MODULE 1

SYSTEM OF EARTH

SYLLABUS

Lithosphere- composition, rocks, soils;

Atmosphere-layers, ozone layer, greenhouse effect,

Weather, cyclones, atmospheric circulations,

Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere.

Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience.

Disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs.

INTRODUCTION ABOUT VARIOUS SYSTEMS OF EARTH

Everything under the earth is placed under 4 subsystems:

1) Lithosphere:

The layer which contains rocks, soils and minerals.

It is the outer layer of the earth

Includes crust and mantle

2) Atmosphere:

The layer which contains all the gases present on the earth.

It contributes the climatic conditions.

Based on temperature subdivided into

:troposphere,stratosphere,mesosphere,thermosphere,exosphere

3) Hydrosphere:

The layer which contains all the water sources present on the earth.

Contains surface and subsurface water sources

Contributes climatic conditions.

4) Biosphere:

The layer which contains all the living components present on the earth.

Commonly known as ecosystem

ZONES OF EARTH

Earth has 4 concentric zones:

1) Inner core

Innermost zone

Contains solid mass of iron

Thickness—1216 km

2) Outer core:

Core which covers the inner core.

Contains molten liquid of iron.

Thickness—2270 km.

3) Mantle:

Layer which covers the outer core.

Contains various minerals.

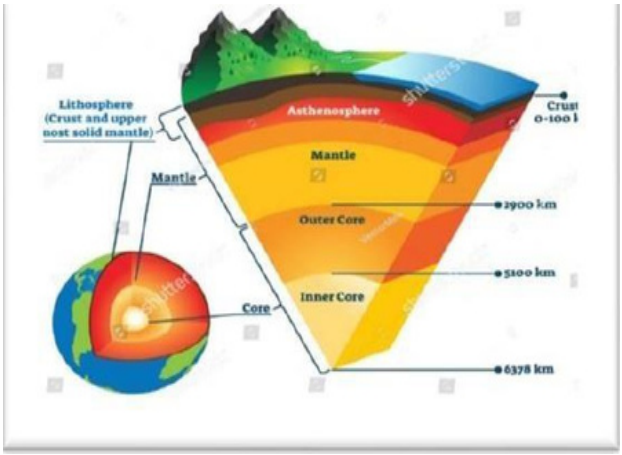
Thickness—2900 km

4) Crust:

Outermost zone

Exterior of the earth

Thickness—5 km.



- ***LITHOSPHERE***
- Outer layer of the earth, which contains soil,rocks and minerals.
- It includes crust and mantle part of the earth
- Lithosphere interacts with atmosphere, hydrosphere and biosphere.so they are known as pedosphere.

TYPES OF LITHOSPHERE

1) Oceanic lithosphere.

5-8 km thickness

Composed of basalt

2) Continental lithosphere

30-40 km thickness

COMPOSITION OF LITHOSPHERE

Lithosphere is composed of minerals, rocks and soil.

- ***MINERALS:***

Minerals are naturally occurring inorganic crystalline solids that have definite chemical composition.

Minerals are composed of group of elements.

Certain minerals are composed of single element. Eg:graphite diamond,made of carbon

List of minerals found on earth's crust are:(CODE:OXY-SIAL-ICASO-POTAMAG)

S.No.	*Elements*	*Per cent*
1	Oxygen	46.6
2	Silicon	27.7
3	Aluminum	8.1
4	Iron	5.0
5	Calcium	3.6
6	Sodium	2.8
7	Potassium	2.6
8	Magnesium	2.1

- ***ROCKS***

- Rocks are naturally occurring hard and consolidated inorganic materials, composed of one or a large number of minerals.

Certain other materials, like coal and limestone are developed from plant and animal remains.

there are mainly 3 types of rocks:

1) Igneous rocks 2) sedimentary rocks 3) metamorphic rocks

1) IGNEOUS ROCKS

These rocks are formed by the solidification of magma or lava.

They are composed of primary minerals, which are predominantly silicates.

They sometimes overlap with sedimentary and metamorphic rocks.

E.g.: Granite ,Basalt (CODE:GRABAS)

2) SEDIMENTARY ROCKS

These rocks are formed by the solidification of sediment deposits.

They are composed of secondary minerals.

In the oceanic beds, sedimentary rocks are formed by the precipitation and settlement of salts.

In the landscape, sedimentary rocks are formed by the solidification of decomposed matter.

E.g.: sandstone,shale,limestone (CODE:SASHAL)

3) METAMORPHIC ROCKS

Rocks which are formed from the metamorphic changes occurred in pre-existing igneous and sedimentary rocks.

Metamorphic changes are the changes in temperature and pressure.

E.g.: marble, Quartzite. (CODE:MARQUAR)

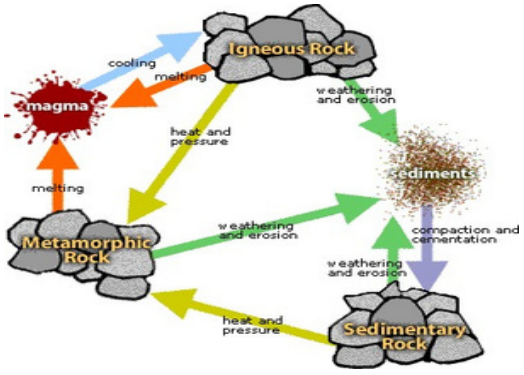
 ROCK CYCLE

It is the cyclical changes occur in igneous, sedimentary and metamorphic rocks.

