DISASTER AND CRISIS MANAGEMENT

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MBA I Year I Semester
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Digital Notes

MRCET CAMPUS

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
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SCHOOL OF MANAGEMENT STUDIES
AUTONOMOUS

ICET CODE MLRD

PREFACE
For
DISASTER AND CRISIS MANAGEMENT

(I YEAR I SEMESTER)

Academic Year : 2021-22
Name of the Subject : DISASTER AND CRISIS MANAGEMENT
Prescribed Textbook : Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K, • Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila
Nature of the Subject : Common Paper

Disaster is an extremely basic phenomenon to the human culture. The objective of disaster management would be to implement a plan with the following criteria. Given country information including maps, disaster history, current population and economic data, available disaster management plans, development plans, and disaster organization, analyse information about hazards, vulnerability and development to identify opportunities or situations where prevention, mitigation and preparedness measures might be applied to reduce risk and improve response. Determine the role of the various agencies/organizations in implementing disaster management programs and activities. This syllabus will enable the readers to understand the various aspects of disaster management. As we know, disasters are likely to happen at any place, at any time, with rarely a warning. We should be regularly prepared so that in case of a disaster we can easily cope up with it. Even if a disaster occurs, we need to have basic requirements like first-aid. In a nutshell, crisis management is a diverse range of strategies that help an organization deal with an unexpected negative event that might otherwise cause significant damage. Crises occur for many reasons, including natural disasters, Recession in different sectors, information leaks and security breaches, public defamation, lawsuits or violence. Despite the nature of these events as unpredictable – happening when the company doesn't expect them – they don't have to be totally unforeseeable. In fact, depending on your industry, there are a number of crises that you *should* see coming and prepare for. Any potential risk to your business is one you should absolutely have a plan to address, which is where crisis management comes in.

- Develop an understanding of why and how the modern disaster manager is involved in pre-disaster and post-disaster activities.

- They Know the key personnel or specialists related to disaster management and associate them with the types of disasters and phases in which they are useful.

- After completing this session, you will be able to affirm the usefulness of integrating management principles in disaster mitigation work.

- They can distinguish between the different approaches needed to manage during pre- and post- disaster periods.

Unit-I: Introduction to Disaster Management

Definition - Nature and Scope. Factors and Significance: Hazard and Vulnerability - Natural and Man - Made Disasters – Impact of Disaster on Socio, Economic and Psychological conditions

Objective: The objective is to facilitate the students to get an idea of factors which can cause disasters.

Outcome: Students get an idea of difference between hazards and disasters which are both natural and man-made.

Overview:

- Disasters are seen as the effect of hazards on vulnerable areas.
- Hazards that occur in areas with low vulnerability do not result in a disaster.
- Great damage, loss, destruction and devastation to life and property are the results of Disasters.
- The immeasurable damage caused by disaster varies with the geographical location.

Unit-II: Consequences of Disasters and Hazards.

Economic Damage - Loss of Human and Animal Life - Destruction of Ecosystem. Pre-Disaster Management - Early Warning and Prediction Systems: Role of IT - RS - GIS - GPS and ICS.

Objective: The objective of this unit is to make the students understand the consequences of disasters and its remedy.

Outcome: To know various disasters prediction systems such as RS, GIS, GPS, ICS.

Overview:

- The amount of exposure to the disaster is highly related to risk of future mental problems.
- At highest risk are those that go through the disaster themselves.
- Next are those in close contact with victims.
- At lower risk of lasting impact are those who only had indirect exposure, such as news of the severe damage.

Unit-III: Global Perspective (Natural and Man-Made Disasters)

History of Disasters and Types of Hazards - Earthquakes - Volcanisms - Cyclones - Tsunamis -Floods - Droughts and Famines - Landslides & Avalanches - Study of Environmental Impacts Induced By Human Activity - Nuclear Reactor Meltdown -Industrial Accidents - Disease and Epidemics

Objective: To understand various natural and man-made disasters.

Outcome: Students come to know about impact of disasters on the Society.

Overview: Floods, Storms, earthquakes, droughts, forest fires and volcanic eruptions are among the most devastating types of natural catastrophe.

- But some disasters are man-made. These include explosions, major fires, aviation, shipping and railway accidents, and the release of toxic substances into the environment.

Unit-IV: Disaster Management and Planning

Post Disaster Management Planning - Management of Essential Supplies and Temporary Shelter Relief - Evacuation & other Logistic Management - Site Management - Medical Trauma and Stress Management - Integrated Developmental Planning for Disaster Management.

Objective: The objective is to facilitate the students to get an idea of Post Disaster Management System and overall planning for Developmental activities.

Outcome: Students get an idea of Post Disaster Management along with planning for Developmental planning.

Overview:

- Effective planning is essential for a community to successfully prepare for, respond to and subsequently recover from a disaster event.
- Risk assessments, risk-based planning and resilience are closely integrated through the planning process.
- Planning provides a means for addressing complex problems in a manageable way.

Unit V: Crisis Management

What is Crisis Management – Identifying a Crisis – Crisis Stages – Steps in managing crisis: establishing crisis executive management team, crisis management team and crisis communication team – Rescue, relief, rehabilitation and reconstruction – Crisis Management Plan.

Objective: To Understand what crisis is and how to build Crisis Management Team.

Out Come: Students will come to know exactly how to manage any crisis.

Overview:

- Crisis Management includes activities and processes which help the managers as well as employees to analyse and understand events which might lead to crisis and uncertainty in the organization.
- Crisis Management enables the managers and employees to respond effectively to changes in the organization culture.
- It consists of effective coordination amongst the departments to overcome emergency situations.

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UNIT 1

INTRODUCTION TO DISASTER MANAGEMENT

Definition - Nature and Scope. Factors: Hazard and Vulnerability. Types of Disasters: Natural and Man - Made Disasters. Impact of Disaster on Socio, Economic and Psychological conditions.

INTRODUCTION

COMMON TERMINOLOGIES

- **Disaster Management**: The body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels.
- **Risk**: The expected losses (lives lost, persons injured, damage to property and disruption of economic activity) due to a particular hazard. Risk is the product of hazard and vulnerability.
- **Vulnerability**: Degree of loss (for example, from 0 percent to 100 percent) resulting from a potentially damaging phenomenon. The following terms are key to understanding slow onset disasters and their impact on populations.
- **Disaster Population**: Usually associated with crisis-induced mass migration in which large numbers of people are forced to leave their homes to seek alternative means of survival. Such mass movements normally result from the effects of conflict, severe food shortages or collapse of economic support systems.
- **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.
- **Early warning system**: The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

❖ Nature And Scope

A disaster is defined as a "sudden or great misfortune" or simply "any unfortunate event." More precisely, a disaster is "an event whose timing is unexpected and whose consequences are seriously destructive." These definitions identify an event that includes three elements:

Suddenness

Unexpectedness

Significant destruction and/or adverse consequences

However, a fourth element, lack of foresight or planning, is sometimes added. Disasters occur with unnerving frequency. Their adverse consequences increase for those who do not prepare for predictable contingencies. A disaster prevention and recovery plan can help protect all of the University's assets including people, jobs, records, vital records, and facilities.

A disaster is an emergency of such severity and magnitude resulting from various uncertainties such as multiple deaths, injuries, illness, and property damage, and often not handled with routine procedures and resources. Such uncertainty can occur for several reasons. The causes can be natural, human error, equipment malfunction, disease, biological danger, etc.

The duration of disasters can range from a minute of disruption to an hour, day, or a week, and the effects can go from minor to large scale. These disruptions caused by various disasters can damage human resources, economic resources, environmental supplies, and even the lives of multiple species, including humans. Although any disaster type may occur for a specific period, it will have long-term effects that are usually beyond the affected society's tolerable capacity.

Disaster Management, Prevention, and Mitigation

Disaster management refers to the systems we use to deal with human, property, economic or environmental resources against disasters. It is how we prepare, deal, respond, and learn from disasters and their effects.

Disasters management mainly aims to:

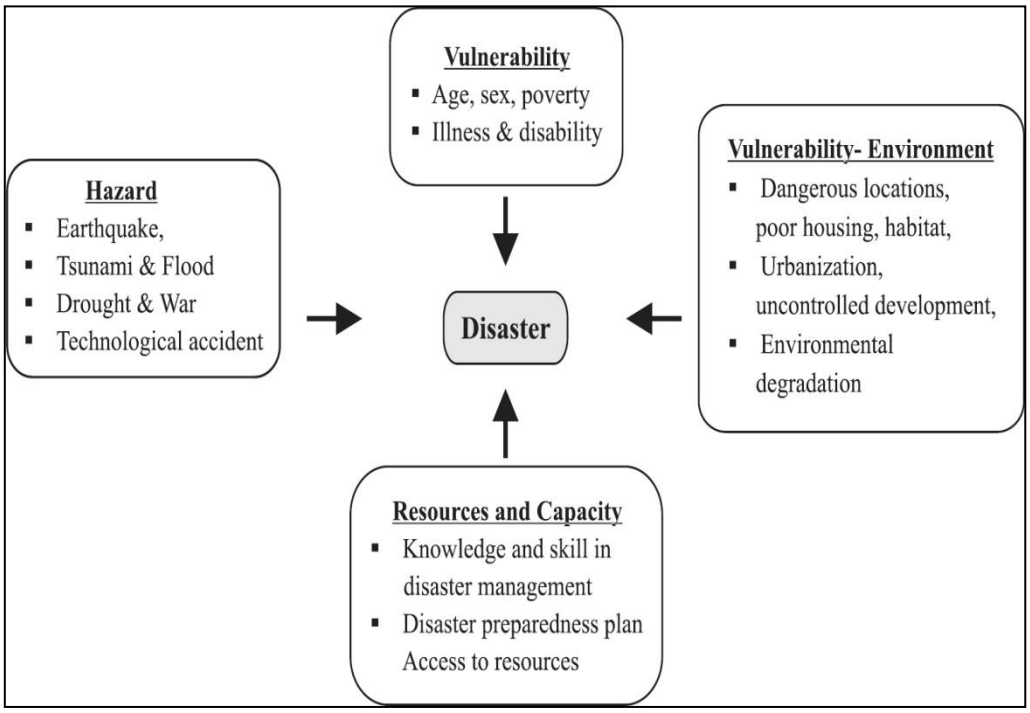
- Prevention of threat of disasters
- Readiness to deal with disasters
- Saving lives of all living organisms
- Minimize sufferings to the maximum possible extent
- Protect and restore livelihoods
- Minimize the risks and uncertainties to societies affected by disaster

Proper planning and mitigation measures can play a leading role in risk-prone areas to prevent or mitigate the worst effects of many disasters, including cyclones, earthquakes, and floods. Besides, many disasters are predictable before arrival, so we can prepare ourselves to reduce the damage caused by them.

CHARACTERISTICS OF DISASTERS

In order to be able to identify that a situation is a disaster, the following characteristics must be eminent and must seem to resonate with the events leading to the situation:

- It is an extra-ordinary event
- Usually occurs because of one of the danger sources, whether caused by nature or human action. Seriously and substantially impact the most vulnerable groups
- Results in serious imbalance in the community functions
- Results in significant losses in human lives, materials and environment
- Exceeds the ability of an affected community to cope with using its own resources



❖ CLASSIFICATION OF HAZARDS:

A. Natural Hazard: These hazards are caused by a natural process. Examples of some Natural hazards are:

- Volcanic Eruptions: Ashes and different toxic gases are expelled through volcanoes from deep inside the earth
- Droughts: A part of a land suffers from lack of rain during specific period of time which causes severe damage to the crops, soil, animals and people also.
- Tsunamis: Very large waves which caused by an Earthquake, Volcanic eruptions smashes into a shore.

B. Man-made Hazard: These hazards are created by humans. Examples of some Man-Made hazards are:

Global Warming: Projected increases in the Earth's atmosphere's average temperature. In the 20th century the Earth's average temperature rose about 0.6 degree Celsius.

Crime: It is a kind of Sociological hazard. Crime is a breach of laws and rules. For example Breach of contract.

Industrial Hazard: It is a kind of Technological hazard. Industrial hazards often have an environmental impact. For example Bhopal Disaster (worst industrial disaster to date)

VULNERABILITY, CAPACITY AND RISK

Vulnerability: Susceptibility of a person, group or society to physical or emotional injury. Or Person or group liable to injury. As far as Hazards and Disasters are concern, the concept of Vulnerability is to link the relationship that people have with their environment to social forces and institutions and the cultural values that sustain them.

- **Vulnerability = (Exposure) + (Resistance) + (Resilience)**
  With: Exposure: at risk property and population;
  Resistance: Measures taken to prevent, avoid or reduce loss;
  Resilience: Ability to recover prior state or achieve desired post-disaster state.

Capacity: Within a community all the available resources, that can reduce risk level and disaster effects. Frequent term used in Disaster is 'Capacity building'. Capacity building is the efforts to develop human skills within a community to reduce risk levels.

Risk: Occurrence probability of a hazard that trigger a disaster with an undesirable outcome Risk involves an exposure to a chance injury or loss. Risk generally described in terms of probability. Risk can also be defined as the probability of a loss, risk depends on three elements:

• Hazard
• Vulnerability
• Exposure

❖ *The different types of vulnerability*

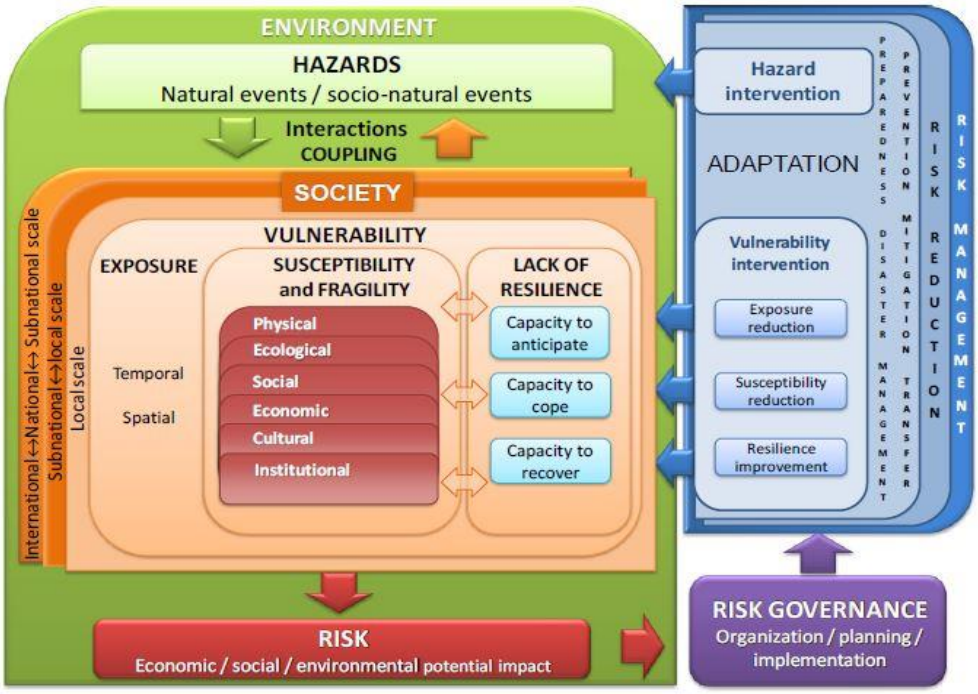
In the table below four different types of vulnerability have been identified, Human-social, Physical, Economic and Environmental and their associated direct and indirect losses. The table gives examples of types of losses. The ones indicated in red are those that are most frequently evaluated.

	Human - social	Physical	Economic	Cultural Environmental
Direct losses	• Fatalities • Injuries • Loss of income or employment • Homelessness	• Structural damage or collapse to buildings • Non-structural damage and damage to contents • Structural damage infrastructure	• Interruption of business due to damage to buildings and infrastructure • Loss of productive workforce through fatalities, injuries and relief efforts • Capital costs of response and relief	• Sedimentation • Pollution • Endangered species • Destruction of ecological zones • Destruction of cultural heritage
Indirect losses	• Diseases • Permanent disability • Psychological impact • Loss of social cohesion due to disruption of community • Political unrest	• Progressive deterioration of damaged buildings and infrastructure which are not repaired	• Economic losses due to short term disruption of activities • Long term economic losses • insurance losses weaken-ing the insurance market • Less investments • Capital costs of repair • Reduction in tourism	• Loss of biodiversity • Loss of cultural diversity

According to the different types of losses, the vulnerability can be defined as physical vulnerability, economic vulnerability, social vulnerability and environmental vulnerability.

- **Physical Vulnerability**: meaning the potential for physical impact on the physical environment – which can be expressed as elements-at-risk (EaR). The degree of loss to a given EaR or set of EaR resulting from the occurrence of a natural phenomenon of a given magnitude and expressed on a scale from 0 (no damage) to 1 (total damage)".

- **Economic vulnerability**: the potential impacts of hazards on economic assets and processes (i.e. business interruption, secondary effects such as increased poverty and job loss) Vulnerability of different economic sectors.
- **Social vulnerability**: the potential impacts of events on groups such as the poor, single parent households, pregnant or lactating women, the handicapped, children, and elderly; consider public awareness of risk, ability of groups to self-cope with catastrophes, and status of institutional structures designed to help them cope.
- **Environmental vulnerability**: the potential impacts of events on the environment (flora, fauna, ecosystems, biodiversity).



❖ **Risk Analysis and Rating**

It considers the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environmentally damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

Risk can be calculated using the following equation:

Risk = Probability of Hazard x Degree of Vulnerability

There are different ways of dealing with risk, such as:

a. **Risk Acceptance**: an informed decision to accept the possible consequences and likelihood of a particular risk.

b. **Risk Avoidance**: an informed decision to avoid involvement in activities leading to risk realization.

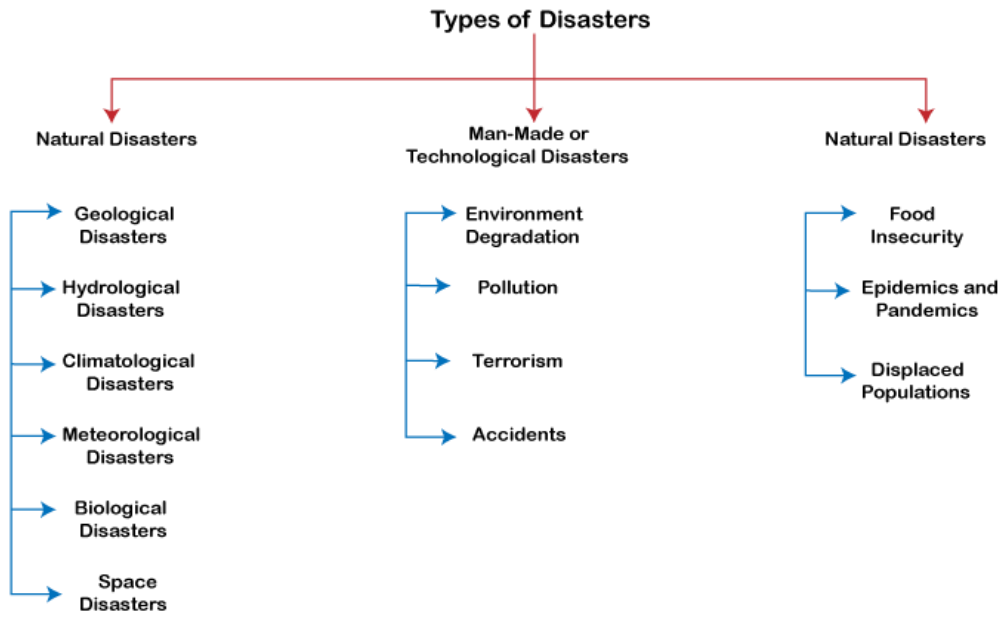
c. Risk Reduction refers to the application of appropriate techniques to reduce the likelihood of risk occurrence and its consequences.

d. Risk Transfer involves shifting of the burden of risk to another party. One of the most common forms of risk transfer is Insurance.

