issues of vulnerable and perceived risk, to individual and social responses and coping strategies, to relief and recovery efforts

(a) **Pre-Disaster Risk and Vulnerability:** Within the same social system, a group of people are more vulnerable to disasters than others. This inequality increases discrimination as well as tensions both during the times of crisis and relief. The severity of disaster impact is increased by conditions like poverty, racism, gender inequality, history of colonial exploitation, global inequities, imbalances of trade and underdevelopment

(b) **Responses to Disaster:** The anthropology of disaster has focused on changes occurring within cultural institutions like religion, ritual, economic organization, politics (local cooperation or conflict), the ability of local institutions to mitigate the impact of a disaster , and the differential capabilities of response due to ethnicity, gender, age and socioeconomic status (Henry, 2005). They have shown adaptive coping strategies that have been used traditionally to cope with disasters. They have noted how disasters change political organizations and power relations between individuals, the state and international actors. They have also looked at the changes that disasters bring to economic system in the form of employment, sharing etc.

(c) **Providing Relief:** Development and Power: They supported a more developmental approach to prevent future disasters than a top-down strategy.

A Development Studies Approach

This approach looks at the problems of providing aid and relief to Third World Countries. Mainly it addresses the problems of refugee management, health care and the avoidance of starvation (Alexander, 1993). Most of the disaster impact occurs in developing countries. This increases poverty and human vulnerability. This approach is more concerned about the issues of vulnerability and livelihood security.

A Medicine and Epidemiology Approach

This approach mainly focuses on the management of mass causalities, treatment of physical trauma and the epidemiological surveillance of communicable diseases. The incidence of such disease generally increases after a disaster as there is a disruption of public health (Alexander, 1993). Medical support is the first priority after initial search and rescue phase (Beinin, 1985). For example disasters like floods can create epidemic in the form of diarrhea, respiratory and infectious diseases. Disasters like earthquakes and technological accidents create problems like bone fractures and psychological trauma.

A Geographical Approach

This approach has used the social science methods and emphasis is given to the spatio-temporal distribution of hazards, impacts and vulnerability. They have discussed how choices are made between different types of adjustment to natural hazards

A Technical Approach

This is the approach of physical and natural scientists. They give more stress to seismology, volcanology, geomorphology and other geophysical approaches (Alexander, 1993). The emphasis here is on nature, scale, intensity and impacts on human structure or engineering. It may have some elements of human ecology.

HAZARD

A **hazard** is any source of **potential** damage, harm or adverse health effects on something or someone.

Basically, a hazard is the potential for harm or an adverse effect (for example, to people as health effects, to organizations as property or equipment losses, or to the environment).

Sometimes the resulting harm is referred to as the hazard instead of the actual source of the hazard. For example, the disease tuberculosis (TB) might be called a "hazard" by some but, in general, the TB-causing bacteria (Mycobacterium tuberculosis) would be considered the "hazard" or "hazardous biological agent".

A common way to classify hazards is by category:

- **biological** - bacteria, viruses, insects, plants, birds, animals, and humans, etc.,
- **chemical** - depends on the physical, chemical and toxic properties of the chemical,
- **ergonomic** - repetitive movements, improper set up of workstation, etc.,
- **physical** - radiation, magnetic fields, pressure extremes (high pressure or vacuum), noise, etc.,
- **psychosocial** - stress, violence, etc.,
- **safety** - slipping/tripping hazards, inappropriate machine guarding, equipment malfunctions or breakdowns.

VULNERABILITY

Vulnerability has been defined as the degree to which a system, or part of it, may react adversely during the occurrence of a hazardous event. This concept of vulnerability implies a measure of risk associated with the physical, social and economic aspects and implications resulting from the system's ability to cope with the resulting event.

RESILIENCE

Concepts of resilience take two broad forms, namely

(1) Hard resilience: the direct strength of structures or institutions when placed under pressure. In the disaster context, resilience is often treated as the simple inverse of fragility. Engineers, for example, often refer to increasing the resilience of a structure through specific strengthening measures to reduce their probability of collapse with respect, for example, to earthquake intensities, wind loading or other physical stresses. As resilience increases, the degree of damage for a given intensity hazard decreases.