Due to weathering action, igneous rocks are disintegrated to sediments and they are consolidated to form sedimentary rocks.

Due to excess heat and pressure the sedimentary rocks again converted into metamorphic rocks.

Due to the action of magma and lava in metamorphic rocks, it again change to sedimentary rocks.



SOIL

Soil is the thin layer of material covering the earth's surface and is formed from the weathering of rocks.

Weathering is the process of disintegration of rocks, to form soil.

Soil mainly consist of mineral particles, organic materials, air, water and living organisms.

Most plants get their nutrients from the soil and they are the main source of food for humans, animals and birds. Therefore, most living things on land depend on soil for their existence.

FUNCTIONS OF SOIL:

Provides ***mechanical support*** to the plant.

It has the property of porosity, i.e. ability to hold water.so that, soil is considered as the reservoir of water.

Provides micro and macro nutrients and p.H for the growth of microorganisms, plants and animals.

Prevents excessive leaching of nutrients.

Contains bacteria that fix nitrogen and other elements; fungi, protozoa and other micro-organisms. These organisms' aids in the decomposition of organic matter.

CLASSIFICATION OF SOIL

Geologically soil is classified into 2 types:

1) Residual soil:

Soil which resides near the parent rock

Very less or no transportation.

More fertile.

2) Transported soil

Soil which transported away from the parent rock.

During transportation, the soil mixed up and it is heterogeneous in nature.

Classified into 6 types, based on the agents of transportation.

1. Colluvial soil – Transported by gravity.
2. Alluvial Soil –transported by water
3. Glacial soil- transported by ice.
4. Aeolian Soil-transported by wind
5. Volcanic Soil-transported by magma, lava

- 6. Lacustrine soil- transported by lakes.

- ***ATMOSPHERE (UNIV QSTN-8 MARKS)***

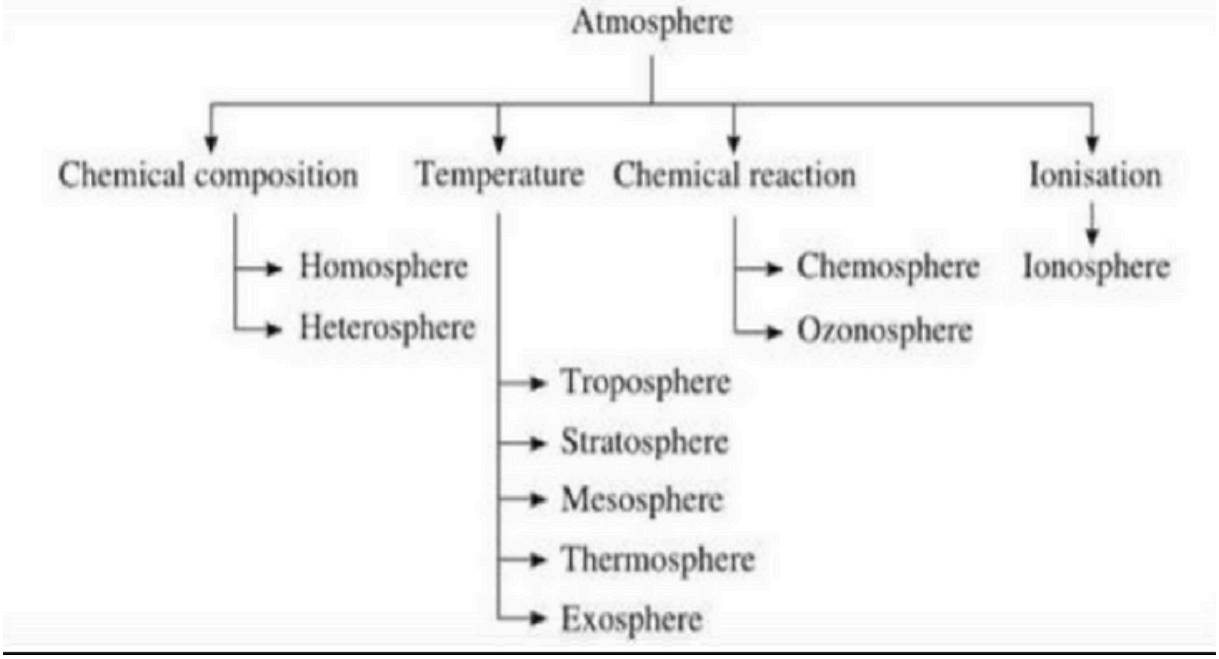
The layer which contains all the gases present on the earth.

It is the layer of gases, which envelops the planet and held in place by the action of gravity by the planetary body.

Chemical composition of atmosphere: the atmosphere contains mixture of gases composed of nitrogen, oxygen, carbon dioxide, water vapour and other non-reactive gases such as neon, Xenon etc…

- ***LAYERS OF ATMOSPHERE***

The atmosphere is divided in to a number of concentric layers that extend from sea level to outer space. Atmosphere is classified in to various types as shown below:



- ***Based on chemical composition atmosphere is divided in to two:***

1. HOMOSPHERE

This layer is homogeneous in composition.