❖ Types of Disasters

There are many types of disasters and can take different forms. However, all these can be broadly classified into the following three categories:

- Natural Disasters
- Human-made or Technological Disasters
- Complex Emergencies



1. Natural Disasters

Natural disasters are defined as a natural event that occurs slowly or rapidly and causes immediate widespread devastation on human health leading to death and suffering. Some biological activities, such as rainfall, can also turn into natural disasters when they occur above the average limit. These disasters are mainly characterized by various factors such as their intensity or magnitude, area of the range, duration, speed of onset, etc.

Natural disasters are also harmful to natural resources. They often cause mass destruction. Such disasters harm humans and other species. For example, a natural disaster like wildfire destroys the environment and loss of life for animal habitat. Also, it damages natural resources and property.

Besides, some natural disasters may be caused by various anthropogenic activities. For example, deforestation, mining, and agricultural activities can trigger landslides. However, they are classified in the category of natural disasters.

- **Climatologically Disasters**

Climatologically Disasters refer to immediate and violent changes in the earth's environment related to or caused by the earth's atmosphere. It is a hazard mainly caused by long-lived/micro to macro-scale processes in the spectrum from intra-seasonal to multi-decadal climate variability. Moreover, these types of disasters can last from minutes to days. They are further classified as Extreme Temperature and Wildfire. Extreme Temperature events are identified as cold waves, heat waves, and severe winter situations (e.g., icing, avalanche, snow pressure, freezing rain, etc.). Besides, wildfire is identified as the forest fires and land fires (fires due to grass, scrub, etc.).

- **Meteorological Disasters**

Meteorological disasters refer to events that are caused by extreme weather conditions, such as rain, snowfall, or drought. Disasters of this type usually affect the Earth's atmosphere and the means of the changing climate. Besides, these disasters are very destructive to the environment and can wreak havoc on many lives, including various species. Some common examples of meteorological disasters are tornados, hailstorms, and hurricanes.

- **Biological Disasters**

Biological disasters refer to natural and unfortunate events that can cause diseases, disabilities, or even deaths at an average to a larger rate of various species, including humans and plants. Biological disasters are defined as catastrophic scenarios caused by living or non-living organisms that cause large-scale severe diseases, viruses, or infections in plants, humans, and other species. These disasters are usually caused by micro-organisms such as infectious, bacteria, toxins, viruses, etc. Some common examples of biological disasters include animal plagues and insect-borne diseases.

- **Space Disasters**

Space disasters are different types of disasters. These usually involve natural actions in space, such as solar flares, airburst events, and impact events. At least once, the impact events have occurred in the history of around 4.5 billion years of the Earth. It is also said that it caused the extinction of all non-avian dinosaurs several million years ago. Solar flares are defined as the sudden release of extensively large amounts of solar radiation by the sun. Airburst events are observed as the enormous energetic explosions of rays (e.g., Gamma-ray) in distant galaxies. If such an event occurs again today, it may result in many species' mass extinction, including humans.

2. Human-made or Technological Disasters

Disasters can also be caused by humans, either directly or indirectly. Human-made disasters are defined as the events generated by humans primarily in, or close to, human settlements. Such events typically cause environmental or technological emergencies.

Human-made disasters have elements of human intent, negligence, or error that involve the human-made system's failure. Additionally, sometimes disturbances in natural resources also lead to human-made disasters. Some of the most common examples of human-made disasters include terrorism, large-scale crime or mass violence incidents, war, arson, civil disorder, biological/chemical threat, Reduction in consumption resources, etc.

Some most common types of human-made or technological disasters are discussed below:

❖ Environment Degradation

Environmental degradation is a type of disaster involving over-consumption of natural resources, reducing the environment's ability to meet social and ecological needs. This ultimately reduces the effectiveness of ecosystem services, resulting in the mitigation of floods and landslides. In turn, the risk of natural disasters increases.

❖ Pollution

Pollution is another type of human-made disaster. Although it does not show any direct symptoms, it affects natural resources and living organisms. This also reduces the environment's quality and further decreases the environment's ability to balance ecological needs. From day to day, pollution reaches significantly higher levels due to humans' large number of wastes. This leads to increased risks of disasters. Besides, when disasters occur, many of them subsequently pollute and degrade the environment.

❖ Terrorism

Terrorism is a type of human-made disaster and is defined as incidents in which terrorists use force or violence against people or property violating criminal laws for purposes such as threats, rebellion, or ransom. Terrorism aims to create unrest within the country and spread panic among the people. Acts of terrorism typically include intimidation, murder, bombing, kidnapping, hijacking, and even cyber-attacks (obtaining intelligence and security information). Terrorists can also use chemical and biological weapons to target people at public events, gatherings and landmarks.

❖ Accidents

Accidents can sometimes take the form of disaster. It usually involves accidental events in which loss of life and material is measured extensively. It includes industrial, technical, and transportation-related accidents during the production, use, or transportation of hazardous materials.

❖ Complex Emergencies

Some disasters can occur due to the impact of many disasters. Such disasters are usually classified under complex emergencies. It is generally defined as the consequences of natural and human-made disasters. In particular, complex emergencies can include the breakdown of authority, attacks on strategic installations, looting, increasing rampant crimes, many other conflict situations, or even wars.

The following are common characteristics for identifying complex emergencies:

- Loss of many life
- Extensive violence
- Extreme damage to economies and societies
- Displacements of populations
- Increased security for humanitarian relief workers
- Large scale humanitarian aid required by various agencies

- Need for political and military barriers that affect or prevent humanitarian aid

Some of the most common types of **complex emergencies** that fall under the category of disasters are discussed below:

❖ **Food Insecurity**

Food insecurity is usually defined as a secondary type of disaster. It is a threat that primarily involves incidents that cause damage to food stores and food systems. For example, natural disasters such as floods and droughts can damage agricultural infrastructure and stored food. Unexpected climate changes can also affect people's food sources. Because people need to consume adequate, healthy, and nutritious food at certain times of the day to live a healthy life, food insecurity leads to problems and other uncertainties. Sometimes, it can also be due to human actions, such as an unsuccessful experiment on agriculture.

❖ **Epidemics and Pandemics**

The epidemic primarily involves the devastating effects of disasters caused by any disease, disability, or death of people in a particular area or community. Besides, pandemics include disasters that affect a large extent, even the entire country or the world. For example, recent corona virus disease has been declared a pandemic by the WHO (World Health Organization). Both these disasters can be caused by nature or humans.

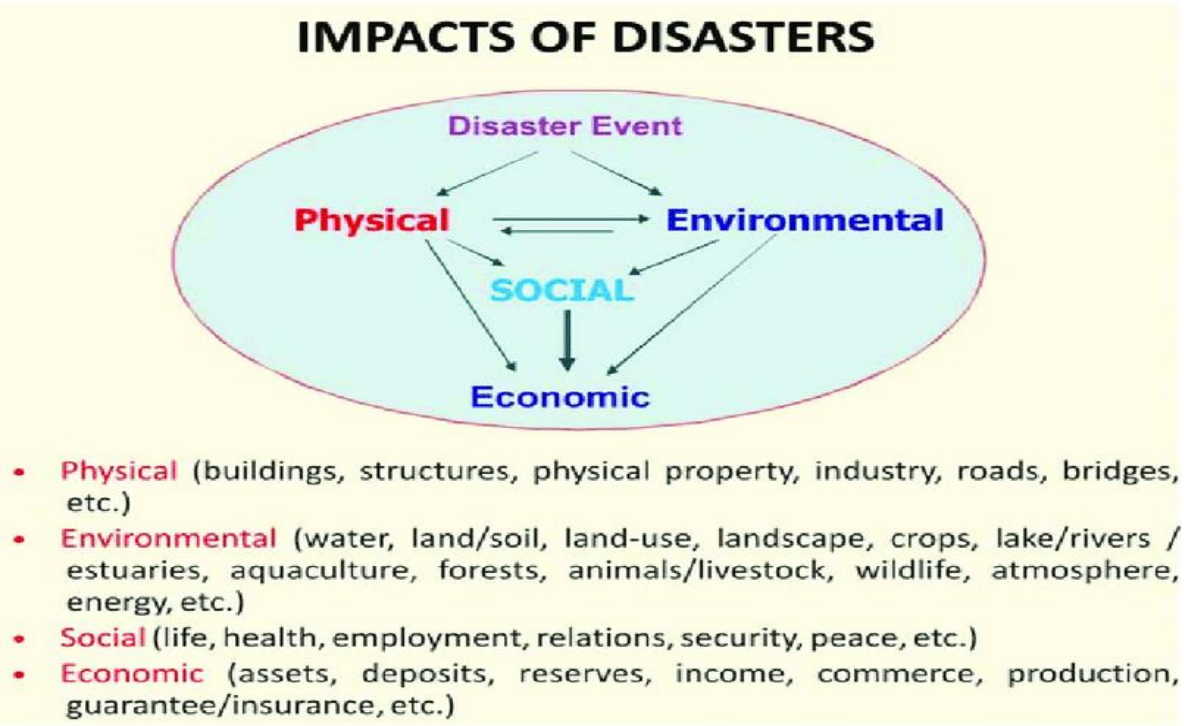
❖ **Displaced Populations**

The displaced population includes people who have had to leave their residents due to disasters/ technical/ intentional incidents. People can be from the same country or refugees (people from other countries or opposite borders). This can lead to a specific emergency as there will be uncertainties to meet the basic structural needs of livelihoods. It can force people to commit crimes and other conflicts.

Classification Based on Categories

Earth, in its 4.54 billion year history, has experienced various types of disasters. Some of these disasters have led to many mass extinctions and drastic consequences for different living species. The most common types of disasters can also be classified according to the following categories:

- **Water and Climate Disasters**: This category includes disasters such as cold waves, heat waves, hail storms, hurricanes, cyclones, droughts, cloudburst, floods, etc.
- **Geological Disasters**: This category includes earthquakes, tornadoes, landslides, volcanic eruptions, etc.
- **Biological Disasters**: This category includes disasters such as locust plagues, cattle epidemics, viral epidemics, pest attacks, etc.
- **Industrial Disasters**: This category includes disasters such as oil spills, mine shaft fires, industrial accidents, etc.
- **Nuclear Disasters**: This category includes disasters such as radiation poisoning, nuclear core meltdowns, etc.
- **Man-made Disasters**: This category includes disasters such as the collapse of large buildings, fires in urban areas, forest fires, pollution, etc.



❖ **Impact of Disasters:**

- Disaster **impacts individuals physically** (through loss of life, injury, health, disability) as well as **psychologically**.

- Disaster results in **huge economic loss** due to destruction of property, human settlements and infrastructure etc.

- Disaster **can alter the natural environment**, loss of habitat to many plants and animals and cause ecological stress that can result in biodiversity loss.

- After natural disasters, food and other natural resources like water often becomes scarce resulting into **food** and **water scarcity**.

- The disaster results in **displacement of people**, and displaced population often face several challenges in new settlements, in this process poorer becomes more poor.

UNIT 2

CONSEQUENCES OF DISASTERS AND HAZARDS

Economic Damage -Loss of Human and Animal Life - Destruction of Ecosystem. Pre-Disaster Management - Early Warning and Prediction Systems: Role of IT - RS - GIS - GPS and ICS.

CONSEQUENCES OF DISASTERS AND HAZARDS

Disasters are an increasingly phenomena that we all clearly perceive and know that may have a direct impact on the welfare of a regions where it hits and also on specific households indicators in such areas. Depending of where we live, hurricanes, earthquakes, floods, droughts, etc, are threats to lives, properties, productive assets, and also can have an impact on social indicators.

The impact of a disaster may also cause inequalities. The poor, who suffer from income fluctuations, and also have limited access to financial services, in the aftermath of a disaster may be more prone to reduce consumption and have a decreasing shock in other household indicators as a consequence. In addition, there are a number of non poor, or close to be, who are not insured against from those risks, and then may fall into poverty as consequence of recapitalizing when coping with the shock, depending the impact and likelihood of falling into poverty of the initial stock assets and coping mechanisms.

Moreover, vulnerability to disasters is a complex issue, as it is determined by the economic structure, the stage of development, prevailing of social and economic conditions, coping mechanism, risk assessment, frequency and intensity of disasters, etc. The impact on the poor could be losing access to some basic services, reversals in accumulation of physical and human capital, and perhaps an increase in child labor and criminal activitie

ECONOMIC DAMAGE

- Impact on the level of economic activities in a given area.
- Usually deals with money.
- Economic loss includes
    - Destruction of local business
    - Loss of property
    - Loss land crops
    - Loss possessions

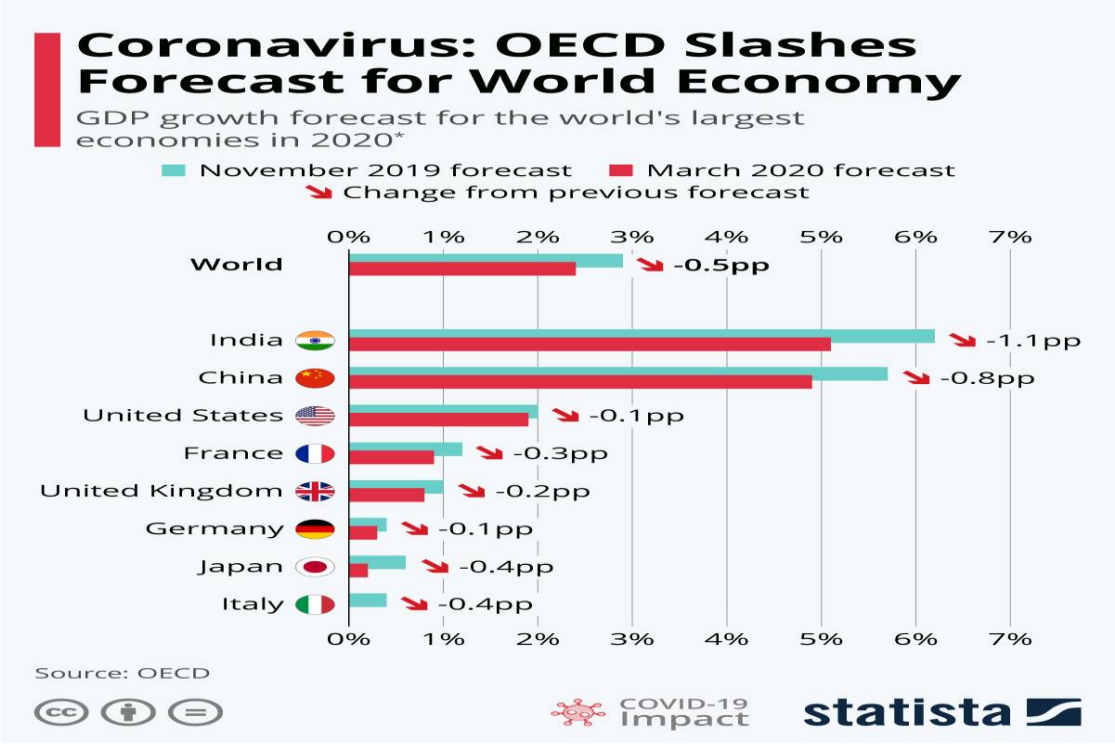
Short-Term Impacts

- Disasters are expected to disrupt economic activities in the short term due the direct and indirect damages they cause direct damages occur in two forms:
- Loss of labor which includes human deaths, disabilities or injuries; and
- Loss of capital which includes loss of physical assets (damage to houses, factories and infrastructure).
- These direct losses may result in a further loss of potential labor hours (wages) and cause a decrease in the expected production output, say, agricultural or industrial output.
- The loss of potential wages and subsequent decrease in expected output may indirectly impact economic growth of the country, as the forgone wages would have been added to the country's GDP if the disaster had not happened.
- Most of the current research in this area finds the impact of natural disasters on short-term economic growth to be negative.
- The negative impacts of relatively severe natural disaster are observed to be even stronger since large-scale destruction and damage caused by such events are more likely to decelerate economic growth or even trap the economy at lower-level equilibrium.
- Developing countries are found to be more sensitive to the economic shocks of natural disasters than developed ones largely due to their limited capacity to cope with the economic and financial consequences of such events.
- Further, countries with higher levels of per capita income, better institutional frameworks, higher literacy rates, greater trade openness and more effective disaster risk financing mechanisms find it easier to absorb the economic shocks of natural disasters.

Long-Term Impacts

- ✓ The long-term economic consequences of natural disasters are not clear, Natural disasters may have negative, positive and even no impact on long-term economic growth and development. The damage to human and physical capital may shift the growth paths of countries experiencing natural disasters to lower-level equilibriums, thereby causing a permanent negative impact in the long term.
- ✓ Disruptions in health and education services are more likely to hamper the current stock of human capital and the future accumulation of skilled human capital. More severe natural disasters often create high opportunity costs.

- ✓ The impact is more pronounced for developing countries as the funds mobilized for post-disaster response and recovery could have been used for other social welfare initiatives. Moreover, frequently recurring disasters can create an atmosphere of uncertainty and hamper long-term investment prospects in a country.



Financial Management of Disaster Impacts

It is very critical to understand and plan the finances during and after disaster.

- Returning to better conditions than pre-disaster conditions, in the shortest possible period of time after a disaster occurs
- Optimum use of scarce resources
- Direct effect like
    - Structure damages
    - Loss of jobs/wages
    - Damage to infrastructure (e.g. railways, highways, telecommunication)Damage to public goods
    - Production losses (e.g. loss of cattle, shutdown of small businesses)
    - Expenses for emergency sheltering
- Indirect effect like
    - Reduction in production demand
    - Changes in GDP per capita
    - Increased transport cost

EFFECT OF DISASTERS ON HUMAN LIFE

Disasters affect communities in multiple ways. They represent a public health hazard for various reasons:

- Can cause an unexpected number of deaths and wounded or sick people that exceed the local resources capacity to respond and require external aid.
- Can destroy health infrastructure not only affecting the immediate response, but also disrupting preventive activities, leading to long-term consequences with increased morbidity and mortality.
- Can have adverse effects on the environment that will increase the risk for infectious transmissible diseases and environmental hazards. This will impact morbidity, premature death, and future quality of life.
- Can affect the psychological and social behavior of the community.
- Can cause shortages of food, with severe nutritional consequences.
- Can cause large movements of the population, both spontaneous or organized, to areas where health services might not be able to handle the excessive requirement

Other long-term effect of disaster on human life

Paediatric characteristic	**Special risk during disaster**
Respiratory	Higher minute volume increases risk from exposure to inhaled agents. Nuclear fallout and heavier gases settle lower to the ground and may affect children more severely.
Gastrointestinal	Higher risk for dehydration from vomiting and diarrhea after exposure to contamination.
Skin	Higher body surface area increases risk for skin exposure. Skin is thinner and more susceptible to injury from burns, chemicals, and absorbable toxins. Evaporation loss is higher when skin is wet or cold, so hypothermia is more likely.
Endocrine	Increased risk for thyroid cancer from radiation exposure.
Thermoregulation	Less able to cope with temperature problems, with higher risk for hypothermia.
Developmental	Lower ability to escape environmental dangers or anticipate

	hazards.
Psychological	Prolonged stress from critical events. Susceptible to separation anxiety.

❖ **EFFECT OF DISASTERS ON ANIMAL LIFE**

When natural disasters hit, whether forest fires, earthquakes or hurricanes, they leave behind a trail of destruction. But, while we report human loss in the news, we often forget about the animals. And the loss can be huge. Read on to find out more about how animals fared in some of the best known natural disasters.