(2) Soft resilience: the ability of systems to absorb and recover from the impact of disruptive events without fundamental changes in function or structure. While the old car or carriage built on rigid supports would certainly end up with some broken axles when driving along some bad roads, the modern car can easily absorb the same impacts with its suspension system

Concept of RISK

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihood, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerabilities

Risk Severity describes the highest level of damage possible when an accident occurs from a particular hazard. Damage can be: Catastrophic, Critical, Moderate, or Negligible.

Risk management

Risk management is the identification, evaluation, and prioritization of risks (defined in ISO 31000 as the effect of uncertainty on objectives) followed by coordinated and economical application of resources to minimize, monitor, and control the probability or impact of unfortunate events or to maximize the realization of opportunities.

Risks can come from various sources including uncertainty in international markets, threats from project failures (at any phase in design, development, production, or sustaining of life-cycles), legal liabilities, credit risk, accidents, natural causes and disasters, deliberate attack from an adversary, or events of uncertain or unpredictable root-cause. There are two types of events i.e. negative events can be classified as risks while positive events are classified as opportunities.

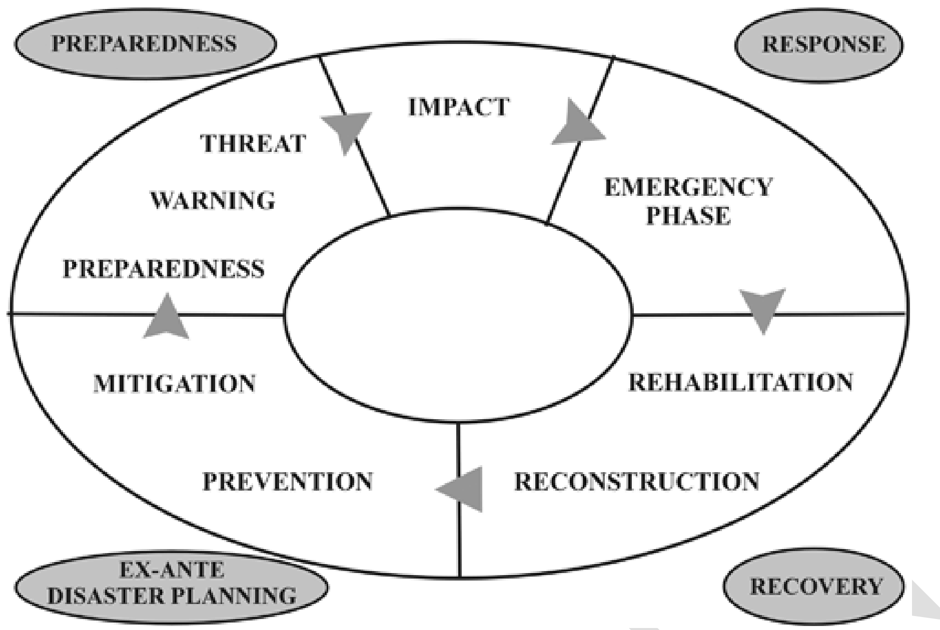
Emergency management consists of five phases:

1. **Prevention** - Prevention was recently added to the phases of emergency management. It focuses on preventing the human hazard, primarily from potential natural disasters or terrorist attacks. Preventive measures are taken, designed to provide permanent protection from disasters. Not all disasters, particularly natural disasters, can be prevented, but the risk of loss of life and injury can be mitigated with good evacuation plans, environmental planning and design standards.
2. **Mitigation** – In electrical risks, a periodical power quality audit and exhaustive preventive maintenance process with the help of electrical consultants can avert fire risks

due to electrical reasons, which is the major cause (>85%) of fires. In earthquake prone areas, these preventive measures might include structural changes such as the installation of an earthquake valve to instantly shut off the natural gas supply, seismic retrofits of property, and the securing of items inside a building. The latter may include 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/stilts.

3. **Preparedness** – Preparedness focuses on preparing equipment and procedures for use. This equipment and these procedures can be used to reduce vulnerability to disaster, to mitigate the impacts of a disaster or to respond more efficiently in an emergency.