Homosphere Extends to a distance of about 88Km from the surface of earth.

2. HETEROSPHERE

The atmosphere lies above homosphere is heterosphere.

The air composition is not uniform.

- ***Based on temperature atmosphere is divided in to five:***

1.TROPOSPHERE

Bottom dense part, closest to the ground

Distance—20 km from the ground level.

Clouds, storms and fog are found here.

Temperature decreases to 6.4 degree Celsius/km,with height.

This decrease in temperature with height is called lapse rate.

Border of troposphere---tropopause.

Temperature stops decreasing at tropopause.

2. STRATOSPHERE

Clear layer above troposphere ,height of about 50 km from earth's surface.

water vapors are absent .

Ozone layer is found in this layer .

Ozone absorbs and prevents the harmful ultraviolet radiations

Border point- stratopause

Temperature neither increases nor decreases with height.

3. MESOSPHERE

Layer above stratosphere—85km height from earth's surface.

starts from the edge of Stratopause

Temperature at stratopause is10 c and falls to -75°C at mesosphere.

Plays a crucial role in radio communication –ionization occur here.

sunlight passing through this layer converts individual molecules to charged ions---D layer

D-layer reflects radio waves transmitted from earth

Border point—mesopause

4. THERMOSPHERE

Layer above mesosphere.

690km height from earth's surface.

temperature increases to about 2000°C

Ions are abundant in thermosphere

Most of the approaching meteoroids burn up before reaching earth.

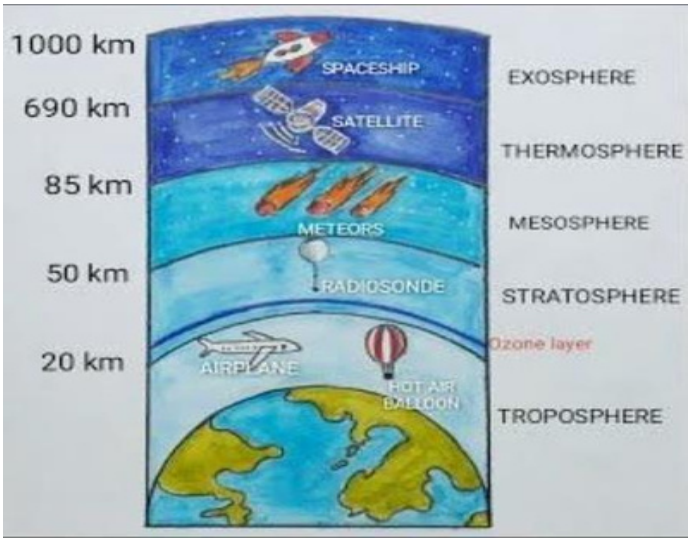
5. EXOSPHERE.

Layer above thermosphere.

Consists of only hydrogen and helium atoms

1000 km from earth's atmosphere.

very high temperature due to solar radiation



 Based on chemical reaction atmosphere is divided in to two:

1.CHEMOSPHERE

Region of the upper atmosphere.

distance- 40 to 80 km

Chemical processes driven by sunlight occurs here.

The chemosphere overlaps the stratosphere and the mesosphere .

2. OZONOSPHERE

Ozone layer is present

Intense chemical reaction takes place with the help of oxygen.

Ozone absorbs and prevents the harmful ultraviolet radiations

 OZONE LAYER (UNIV 3 MARKS)

 Ozone is a protective layer found in ozonosphere, which is in the stratosphere layer of atmosphere.

Ozone absorbs and prevents the harmful ultraviolet radiations from reaching earth.

Maximum concentration of ozone occurs at 22 km from the ground level.

It has the potential to absorb 97-99% UV radiations from the sun, which can damage life on earth.

If the ozone layer was absent, millions of people would develop skin disease and may have weaken the immune systems.

Formation/Mechanism of ozone layer

Oxygen molecule is photolysed by solar radiation, creating 2 oxygen radicals.

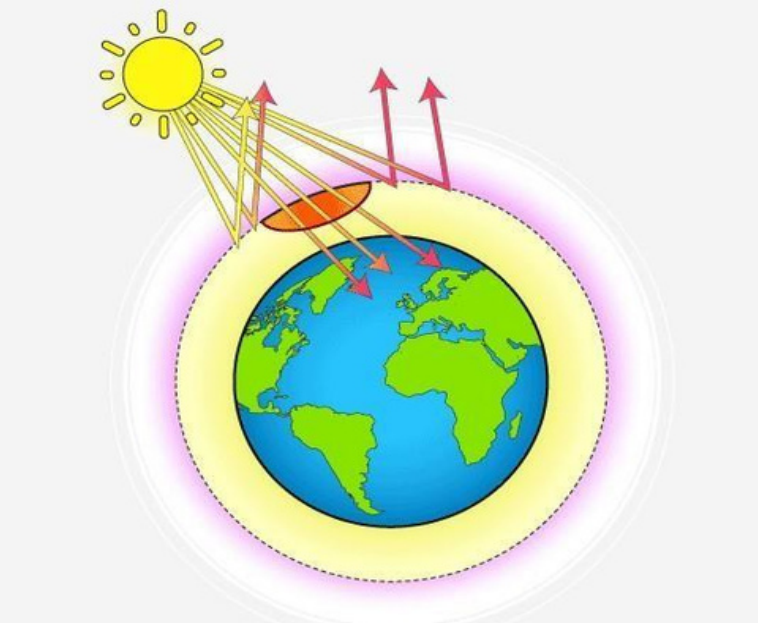
$O2 \xrightarrow{\text{photolysis}} 2O$

Oxygen radicals react with molecular oxygen to produce ozone.