1. Hurricanes

When Hurricane Katrina hit in 2005, there was no evacuation plan for animals in the US. The National Guard and a team of volunteers rescued 250,000 trapped animals, while many owners lost their lives staying home with pets. The aftermath was huge, spurring the introduction of the Pets Evacuation and Transportation Standards Act, which came into force in 2006.

In 2017, Hurricanes Irma and Maria devastated islands off the east coast, as well as parts of mainland USA. While pet-friendly shelters were available, many pets were left homeless, starving and without access to fresh water when owners fled. Though in Palm County, Florida, owners who did were prosecuted.

2. Tornados

The 2014 Tupelo tornado lasted 20 minutes and caused massive destruction, killing at least 21 people. Many animals were left homeless and in need of shelter. Luckily, help was on hand. **The Tupelo-Lee Humane Society (TLHS)** took in 184 animals and even carried out life-saving surgery on a Boston terrier, Lulu, as the tornado sirens sounded.

3. Floods

In 2011, one of the worst floods in its history hit Bangkok, leaving over 2,800 animals needing care. A TWP shelter took in and treated more than 120 homeless animals, many of which were suffering from parasites, sticker tumours, wounds, and broken bones.

In 2015, parts of Malawi were left underwater after a flood. The prior evacuation of people saved many lives, but thousands of animals were left behind to fend for themselves. In an effort to survive, **dogs** began forming packs, increasing the risk of rabies outbreaks and distemper in the area. Lumpy skin disease also posed a threat to livestock. A vaccination programme, set up to protect survivors, however, vaccinated 3,000 cattle and 500 dogs in mobile clinics.

4. Earthquakes and tsunamis

The 2004 Indian Ocean tsunami killed more than 150,000 people in Indonesia, Malaysia, Sri Lanka, India, and Thailand. The animal death toll is unknown but includes those caught in the initial disaster and the aftermath. The lack of food and clean water after a natural disaster, such as this one, leaves animals starving while the unsanitary conditions lead to a spread of disease in both humans and animals.

Six years later, the 2010 Haiti earthquake hit leaving more animals in need. Within days of the disaster, The Animal Relief Coalition for Haiti (ARCH) came to life to provide relief for animal survivors and prevent disease outbreaks. Their mobile clinic treated almost 68,000 animals, including cats, dogs, horses, and cattle.

5. Fires

The 2016 Victoria bushfires were so severe that smoke was visible from space. It wiped out thousands of acres of eucalyptus forest and left wildlife, including **koalas**, **kangaroos**, wallabies and possums, with horrific burns. A triage centre with wildlife vets, set up in Lorne by the **Department of Environment, Land, Water and Planning (DELWP)**, worked to rehabilitate animals, with around 30 admitted in just ten days.

In California, the 2017 Wall Fire spread over 5,000 acres in under a week in Butte County. Temporary shelters proved a haven for both wildlife made homeless and pets left by fleeing owners. Roughly 200 animals were rescued in total.

The impact natural disasters can have on animals is enormous, making relief efforts for them as well as the human victims a necessity. Luckily, there are a few things you can do to help.

1. If we live in an area prone to natural disasters, make sure you have a plan in place for your pets should you need to evacuate.
2. When disaster strikes, keep an eye open for relief efforts and appeals and donate what you can.

- **DESTRUCTION OF ECOSYSTEM**

Disasters are not random and do not occur by accident. They are the convergence of hazards and vulnerable conditions. Disasters not only reveal underlying social, economic, political and environmental problems, but unfortunately contribute to worsening them. Such events pose serious challenges to development, as they erode hard-earned gains in terms of political, social and educational progress, as well as infrastructure and technological development.

The impacts of disasters on environment and development are manifold. Disasters create substantial environmental degradation and ecological imbalance, hinder socioeconomic development and retard the process of improving the quality of life of the people. The interaction

of disasters and environment has both short-term and long-term effects. These interaction and interdependencies work in a complicated way, affecting people, ecosystem and bio-diversity.

Environmental vulnerability

It includes the extent of natural resource depletion and data on resource degradation. Reduced access to clean air, safe water and sanitation and inappropriate forms of waste management, especially in heavily populated and urban environments, can aggravate socio economic vulnerability[4]. Poorer environmental conditions such as diminished biodiversity, soil degradation or growing food scarcity can easily threaten food security for people dependent on the products of land, forests, pastures and marine environment for their livelihoods. As natural resources become scarcer, the range of options available to communities become more limited, reducing the availability of coping solutions and reducing local resilience to hazards or capacity to recover from disasters. Over a period of time, environmental factors can further increase vulnerability by creating new and undesirable patterns of social discord, economic destitution and eventually forced migration of entire communities.

Environmental Management and Disaster Reduction

- **Deforestation,** forest management practices, agriculture systems etc. can exacerbate the negative environmental impacts of a storm or typhoon, leading to landslides, flooding, silting and ground/surface water contamination - as illustrated by the 2004 hurricane and storm tragedies in Haiti, and in the Philippines

.

- An ecosystem is a community of plants, animals and other living organisms that share the benefits of a particular space or environment such as air, food, water and soil.
- It's no different from our human community where every citizen of a city relies on its own resources and interacts with its environment.
- In an ecosystem, each organism has its role and purpose. Disturbing the balance of an ecosystem can be disastrous for all the living things relying on it.
- An example of an ecosystem is Coral Reefs but there are much smaller ecosystems.

- **Are Coral Reefs in Danger?**
  - Our Earth is also considered as an ecosystem on a much larger scale.
  - When we introduce external factors such as too much carbon dioxide or methane, it destroys the balance of the ecosystem which in turn affects those who live in it.
  - The result is global warming, water shortage, extinction of species, etc.
  - These impact every living thing on the planet, which includes us. The impact of ecosystem destruction will be felt by everything eventually.

- **Factors destroying an Ecosystem**
  - When an ecosystem is stable and healthy, we call it Sustainable. This means that it is capable of sustaining itself and reproducing. Sustainable ecosystems have biodiversity. There's a variety of species and organisms living there and contributing.
  - Ecosystem destruction is already happening. 25% of our coral reefs have disappeared and it is expected that 60% more will be gone in 30 years.
  - This is due to ocean acidification, water pollution and illegal fishing. If all the corals go, what will happen to our marine life?

- Deforestation is caused by Illegal logging and human need and progress. More than 4.6 million hectares of forest have been burned or cut down. How many species have become extinct due to this
- Habitat loss is endangering our animal species. Even our apex predators are being affected – the lion, tiger, polar bear and even the majestic mountain gorillas are all being threatened by habitat loss.
- Humans destroy ecosystems. Our lifestyle creates pollution and we overuse our natural resources.
- We build roads, hunt animals, cut down trees destroying forests and just litter the planet like crazy. We waste resources that are not infinite and will soon run out, if we continue our practice.
- In the past 60 years, 60% of the Earth's ecosystem has been degraded. To date, we have extracted approximately 23 billion tons of resources from the Earth. That's this year alone. It's a continuous practice in spite of our best efforts to change.
- Our natural ecosystems are finding it hard to cope with the different pressures and are unable to adjust. If we continue depleting resources and destroying our environment.

❖ **The impact of ecosystem destruction**

- Increased flooding due to the erosion of soil and lack of trees
- Rising of the sea levels due to the melting of the glaciers, caused by Global Warming
- Disruption of the food chain when the apex predators become extinct
- Water shortage - we only have a finite supply of fresh drinking water
- Food shortage as the lands become barren and the oceans become fishless
- Loss of biodiversity as whole species of living things disappear due to deforestation
- Pollution will eventually become unmanageable and affect our health.
- Rising temperatures may be too much for all living things on the planet

❖ **Pollution**

Pollution is one of the main causes of ecosystem destruction. Pollution can deplete resources and drive away local animal populations. Significant sources of pollution include trash, carbon emissions, oil spills and pesticides.

❖ **Climate Change**

Climate change continues to play a significant role in the destruction of the ecosystem. Global warming has led to increased temperatures, sea levels and ocean acidity that disrupt an ecosystem's natural balance.

❖ **Land Clearing**

As human populations increase, so does the need to develop more land. Many ecosystems are destroyed in order to clear land for housing developments and roads, agricultural uses and raising livestock.

❖ **Resource Exploitation**

Many ecosystems are rich in natural resources like nutrient-rich soil, water, trees and fossil fuels. Excessive efforts to extract these resources like mining, logging and oil drilling contribute to ecosystem destruction.

❖ **Animal Population Decline**

An ecosystem's animals are vital sources of food and population control. Many animal populations are declining due to overfishing and hunting. Animals are often hunted for their valuable skins, plumage, horns and meat.

❖ **Overhunting**

- They obtained food and necessary materials from animals and eliminated competition for crops and prey.
- They protected livestock by trapping or hunting animals such as wolves. As the human population grew, more and more species of animals were threatened with extinction from overhunting..
- Nevertheless, poaching, or illegal hunting, continues to threaten many populations.
- Human Population Growth
- Habitat replacement

❖ **Pre-Disaster Management:**

Disaster Management is done by following steps:

1. Planning and Analysis
2. Situational Awareness
3. Data Management
4. Field Operations

Planning and Analysis:

GIS is the most complete information system for modelling, analyzing spatial data and displaying community vulnerability. Processed GIS Models can be useful for determination of event impact and necessary mitigation requirement. Preparedness is important when disastrous event occurs. On analysis of risk and hazards is beneficial in Emergency management program

Situational Awareness:

Disaster and emergency management in situational awareness is essential thing. GIS techniques plays vital role to provide location information of the event, that is, where is the event happened and what happening exactly in real time. Also by linking people, processes spatial information situational awareness established. GIS map interface important in handling emergency condition.

Data Management:

To achievement of preparedness, gathering of information and its advance data storing is important. In GIS, integration of information from other sources is possible. GIS solution is a standards-based. Accurate cataloguing of GIS data provide useful information during emergency conditions.

Field Operations:

Field data is very important in GIS applications and Mobile GIS provides crucial information. Field teams capture information and sent back to user. Ground information useful for recognizing actual event conditions. Then new data can be sent to operation teams in field (where disaster

occur), so they have the information possible for protecting lives and providing safety to people. Whether its response or recovery phase, Mobile GIS provides right information.

- **Early Warning and Prediction systems**

The Key Elements

The objective of people-centred early warning systems is to empower individuals and communities threatened by hazards to act in sufficient time and in an appropriate manner to reduce the possibility of personal injury, loss of life and damage to property and the environment.

A complete and effective early warning system comprises four inter-related elements, spanning knowledge of hazards and vulnerabilities through to preparedness and capacity to respond. Best practice early warning systems also have strong inter-linkages and effective communication channels between all of the elements.

1. **Risk Knowledge:** Risks arise from the combination of hazards and vulnerabilities at a particular location. Assessments of risk require systematic collection and analysis of data and should consider the dynamic nature of hazards and vulnerabilities that arise from processes such as urbanization, rural land-use change, environmental degradation and climate change. Risk assessments and maps help to motivate people, prioritise early warning system needs and guide preparations for disaster prevention and responses.
2. **Monitoring and Warning Service**: Warning services lie at the core of the system. There must be a sound scientific basis for predicting and forecasting hazards and a reliable forecasting and warning system that operate 24 hours a day. Continuous monitoring of hazard parameters and precursors is essential to generate accurate warnings in a timely fashion. Warning services for different hazards should be coordinated where possible to gain the benefit of shared institutional, procedural and communication networks.
3. **Dissemination and Communication**: Warnings must reach those at risk. Clear messages containing simple, useful information are critical to enable proper responses that will help safeguard lives and livelihoods. Regional, national and community level communication systems must be pre-identified and appropriate authoritative voices established. The use of multiple communication channels is necessary to ensure as many people as possible are warned, to avoid failure of any one channel, and to reinforce the warning message.

4. **Response Capability:** It is essential that communities understand their risks; respect the warning service and know how to react. Education and preparedness programmes play a key role. It is also essential that disaster management plans are in place, well practiced and tested. The community should be well informed on options for safe behaviour, available escape routes, and how best to avoid damage and loss to property.

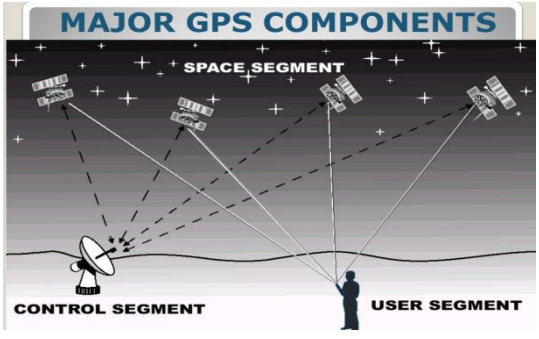
❖ ROLE OF GIS, GPS, RS, IT, ICS IN DISASTER MANAGEMENT

- ❖ Geographic information system (GIS) and remote sensing (RS) are very useful and effective tools in disaster management. Various disasters like earthquakes, landslides, floods, fires, tsunamis, volcanic eruptions and cyclones are natural hazards that kill lots of people and destroy property and infrastructures every year.
- ❖ Landslides are the most regular geological vulnerabilities in mountain regions, particularly in Sikkim Himalaya. Remotely sensed data can be used very efficiently to assess severity and impact of damage due to these disasters.
- ❖ In the disaster relief phase, GIS, grouped with global positioning system (GPS) is extremely useful in search and rescue operations in areas that have been devastated and where it is difficult to find one's bearings.
- ❖ Disaster mapping is the drawing of areas that have been through excessive natural or man-made troubles to the normal environment where there is a loss of life, property and national infrastructures.

❖ Introduction

- ❖ These technologies have been the object of substantial interest for all countries and bodies concerned with space and in exacting emergency services and disaster management.
- ❖ In disaster management, the objectives of the disaster experts are to monitor the situation, simulate the complicated disaster occurrence as accurately as possible so as to come up with better prediction models, suggest appropriate contingency plans and prepare spatial databases.

- Remotely sensed data can be used very effectively for quickly assessing severity and impact of damage due to, earthquakes, landslides, flooding, forest fires, cyclones and other disasters.
- During the disaster prevention stage, GIS is used in managing the huge levels of data required for vulnerability and hazard assessment.
- In the disaster preparedness stage, it is a tool for planning evacuation routes, designing centres for emergency operations, and for the integration of satellite data with other relevant data in the design of disaster warning systems.
- In the disaster relief phase, GIS, in combination with GPS, is extremely useful in search and rescue operations in areas that have been devastated and where it is difficult to find one's bearings.
- In the disaster rehabilitation stage, GIS is used to organise the damage information and post-disaster census information and in the evaluation of sites for reconstruction.
- Natural hazard information should be included routinely in developmental planning and investment projects preparation.
- They should include cost/benefit analysis of investing in hazard mitigation measures and weigh them against the losses that are likely to occur if these measures are not taken.
- GIS can play a role at the following levels:
  National level
  State level
  District level
  Block level
  Ward or village level
  Site investigation scale
- GPS stands for Global Positioning System
- GPS is a satellite navigation system designed to provide accurate position, velocity, and time information almost anywhere in the world
- the present system is known as NAVSTAR - NAVigation Satellite Timing And Ranging
- the GPS program operated and controlled by the US Department of Defense



Use of GIS and RS Technology in Disaster Management

- ❖ India is vulnerable to natural and manmade disasters. All disasters are spatial in nature.
- ❖ GIS techniques act as a decision support tool. Decision making can possible by analysis of different GIS layers.
- ❖ Currently socio-economic and geo-spatial data is useful for management and planning of disasters as well as tackling of disastrous condition.
- ❖ Various departments and agencies who are stakeholders using GIS in the disaster management process. GIS, RS & GPS is useful in disaster management applications & for decision making.
- ❖ Evolution of computer technology and availability of hardware is helpful for rapid expansion of GIS in both disaster research and practice.
- ❖ GIS is useful for hazard zone mapping and during emergency conditions mitigation of people can easily possible using this maps. GIS and RS much beneficial in mitigation strategies and preparedness plans.
- ❖ Real time geographic data can improve the allocation of resources for response.
- ❖ GIS technologies is much useful in modelling of disaster risks and human adaptations to hazards. It is also provides decision support system in disaster management.

Important objectives of GIS database generation are,

Disaster managers from different state, city, village level using GIS database for disaster planning.

- Preparedness and planning of disasters
- Forecasting and early warning of disastrous event
- For relief management, rescue operations

GIS database with various themes is helpful to disaster managers in decision making process when catastrophic event occur.

GIS database include following information which is beneficial in disaster management.

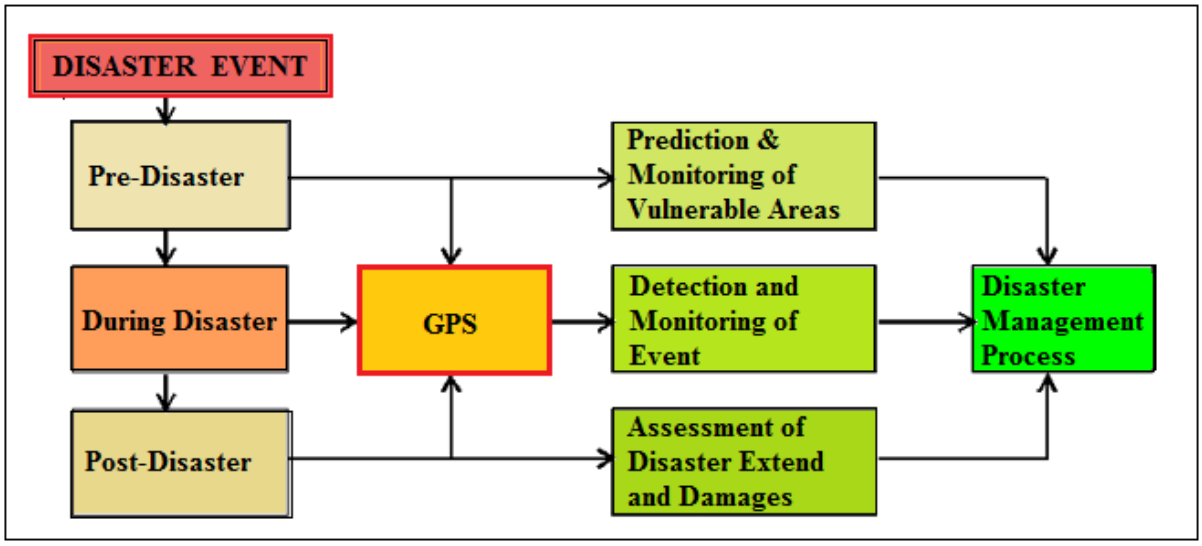
1. Use of different satellite imageries (Remote Sensing data) ex. Quickbird, SPOT, IKONOS for GIS data creation.
2. Preparation of base map of different themes using satellite imageries.
3. Thematic maps such as hydro geomorphologic map, slope map, terrain map, and DEM generation in GIS. It is used for disaster planning.
4. Macro and micro level maps used for identifying vulnerability and threat condition
5. Identification of safe locations and zones for rehabilitation
6. Road and location maps used for finding alternate routes, shelters and locations
7. Planning of evacuation and operation
8. Management of Rehabilitation and post-disaster reconstruction.
9. Suitable locations identifying scientifically for construction of houses and shelters
10. No construction areas identified and rehabilitation of existing people can be done.
11. Hospitals and medical facilities identification for injured people.