    1. Conduct disaster risk assessments
    2. Integrate broader social and environmental issues into business strategies and operations
    3. Enact measures and systems that reduce risks
    4. Develop plans for response and recovery
    5. Disaster risk management (DRM) is a systematic application of management policies, procedures and practices to the tasks of identifying, analyzing, evaluating, treating and monitoring risk. Disaster risk reduction (DRR) entails measures to curb disaster losses by addressing hazards and people's vulnerability to them.
    6. The most effective disaster risk management often happens before disasters occur, continues after a disaster and incorporates lessons learned, thus mitigating risks to future disasters.
    7. Disaster risk reduction is about modifying hazards, reducing vulnerability, increasing capacity.



4. **Response** - The response phase of an emergency may commence with Search and Rescue but in all cases the focus will quickly turn to fulfilling the basic humanitarian needs of the affected population.
    1. Disaster response refers to actions taken during and immediately after a disaster to ensure that its effects are minimized, and that people affected are given immediate relief and support.
    2. These include providing food, water, shelter, and medical aid, removing people from danger, among other outreach efforts.
    3. Disaster recovery refers to the coordinated process of supporting disaster affected communities in reconstruction of physical infrastructure and restoration of emotional, social, economic and physical well- being.
    4. This includes re-building houses and businesses, and providing medical aid and counseling, among other efforts.
5. **Recovery** - The recovery phase starts after the immediate threat to human life has subsided. The immediate goal of the recovery phase is to bring the affected area back to normalcy as quickly as possible. During reconstruction it is recommended to consider the location or construction material of the property.

Temporal characteristics of hazards are those elements linked to time. These characteristics are typically associated with the following questions:

- When do they occur?
- How often?
- How long do they last?
- How quickly do they strike?
- Can we predict their behavior?

Frequency

The first temporal characteristic of hazards that we need to consider is: How often does this event occur? The frequency of a hazard contributes to the perception of risk prevalent in different communities. The higher the frequency the greater the perception of risk will be throughout the elements at risk. A much lower frequency contributes to an attitude of "This will never happen to me".

A variety of different types of information will provide us with facts on which to base our frequency analysis. Historical data constitute one of the most well-known and widely used sources of information. Certain patterns in relation to the characteristics of the hazard can be identified and fairly accurate deductions can be made. In determining the frequency of a hazard, we will be able to establish the possibility of the next hazardous event and its time and space variables. An accurate assessment and analysis of the frequency will provide us with an early warning system. Many of the current weather predictions are based on frequency analysis.

Duration

Different types of hazards, with different characteristics, have a different duration. The magnitude of the hazards and the coping mechanisms will have an obvious contribution to their duration (e.g. the presence of water or storm water channels in urban areas). The pace of onset will further play a critical role. The slower the onset the longer the possible duration of the hazard will be (e.g. droughts). A more rapid onset might have a short duration but could have effects that are more devastating. It should be noted that although some correlation exists between the speed of onset and the duration, this should not be used as a benchmark to measure duration. Duration in this instance should rather be linked to the magnitude of the hazard and the affected community's ability to cope. A rapid onset hazard such as an oil spill could have a lasting impact on the immediate environment whereas a slower onset hazard, such as a possible epidemic, could be prevented by adequate research into a vaccine and its application.

Forewarning

Forewarning or early warning is the time between the identification or warning of a hazard and its actual impact. The speed of onset will therefore determine the period of warning. A more rapid onset hazard provides less forewarning than a slow onset hazard. The way in which different hazards (with different forewarning) will be managed becomes relevant. The less the forewarning the better our planning and systems must be in order to reduce the risk or respond to the hazard to diminish its impact. The warning period allows us to prevent loss of lives and property by removing the elements at risk from the impact area

Characteristics of hazards

Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and the area they cover.

Hazards occur at different intensities (or magnitudes) over different time scales (sometimes known as temporal scales). Scientists talk about the occurrence of hazards of different intensities in terms of probabilties or return periods (also known as recurrence intervals), within the context of uncertainty. In general, the longer the return period (the less frequent the hazard) the greater the intensity of the hazard. Because of these long return periods, some communities may have no memory of the potential threat of a high intensity hazard.

Hazards also occur at different geographical (spatial) scales. For instance, the occurrence and impact of tornadoes tends to be quite localized, whereas droughts can occur over several tens of thousands of kilometers.

Many countries are exposed to multiple hazards. It is therefore essential to consider the risk related to the full range of hazards that might affect people or assets.