$2O+O \longrightarrow O3$

OZONE LAYER DEPLETION (UNIV QSTN. -8 MARKS)

Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmospherecaused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities."



When CFC come in contact with ozone, chlorine splits ozone into individual molecules.

Here chlorine acts as a catalyst.

Chlorine breakdown the ozone and combine with free oxygen to create 2 oxygen molecule

$Cl+O3 \longrightarrow ClO+O2$

$Cl\ O + O \longrightarrow Cl+O2$

- ***OZONE DEPLETING SUBSTANCES (ODS)***

The substances which are responsible for the depletion of ozone layer is known as ozone depleting substances. (ODS)

E.g.: CFC,BFC,NO

Ozone depleting substances	Sources
Chlorofluorocarbons (CFCs)	Refrigerators, air-conditioners, solvents, dry-cleaning agents, etc.
Halons	Fire-extinguishers
Carbon tetrachloride	Fire extinguishers, solvents
Methyl chloroform	Adhesives, aerosols
Hydrofluorocarbons	fire extinguishers, air-conditioners, solvents

 REASONS FOR OZONE DEPLETION:

1) DEPLETION BY CFC AND BFC:

Emitted by refrigerators and AC

CFCS and BFCS are stable compounds in the atmosphere that have the property of living longer

UV radiation split these as, Chlorine (Cl) and Bromine (Br) radicals.

These radicals act as catalysts, and initiate breaking down of ozone molecules.

Due action, Ozone concentration is decreasing at a drastic rate

2) DEPLETION BY NITRIC OXIDE (NO)

Large quantities of nitrogen are emitted by aircrafts .

One molecule of nitric oxide (NO) combines with ozone .

oxidised to nitrogen dioxide and Oxygen

NO2 combines with another O3 molecule to become NO3 (Nitrate) and O2 .

This series of actions and reactions utilizes and depletes ozone.

3) DEPLETION BY NATURAL CAUSES

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots andstratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

The volcanic eruptions are also responsible for the depletion of the ozone layer.

 PREVENTION OF OZONE LAYER DEPLETION

1) Avoid Using ODS

Reduce the use of ozone depleting substances.

E.g.: avoid using malfunctioning A C and refrigerators, which emits more CFC and BFC

2) Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer.

These should be substituted with natural products to protect the environment

3) Encourage Public transportation

Use of private vehicles will emits more pollutants to the atmosphere, so public transportation should be promoted.

4) Use electric driven vehicles, in place of fuel driven vehicles

Promote the use of EVs in place of vehicles run by petrol /diesel.
Lead contained petrol will emits more pollutants.

5) Use of Nitrous Oxide should be prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer.

People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimized at the individual level as well.

 GREEN HOUSE EFFECT

The greenhouse effect is the process that occurs when gases in Earth's atmosphere trap the Sun's heat.

The gases which traps suns heat is known as greenhouse gases.

Eg:CO2,methane

GREENHOUSE

A house made of glass that can be used to grow plants.

The sun’s radiations warm the plants and the air inside the greenhouse.

The heat trapped inside can’t escape out and warms the greenhouse which is essential for the growth of the plants.

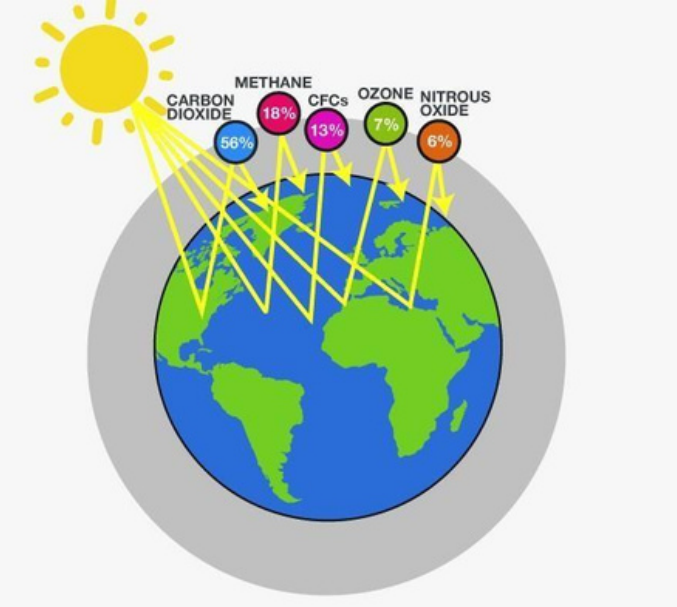
EFFECT OF GREEN HOUSE IN ATMOSPHERE

During the day the sun heats up the earth’s atmosphere.

At night, when the earth cools down the heat is radiated back into the atmosphere. During this process, theheat is absorbed by the greenhouse gases in the earth’s atmosphere.