GIS solutions for different hazards:

1. Earthquake
   - GIS can be useful for monitoring historical sites of earthquake also to Response & data management for recovery.
   - It's also useful for Impact assessment.
2. Flood
   - Flood mapping from Macro level to Micro level.
   - Flood Zone mapping.
   - Detecting Potential Site of Flood in reference with rainfall
   - Elevation Mapping
   - Preparing Response map in response to manage after flood situations

- Techniques like satellite imagery and GIS help to identify areas that are disaster prone, zoning them according to risk magnitudes, inventory populations and assets at risk, and simulating damage scenarios.
- These tools are even useful in managing disasters as they provide instant access to information required in management decisions.
- Modern communication systems have also proved very useful, particularly in search and rescue operations.
- They not only help in providing warnings before the disaster, but also help in creating awareness which helps in reducing panic, confusion and mental stress.
- A communication network system helps in establishing contacts between relief teams which, with better central coordination, can work more efficiently.

GPS Disaster management process



<u>Role of Information Technology (IT) in Disaster Management</u>

- ❖ To catalyse the process of preparedness, response and mitigation.
- ❖ Providing access to vital information on Disaster preparedness to citizens
- ❖ GIS based decision support system for planning
- ❖ Designing early warning system

- ❖ Emergency communication for timely relief & response measures
- ❖ Building knowledge warehouses to facilitate planning and policy making
- ➢ Taking SMS (short message system) as an example, this technology is supported by every phone in the market by default, and telecommunications gateways at the local level can relay messages when the power grid comes back. It was designed to be resilient, and the system can handle a large number of messages when internet service is not available.
- ➢ Information and Communication Technologies (ICTs) play a significant role in disaster prevention, mitigation response and recovery.
- ➢ Timely, predictable and effective information is much needed by government agencies and other humanitarian actors involved in rescue operations and decision-making processes.

ICTs for Disaster Management can be summed up in four principles:

- ❖ multi-hazard,
- ❖ multi-technology
- ❖ multi-phased,
- ❖ Multi-stakeholder.

- Awareness creation, Internet, E-mail, TV, Radio, Mobiles, Social networking, blogging
- Disaster Management training: Useful ICT tools: PCs and peripherals, TV, Radio.
- **Information Requirements**
- Key Challenge - Information is Scattered, Data Exchanges, Regional Centres of Operations Information Requirements, Fire Dept, Early Responders, Other Disciplines.

- ➢ **Enabling the Possibilities**
  We must collect, integrate, and analyze the scattered pieces of data and information required to assemble the big picture
- ➢ **Emergency Information Management**
- ➢ Defined as the collection, consolidation, analysis and dissemination of the information — requires that the emergency manager be fully aware of the needs of the eventual users of the information.
- ➢ Effective emergency information management requires concerted planning, organizing, controlling, and influencing of human, material, and information resources to endure that information is disseminated to the right decision-makers at the right time to satisfy those needs.

❖ **Remote sensing** is the acquiring of information from a distance. NASA observes Earth and other planetary bodies using sensors aboard satellites and aircraft that detect and record reflected or emitted energy. Remote sensors, which provide a global perspective and a wealth of data about Earth systems, enable data-informed decision making based on the current and future state of our planet.

- Orbits
- Observing with the Electromagnetic Spectrum
- Sensors
- Resolution
- Data Processing, Interpretation, and Analysis
- Data Pathfinders

- ASA's Aqua satellite completes one orbit every 99 minutes and passes within 10 degrees of each pole. This enables the Moderate Resolution Imaging Spectro radiometer (MODIS) aboard Aqua to acquire full global imagery every 1-2 days. Credit: NASA Aqua.
- Electromagnetic energy, produced by the vibration of charged particles, travels in the form of waves through the atmosphere and the vacuum of space.
- These waves have different wavelengths (the distance from wave crest to wave crest) and frequencies; a shorter wavelength means a higher frequency. Some, like radio, microwave, and infrared waves, have a longer wavelength.

❖ **Information and Communication Systems**

The first important steps towards reducing disaster impact are to correctly analyse the potential risk and identify measures that can prevent, mitigate or prepare for emergencies. ICT can play a significant role in highlighting risk areas, vulnerabilities and potentially affected populations by producing geographically referenced analysis through, for example, a geographic information system (GIS).

The following are some of the media – both traditional and new – that can be effectively used for disaster warning purposes. Some may be more effective than the rest, depending on the nature of the disaster, the regions affected, the socio-economic status of the affected communities and their political architecture. Any one or combination of the following media can be used.

1. Radio and Television Considered the most traditional electronic media used for disaster warning, radio and television have a valid use. The effectiveness of these two media is high because even in developing countries and rural environments where the tele-density is relatively low, they can be used to spread a warning quickly to a broad population. The only possible drawback of these two media is that their effectiveness is significantly reduced at night, when they are normally switched off.

2**. Telephone (Fixed and Mobile)** Telephones can play an important role in warning communities about the impending danger of a disaster. There were many examples of how simple phone warnings saved many lives in South Asian countries during the 2004 tsunami. Perhaps the most famous was an incident that occurred in one small coastal village of Nallavadu in Pondicherry, India. A timely telephone call – warning about the impending tsunami – was said to have saved the village's entire population of 3,600 inhabitants, as well as those of three neighbouring villages.

3.Short message service (SMS) is a service available on most digital mobile phones that permits the sending of short messages (also known as 'text messages', 'SMSes', 'texts' or 'txts') between mobile phones, other handheld devices and even landline telephones. During the 2005 Hurricane Katrina disaster in the US, many residents of affected coastal areas were unable to make contact with relatives and friends using traditional landline phones. However, they could communicate with each other via SMS more easily when the network was functional. This is because SMS works on a different band and can be sent or received even when phone lines are congested. SMS also has another advantage over voice calls in that one message can be sent to a group simultaneously.

4. **Cell Broadcasting** Most of today's wireless systems support a feature called cell broadcasting. A public warning message in text can be sent to the screens of all mobile devices with such capability in any group of cells of any size, ranging from one single cell (about 8 kilometres across) to the whole country if necessary.

5. Satellite Radio A satellite radio or subscription radio is a digital radio that receives signals broadcast by communications satellite, which covers a much wider geographical range than terrestrial radio signals. Satellite radio functions anywhere there is line of sight between the antenna and the satellite, given there are no major obstructions such as tunnels or buildings. Satellite radio audiences can follow a single channel regardless of location within a given range. Satellite radio can play a key role during both disaster warning and disaster recovery phases. Its key advantage is the ability to work even outside of areas not covered by normal radio channels. Satellite radios can also be of help when the transmission towers of the normal radio station are damaged in a disaster.

6. Internet/Email The role Internet, email and instant messages can play in disaster warning entirely depends on their penetration within a community and usage by professionals such as first responders, coordinating bodies, etc. While these media can play a prominent role in a developed country, where nearly half of all homes and almost all offices have Internet connections, this is not the case in the developing world. In many developing countries, less than 5 percent of the population uses the Internet and even those who are users do not use it on a regular basis. In such a situation, it is difficult to expect Internet and email to play any critical role. In spite of that drawback, many disaster-related activities are already underway within the Internet community.

7. Amateur and Community Radio For almost a century, amateur radio (also known as 'ham radio') operators have assisted their communities and countries during disasters by providing reliable communications to disaster relief organizations at a moment's notice – especially when traditional communications infrastructure breaks down. In such a situation, amateur radio operators transmit emergency messages on voice mode about the well-being of survivors and information on casualties to friends and relatives. As was evident during the Indian Ocean tsunami that destroyed electricity and communications infrastructure in the Andaman and Nicobar Islands, amateur radio operators were the critical link between the islands and the Indian mainland and helped in the coordination of rescue and relief operations.

8. Sirens Though not necessarily an ICT-based solution, sirens can be used in tandem with other ICT media for final, localized delivery.

UNIT-III
GLOBAL PERSPECTIVE (NATURAL AND MAN-MADE DISASTERS)

Natural Disasters: Volcanoes - Floods - Famines - Landslides. Man-Made Disasters: Study of Environmental Impacts Induced by Human Activity - Nuclear Reactor Meltdown - Industrial Accidents - Disease and Epidemics.

❖ NATURAL DISASTERS

- A **natural disaster** is a major adverse event resulting from natural processes of the Earth; examples include floods, hurricanes, tornadoes, volcanic eruptions, earthquakes, tsunamis, storms, and other geologic processes.
- A natural disaster can cause loss of life or damage property, and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience and on the infrastructure available.

❖ **VOLCANOES:** A volcano is the term for any place on the surface of the earth, where hot molten rock (magma) reaches the surface.

- A place on the earth's surface (or any other planet) where molten rock and gases are erupted. A hill or mountain built up by the eruption of molten rock.
- Pressure builds up in the earth's crust and this is the reason why eruptions occur. Gases and **igneous rocks** shoot up and splash over or fill the air with lava fragments. The volcano eruption can cause hot ash, lateral blasts and lava flow, mudslides, and more.

Formation of Volcanoes:

- A volcano mountain is formed by the surface eruption of magma from within the earth's upper mantle. The magma that erupts to the surface and forms lava flow that deposits ash. As the volcano continues to erupt, a new layer of lava is added to the surface accumulating to form a mountain.
- Volcanoes can produce ash, toxic gases, flash floods of hot water and debris called lahars, lava flows, and fast-moving flows of hot gases and debris called pyroclastic flows. Some dangers from volcanoes can be predicted ahead of time while others may occur with little or no notice after an eruption. Each volcano and situation is unique. Learn more about volcanic eruptions and pay attention to warnings from local authorities for the best advice available on specific actions you can take to stay safe.

Different Stages of Volcanoes:

They tend to be conical although there are a variety of forms, depending upon:

- The nature of the material erupted
- The type of eruption

- The amount of change since the eruption

Volcanoes are categorized into three main categories:

- **Active Volcanoes:** A volcano will be classified as an active volcano if at the present time it is expected to erupt or is erupting already.
- **Dormant Volcanoes:** The classification of volcanoes which is called dormant would be a volcano that is not erupting or predicted to erupt in the near future.
- **Extinct Volcanoes:** An extinct volcano is a volcano that no one expects will ever have another eruption.

Reason behind the Eruption of Volcanoes:

The volcano eruption begins with the formation of magma in the lower section of the earth's crust. The earth's crust is made up of massive slabs called plates, which fit together like a jigsaw puzzle. The friction during the movement of plates causes earthquakes and volcanic eruptions. With pressure, it travels upwards with tremendous force hitting solid rocks and other material and creates a new passage to the earth's surface. Once the magma reaches the air it is called lava.

Types of Volcanoes:

These are grouped into four types:

- Cinder cones
- Composite volcanoes
- Shield volcanoes
- Lava volcanoes

Cinder Cones: These are the simplest type of volcano. They occur when particles and blobs of lava are ejected from a volcanic vent. The lava is blown violently into the air, and the pieces rain down around the vent. Over time, this builds up a circular or oval-shaped cone, with a bowl-shaped crater at the top. Cinder cone volcanoes rarely grow larger than about 1,000 feet above their surroundings.

Composite Volcanoes: Composite volcanoes are some of the Earth's grandest mountains, and they are also called as stratovolcanoes. They are typically symmetrical cones of large dimension built of alternating layers of lava flows, steep-sided, volcanic ash, blocks, bombs, and cinders and may rise as much as 8,000 feet above their bases.

Shield Volcanoes: A shield volcano is a type of volcano usually built almost entirely of fluid lava flows. They have very gentle slopes and are developed horizontally. Shield volcanoes are built by effusive eruptions, which flow out in all directions. They almost never have violent eruptions, with basic lava simply flowing out.

Lava Domes: Lava domes are the fourth type of volcano that we are going to discuss. Unlike composite and shield volcanoes, lava domes are of tiny stature. They are formed when the lava is too viscous to flow to a great distance. As the lava dome slowly grows, the outer surface cools and hardens as the lava continues to pile within. Eventually, the internal pressure can shatter the outer surface, causing loose fragments to spill down its sides. Generally, such lava domes are found on the flanks of larger composite volcanoes.

❖ **Major health threats from a volcanic eruption**

- Volcanoes spew hot, dangerous gases, ash, lava, and rock that are powerfully destructive.
- People have died from volcanic blasts.
- The most common cause of death from a volcano is suffocation.
- Volcanic eruptions can result in additional threats to health, such as floods, mudslides, power outages, drinking water contamination, and wildfires.
- Health concerns after a volcanic eruption include infectious disease, respiratory illness, burns, injuries from falls, and vehicle accidents related to the slippery, hazy conditions caused by ash.
- When warnings are heeded, the chances of adverse health effects from a volcanic eruption are very low.

The positive and negative effects of volcano eruptions

Volcanoes have a large effect on their locality. They produce ash, lava, volcanic bombs, pyroclastic flows and lahars. Ash from large volcanoes has been known to affect global climates.

The effects of volcanoes can be both positive and negative.

Positive effects

- Geothermal energy is where heat from within the Earth is used to generate electricity. Geothermal energy can be generated in areas where magma lies close to the surface. This is good for increasing our renewable energy use.
- Ash ejected by the volcano acts as a good fertiliser for soils.
- Volcanoes attract many tourists, who enjoy the dramatic scenery that they produce.

Negative effects

- Volcanoes are dangerous. They can kill people and damage property.
- Economic activity can suffer as it is hard for businesses to operate after an eruption.
- Habitats and landscapes are damaged by lava flows.

❖ **FLOODS**

- A flood is an overflow of a large amount of water beyond its normal limits, especially over what is normally dry land. Flooding may occur as an overflow of water from water bodies, such as a river , lake, or ocean, in which the water overtops or breaks levees , resulting in some of that water escaping its usual boundaries

❖ **Protection against Floods**

- Floods caused by cloud bursts, bursting of dams, or tsunamis are called flash floods. Any flood is preceded by a threat period known as the Probability Period. This allows the authorities to issue warnings and plan evacuation.

- Artificial reservoirs should be built with sluice gates and sand bags should be used to block the flow of water. Low grounds or viaducts can be created to carry water in a certain direction or underground. Trees should be planted in the catchment areas to stop soil erosion.
- A **flood** is an overflow of water that submerges land that is usually dry. Floods are an area of study in the discipline of hydrology. They are the most common and widespread natural severe weather event.
- Floods can look very different because flooding covers anything from a few inches of water to several feet. They can also come on quickly or build gradually. To better answer the question of "What is a flood?" we'll answer what each specific type of flooding event is.
- According to our friends at the National Severe Storms Laboratory, there are five types of floods. They include:

1. **Urban Floods**
2. **River Flood**
3. **Coastal Flood**
4. **Storm Surge**
5. **Inland Flooding**
6. **Flash Flood**
7. **Pluvial Floods**

Flooding can happen anywhere, including both coastal and inland locations

Urban floods occur when the drainage system in a city or town fails to absorb the water from heavy rain. The lack of natural drainage in an urban area can also contribute to flooding. Water flows out into the street, making driving very dangerous. Although water levels can be just a few inches deep, urban floods can cause significant structural damage.

Pluvial floods form in flat areas where the terrain can't absorb the rainwater, causing puddles and ponds to appear. Pluvial flooding is similar to urban flooding, mainly in rural areas. The agricultural activities and properties in areas where pluvial floods have occurred can be seriously affected.

River Flooding

A **river flood** occurs when water levels rise over the top of river banks. This flooding can happen in all river and stream channels. This includes everything from small streams to the world's largest rivers.

River floods are characterized by gradual riverbank overflows caused by extensive rainfall over an extended period. The areas covered by river floods depend on the size of the river and the amount of precipitation. River floods rarely result in loss of lives but can cause immense economic damage.

Causes of River Flooding

- River flooding typically happens for four reasons. They are:
- Excessive rain from tropical storm systems making landfall
- Persistent thunderstorms over the same area for extended periods
- Combined rainfall and snowmelt
- Ice jam

More on River Floods

River floods can happen suddenly or slowly. Sudden river flooding events occur more often on smaller rivers, rivers with steep valleys, rivers that flow for much of their length over impermeable terrain, and normally dry channels.

On the other hand, low-rising river floods typically occur in large rivers with large catchment areas. In case you didn't know this already, a **catchment area** is any area of land where precipitation collects and runs off into a common outlet.

- **Coastal Flood**

A **coastal flood** is the inundation of normally dry land areas along the coast with seawater.

Coastal floods are caused by strong winds or storms that move towards a coast during high tide. When powerful waves breach the coast's dune or dike, the area is usually flooded. Coastal regions with fewer defences and lower elevations are the most affected. The best time to repair the breach is during low tide.

Causes of Coastal Flooding

Coastal flooding is typically a result of a combination of sea tidal surges, high winds, and barometric pressure.

These conditions typically come from storms at sea like:

Tropical cyclones
Tsunami
Higher-than-average tides

- **Storm Surge**

Storm surge is an abnormal rise in water level in coastal areas over and above the regular astronomical tide.

Causes of Storm Surge

Storm surge is always a result meteorological storms that cause higher than normal tides on the coast. There are three parts of a storm that create this surge. They are:

Wind
Waves
Low atmospheric pressure

- **Inland Flood**

An **inland flood** is flooding that occurs inland or not in a coastal area. Therefore, coastal flooding and storm surge are not inland floods.

Causes of Inland Flooding

Rainfall is almost always to blame for inland floods. Rain causes inland flooding in two ways. It can happen with steady rainfall over several days or it can happen because of a short and intense period of rainfall.

Snowmelt also causes inland floods, although rainfall is a more common cause.

Another way inland flooding happens is when water ways get blocked by debris, ice, or dams.

More on Inland Floods

Inland floods are often worse in urban areas because there isn't anywhere for the water to go. The following urban features can create urban flooding or make inland floods worse:

Paved roads and streets
Low-capacity drainage equipment
Dense buildings
Low amounts of green space

- **Flash Flood**

A **flash flood** is flooding that begins within 6 hours, and often within 3 hours, of heavy rainfall (or other cause).

Flash floods are fast-moving waters that sweep everything in their path. So, how do flash floods form? They are caused by heavy rainfall or rapid snow thaw. Flash floods usually cover a relatively small area and occur with little to no notice, generally less than six hours. The rapid water torrents can move large objects like cars, rocks, and trees.

Causes Flash Floods

Flash floods can happen for several reasons.

Most flash floods happen after extremely intense rainfall from severe thunderstorms over a short period of time (normally 6 hours or less). There are two key elements to determine is flash flooding are likely:

- Rainfall rate
- Rainfall duration

Flash floods also happen when damns break, when levees fail, or when an ice jam releases a large amount of water.

Dangers of Flash Floods

Flash flooding is the #1 severe weather killers in the United States.

Flash floods are extremely powerful. They have enough force to roll boulders, tear trees from the ground, destroy buildings and bridges, and scour out new channels. This type of flood is characterized by raging torrents that rip through river beds, urban streets, or canyons, wiping out everything in their paths. With heights reaching 30 feet, flash floods can completely cover communities.

Another reason why flash flooding is so dangerous is that it can happen with little to no warning. This is especially true when dams or levees break.
The National Weather Service recommends knowing your area's flood risk before a flash flooding event happens. They also recommend having a family or business disaster plan ready in the case of a flash flood.

Flood Causes & Effects
No matter what type of flood you're dealing with, they are generally caused by the same key factors and there are always negative effects.
In this section, we'll cover the basic causes and effects of flooding to help you better understand this dangerous meteorological and hydrological phenomenon. If you read through the above section on types of floods, you might just want to skip down to flooding effects.
What Causes Flooding?
As we mentioned above, there are plenty of different causes of flooding. While different flood types typically have different causes, most floods are caused by one of the following activities.

Heavy rainfall is the simplest cause of flooding. When there is too much rain or it happens too fast, there just isn't a place for it to go. This can result in floods like flash flooding.

Overflowing rivers are another cause of floods. You don't necessarily need heavy rains though to experience river flooding. As we mentioned before, river flooding can happen when there is debris in the river or dams that block the flow of the water.