How do we measure hazards (Hazard assessment)

Essential steps in hazard assessment are identifying the relevant hazard(s) and the collection of hazard-related data. Once the hazards are defined, the next step often involves obtaining a variety of hazard-related data. The most essential data define the date, geographical location and extent, and maximum intensity of historical events. A collection of the spatial, intensity, and temporal characteristics for events in an event set is termed a hazard catalogue. Hazard catalogues can be used with risk models in a deterministic or probabilistic manner.

This process may include difficult decisions, such as whether to consider secondary (or chains of) hazards that might be triggered by a primary event (e.g. a fire after an earthquake) and/or the interactions between hazards.

Historical events are often used in deterministic analyses that assess the impact of past events with current exposure, but can also be used to estimate the probability of a hazard occurring at a location with a specific intensity. However, we have already identified that high intensity hazards tend to occur infrequently and have long return periods. This means that many of the intensities of hazards (and ultimately disasters) that could occur have not yet happened, which is particularly the case for geological hazards because they often occur over long time periods. Historical records of these types of events do not show the true picture of hazard return periods. Computer generated hazard events with statistical characteristics consistent with the historical record are therefore used to ""complete"" hazard catalogues. Such event sets can typically include thousands or tens of thousands of potential events and are intended to define the full range of potential events for a hazard. Event sets are used with information on exposure and vulnerability to quantify probabilities of loss and risk from a hazard. A probabilistic risk model contains a compilation of all possible “impact scenarios” for a specific hazard and geographical area. Note that hazard catalogue are generally associated with rapid onset hazards. Risk assessments for slow onset hazards, such as drought, are typically undertaken using deterministic approaches.

Dimensions of vulnerability

There are three dimensions of vulnerability:

1. exposure
2. sensitivity, and
3. Adaptive capacity.

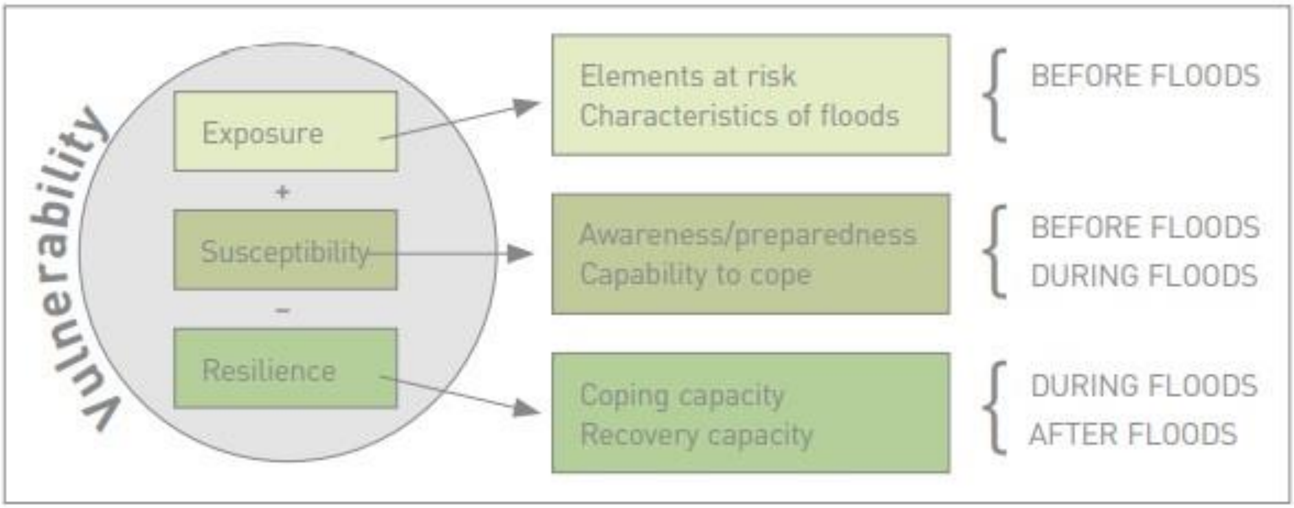
- Exposure is the degree to which people and the things they value could be affected or "touched" by coastal hazards
- Sensitivity is the degree to which they could be harmed by that exposure;
- Adaptive capacity is the degree to which they could mitigate the potential for harm by taking action to reduce exposure or sensitivity.

Some people and the things they value can be highly vulnerable to low-impact coastal hazards because of high sensitivity or low adaptive capacity, while others can have little vulnerability to even high-impact coastal hazards because of insensitivity or high adaptive capacity. Coastal hazards result in highly variable impact patterns because of these variations in vulnerability in time and space.