This is what makes the surface of the earth warmer that makes the survival of living beings on earth possible.

- However, due to the increased levels of greenhouse gases, the temperature of the earth has increased considerably. This has led to global warming



CAUSES OF GREENHOUSE EFFECT

The major causes of the greenhouse effect are:

- ***Burning of Fossil Fuels***

Fossil fuels are an important part of our lives. They are widely used in transportation and to produce electricity. Burning of fossil fuels releases carbon dioxide. With the increase in population, the utilization of fossil fuels has increased. This has led to an increase in the release of greenhouse gases in the atmosphere.

- ***Deforestation***

Plants and trees take in carbon dioxide and release oxygen. Due to the cutting of trees, there is aconsiderable increase in the greenhouse gases which increases the earth's temperature.

- ***Farming***

Nitrous oxide used in fertilizers is one of the contributors to the greenhouse effect in the atmosphere.

- ***Industrial Waste and Landfills***

The industries and factories produce harmful gases which are released in the atmosphere. Landfills also release carbon dioxide and methane that adds to the greenhouse gases

EFFECTS OF GREENHOUSE EFFECT

The main effects of increased greenhouse gases are:

1) Global warming

It is the phenomenon of a gradual increase in the average temperature of the Earth's atmosphere.

The main cause for this environmental issue is the increased volumes of greenhouse gases such as carbon dioxide and methane released by the burning of fossil fuels, emissions from the vehicles, industries and other human activities.

2) Smog and air pollution

Smog is formed by the combination of smoke and fog. It can be caused both by natural means and man- made activities.

In general, smog is generally formed by the accumulation of more greenhouse gases including nitrogen and sulfur oxides.

The major contributors to the formation of smog are the automobile and industrial emissions, agricultural fires, natural forest fires and the reaction of these chemicals among themselves.

3) Acidification of water bodies

Increase in the total amount of greenhouse gases in the air has turned most of the world's water bodies acidic.

The greenhouse gases mix with the rainwater and fall as acid rain.

This leads to the acidification ofwater bodies.

Also, the rainwater carries the contaminants along with it and falls into the river, streams and lakes thereby causing their acidification.

- ***WEATHER***

Weather is the mix of events that happen each day in our atmosphere.

It is the fluctuations occur in the atmosphere.

Weather is different in different parts of the world and changes over minutes, hours, days and weeks.

Most weather happens in the troposphere, the part of Earth's atmosphere that is closest to the ground.

Air Pressure and Weather

The weather events happening in an area are controlled by changes in air pressure.

Air pressure is causedby the weight of the huge numbers of air molecules that make up the atmosphere.

When air pressure is high there skies are clear and blue. The high pressure causes air to flow down and fan out when it gets near the ground, preventing clouds from forming.

When air pressure is low, air flows togetherand then upward where it converges, rising, cooling, and forming clouds.

Predicting weather

Meteorologists develop local or regional weather forecasts including predictions for several days into thefuture.

The best forecasts take into account the weather events that are happening over a broad region.

Knowing where storms are now can help forecasters predict where storms will be tomorrow and the nextday.

Technology, such as weather satellites and Doppler radar, helps the process of looking over a large area, as does the network of weather observations.

- ***CYCLONES (IMP)***

System of winds rotating inwards to an area of low pressure, in a coiled manner.

Cyclone is derived from a Greek word ***cyclos*** which means coils of snake

Reason: due to coriolis force, surface wind get spiralled towards the low pressure area.

Cyclones are not present in equatorial regions because coriolis force is absent.

FORMATION OF CYCLONE

1) Warm moist air rises upwards over the ocean, the air moves up and low pressure area is formed.
2) Low pressure area is filled with high pressure air from surroundings.

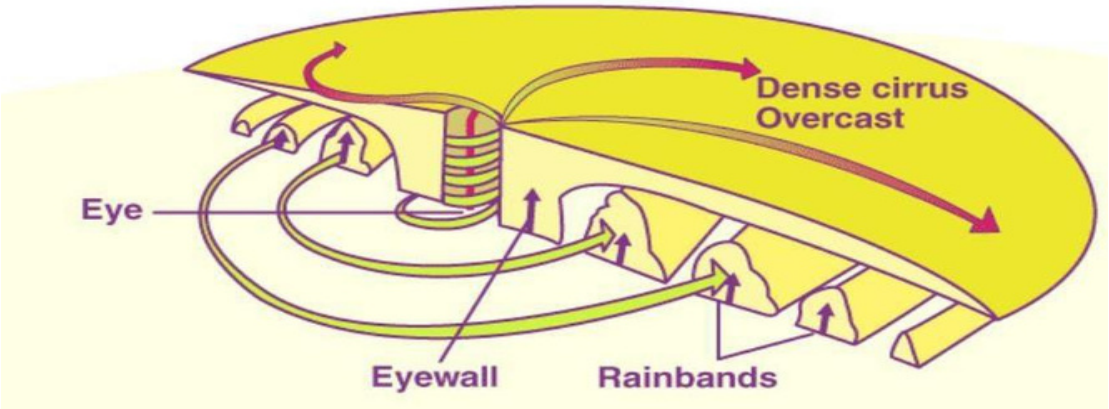
3) Again next batch cool air get warm and low pressure area is again formed.