Speaking of dams, **broken dams** are another cause of flooding. Older infrastructure can fail when heavy rains come and water levels rise. When dams break, they unleash torrents of water on unsuspecting households. This is part of what happened when Hurricane Katrina hit New Orleans in 2005.

Storm surge and tsunamis also cause flooding. Storm surges from hurricanes and other tropical systems can cause sea levels to rise and cover normally dry coastal areas in several feet of water. Tsunamis on the other hand are giant waves caused by earthquakes or underwater volcanic eruptions. As these waves move inland, they build height and can push a lot of water inland in coastal areas.

Channels with steep banks are also to blame for flooding. Flooding often occurs when there is fast runoff into lakes, rivers, and other basins. This is often the case with rivers and other channels that feature steep sides.

A lack of vegetation can cause flooding. Vegetation can help slow runoff and prevent flooding. When there is a lack of vegetation, there is little to stop water from running off and overflowing river banks and streams.

Melting snow and ice is another common reason for flooding. When a large amount of snow and/or ice melts quickly, it often doesn't have somewhere to go except low-lying areas.
These aren't all the reasons that flooding can happen, but they are some of the most common.

Flooding Effects

No matter what causes of a flood, it can have devastating effects on your community. There are actually many dangerous flooding effects. Besides physical danger, floods also cause economic and social problems. In this section, we'll cover the most common flood effects.

Loss of Lives

The gravest effect of flooding is death. In fact, flooding is the number one severe weather killer. Floods have claimed thousands of lives throughout history. But how does flooding kill

Floods kill by carrying people away in fast-moving water or drowning them. It only takes six inches of water to wash a person away. Floods can also kill people by destroying buildings and creating unsafe environments. One often-overlooked deadly effect of flooding comes from waterborne illnesses.
From 2010 to 2018, the National Weather Service recorded hundreds of flooding deaths across the United States. Texas saw most of those deaths, with the 8-year total sitting at 212 fatalities.

Property Damage

Since it only takes two feet of flood water to wash a car away, flooding can also cause great loss of property. Surely you've seen images of cars floating away in flood waters. This is why it is so important to avoid flooded areas when driving. You don't want to be in your car when it gets washed away in the flood!
Flooding also causes property damage to buildings by blowing out windows, sweeping away doors, corroding walls and foundations, and sending debris into infrastructure at a fast pace. Not to mention the furniture and items inside a home or business that are damaged when flood waters make it inside.

Economic Impacts

The economic impact of flooding can be devastating to a community. This comes from damage and disruption to things like communication towers, power plants, roads, and bridges. This brings business activities in an area to a standstill. Oftentimes, major flooding results in dislocation and dysfunction of normal life long after flood waters recede.
Flooding hinders economic growth and development because of the **high cost of relief and recovery** associated with floods.
In frequently flooded areas, there is less likely to be any investment in infrastructure and other developed activities.

Psychosocial Flooding Effects

Flooding can also create lasting trauma for victims. The loss of loved ones or homes can take a steep emotional toll, especially on children. Displacement from one's home and loss of livelihood can cause continuing stress and produce lasting psychological impacts.

- **FAMINE**

Introduction

Famine is an extreme and prolonged state of hunger in a considerable proportion of masses of a country or a region that results in widespread and acute malnutrition and death by starvation or diseases due to the inadequacy of food and nutrition. Famine in a literal sense indicates extreme inadequacy and the scarcity of food and nutrition. It is a phenomenon that occurs in a vast terrestrial area due to different environmental and biological reasons. Famines may range from a few weeks to a few years in a community. The major factors that lead to famine in today's world are population imbalance, lack of rainfall causing scarcity of freshwater, crop failure, government policies, and so on.

A famine is a period of severe food scarcity brought on by a variety of circumstances such as war, natural disasters, crop failure, population imbalance, widespread poverty, an economic calamity, or government policy. Regional hunger, starvation, epidemics, and increased mortality are generally accompanied or followed by this occurrence. Every inhabited continent on the planet has experienced starvation at some point in its history. Southeast and South Asia, as well as Eastern and Central Europe, were often classified in the 19th and 20th centuries as having suffered the greatest number of deaths from starvation. Since the 2000s, the number of people dying from famine has steadily decreased. Since 2010, Africa has been the world's most afflicted continent.

Food is one of the most important assets in life, you need it to survive.

Caused by the shortage of inability of people to obtain food. Usually caused by low food production resulting from drought, other factors, or it could be a result of the inability of a country or its population to afford to buy food.

Conditions Leading to Famine

Famines are lurking in the community from olden times. Even in ancient times as a result of war or epidemic masses have faced famine and bore the consequences of it. It has affected populations across the world. Many famines in history have precipitated from natural causes like drought flooding, unseasonable cold, typhoons, Cyclones, vermin depredations, insect infestations, and plant diseases. However, some famines were a result of social causes like population explosion leading to food shortages that extended into malnutrition, starvation, and widespread diseases, feudal social systems, etc.

Characteristics of a Famine

A Famine is characterized by the following factors:

- Severe food shortage triggered causes like conflict, drought, crop failure, demographic disequilibrium, governmental policies, and so on.
- Widespread death due to diseases, starvation, and scarcity of food.
- Malnutrition and other deficiency diseases plague a huge amount of the population.
- Crop failure led to a nationwide scarcity of food.
- Poverty with various social disorganization consequences include overcrowding, the break-up of hygiene, escalated vermin, failure to bury the deceased, and unregulated population growth and/or camp advancement that support the occurrence of epidemics and diseases.

Famines in India

India is a developing nation with its economy and population majorly dependent on agriculture. Although various advancements in the field of agriculture have improved its quality it is still primarily dependent on climatic conditions. For example- Rain during summer is crucial for the process of irrigation in agriculture. Lack of rainfall leads to a lack of proper irrigation and the failure of crops. Thus, these consequences lead to famines. Many such conditions like lack of rainfall or drought had led to several famines in India 11th to 17th Century. The most severely recorded famines in India are as follows:

- The famine of 1943 in Bengal.
- The famine of 1770 in Great Bengal.
- Skull Famine of 1791.
- The famine of 1866 in Orissa.
- The famine of 1630 in Deccan.
- The famine of 1873 in Deccan.
- The famine of 1837 in Agra.

Widespread scarcity of food was caused as a result of these great famines. This also led to many deaths across the country. The most serious of all these famines was the famine of 1770 in Great Bengal that caused around 10 million deaths; the skull famine of 1791 caused about 11 million deaths on average.

Causes of Famines

The occurrence of famines mainly was recorded to be caused as a result of natural causes that include the after-effects of flood, cyclone, storms, or droughts due to scarcity of rainfall, earthquake, leading to crop failure and agricultural degradation. Floods and earthquakes destroy crops or food storage places resulting in scarcity of food and thus leading to famine.

– Scarcity- mainly farmers, no irrigation, crop failure
– Drought, flood

– Natural disasters
– Ban natural resources
– Population Imbalance
– Political Conspiracy &
– Government Policies

Diseases related to famine

Cholera: Cholera is transmitted through contaminated water or food and can rapidly lead to severe dehydration and death if left untreated.

Acute malnutrition: Acute malnutrition and micronutrient deficiencies can be widespread among refugees and displaced people.

Measles: Outbreaks can result in epidemics that cause many deaths, especially among malnourished children.

Pneumonia: Children whose immune systems have been weakened by under nutrition are at higher risk of developing pneumonia.

Malaria: Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes.

Diarrhoeal disease: Diarrhoea can last several days, and can leave the body without the water and salts that are necessary for survival.

Human Intervention

The man-made causes of famine include lack of food due to inefficient agricultural processes, resulting in crop failure. Or, no proper storage of crops that lead to large-scale loss of harvested crops or infestation by rodents.

It is also caused by the improper distribution of food in some of the regions.

Contamination of water bodies or air hampers crop production and may also make it impossible for crops to grow in such regions.

Prevention of Famine

It is difficult to control and impossible to eradicate famine as it is mostly caused by natural reasons, however the effects of famine can be prevented by certain measures. These include:

- Encouraging surplus agricultural production beyond the requirements of the rural population.

- A well-developed transportation system between urban and rural areas. Connectivity of urban and rural areas plays an important role in the prevention of famine.

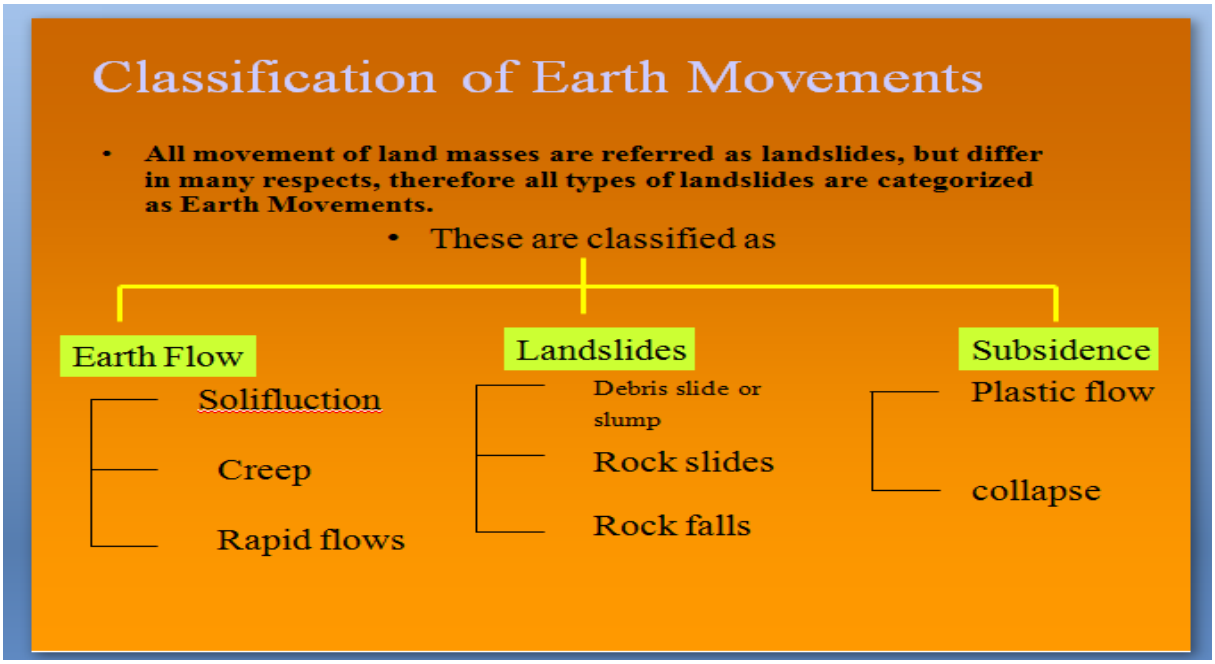
- Ensuring proper health care, clean drinking water, and sanitation facilities for the prevention and spread of diseases.

➢ **Landslides**

Landslide: refers to the downward sliding of huge quantities of land mass which occur along steep slopes of hills or mountains and may be sudden or slow

Classification of Earth Movements

- All movement of land masses are referred as landslides, but differ in many respects, therefore all types of landslides is categorized as Earth Movements.



Solifuction

- Solifuction is a downward movement of wet soil along the slopes under the influence of gravity.

Soil Creep

- Creep is extremely slow downward movement of dry surface matter.
- Movement of the soil occurs in regions which are subjected to freeze-thaw conditions. The freeze lifts the particles of soil and rocks and when there is a thaw, the particles are set back down, but not in the same place as before.
- It is very important for CEs to know the rate of movement

- ***Rapid Flows:*** Rapid flow is similar to the creep, but differs in terms of speed and depth. It is faster.
- Creep is involved up to shallow depth (app. 1-2 m), whereas the rapid flow is involved to greater depth (app. up to 5 m or more)

Landslides

- If a mass of earth moves along a definite plane or surface the failure is termed as Landslide
- Large block known as a slump block moves during the landslide.
- The scar above a landslide is easily visible.
- They can occur along a slope where the internal resistance of the rocks are reduced or they lose their holding capacity.
- Common after earthquakes or after removal of part of the slope due to construction, particularly for construction of roads.
- During the movement landslide can result into the Debris slides - are failure of unconsolidated material on a surface; Rock slide or Rock Fall – where movement of large rock block rolls
- They are also common along the steep banks of rivers, lakes etc.
- Pour Water Pressure is the key to monitoring landslides. Shear strength (a resisting force) decreases and the weight (a driving force increases).
- Talus – accumulation formed by the coarser rock fragments resulted from the mechanical weathering along a slope under influence of gravity

Subsidence

- It represents the downward movement of the surface
- It may occur due to plastic outflow of the underlying strata or due to the compaction of the underlying material
- (1) ***Subsidence due to Plastic outflow:*** It may occur when a plastic layer like clay bed is squeezed outward due to overlying heavy load
- (2) ***Subsidence due to collapse:*** It occur due to extensive pull out of large volume of underground water or due to subsurface solution activity in limestone terrain.

Example:

The Leaning Tower of Pisa, Italy, the tilting of which accelerated as groundwater was withdrawn from aquifers to supply the growing city.

CAUSES OF LANDSLIDES

Landslides Occur Due to Various Reasons

Internal Causes:

- Influence of slope- Provides favorable condition for landslides; steeper slope are prone to slippage of land. It is known that most of the materials are stable upto certain angle- "Critical angle" or "angle of repose" – it varies from 30^0 for unconsolidated sediments to 90^0 for massive rocks and 60^0-90^0 for partially jointed rocks.
- Ground water or associated water- Main factor responsible for slippage. Suppose the hard or massive rocks are underlined by softer rocks (shale or clay bed)

- When rain water percolates through some fractures or joints the clayey beds becomes very plastic and acts as slippery base, which enhance the chances of loose overburden to slip downward.
- Water is the most powerful solvent, which not only causes decomposition of minerals but also leaches out the soluble matter of the rock and reduces the strength.
- **Lithology-** rock which are rich in clay (montmorillonite, bentonite), mica, calcite, gypsum etc are prone to landslide because these minerals are prone to weathering.
- **Geological structures-** Occurrence of inclined bedding planes, joints, fault or shear zone are the planes of weakness, which create conditions of instability.
- **Human Influence-** undercutting along the hill slopes for laying roads or rail tracks can result into instability.
- Deforestation in the uplands, result into more erosion during the rainy season.

External Causes

- Most common is the vibration resulted due to earthquakes; blasting to explosives; volcanic eruption etc.
- Earthquakes often initiate mass failures on large scale eg. 1897 Assam quake produced gigantic landslide ever recorded in the region.

Preventive Measures

- The main factors which contribute to landslides are *Slope, water content, geological structure, unconsolidated or loose sediments, litho logy and human interference.*
- **Slope:** Retaining wall may be constructed against the slopes, which can prevents rolling down of material. Terracing of the slope is an effective measure.
- **Effect of water:** Make proper drainage network for quick removal of percolating moisture or rain water by constructing ditches and water ways along the slope
- **Geological structures***:* Weak planes or zones may covered or grouted to prevent percolation of water, this increases the compaction of loose material.

Landslides and Mudflows

- Plant ground cover on slopes and build retaining walls.
- In mudflow areas, build channels or deflection walls to direct the flow around buildings.
- Install flexible pipe fittings to avoid gas or water leaks.

Study of Environmental Impacts Induced by Human Activity

Human beings form an integral part of the Environment and have the greatest ecological footprint. We have resourcefully restructured all aspects of earthly life. This has influenced Human evolution, from the very first Human ancestors to our modern-day selves, and indeed, we have come a long way through nearly two million years of evolution. From advances in man's social behavior to accomplishing new feats in various fields, we always strive to provide a better standard of living for civilization. However, Humans are very much a part of the Environment we live in, and our mostly well-intended actions have far-reaching side Effects on the entire

ecosystem and Environment. In this article, we explore the various Human Activities that destroy the Environment.

The Environment has suffered for thousands of years due to Human Activities. Since as Homo sapiens we first walked the earth, there have been several modifications on the planet and around us through the development of infrastructure, travel, and the incorporation of urbanization and other commercial networks. The change, however, has been both positive and negative—and likely for the betterment resulting in the worse at some point in time.

Reason for changes

The reason for the changes in the Environment primarily constitutes to the following facts that have made an adverse Effect on it-

1. The increasing Population:

As the Human race we have been affecting our Environment for thousands of years and this has been a topic of worry for the scientists primarily because of the surpassing of the planet's food supply. Accommodating the increasing population has been a major cause for much of the impact that we've had on our Environment. However, the food supply of ours can support more lives than ever at the moment, although this reality has the profound impact of reducing the population turnover and leading to its rapid expansion.

2. Modification of Agriculture, Domesticated Animals, and Genetics

So the demand to feed a growing Human population has resulted in advances in agriculture, which are the first major Human innovation to enable survival as a species. Earlier agriculture allowed the hunter-gatherer cultures to settle an area and cultivate their food, which immediately impacted the Environment by transplanting the non-native species to newer areas and prioritizing the growth of various plants and animals over each other. Recently there have been several genetic modifications in Human beings to enhance their lifespan and health. Also, the domestication of livestock and other species by early Humans has affected the Environment by altering the land in significant ways as animal grazing contributed to Environmental changes by deteriorating native grasses and thus, leading to soil erosion. Industrialization of agriculture is another major cause for the same as in the last several centuries it has prompted a subsequent wave of counter-movements, which seek to undo the negative Effects of Human intervention.

3. Deforestation and Reforestation

Since the growth in the population needs to be housed there has been massive deforestation to build homes for the people, which has resulted in significant negative Effects on the Environment. Deforestation has many adverse Effects, including decreasing oxygen levels (and increasing greenhouse gases), elevated risk of soil erosion,

and the destruction of animal habitats. However, the reforestation efforts seek to replace as much forest land as is possible every year.

4. Pollution

A major life-threatening Human activity that affects the Environment not only by contributing to air pollution, or water, or soil pollution but has also become a major threat for the entire Human species. It has also contributed to tremendous Effects on the world, leading to Environmental degradation and problems like acid rain and harmful algal blooms in the ocean.

5. Global Warming and Climate Change

They are amongst the major challenges faced not only by the Environment but by the entire Human race as they are among the most critically impactful ways that Humans have affected the Environment. The release of CO2 contributes to the deterioration of the earth's ozone layer, which in turn, contributes to global climate change, hence, the Human Impact on the Environment is a Double-edged Sword as the expansion of the Human population and the growing requirements are resulting in changes that may be negative, but as Humans also have the power to correct their mistakes and change the Environment for the better, there's a ray of hope.

10 Human Activities That Affect the Environment

1. **Deforestation:**

Deforestation refers to the clearing of trees from a forest, which is then converted into non-forest use. Deforestation can include forest land being turned into farmland, ranches, or for public usage and urbanization. Trees take in greenhouse gases and give oxygen to nature, which we use to breathe. Chopping down trees to increase land availability due to an increase in population and bringing up new industries has led to an ecological system imbalance, leading to a decrease in oxygen levels.

2. **Water Pollution:**

The presence of an excessive amount of toxins in water bodies is referred to as water pollution. Polluted water from large-scale factories, the absence of adequate sanitation facilities, and numerous Human actions along water sources have facilitated water contamination to a great degree. Industrial effluents and sewage are directly released into the rivers, increasing this pollution. Seas and oceans also sometimes face oil spills, which have long-term Effects on water, leaving it inhospitable to aquatic life.

3. **Air Pollution:**

The presence of an excessive amount of toxins in the air is referred to as air pollution. Overpopulation has caused a great deal of air pollution, especially due to the use of

vehicles for transport. Harmful factory gases are released into the atmosphere, forcing us to breathe air that contains toxic substances and pollutants, which contribute to different medical conditions, including respiratory and cardiovascular disorders.