The flood hazard has a varied impact on people, which is partly controlled by the socio-economic system they live in. Within a country or region, some communities are more vulnerable than others, and within some communities, individuals may be more or less vulnerable. Those who are most vulnerable to the flood hazard may be unable to escape the risk due to limited resources (money, knowledge, work flexibility etc.).

An alternative way of looking at vulnerability is to categorise it according to population, social, economic and environmental factors. There may be other more complex and interrelated human vulnerability factors that should be included in flood hazard vulnerability models. These may include gender: economic and cultural systems are male-dominated and tend to allocate power and resources in favour of men, which may impact on local vulnerability. Ethnic divisions, although often linked to socioeconomic status, may be a factor controlling vulnerability. There may be unequal access to/possession of resources, or differences in lifestyles because of racial or cultural differences.

Vulnerability = Exposure + Susceptibility – Resilience



Vulnerable factors	Indicators	Details and units (where relevant)
Population	• Density • Age • Demographic pressure • Unsafe settlements • Access to basic services • Disability	• People per km2 •Advancing age generally increases susceptibility • Population growth rate •Homes in hazard-prone areas (ravines, river banks etc.) •Percentage of homes with piped drinking water •Certain disabilities predispose people, e.g. lack of mobility
Social	• Poverty level • Literacy rate	• Percentage of population below poverty level • Percentage of adult population

	• Attitude • Decentralization • Community participation	that can read and write • Priority of population to protect against a hazard • Portion of self-generated revenues of the total budget • Percentage voter turn-out at most recent communal elections
Economic	• Local resource base • Diversification • Small businesses • Accessibility • Local gross domestic product	• Total available local budget • Economic sector mix for employment • Percentage of businesses with fewer than 20 employees • Number of interruptions of road access in the last 30 years • Total locally generated GDP in constant currency
Environmental	• Area under forest • Degraded land • Overused land	• Percentage of area of the commune covered with forest • Percentage of area that is degraded/eroded/decertified • Percentage of agricultural land that is overused

Earthquake Vulnerability

Within minutes of shaking, the earthquake reveals the vulnerabilities of buildings, households, communities, and of a country. The consequences expose flaws in governance, planning, siting of physical structure, design, construction, and use of the built environment in country with seismic hazard. It reveals the influence of prevailing culture and way of life, on the capacity of the community to be preparedness for an earthquake hazard. The scale of physical damage and social disruption inflicted upon a community or a nation by an earthquake event is the measure of how vulnerable the community or the nation is.

Factors contributing to earthquake vulnerability of built environment in developing countries

- Large settlements already in seismic areas
- Prevalence of non-engineered constructions
- Prevalence of the use of poor building typologies
- Inadequate control in building construction

SOCIAL AND ECONOMIC VULNERABILITY

Household level

Earthquakes affect the full range of social classes – from royalties to the homeless. Apparently, earthquake treats everyone equally. However, some are more equal than others! Actually, the poor and socially disadvantaged groups of the society are the most vulnerable to, and affected by, earthquakes and other natural hazards, reflecting their social, cultural, economic and political environment. Thus at the household level, poverty is the single most important factor determining vulnerability to natural hazards including earthquake. The poor are the vulnerable.

Community level

Vulnerability of the individual households, naturally, contributes to the communities' overall vulnerability to earthquakes. However, existing social and cultural structures within the community determines, to a great extent, the resilience of the community to the disaster. The socio-cultural networks – extended family, neighbors, community organizations (e.g., community and religious trusts), and the interdependence within communities, provide the strength during disasters. Destruction of such network, for example by relocation during the reconstruction phase of an earthquake, causes the community to be more vulnerable.

National Level

A nation, or its government, in a seismic country is vulnerable to earthquakes and disaster risks unless it actively realizes the inevitability of earthquakes and the treat they represent to the nation, and invests in mitigation, the most cost-effective long-term strategy for loss reduction. Nation’s declared policies to protect people, property, and community resources, provide the legal mandate for implementing mitigation, preparedness, emergency response, and recovery and reconstruction and regulation. Countries without such policies, or those not implementing such policies (if they exist), in line with their developmental policies are vulnerable to disasters including earthquake disasters.