4) Continuous cycle results in the formation of clouds.

5) When more clouds get formed,more water from the ocean get evaporates and storm is formed.

6) Due to coriolis force, storm system rotates faster and eye is formed in the center.

7) Eye of the storm is calm---air pressure is low



C***ategories of Cyclone*** Cyclones are categorized on the basis of the strength of the winds. Below
mentioned are the different categories starting from level 1. The wind speed and damage potential of each category cyclones have also been mentioned.

- ***Category 1:***

  Wind Speed 74-95 mph

  Damage: Minimal

  Surge surface: 4-5 feet
- ***Category 2***: Wind
  Speed 96-110 mph
  Damage: Moderate
  Surge Surface: 6-8 feet
- ***Category 3:*** Wind Speed
  111-130 mphDamage:
  Extensive

Surge surface: 9-12 feet

- ***Category 4:*** Wind

  Speed 131-155 mph

  Damage: Extreme

  Surge surface: 13-18 feet

- ***Category 5***: Wind

  Speed >155 mph

  Damage:

  Catastrophic

  Surge surface: 19+ feet

TYPES OF CYCLONE

1) TROPICAL CYCLONE

Occurs in tropical oceans

Hurricanes and typhoons are two types.

2) POLAR CYCLONE

Also known as arctic hurricanes.

Formed over arctic and Antarctic oceans.

It takes place quickly, so forecasting is difficult.

3) MESO CYCLONES

Formed along with strong thunderstorms.

Known as vortex of air

Air rises and rotates along vertical axis

4) EXTRA TROPICAL CYCLONES

Also known as mid latitude cyclones.
Winds are weaker
Temperature gradient is sharper

DIFFERENCE BETWEEN CYCLONES AND ANTI CYCLONES

Cyclones	Anti cyclones
It is a low pressure system with surroundings of high pressure.	It is a high pressure system with surroundings of low pressure.
It blows anti clockwise in the Northern Hemisphere.	It blows clockwise in the Northern Hemisphere.
It blows clockwise in the Southern Hemisphere.	It blows anti clockwise in the Southern Hemisphere.
It is associated with cloudy skies, heavy rainfall with stormy winds.	It is associated with clear skies, mild winds and dry conditions.
It can cause great damage to lives and property if precautions are not taken.	The weather is settled and pleasant.

 ATMOSPHERIC CIRCULATIONS

Atmospheric circulation is the large scale movement of air in which thermal energy is redistributed on the surface of earth.

Earths atmospheric circulation varies from year to year

It is linked with oceanic temperature and winds.

REASON FOR ATMOSPHERIC CIRCULATION:

This is caused because sun heats the earth more at the equator than at the poles.

It is controlled by three forces pressure gradient force, frictional force and coriolis force.

When warm air rises from the equator, it starts moving towards the poles.

Air moving from equator towards the pole does not travel in a straight line, and deflected because of the coriolis force.

When the warm air get cools, it drops back to the ground and flows toward the equator and warm again.

Now the warm air rises again and the pattern continues.

FORCES ACTING ON ATMOSPHERIC CIRCULATION:

Pressure Gradient Force

The differences in atmospheric pressure produces a force.

The rate of change of pressure with respect todistance is the pressure gradient.

Frictional Force

The force which affects the speed of the wind.

It is greatest at the surface and it is minimal over the sea level

Coriolis Force

The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force

It deflects the wind to the right direction in thenorthern hemisphere and to the left in the southern hemisphere.

The deflection is more when the wind velocity is high.

The Coriolis force is directly proportional to the angle of latitude.

It is maximum at the poles and is absent at the equator.

The Coriolis force acts perpendicular to the pressure gradient force.

 INDIAN MONSOON (UNIV 3 MARKS)

The term monsoon has been derived from the Arabic word ***mausin*** meaning ***'season'.***

Monsoons are seasonal winds which reverse theirdirection with the change of season.

The monsoon is a double system of seasonal winds – They flow from sea to land during thesummer and from land to sea during winter.

Monsoon wind blows over all parts of the world- well developed in India and South East Asia

TYPES OF MONSOON

Indian subcontinent has 2 types of monsoon

1) South-West Monsoon

2)North –East Monsoon.

SOUTH –WEST MONSOON:

The south east trade winds originates from the southern hemisphere in the indian ocean

When these winds cross the equator, they get deflected by coriolis force and becomes south west trade winds.

These winds gather larger quantities of moisture, as they pass over Indian Ocean.
As the S-W monsoon approaches the indian peninsula they are diverted into 2:

1) The Arabian sea branch 2)The bay of Bengal branch.

When the moisture laden Arabian sea branch reaches the south western side of India, they are blocked by western ghats.
When the mountain range blocks the wind, it get cooled down and form clouds. These clouds then results in precipitation.
Kerala gets southwest monsoon during june every year.

NORTH –EAST MONSOON:

Originates from landmass of north east regions of India.
Relatively dry
These winds pass over bay of Bengal and gather moisture and cause rainfall over the parts of Odisha, Andhra Pradesh and Tamilnadu.
Cyclone formation is common over bay of Bengal during north east monsoon season
Cyclones also bring heavy rainfall.

- ***HYDROSPHERE***

The layer which contains all the water sources present on the earth.