4. **The exploitation of Marine Life:**

Our marine life is becoming endangered due to the massive scale of commercial fishing. Water degradation continues to hamper the lives of marine organisms and renders their longevity uncertain. In certain instances, when these fish are ingested by Humans, it contributes to sickness and disease.

5. **Global Warming:**

Global warming refers to the rapid rise in Earth's average surface temperature over the past century, mainly due to the greenhouse gasses released by people burning fossil fuels necessary for industrialization. It is seen as a consequence of an increase in Earth's temperature due to the greenhouse Effect and connected Human actions. It results in the melting of ice caps and therefore increases the sea levels triggering tsunamis, cyclones, and other natural calamities.

6. **Habitat Loss:**

Wildlife conservation is becoming tougher because their natural habitat is constantly being threatened and destroyed. Water pollution and deforestation are the main reasons for habitat loss. Deforestation may give rise to abundant land for Humans but leaves animals homeless.

7. **Extinction:**

Human Activities are triggering extinction on an unprecedented and mass scale. The destruction of natural habitats, Environmental hazards, global warming, poaching, pollution, and deforestation are some of the leading causes of this tragedy.

8. **Overuse Of Harmful Pesticides And Fertilizers:**

With a great uptick in population, there is also a rise in food production. To aid this production, however, crops are produced through the use of toxic fertilizers and have extremely poor nutritional values to satisfy the demand for food security.

9. **Urbanization:**

Urbanisation refers to the increasing number of people who reside in cities. Urbanization has also contributed to a major transition and disparity in our ecological Environment. This is because urbanization requires large tracts of land to be deforested and then used for building cities.

10. **Ozone Layer Depletion:**

The three oxygen atoms make up an ozone ring. While oxygen lends life to organisms, ozone is a toxic gas. It may be dangerous on Earth, but ozone plays a critical function in the various ambient layers of the atmosphere. UV rays are emitted by the sun, causing harm to animals, specifically skin cancer in Humans, and hence are harmful. Ozone is preventing such UV radiation from entering the planet, thus protecting all of us from UV damage. Over the years, however, this defensive layer has been eroding across the world.

A dramatic depletion was discovered back in the 1980s due to the CFCs (chlorofluorocarbons) used in refrigerators and fire extinguishers. This is why production firms are now mandated to produce CFC-free devices around the world.

- **Nuclear Reactor Meltdown**

  A nuclear disaster could take several forms. The most obvious would be a meltdown at a nuclear reactor plant. Though the plant could not explode, the results of such a disaster would very likely be the release of massive amounts of radiation and radioactive material into the environment. And it would take hundreds of years to decay to anything near "safe" levels. Cleaning it up is out of the question, as exemplified by the Chernobyl disaster. In the Ukraine event, the reactor actually caught fire and burned.

- Prypiat is a ghost town. In the case of Three Mile Island,
  The meltdown was contained within the reactor vessel and the containment
  Building, but there were some large releases of steam that was heavily laced with the radioactive debris of spent fuel fission fragments. These radioactive materials, which would normally be contained inside fuel elements, were released into the primary coolant when a loss of coolant accident overcame the plant.

Introduction about Fukushima Disaster

Fukushima Daiichi Nuclear disaster on March 11th 2011 which is happened due to Earthquake and following by tsunami at Japan. This Nuclear disaster which release Radioactive materials due to nuclear meltdown caused by equipment failures at

Fukushima Nuclear Power plant.

This power plant with six boiling water reactors is designed by General Electric's and Maintained by Tokyo Electric Power Company. From this 6 Reactors, Reactor 5 and 6 is under cold shutdown and Reactor 4 had been de-fuelled for planned maintenance purpose.
Reactor 1, 2 and 3 is shutdown automatically immediately after earthquake and Emergency Generator system activated automatically to control electronics and coolant system. However this generator system is failed to continuously operate due to tsunami following earthquake flooded this generator system located at low-lying room and causing power failure for the critical pumps which should function continuously to circulated coolant water through a nuclear reactor for few days to avoid it from melting down after being shutdown.

These failures causing reactors overheated due to high radioactive will be produced in first few days of shutdowns.

Nuclear Explosions

- A nuclear explosion is an explosion that occurs as a result of the rapid release of energy from a high- speed nuclear reaction. The driving reaction may be nuclear fission, nuclear fusion or a multistage cascading combination of the two, though to date all fusion-based weapons have used a fission device to initiate fusion, and a pure fusion weapon remains a hypothetical device.
- Atmospheric nuclear explosions are associated with mushroom clouds, although mushroom clouds can occur with large chemical explosions. It is possible to have an air-burst nuclear explosion without these clouds. Nuclear explosions produce radiation and radioactive debris.
- Nuclear disasters generally occur in nuclear reactors which are used to generate electric power. Accidents can occur during transportation of nuclear waste or during temporary storage of spent radioactive fuel at nuclear power plants.
- Strontium-90, Uranium-235, Cesium-137 are some examples of radioactive materials
- Nuclear disasters occur as a result of release of massive amount of radiation and radioactive material into the environment. They have the greatest damage potential, over a wide geographical area, often leading to mass destruction of human civilization.

- **CAUSES OF NUCLEAR HAZARDS**

  Nuclear disasters and accidents usually occur in nuclear reactors that are used to generate electric power.

  Some of the major causes

  - Release of massive amounts of radiation and radioactive material
  - Improper transportation of nuclear waste has potential risk of pollution and environmental contamination.
  - Improper storage of spent radioactive fuel at nuclear power plants.
  - Non-standard operations, mismanagement of nuclear reactors
  - Poor instrumentation
  - Lack of well-trained staff
  - Unreliable Instruments
  - Errors in operation procedures
  - Spills & Leaks from nuclear industry, medical radiology and defence activities

- **CHERNOBYL DISASTER**

  The disaster at the Chernobyl nuclear power plant in north-central Ukraine on April 26, 1986 is considered as one of the greatest nuclear accidents of all time. On the fateful day, one of the reactors of the nuclear power plant exploded and released thirty to forty times the radioactivity of the atomic bombs dropped on Hiroshima and Nagasaki.

  About 30 people were killed immediately; including 28 from radiation exposure, 209 cases were treated for acute radiation poisoning.

  Large areas of Ukraine, Russia and beyond were contaminated with radioactive material in varying degrees.

  A second explosion caused burring of 1200 tonnes of graphite for nine days and releasing of radioactive material into the environment.

  About 5000 tonnes of boron, dolomite, sand, clay and lead were dropped on the flames bursting out of the graphite moderator in an effort to put off the blaze and control the release of radioactive particles.

- **Impacts of the nuclear disaster**

  • Nearly, 45% of children have experience with thyroid exposure to radiation.

  • In order to protect the children from radiation exposure, the top soil from the school yards have been removed, the walls of the school building have been cleaned, and the gutters have been cleared of the mud as well.

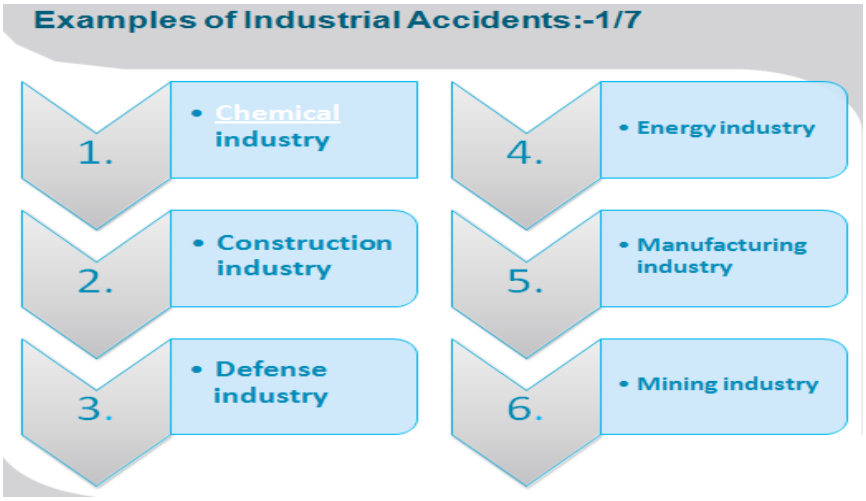
  • Reports from WHO indicate that the Agricultural Products, milk and seafood have been contaminated with radioactive material.

  • The nation may be struggled to find effective methods to monitor health, protect its food supply from contamination and complicated poster disaster clean up.

- **Impact & Elements at risk**

Science there is little or no warning of an industrial/chemical accident, the loss incurred is very high. There is a huge loss to life, property, livelihood and environment. Hazardous materials in various forms can cause death, serious injury, and damage to buildings, homes and other properties. The areas close to an industrial setup are under immediate threat. People working in that industry or people residing in the neighbouring areas are normally affected.

There has been large number of incidents where the farmers have faced the brunt of crop loss because of the toxic gases released by the industries into the air or polluting the water.

- **Diseases** 

and Epidemics

WHAT IS AN EPIDEMIC?

The Centres for Disease Control and Prevention (CDC) describes an epidemic

An unexpected increase in the number of disease cases in a specific geographical area. Yellow fever, smallpox, measles, and polio are prime examples of epidemics.

An epidemic disease doesn't necessarily have to be contagious. West Nile fever and the rapid increase in obesity rates are also considered epidemics. Epidemics can refer to a disease or other specific health-related behavior (e.g., smoking) with rates that are clearly above the expected occurrence in a community or region.

What Is A Pandemic?

The World Health Organization (WHO) declares a pandemic when a disease's growth is exponential. This means the growth rate skyrockets, and each day cases grow more than the day prior. In being declared a pandemic, the virus has nothing to do with virology, population immunity, or disease severity. It means a virus covers a wide area, affecting several countries and populations.

What Does Endemic Mean?

A disease outbreak is endemic when it is consistently present but limited to a particular region. This makes the disease spread and rates predictable. Malaria, for example, is considered endemic in certain countries and regions.

What Are The Differences Between Pandemics And Epidemics?

The WHO defines pandemics, epidemics, and endemic diseases based on a disease's rate of spread. Thus, the difference between an epidemic and a pandemic isn't in the severity of the disease, but the degree to which it has spread.

A pandemic cuts across international boundaries, as opposed to regional epidemics. This wide geographical reach is what makes pandemics lead to large-scale social disruption, economic loss, and general hardship. It's important to note that a once-declared epidemic can progress into

pandemic status. While an epidemic is large, it is also generally contained or expected in its spread, while a pandemic is international and out of control.

CAUSES OF DISEASE OUTBREAKS

Several factors contribute to the outbreak of infectious diseases. Contraction can occur as a result of transmission from people, animals, or even the environment. For example:

- Weather conditions. For example, whooping cough occurs in spring, whereas measles tend to appear in the winter season.
- Exposure to chemicals or radioactive materials. For example, Minamata is a disease contracted after exposure to mercury.
- The social aftermath of disasters such as storms, earthquakes, and droughts can lead to high disease transmission.
- A number of environmental factors such as water supply, food, air quality, and sanitation facilities can catalyze the spread of infectious diseases.

Disease origins can also be unknown. These kinds of diseases could be caused by a variety of factors, including:

- A new or newly modified pathogen
- Natural toxins
- Undetected chemical releases
- Unknown ionizing radiation over-exposure

The field of epidemiology works to trace these unidentified outbreaks to the source in an effort to protect public health and safety.

NOTABLE PAST PANDEMICS

The current COVID-19 outbreak is not the only disease to have impacted the world on a global scale. Here are just a few examples of past pandemics that have shaped the evolution of outbreaks and human immunity:

The Black Death (1346 - 1353): The Black Death caused an estimated death of 25 million people across the world in the 14th century. According to scientists, the outbreak was caused by bacteria called Yersinia pestis. This Bubonic Plague lasted for about four years.

American Plagues (16th Century): A cluster of Eurasian diseases brought to the Americas by European explorers, smallpox was one of the chief illnesses of the American Plagues, which contributed to the collapse of the Inca and Aztec civilizations. Some estimates suggest that 90 percent of the indigenous population in the Western Hemisphere was killed off as a result.

The Flu Pandemic (1889-1890): New transportation routes made possible in the Industrial Age made it easier for influenza viruses to spread widely in the U.S. and beyond. In the span of

months, influenza traveled around the globe, with the earliest cases reported in Russia. The virus spread rapidly throughout St. Petersburg before quickly making its way through Europe and the rest of the world, despite the fact that air travel didn't exist yet, leaving 1 million people dead in its wake.

Spanish Flu (1918-1920): Another massive disease outbreak was the influenza pandemic, popularly called Spanish flu. This viral pandemic began in 1918, immediately following World War I. Over 50 million deaths were recorded during this outbreak, with the disease lasting only two years.

The Asian Flu (1957-1958): The Asian Flu pandemic, which was a blend of avian flu viruses, began in China and eventually claimed more than 1 million lives. The CDC notes that the rapidly-spreading disease was reported in Singapore in February 1957, Hong Kong in April 1957, and the coastal cities of the U.S. in the summer of 1957. The total death toll was more than 1.1 million worldwide, with 116,000 deaths nationally.

AIDS Pandemic and Epidemic (1981-present): Since it was first identified, AIDS has claimed an estimated 35 million lives. Scientists believe that HIV, the virus that causes AIDS, is likely to have evolved from a virus found in chimpanzees that was transferred to humans in West Africa in the 1920s. By the late 20th century, the virus had made its way around the world. For decades, the disease had no known cure, but medication developed in the 1990s now allows people with the disease to experience a normal life span with regular treatment.

The Way Out

A common attribute of epidemics and pandemics is the need to take preventive care from infection. Typically, there is a large time lag between an outbreak and when vaccinations can be distributed, as we have seen with COVID-19. In the meantime, it’s crucial to take the following steps to stay healthy:

- Wash your hands often with soap and water. Make use of hand sanitizer.
- Don't touch your mouth or nose without sanitizing or washing your hands.
- When you cough or sneeze, cover your mouth and nose with a tissue.
- Avoid crowded places. Stay home if you can.
- Disinfect household surfaces regularly.
- Practice social distancing when you go out of the house.
- Employ properly fitted face masks and other protective shields when outside of your household.

UNIT-IV

DISASTER MANAGEMENT AND PLANNING

Disaster Management & Planning: Management of Essential Supplies and Temporary Shelter Relief - Evacuation & Other Logistic Management - Site Management - Medical Trauma and Stress Management - Integrated Developmental Planning For Disaster Management.

DISASTER MANAGEMENT

The body of policy and administrative decisions and operational activities that pertain to various stages of a disaster at all levels. It encompasses all the aspects of planning for and responding to disasters, including both pre and post disaster activities.

A continuous and integrated process of planning, organizing, co-coordinating & implementing the measures which are necessary or expedient for:

- Prevention of danger or threat of any disaster.
- Reduction of risk of any disaster or its severity or consequences.
- 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.

❖ DISASTER MANAGEMENT CYCLE

The Disaster management cycle includes several phases:

1. Mitigation: Disaster mitigation work involves directly preventing future emergencies and/or minimizing their negative effects. It requires hazard risk analysis and the application of strategies to reduce the likelihood that hazards will become disasters, such as flood-proofing homes or buying insurance.

2. Disaster preparedness: Disaster preparedness efforts include plans or preparations made in advance of an emergency that help individuals and communities get ready. Such preparations might include the stocking of food and water or the gathering and screening of willing volunteers, ready to mobilize post-disaster.

3. Disaster response: Disaster response work includes any actions taken during or immediately following an emergency, including efforts to save lives and to prevent further property damage. Ideally, disaster response involves putting already established disaster preparedness plans into motion. Typically, this phase of the disaster life cycle draws the most attention. It is also known as "disaster relief."

4. Disaster recovery: Disaster recovery happens after damages have been assessed and involves actions to return the affected community to its pre-disaster state or better – and ideally, to make it less vulnerable to future risk. Risk identification includes understanding the nature of hazards as well as understanding the nature of vulnerabilities. Subsequent efforts may range from physical upgrades to education, training and public awareness campaigns.

PHASES OF DISASTER

1. **Pre-impact Phase**

Disaster preparedness: - It is an on-going multi- sectoral activity. Integral part of the national system responsible for developing plans and programs for disaster management, prevention, mitigation, response, rehabilitation and reconstruction.

Co-ordination of a variety of sectors to carry out:

- Evaluation of risk.
- Adopt standards and regulations.
- Organize communication and response mechanism.
- Ensure all the resources –ready & easily mobilised.
- Develop public education programs.

2. **Impact Phase**

- Search, rescue and first aid.
- Field care
- Triage
- Tagging
- Identification of dead

3. **Post impact phase: Post disaster management planning**

i. Disaster response:- Immediate reaction to disaster as the disaster is anticipated , or soon after it begins in order to assess the needs , reduce the suffering, limit the spread and consequences of the disaster, open up the way to rehabilitation by:-

- Mass evacuation
- Search and rescue
- Emergency medical services Securing food and water

- Maintenance of law and order
- Implementing the disaster management plan.
- Setting up medical camps and mobilizing resources.
- Providing adequate shelter and sanitary facilities.
- Development of search and rescue team.
- Epidemiologic surveillance and disease control.
- Vaccination.

ii. Rehabilitation:-

- Water supply
- Food supply
- Basic sanitation & personal hygiene.
- Vector control.

iii. Disaster mitigation:-

- This involves lessening the likely effects of the emergencies. These include depending upon the disaster, protection of vulnerable population and structure.
- For ex. Improving structural qualities of the schools , houses and such other buildings so that medical casualties can be minimized.
- Similarly, ensuring the safety of health facilities and public health services including water supply and sewerage system to reduce the cost of rehabilitation and reconstruction.
- This mitigation complements the disaster preparedness and disaster response activities.

NATIONAL GUIDELINES ON TEMPORARY SHELTERS FOR DISASTER - AFFECTED FAMILIES

1. **Emergency Shelters** – Short-term Temporary Shelters are made with an objective of immediate protection of life from the elements like sun, wind, rain or snow and to ensure a necessary degree of privacy.
   - The process of emergency shelters starts spontaneously as a self-protection measure by the affected households usually done on their own or with support from within the community and their own social networks.

- The Government normally sets up relief camps during such emergency situations using existing community and public buildings and infrastructure and may also undertake distribution of cash or shelter materials like plastic sheeting, tarpaulins, etc. to support immediate sheltering.

2. Intermediate Shelters – Mid-term Temporary Shelters

- Once immediate exigencies of the hazard event are over, basic conditions of safety are somewhat restored and families, to an extent, have regained some control of their disturbed lives, emergency makeshift shelters are not found to be adequate.
- The affected community needs to move to durable intermediate shelters where a reasonable duration of time can be spent before permanent houses can be constructed.
- This indicates need of shelters which though not permanent but have greater extent of stability, robustness and comfort.
- Permanent housing reconstruction often takes 2-3 years so as to effectively address aspects of eligibility, habitat planning, land rights, resources and technical norms.
- While housing reconstruction policy and programme are being implemented, intermediate shelters play a significant role for affected people by offering space to reorganise their lives and revive livelihoods.

GUIDING PRINCIPLES FOR TEMPORARY SHELTERS

Following principles are the foundation for these guidelines on 'temporary shelters – emergency and intermediate':

1. Affected people are entitled to **non-discriminatory, equitable, inclusive and respectful access to support** from the state and other public agencies for housing including temporary shelters. An entitlement perspective of recovery support automatically implies accountability and transparency by all the stakeholders including homeowners, communities, other agencies including NGOs and donors, and the Government.

2. Affected people should **not be treated as hapless passive recipients of relief** but as resourceful agency. Housing, particularly, is a people-led process. But after a disaster when people are in shock, they are generally seen as victims and control over the process of shelter construction is taken away by external agencies in name of quick delivery.

- Temporary shelters should be disaster resistant and not cause any further injury or loss of life.
- Temporary shelters should be durable at least until permanent house is reconstructed.
- Continuously Evolving Shelter Needs Shelter reconstruction and recovery needs to evolve continuously, beginning with emergency makeshift shelters to intermediate shelters in early recovery phase and finally permanent housing in rehabilitation and reconstruction phase.

❖ EVACUATION AND LOGISTICS MANAGEMENT

Search and rescue, often known by the acronym SAR, is the process of identifying the location of disaster victims who may be trapped or isolated, and bringing them to safety and providing them with medical attention after a disaster strikes.
Search and rescue generally involves use of-

- Local people who are well versed with the local terrain
- SAR teams
- Sniffer dogs that are specially trained to smell out human beings trapped under the rubble.
- Heavy machines such as cranes and earthmovers are used to remove heavy rubble.
- Special equipment to delicately remove fallen structural elements and reach out with visual or sound equipment for locating survivors.
- In case of floods and cyclones, boats and helicopters are used.

Evacuation

- Evacuation implies removing all people from a threatened area to a safer place, before, during or after an emergency.
- It has been observed that in most disaster events, like earthquakes, cyclones and fires, a large percentage of total deaths occur due to wrong evacuation practices or stampede.
- It is necessary to evacuate using short and safe exits.

Evacuation in Slow and Rapid Onset Disasters

- Mass evacuations are carried out to move people out of impact areas in case of cyclones or floods, once the warnings have been received.
- People from expected areas of impact are moved to cyclone shelters or schools or other public buildings in nearby places that are designated, emergency shelters.
- Public vehicles are often organised to make such evacuation possible.
- The general public is warned of the coming disaster, and advised to evacuate themselves or take the help of the government or NGOs working in the area to move out.
- Evacuation is more difficult in very rapid onset disasters such as earthquakes, fires or accidents.

- Mass evacuation is not possible in such cases since there is very little or no warning time available.
- In such cases people caught in the event can just follow preplanned evacuation systems and use exit signs, exit routes, meeting points etc.
- Preplanning for evacuation is most critical for such situations.

Evacuation Planning

- An Evacuation Plan is a plan that shows the shortest and safest exit routes and the location of first aid, firefighting equipment and SAR equipment in a building or area.
- The evacuation plan should be prepared in non-disaster times, and should be kept updated.
- It should also be used in mock drills.
- To check the level of preparedness provided for in evacuation planning,

Evacuation Checklist

- Does any person or organisation have the authority to evacuate people?
- Are there designated locations to which evacuees should travel?
- How many people may need to be evacuated?
- What circumstances should they be evacuated?
- Who will tell people, that it will be safe to return?
- Who will trigger this?
- Are staging areas and pick -up points identified for evacuation?
- Are evacuees to be provided with information or where they are going and how they will be cared for?
- Is there security for evacuated areas?
- How are prisoners to be evacuated?
- How are the cultural and religious requirements of evacuees to be catered for?
- Who is responsible for traffic control during evacuation?
- How are evacuees to be registered?

Importance of Exit Signs

- Exit signs help in getting out of a building during an emergency. As we know, during emergencies people panic and sometimes forget the exit routes.
- During such times, exit signs help people get oriented and exit the danger areas.

Planning for Evacuation -An order to evacuate could come at any moment. By planning ahead, individuals can evacuate quickly and safely without sacrificing life, limb and property. The goal should be to spend as little time as possible following an evacuation order.

Evacuation Activities

- Lock door and windows and turn off utilities like water taps, cooking gas and electricity.
- Shut off systems that draw outside air, such as fireplaces and air conditioners.

- If you can provide transportation for a neighbor who has none, do so. Try to help the aged, disabled and other people around you who may need special attention, such as women and children.
- In case of fire or earthquake, evacuate immediately.

In case of cyclone or any other evacuation where there is a little time, carry essential items, such as:

- Medical supplies (prescriptions, first aid)
- Money (cash, credit cards, important documents)
- Personal hygiene items (washing, shaving, dental, eye-care, sanitary)
- Clothing, bedding
- Baby needs (food, diapers, favorite toys)
- Portable radio and batteries
- Miscellaneous useful items (matches, flashlights, plastic bags)
- Keep your radio tuned to a local station for emergency news updates.

LOGISTICS AND METHODS

Search and Rescue (SAR) Kit

SAR kits should ideally be kept in central locations in areas of vulnerable buildings. Local trained personnel can make use of these kits should a disaster strike the area.
A typical SAR kit will comprise the following items:

- Evacuation map of the building or area
- Hammer
- Screw driver (6" flat)
- Axe
- 24" Crow bar
- Spade
- Pickaxe
- 50-foot rope
- Torch
- Spare battery cells
- Hard shoes or Gum Boots
- Helmet
- Hand gloves
- Dust Mask

Simple Rescue Methods

Rescue can be carried out ideally by using rescue equipment but also by ordinary methods when equipment is not available.
For rescuing an affected individual, there are two types of methods: Single Person Methods and Two Person Methods.

A) **Single Person Methods**

 Firemen's Lift

This method is used when the affected person is unconscious and only one rescuer is available for carrying out rescue work.

In this method, the rescuer first makes the affected person lay on his or her abdomen. Then he uses both his hands to lift the affected person by his armpits.

 Human Crutch

This method is used when affected person has an injury in one of his/her leg. In this method, the rescuer first ties the injured leg of the affected person with his opposite leg with a handkerchief. The rescuer holds the affected person's waist with his hand and then they both can walk slowly with the rescuer supporting the affected person's injured leg with his own leg.

 Pick a back

This method is used when the affected person has an injury in his or her leg and is not able to walk long distances, but can support himself or herself with his or her hand. In this method, the rescuer first gets down on one knee and allows the affected person to saddle on his back.

 Staircase drag

This method is used when one has to rescue an unconscious person from a floor higher than the ground floor. In this method, the affected person is laid down on his back and his hands and feet are tied with a handkerchief. The rescuer holds the casualty's armpits and slowly drags him or her down the stairs head, first.

 Firemen's Crawl

This method is used when the affected person is trapped inside a smoke filled area and is unconscious. The rescuer first ties the hands of the casualty and then goes astride the casualty. The rescuer inserts his head in the loop made by the casualty's hands. Then by pushing his hand and foot against the ground, he can drag the casualty to a safer place.

 Tow Drag

The affected person may or may not be unconscious. In this rescue method, the rescuer inserts his feet into the casualty's armpits and then pulls the casualty out of the confinement area.

After taking the casualty out, the rescuer can lift the casualty with any appropriate method.

B) **Two Person Methods**

 Fore and Aft

This method is used when the affected person is having an abdominal injury. In this method, the affected person is laid down flat on his/her back. One of the rescuers holds the casualty from the armpits while the second rescuer holds the legs. Then they both lift the casualty and in this way they can shift the casualty to a safer place.

 Two Hand Seat

This method is used when the affected person is injured in one leg. For carrying out this method two rescuers face each other on either side of the affected person. They both bend and place their inside arms under the casualty's back just below the shoulders, raise him and put their outside arms under his thighs, holding each other's hands with a hook grip. The affected person can place his/her hands around rescuers' necks.

 Three Hand Seat Method

This method is used when the rescuers need one hand free to support the affected person's injured leg. In this method, if the affected person's left leg is injured, the rescuer on the right grasps his own left wrist with his right hand & the other rescuer's left wrist with his left hand.

The second rescuer will hold the right wrist of first rescuer keeping his left hand free to support the casualty's injured leg or any other medical equipment.

 Four Hand Seat Method

This method is used for an affected person who is heavy and who can support her/ his self with his/ her hand. In this case, each of the two rescuers grasps his left wrist with his right hand, grasping the other rescuer's right wrist with his left hand.

 Carry Chair

This method is useful to lift a handicapped or a very old person. The person to be lifted is placed on a chair, and then, the chair can be carried to a safer area.

 Knots and Lines

A rope is an important part of SAR operations. It can act as a guideline during searching; it can be used to lift equipment during rescue work or while carrying out fire fighting, and it can be used for rescuing people.

❖ DISASTER SITE MANAGEMENT

Disaster site management is the management of casualties at the site of disaster. Effective disaster site management will lessen deaths, disabilities, and diseases among the affected.

- The first life saving procedure is "rescue" of victims, without aggravating the existing damage to their health and safety.
- This is to be followed by first aid and definitive care.
- Disaster Medicine A: Airway Maintenance
  B: Breathing
  C: Circulation
- This is the ABC of providing first aid to any casualty.

Disaster site management requires consideration of:

- ➢ Command and Control
- ➢ Communication
- ➢ Coordination
- ➢ Continuity of medical care

Management of disaster site is different in each disaster due to:

- Population density of the area
- Extent of urbanisation
- Language and cultural differences
- Shortage of resources
- Greater risk to life and property
- Media activism demanding immediate answers

Management problems at disaster site

- Lack of reliable and accurate information
- Inadequate communication
- Too many people reporting to one supervisor
- Too many supervisors for one given activity
- Unclear line of authority
- Coordination between various agencies is not proper.
- Difference in response structure of various government agencies, for example, civic authorities, police, health, etc.

Standardised disaster site management system

An efficient and effective system which is applicable in any disaster situation. Such a system should be:

- Simple
- Flexible
- Viable
- Cost effective
- Multi-stakeholder based.

It should aim to provide:

- A high degree of co-ordination between various working groups/agencies
- Improved communications
- Resources optimization
- Reduced or nil duplication of efforts

Nature of Disaster site management

Disaster site management is medico – administrative in nature

Administrative activities include

a) Law enforcement

b) Site surveillance and supervision by police

c) Organisation of the site: water, food, health facilities marking, toilets, neutralisation of dangerous areas, access and evacuation, marking of health facilities, such as, hospitals, etc.

d) Transportation including ambulance services.

The medical and related activities are:

a) Activation of medical facilities locally available

b) Provision of first aid and medical care

c) Evacuation of casualties or patients to health facilities.

TRIAGE

The term triage originates from the French verb ‘trier’, which means to sort, select, or classify.

In disaster medicine, triage is an evaluation or an assessment process of the medical condition of victims and their categorisation depending on the severity of sustained injuries

These are two major types of triage:

1. **Site Triage** — The non-medical triage and is done by the rescue team or the first aid providers at the site. It is also called pre-hospital triage.

2. Hospital Triage — Medical triage done by trained physicians and surgeons in the receiving hospital.

Triage must distinguish the casualties by different colour tagging, according to the gravity of their injury, and need for urgent medical care or priority for transportation.

The Airport Colour Coded Triage Tagging System is accepted world-wide and is used internationally.

- **RED**-First priority, critical and unstable, urgent care is required.
- **YELLOW**-second priority, serious but stable vital functions, no immediate risk but can’t move.
- **GREEN**- Light injuries but able to walk.
- **BLACK**-Dead

❖ MEDICAL TRAUMA AND STRESS MANAGEMENT

Trauma is a deeply distressing or disturbing experience and an emotional response to a terrible event liked natural hazards, disasters etc.

Trauma is damage to the mind that occurs as a result of a distressing event. Trauma is often the result of an overwhelming amount of stress that exceeds one's ability to cope, or integrate the emotions involved with that experience.

Trauma may result from a single distressing experience or recurring events of being overwhelmed that can be precipitated in weeks, years, or even decades as the person struggles to

cope with the immediate circumstances, eventually leading to serious, long-term negative consequences. Because trauma differs between individuals, according to their subjective experiences, people will react to similar traumatic events differently.

In other words, not all people who experience a potentially traumatic event will actually become psychologically traumatized. However, it is possible for some people to develop post-traumatic stress disorder (PTSD) after being exposed to a major traumatic event. This discrepancy in risk rate can be attributed to protective factors some individuals may have that enable them to cope with trauma; they are related to temperamental and environmental factors from among others. Some examples are resilience characteristics, and active seeking of help.

Trauma caused due to hazards or disasters:

There are various types of common traumatic events, all known to lead to Post Traumatic Stress Disorder (PTSD). One type of trauma results from natural disasters such as earthquakes, tornados or hurricanes, forest fires, floods, volcanic eruptions, landslides, or tsunamis. These types of experiences are particularly insidious because they tend to traumatize large populations of people at once, and can result in epidemics of Survivor Guilt and other PTSD symptoms.

- Like many causes of trauma, natural disasters can be sudden and overwhelming.
- The most immediate and typical reaction to a calamity is shock, which at first manifests as numbness or denial. Quickly—or eventually—shock can give way to an overemotional state that often includes high levels of anxiety, guilt or depression.
- People might have lost their loved ones or their homes. As a result, they may feel helpless; they may have to live in camps or shelters without support from relatives or friends for extended time periods. However, living with other survivors can also be a time to reconnect, talk about the event with others, and help to reframe the event. Being able to help another survivor can reduce helplessness, and may start the healing process.
- Natural disasters in particular can bring victims a feeling of being betrayed by "their god," which can result in a loss of faith. Making peace with "the divine" might be one step toward healing and gaining faith (which can be crucial to health) back.

Common symptoms of medical trauma caused due to hazards or disasters

According to the American Psychological Association, the following are the common symptoms of trauma:

1. Feelings become intense and sometimes are unpredictable. Irritability, mood swings, anxiety, and depression are coming manifestations of this.

2. Flashbacks: repeated and vivid memories of the event that lead to physical reactions such as rapid heartbeat or sweating

3. Confusion or difficulty in making decisions

4. Problems in sleeping and /or eating issues

5. Fear that the emotional event will be repeated

6. A change in interpersonal relationships skills, such as an increase in conflict or a more withdrawn and avoidant personality

7. Physical symptom-such as headaches, nausea, and chest pain.

It's hard to predict when PTSD will set in with a survivor of a traumatic natural disaster. Some victims seem at first perfectly (or even abnormally) fine, only to be beset with symptoms later on.

Steps to be followed for the Management of hazard and disaster related Trauma

Population in general and special populations in particular is vulnerable to mental health problems in the aftermath of a hazard or disaster.

- Efficient delivery of mental health services
- The integrated use of psychosocial services and
- Mental health facilities and the active intervention of trained community health care workers can offer effective management of such psychosocial problems
- Women, children, adolescents, the poor, the elderly, and individuals with preexisting health problems have been identified as special populations who often suffer psychological morbidity as a result of a catastrophic disaster. Understanding the cultural, ethnic, and socioeconomic factors in a post-disaster situation is crucial to helping special populations overcome debilitating mental illness and declining quality of life.
- Planning the delivery of mental health services is critical and includes hazard mapping to identify vulnerable geographic and social areas, screening instruments to identify at-risk populations, and education of community leaders and health care workers
- Essential community resources, such as schools, hospitals, places of worship, shelters, community halls, and local service groups, that are likely to be helpful in responding to a disaster should be well known.
- A community vulnerability inventory should be included to pinpoint local concentrations of at-risk groups, which can then be used to direct services and resources to those with the greatest needs.
- Capacity analysis identifies those individuals and groups that are able to be mobilized in the event of a disaster, such as primary health care workers, community and social workers, nongovernmental organizations, and those with specific training in responding to disasters.
- An integrated approach using psychosocial and institutionalized interventions can provide better outcomes than either approach alone. A community-based approach with trained grassroots health care workers can provide effective psychosocial support and rehabilitation services.

❖ STRESS MANAGEMENT IN DISASTER

Stress is an expected hazard of disaster behavioral health response activities based on the fact that a disaster is a traumatic event and staff is exposed to the survivors' experiences in an in-depth and intimate way.

Factors determine the stressfulness of a disaster

Features of the disaster:

• Familiarity with the event,

• Suddenness of its onset,

• Intensity of its impact,

• Course and duration of the event,

• Degree to which it could be controlled.

Community or societal factors:

• The pre-existing level of resources,

• The community's level of preparedness,

• The community's past experiences with such an event,

• Extent and nature of the damage done,

• Consequent social and/or political unrest,

• Availability of resources to rebuild.

Characteristics of the individual involved:

• Previous experiences with similar events,

• Potential and actual losses,

• Physical or psychological closeness with the event,

• Level of background stress in one's life,

• Effectiveness of one's coping mechanisms,

• Nature and extent of available social support.

MANAGING STRESS IN A DISASTER

Stress and anxiety are a given in the aftermath of a natural disaster -- particularly for those living in shelters; those still lacking power; those attempting to return to work with no transit system; or those who must deal with insurance companies -- or worse.

Short-term emotional and behavioral reactions are both common and normal following a natural disaster. The following are the ways to manage stress-

1. Keep in touch-Connection and communication is both critical. People experiencing strong emotional reactions may sometimes withdraw and pull inside themselves. This gets in the way of managing and dealing with the stress of traumatic incidents.

- Do not withdraw from important relationships. Keep in touch with the people one is worried about, so that you know what is happening instead of continuing to worry.
- If necessary, find ways of connecting that require less energy. Send a text message. Use social media. There may be ways that work better for you than picking up a phone.
- Connecting on a local level can help ease worries by providing important updates that are relevant to us.

2. Take care of oneself and get back to routines

- As we strive for a return to normalcy, there may be a tendency toward over-work, particularly for those involved in some way in cleanup and recovery efforts.
- It is important to take time to care for oneself. Think about what one is eating. Do your best to sleep enough. Consider whether there are any major decisions that you can put off right now."
- Reestablishing routines and returning to old patterns is important because they can serve as a signal that we are moving past the trauma.
- Returning to normal eating and activity patterns -- and especially sleep patterns -- to the best of one's ability.

3. Process through storytelling

- Storytelling -- orally, in writing, or whatever other form it may take -- can be healing. Make an effort to talk to friends or family about what one has experienced or write down the thoughts and ideas in a journal or diary.
- Communicating their thoughts and feelings helps people understand the reality of what they have experienced. It also opens the door to the possibility of moving forward past the trauma.

4. Honor other ways of coping

- There is no one way of coping. Individuals, even members of the same family who went through the same disaster together, have different ways of expressing themselves about the event.
- Each one has been impacted in a different way and we must accept that others may have their own way of expressing themselves.
- If someone needs a longer period of time before they can talk about what has happened, be OK with that.
- Be willing to listen when they are ready.

5. Limit exposure

Many of us have been glued to our various media screens for updated images and news about the disaster and rescue efforts. Ongoing exposure can make some people even more anxious and worried."

6. Practice calming and relaxation methods

- Finding ways to calm oneself during anxious moments. This can take many forms, including deep breathing or meditation.
- Some people like music or singing. Others prefer praying.
- When we are distressed, we take rapid and shallow breaths.
- Tense your muscles and then relax them. This helps people identify where the tension may lie in their bodies and tightening the muscles may help people relax them more effectively.
- "Remind yourself that you are OK right now, that you are safe. And keep repeating it, if you need to. Self-talk can be very helpful."

7. Lend a hand in any way one can

- Service is a therapeutic activity. Some people find it difficult to accept help. It's important to accept help, but it is equally important to help others.
- Seek support from mental health professionals if stress reactions to the disaster feel overwhelming or continue long-term.

❖ INTEGRATED DEVELOPMENTAL PLANNING FOR DISASTER MANAGEMENT

- Integrated Development Planning (IDP) is a process by which municipalities prepare a five-year strategic plan that is reviewed annually in consultation with communities and stakeholders.
- The IDP is a principal strategic planning mechanism that guides and informs all development planning, budgeting, management and decision-making in a municipality.
- This plan seeks to promote integration by balancing social, economic and ecological (human and environmental) pillars of sustainability without compromising the capacity of the institution to implement its ideals.
- The IDP also aims to coordinate actions across sectors and spheres of government.

Phases in the development of the IDP

1. Analysis phase

The analysis phase involves an assessment of the existing level of development, which includes identification of communities with no access to basic services.

2. Strategy development phase

- When developing strategies, a municipality needs to develop the following:
- The municipality's vision (including internal transformation needs)
- The council's development priorities and objectives
- The council's development strategies

3. Projects identification phase

- In order to realize the strategies identified in the preceding phase, certain projects must be identified.
- These projects can take on a variety of forms, for example, infrastructure development, local economic enhancement projects (e.g., tourism, establishment of new government structures to address needs, projects to enhance service delivery, and training and capacity building programmes).

4. Integration phase

- The integration phase is aimed at ensuring that all the projects identified are integrated into an understandable and holistic whole, taking into account the limited resources available to the municipality.
- The following plans and programmes aim to achieve this integration:
- A spatial development framework
- Disaster management plan
- Integrated financial plan (both capital and operational budget)
- Key Performance Indicators and performance targets
- Other integrated programmes.

5. Approval phase

- Following the planning and integration phases, the municipal council must approve all plans and projects associated with the IDP.
- In doing so, a final political authorisation is given and the council takes ownership of all development that will take place in their municipality for the next five years.
- Disaster management as an activity must be incorporated into each and every phase of the IDP

- Disaster management must, therefore, function as an integrated, multi-sectoral, multi-disciplinary approach towards planning, disaster risk reduction, emergency preparedness and disaster recovery.
- In terms of the IDP, disaster management must be integrated into all development planning that takes place in government. This can be established through a planning process that is parallel with the phases of the IDP.

Disaster Management Integration

Phase I: Analysis

- Compile disaster management information:
- Hazard assessment (which types of hazards are prevalent?)
- Vulnerability assessment
  - Social/Cultural environment
  - Economic environment
  - Political environment
  - Natural/Ecological environment
- Capacity assessment
  - Livelihoods analysis
  - Capacity analysis
  - Resilience analysis
  - Critical facility analysis
- Historical disaster occurrences (which disasters have occurred in the past?)
- Historical loss parameters (magnitude of disasters and their effects)
- Communities-at-risk (who is at risk of hazards?)

Phase 2: Strategy

- Formulate disaster management strategies:
  - Prevention and mitigation strategies
  - Vulnerability reduction strategies
  - Capacity building
  - Contingency plans
  - Emergency preparedness
- Operationalise disaster management in the municipality – identify projects:
  - Setting up structures (as per section 4 above)
  - Community awareness
  - Volunteer structures

Phase 3: Projects

- Design disaster management projects:

- According to the disaster management projects identified (e.g., establishment of the district disaster management centre or livelihoods analysis)
- Includes all activities related to disaster management for ALL other projects (all Project plans MUST be assessed according to the disaster risk they pose (e.g., building a new dam).

Phase 4: Integration

- Compile disaster management plan, including:
- Risk profile of municipality (hazards and vulnerability prevalence)
- Risk reduction strategy
- Disaster response strategy
  - Field operation guides
  - Standard operating procedures
- Emergency preparedness
- Disaster management information sys- tem
  - GIS (link with spatial development framework)
  - Electronic database (link with other sectors)
  - Communications

Phase 5: Approval

- Adoption of the disaster management plan, and submission to various bodies in terms of the Disaster Management Act (Act 57 of 2002).

CONCLUSION

Disaster management, as an activity, needs to be integrated into all aspects of the development planning process. Each sector of government is expected to be responsible by engaging in disaster risk reduction activities. By doing so, a municipality ensures that all hazards, vulnerability and capacity are taken into consideration in the development and execution of the project.

UNIT V
CRISIS MANAGEMENT

What is Crisis Management – Identifying a Crisis – Crisis Stages – Steps in managing crisis: establishing crisis executive management team, crisis management team and crisis communication team – Rescue, relief, rehabilitation and reconstruction – Crisis Management Plan

What is Crisis Management?

- Crisis management is the process by which an organization deals with a disruptive and unexpected event that threatens to harm the organization or its stakeholders.
- It is a situation-based management system that includes clear roles and responsibilities and process related organisational requirements company-wide.
- The study of crisis management originated with large-scale industrial and environmental disasters in the 1980s.
- It is considered to be the most important process in public relations

There are mainly three common elements of crisis

- A threat to the organization
- The element of surprise, and
- A short decision time

Response to crisis

- Crisis prevention
- Crisis assessment
- Crisis handling, and
- Crisis termination

The aim of crisis management is to be well prepared for crisis, ensure a rapid and adequate response to the crisis, maintaining clear lines of reporting and communication in the event of crisis and agreeing rules for crisis termination.

Crisis can just as easily arise from a single devastating event, as it can from a series of unattended critical events. But either way it happens, crisis can present a serious threat to a business's core objectives, reputation – even its viability. What's more, crisis, once underway, doesn't just burn bright, then suddenly extinguish. That's because crisis is by definition multi-layered and multidimensional.

Identifying a crisis: Types of crisis

During the crisis management process, it is important to identify types of crises in that different crises necessitate the use of different crisis management strategies.

1. Natural disaster
2. Technological crisis
3. Confrontation
4. Malevolence
5. Organizational Misdeeds
6. Workplace Violence
7. Rumours
8. Terrorist attacks/man-made disaster

1. **Natural Crisis:** Natural disaster related crises, typically natural disasters, are such environmental phenomena as earthquakes, volcanic eruptions, tornadoes and hurricanes, floods, landslides, tsunamis, storms, and droughts that threaten life, property, and the environment itself.
2. **Technological crisis**: Technological crises are caused by human application of science and technology. Technological accidents inevitably occur when technology becomes complex and coupled and something goes wrong in the system as a whole (Technological breakdowns). Some technological crises occur when human error causes disruptions (Human breakdowns[1]). People tend to assign blame for a technological disaster because technology is subject to human manipulation whereas they do not hold anyone responsible for natural disaster. When an accident creates significant environmental damage, the crisis is categorized as *megadamage*. Samples include software failures, industrial accidents, and oil spills.
3. **Confrontation crisis:** Confrontation crisis occur when discontented individuals and/or groups fight businesses, government, and various interest groups to win acceptance of their demands and expectations. The common type of confrontation crisis is boycotts, and other types are picketing, sit-ins, ultimatums to those in authority, blockade or occupation of buildings, and resisting or disobeying police.
4. **Crisis of Malevolence:** An organization faces a crisis of malevolence when opponents or miscreant individuals use criminal means or other extreme tactics for the purpose of expressing hostility or anger toward, or seeking gain from, a company, country, or economic system, perhaps with the aim of destabilizing or destroying it. Sample crisis

include product tampering, kidnapping, malicious rumors, terrorism, cybercrime and espionage.

5. **Crisis of organizational misdeeds:** Crises occur when management takes actions it knows will harm or place stakeholders at risk for harm without adequate precautions. There are three different types of crises of organizational misdeeds: crises of skewed management values, crises of deception, and crises of management misconduct.

   Crises of skewed management values: Crises of skewed management values are caused when managers favour short-term economic gain and neglect broader social values and stakeholders other than investors. This state of lopsided values is rooted in the classical business creed that focuses on the interests of stockholders and tends to disregard the interests of its other stakeholders such as customers, employees, and the community

   Crisis of deception: Crisis of deception occur when management conceals or misrepresents information about itself and its products in its dealing with consumers and others.

   Crisis of management misconduct: Some crises are caused not only by skewed values and deception but deliberate amorality and illegality.

6. **Workplace violence:** Crises occur when an employee or former employee commits violence against other employees on organizational grounds.
7. **Rumours:** False information about an organization or its products creates crises hurting the organization's reputation. Sample is linking the organization to radical groups or stories that their products are contaminated.
8. **Terrorist attack:** These occur when the crisis was triggered by people, for example global financial crises, transportation accidents, massive destruction.

Crises have the potential to create significant financial, safety, security, or reputational harm, depending on the nature and severity of the event. Decision-makers who believe a crisis can't happen to their organisation fail to understand the sheer variety of **potential crises**. Those include:

1. Economic crises, events or situations like strikes, market crashes, and labour shortages.
2. Informational crises, loss of important information or organisational records, including public and/or confidential records, theft through phishing attacks, social engineering, or the leaking of sensitive data.
3. Physical crises, compromised major equipment, loss of suppliers, or a major disruption at a key operating plant.
4. Human resources crises, the loss of a key executive or team member, vandalism, or workplace violence.
5. Reputational crises, rumours and gossip that can significantly hurt the reputation of the organisation.

6. Psychopathic crises, unthinkable acts such as terrorism, kidnapping, or even tampering with products.
7. Natural disasters, including tornadoes, earthquakes, fire and flash foods, disease outbreaks, etc.

Stages of Crisis

A crisis interrupts everyday operations and can cause financial losses, destruction of property, security breaches, personal injury, loss of life and damage to an organization's reputation. A crisis is also complex and of unknown duration. As the crisis unfolds in real time, circumstances can change radically, as will the requirements, roles and responsibilities of the various people have involved. Notifications will also change — both in terms of the information audiences need to receive and how they need to receive it. Those needs are partly dictated by whichever stage the crisis is currently in.

There are six stages within every crisis:

(1) Warning;
(2) Risk assessment;
(3) Response;
(4) Management;
(5) Resolution and
(6) Recovery

The above states can also be classified as below.

The basic stages of crisis are as follows:

1. Pre-crisis. As the name implies, the focus at this point is on prevention and preparation, in other words, reducing the known risks that can lead to crisis.
2. Response. Now, you're in the thick of it. This stage deals with the actual response to a real, live crisis.
3. Post-crisis. All great crises must come to an end. But that doesn't mean they won't reoccur, especially if companies don't undertake this final, post-crisis stage. During this phase, companies will take the opportunity to look back and reflect. They create a post-mortem to see what went wrong, which helps them think of ways to better prepare for the next crisis. It's also when companies begin fulfilling the commitments they made while the crisis was still raging.

Understanding that beginning, middle, and end-framework to the crisis management lifecycle is just a start though. A crucial start, but a start all the same. That's because the stages of crisis don't break down that neatly. Advanced crisis management techniques rely on a more strategic, cyclical lifecycle approach. I'll lay out one formulation of the crisis management lifecycle here:

- During the first, build up stage; you'll see hints of a potential crisis brewing, often on social media. At this point, you should be looking for certain repeat messages that foreshadow crisis.
- By the impact stage, that earlier trigger has now morphed into a full crisis. You should expect to get the most media scrutiny at this point. But it's not over yet…
- Because during the chronic crisis stage, the media usually shifts the script from what's happening to who's to blame. Meanwhile, a crisis-sieged company is still suffering through the effects of impact, which can be as significant as physical restoration.
- Eventually, you'll get to the resolution stage when the crisis-hit company is up, running, and (hopefully) out of the media glare. But if this stage doesn't include deep analysis and investigation, that company is basically just biding its time, waiting for the next crisis to strike.

Steps in Managing Crisis

This more cyclical mode of crisis management tends to be more strategy- than tactics-oriented

Crisis Management Lifecycle

- **The build-up stage, or the Prodromal Crisis**, when you might see hints or clues of a potential crisis appearing in media outlets. At this stage, you should be looking for the repetition of certain trigger themes, repeated messages describing symptoms or precursors to a crisis.

- **The impact stage, or the Acute Crisis**, when a trigger develops into a full-bore crisis. Often the shortest stage in the crisis management lifecycle, the impact stage tends to result in the most physical, fiscal, emotional, and reputational damage to a company. Companies can usually expect the most media scrutiny during this phase of the crisis management lifecycle.

Source: Gwyneth Veronica James Howell, Queensland University of Technology: Description of the Relationship between the Crisis Life Cycle and Mass Media

- **The Chronic Crisis stage**, the company suffers through any lingering effects of the acute crisis, which can be physical restoration, legal action, or public activism. Media coverage, at this juncture, tends to focus on blame and responsibility.
- **The Resolution stage**, the crisis no longer impairs the organisation's operations or directly impacts the public. The risk at this stage is that the crisis remains latent, with the potential to strike again to even more devastating effect.

Crisis Executive Management Team

A Crisis Management Team is formed to protect an organization against the adverse effects of crisis. Crisis Management team prepares an organization for inevitable threats.

Role of Crisis Management Team

Crisis Management team primarily focuses on:

- Detecting the early signs of crisis.
- Identifying the problem areas
- Sit with the stakeholders face to face and discuss on the identified areas of concern
- Prepare crisis management plan which works best during emergency situations
- Encourage the stakeholders to face problems with courage, determination and smile.
- Motivate them not to lose hope and deliver their level best.
- Help the affected community to come out of tough times and also prepare it for the future.

How does Crisis Management Team function?

- A Team Leader is appointed to take charge of the situation immediately and encourage the stakeholders to work as a single unit.
- The first step is to understand the main areas of concern during emergency situations.
- Crisis Management Team then works on the various problems and shortcomings which led to crisis at the place of disaster. The team members must understand where things went wrong and how current processes can be improved
- It is important to prioritize the issues. Rank the problems as per their effect on the victims as well as the location. Know which problems must be resolved immediately and which all can be attended a little later.
- A single brain cannot take all decisions alone. Crisis Management Team should sit with rest of the stakeholders on a common platform, discuss prevailing issues, take each other's suggestions and reach to plans acceptable to all.
- One of the major roles of the Crisis management team is to stay in touch with external clients as well as media. The team must handle critical situations well.
- Develop alternate plans and strategies for the tough times. Make sure you have accurate information. Double check your information before finalizing the plan.
- Implement the plans immediately for results. Proper feedback must be taken from time to time.
- Crisis Management team helps to take the right step at the right time and help the stakeholders overcome critical situations.

Effective Practices for Crisis Management Planning

The crisis management lifecycle is an important framework for understanding and preparing for crises. But organisations will need a proactive crisis management plan to address all stages

within the lifecycle. Effective crisis management preparation should involve all of the following best practices:

1. **Pre-crisis: creating your crisis management plan**

- Identify a crisis management team to create and enact a crisis management plan, as well as to deal with the problems not covered by it, when a crisis does arise.
- Create the crisis management plan to help reduce chaos when a crisis strikes. Your plan should include information regarding potential crises, policies for prevention, as well as strategies and tactics on how to deal with each crisis. Address who will be empowered to enact the crisis management plan, who will be affected by the crisis, how to communicate crisis developments, and how to centralise operations.

  How to make a crisis management plan?

  - Identify the problem areas and various factors which led to crisis at the workplace.
  - Discuss issues and areas of concern amongst yourselves on an open forum for everyone to share their opinion.
  - Make sure you have accurate information. Don't depend on guess works and assumptions. Double check your information before submitting the final plan.
  - Crisis Management Plan should not only focus on ways to overcome crisis but also on making the processes fool proof to avoid emergency situations in future.

- Hold practice simulations and exercises to train staff and expose weaknesses in your plan.
- As part of your crisis management planning effort, identify crisis management software to help you better manage the entire crisis management lifecycle, keep internal stakeholders informed and on message, and monitor media response.
- Create your crisis communication plan, which should include a system to reach the relevant stakeholders, identified crisis communication team members, roles, and responsibilities, a list of key media contacts, company background information, and a set of pre-approved, pre-fabricated messages for use during any variety of crises.

2. **During the crisis: putting your crisis management plan into practice**

- Communicate information about the crisis to the public, media, and employees as quickly, forthrightly, and often as possible.
- Focus crisis communications on how people can protect themselves from the effects of the crisis, as well as what you are doing to prevent the crisis from happening again.
- Ensure strong leadership is visible throughout.

  Crisis Communication

  - Crisis communication can be defined broadly as **the collection, processing, and dissemination of information required to address a crisis situation**. It is the "dialog between the organization and its public(s) prior to, during, and after the negative occurrence.

- Crisis communication is the circulation of information by a company to address any crisis that impacts customers and the brand and its reputation.

Some of the **most common types of crises** include:

- **Financial** - Financial loss such as announcing a bankruptcy or store closures.
- **Personnel** - Changes to staff that may affect operations or reputation such as employee furloughs, layoffs, or controversial behavior.
- **Organizational** - An apology for misconduct or wrongdoing as a result of organizational practices.
- **Technological** - Technological failure that results in outages causing reduced functionality or functionality loss.
- **Natural** - Natural crisis that necessitates an announcement or change of procedure. For example, defining safety precautions amid a health crisis.

For example, the COVID-19 pandemic is considered a natural crisis that requires businesses globally to halt operations. Without a crisis communication plan in place, a company may find themselves struggling with how to communicate with their employees and their customers, leading to frustrations all around.

The effort taken by the Crisis management team to communicate with the public and stakeholders when an unexpected event occurs that could have a negative impact. This can also refer to the efforts to inform the stakeholders or the public of a potential hazard which could have a catastrophic impact.

There are 3 essential steps that the crisis management team can take to prepare for and withstand a communications crisis:

1) Define your philosophy;
2) Assess your vulnerabilities;
3) Develop a protocol

3. Post-crisis: debriefing and evaluating for next time

- Evaluate how your crisis management plan performed during the crisis, correcting errors as you update and revise your plan.
- Communicate key lessons learned (during the crisis) with the public and your internal stakeholders.
- Treat the crisis as an opportunity for further company growth.

Finally, if crises had the regularity of a calendar event, businesses wouldn't have to plan for them. That's not the world we live in.

Even if there are warning signs, crises are by nature wildly unpredictable, taking many different forms. But just because organisations can't always predict when and how crises will hit, it doesn't mean they can't plan to manage the effects. That's the role of crisis management.

A crucial business function, crisis management minimises the time, money, and effort it takes to recover from a crisis. Undertaken successfully, crisis management can even allow the resilient organisation to emerge from the disaster stronger than ever.

CRISIS COMMUNICATION TEAM

The Crisis Communication Planning (CCP) Team will divide up and assign with the responsibility for the development of different aspects of the Crisis Communication Plan. Subsequently, the team decides who will be on point for management roles in the event of certain kinds of crises.

Expectation and Suitability of Roles

During the start of the Crisis Communication planning process, the Crisis Communication Planning Team needs to:

- Establish this expectation of the newly appointed Crisis Communication Team.
- Define the key roles.
- Identify who is suitable for the tasks.

Training for a second-nature response is the goal, so it makes good sense to the member of the Crisis Team responsible for communications to handle the Communications Planning Team, the lawyer of the legal team and so on.

Crisis Communication Teams

1. Public Relations/ Corporate Communication

- Ensure accurate and timely public response is being made and develop press releases and interface with the media proficiently.
- Coordinate media response with the site’s public relations member.
- Incorporate legal advice in communications.
- Prepare updates for executives and arrange executive travel to the incident scene.
- Advise the incident scene in media relations

2. Communication Liaison

A communication liaison handles the interaction with people affected by an emergency. For example, in a hostage situation, the liaison is family members' direct point of contact.

He or she will privately relay information to relatives about the situation. This person often does not communicate with the media. The communication liaison can be anyone in the organisation who has good communication skills, can show empathy and is not easily frazzled by stressful or emotional situations.

3.Legal

An organisation faced with a crisis, such as a massive recall, needs to protect itself legally. Legal experts on Crisis Communication Teams focus on the situation at hand instead of everyday legal concerns. The detailed roles are to:

- Provide legal counsel and advice to the Crisis Communication Team
- Coordinate with the Legal Coordinator at the incident scene and arranges for external legal support as needed.
- Participate in communication preparation and provide advice on securing the incident scene for subsequent investigation.

For instance, in a product recall situation, the Legal Team researches laws and regulations to ensure that the organisation is adhering to the proper rules. The Legal Team's efforts extend past the original crisis to include long-term monitoring of legal pitfalls, such as lawsuits against the organisation. Usually, the Legal Team Leader is supported by some lawyers reporting to the head of in-charge.

4. Emergency Services Liaison

The emergency services liaison works closely with police, fire, and medical responders during a crisis. For example, during a hostage situation, the emergency services liaison will provide responders with maps of the building and security footage. The liaison is usually the head of security or a high ranking guard in the organisation.