It includes all the surface and subsurface water sources.

It forms over 70% of earth's surface.

Hydrosphere has direct influence on weather and climatic condition on the earth.

WATER CYCLE

The water cycle transfers water from one state to another.

It consists of four stages:

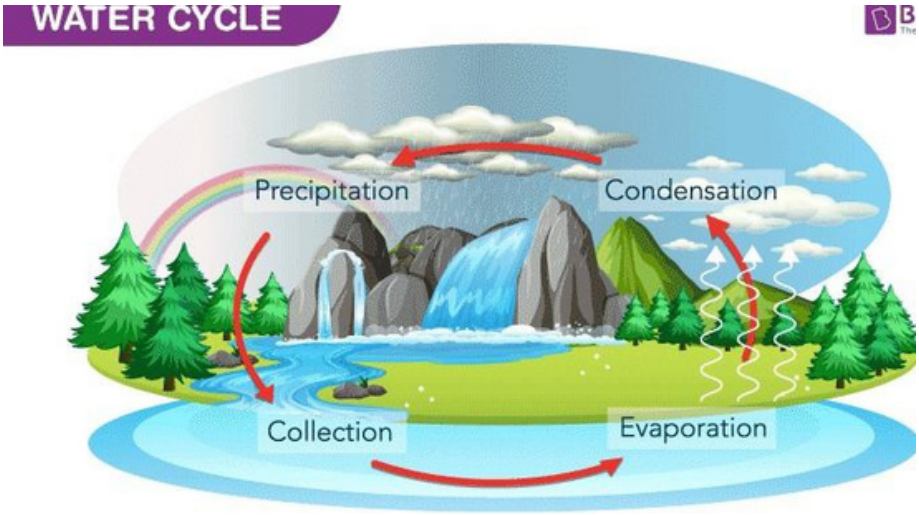
EVAPORATION: sun's heat evaporates water from surface sources.

CONDENSATION: evaporated water cools down and form clouds.

PRECIPITATION: the clouds then precipitates to form rain.

COLLECTION: rain water is then collected in surface and subsurface sources.

The whole process is repeated in a cyclic manner.



IMPORTANCE OF HYDROSPHERE:

Helps to maintain hydrological cycle.

Plays vital role in earth's climate.

Helps in the process of water transportation.

- ***OCEANS***

Ocean is the body of salt water, which covers 70% of earth's atmosphere.

It is the principal component of earth's hydrosphere and acts as a huge heat reservoir.

It influences climate and weather patterns.

The salinity of ocean is due to dissolved materials (mainly salts) contained in it.

Mean salinity of ocean is 34.7g/kg, lowest value of salinity is 33 g/kg and highest value is 36 g/kg

Dominant salt in ocean –NaCl

Salt is spread to the atmosphere when wind blows sprays the sea water.

TYPES OF OCEANS:

1) Atlantic Ocean

2) Pacific Ocean

3) Indian Ocean

4) Arctic Ocean

5) Antarctic Ocean.

IMPORTANCE OF OCEANS:

A) Oceans as Moderator of climate:

Water in oceans moves in regular patterns due to activity of winds.

These movement of water is called ocean circulation or ocean currents.

Current arise due to the interplay of wind and water.

Current plays a significant role in heating up the globe and climate

When water moves from deeper part to warmer part, heat is carried with it and spread to atmosphere.

This heat transfer plays an important role in moderating the climate.

B) Oceans as Heat Reservoir:

Oceans play a role of heat reservoir, by moderating extreme temperature.

Water in upper portion of ocean store higher heat than entire atmosphere.

During spring and summer seasons, oceans are cooler than nearby lands.

During winter, oceans are warmer than land masses.

Due to the temperature difference in sea and land, heat energy is transfer from lad to water and vice versa

C) Ocean as Carbon Reservoir:

Oceans are largest carbon reservoir on earth

It gives of large amounts of carbon into the atmosphere.

Through certain biological and chemical exchange process ,it plays an implant role in carbon cycle

- ***INLAND WATER BODEIS:***

Fresh water constitute the basis for life on land

On land water if found in all 3 states:

a) Solid b) Liquid c) Gas

In solid form, water is found as glacial ice, ice caps and ground ice

In liquid form, water is found in lakes, rivers and streams and also as groundwater and soil moisture.

In gaseous form, the fresh water of earth is interchanged between surface of earth and atmosphere through evaporation and precipitation.

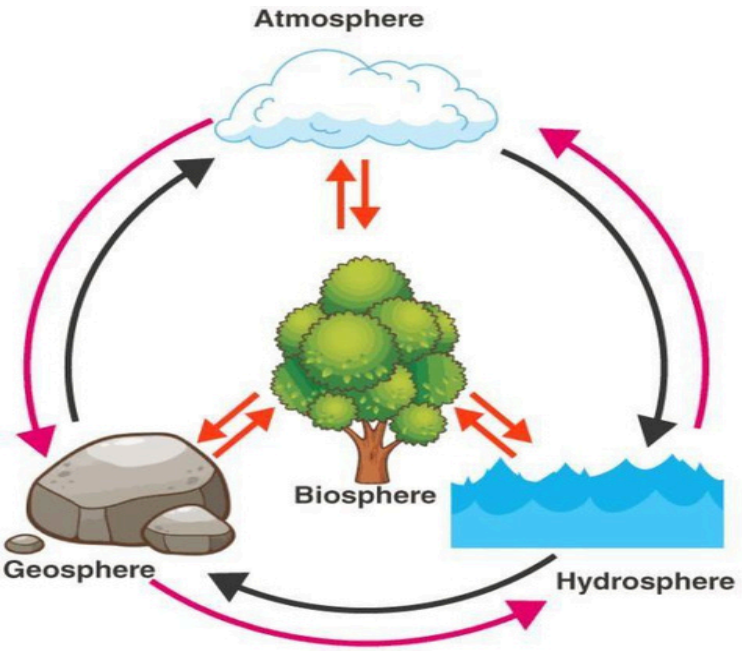
BIOSPHERE:

Biosphere is a thin envelop that encircles most of the earth, and supports life. It is the global sphere in which the biota interacts with lithosphere, atmosphere and hydrosphere.

It is totally dependent on, and involves complex interactions between the atmosphere, hydrosphere, and lithosphere.

Biosphere is the spherical terrestrial layer that comprises of the lower part of the atmosphere, the seas and the upper layers of the soil wherein living organisms exist naturally.

All forms or life including human beings dwell in biosphere. The health of the biosphere is determined by the availability of oxygen, moisture, temperature, air pressure and soil.



- Biosphere is a giant ecosystem that consists of two major ecosystems:
- (a) Terrestrial ecosystem
- b) Aquatic ecosystem

a) Terrestrial ecosystem

- The terrestrial ecosystem consists of plants, animals, microorganisms their dependencies and interdependencies with the non-living items around it on the land.
- A terrestrial ecosystem is made up of either natural ecosystem or artificial/man-made ecosystem
- Ecosystem ,which is made naturally is called natural ecosystem eg:Forest
- Ecosystem ,which is made artificially is called manmade ecosystem eg:zoo

b) Aquatic Ecosystem

- Aquatic ecosystem consists of marine and fresh water ecosystem. While seas and oceans form the marine ecosystem; the rivers, pond, lakes, and wetlands form fresh water ecosystem. Aquatic ecosystems provide human beings with a wide range of services.
- Some of the services include the availability of water for day to day uses, foods like fish and crustaceans, breaking down: of chemical and organic wastes, recreation, etc. The aquatic ecosystem provides the human beings with a wealth of natural resources.

 DEFINITION AND KEY TERMS IN DISASTER MANAGEMENT (IMP)

1) DISASTER:

A sudden occurrence of an accident that causes huge loss of life and property is called as a disaster. It is also called as a calamity.

- ***Types of Disasters***

► ***1. Natural Disaster:*** A disaster caused by natural factors called as a natural disaster e.g., earthquake, flood, cyclone etc.

► ***2. Man-made disaster:*** A disaster caused due to the human activities e.g: wars, fire accidents, industrial accidents etc.

2) HAZARDS:

► A hazard can be defined as a potentially damaging physical event, social and economic disruption or environmental degradation.

► Typical examples of hazards can be absence of rain (leading to drought) or the abundance thereof (leading to floods).

► Chemical manufacturing plants near settlements and incorrect agricultural techniques, can also been seen as hazards which could lead to possible disasters.

► Hazards are the reason behind a disaster

DIFFERENCE BETWEEN DISASTER AND HAZARD (3 MARK)

Hazard	Disaster
Hazard is an event that has potential for causing injury/ loss of life or damage to property/environment.	Disaster is an event that occurs suddenly/unexpectedly in most cases and disrupts the normal course of life in affected area.
Hazards can lead to disasters.	A disaster is the result of a hazard but at the same time is also a hazardous event.
Hazards come with warnings.	Ignoring warnings can lead to disaster.
Hazards may be inevitable.	Disasters can be prevented.
Hazard occurs at less populated area.	Disaster occurs at overpopulated area.

3) EXPOSURE

It is the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

- Exposure changes over time and from place to place.
- As more people and assets are exposed, risk in these areas becomes more concentrated.
- If global exposure continues to trend upwards, it may increase disaster risk to dangerous levels.

4)VULNERABILITY

- Vulnerability is the inability to resist a hazard or to respond when a disaster has occurred.
- For example, people who live on plains are more vulnerable to floods than people who live higher up.

Vulnerability depends on several factors, such as people's age and state of health, local environmental and sanitary conditions, as well as on the quality and state of local buildings and their location with respect to any hazards.

5) RISK

Measure of expected losses due to a hazard, occurring in a given area over a specific time period.

It considers the probability of harmful consequences, or expected losses resulting from a hazard.

Risk = Probability of Hazard x Degree of Vulnerability.

6) RISK ASSESSMENT

Process of identifying the potential hazards and analyse what could happen, if a hazard occurs.

Disaster risk assessments include:

the identification of hazards;

a review of the technical characteristics of hazards such as their location, intensity, frequency and probability;

the analysis of exposure and vulnerability, including the physical, social, health, environmental and economic dimensions;

Evaluation and results.

7) RISK MAPPING

Risk mapping is a process of analyzing the hazard, vulnerability and capacity through a scientific methodology.

It is based on the risk assessment.

There are 2 main components:

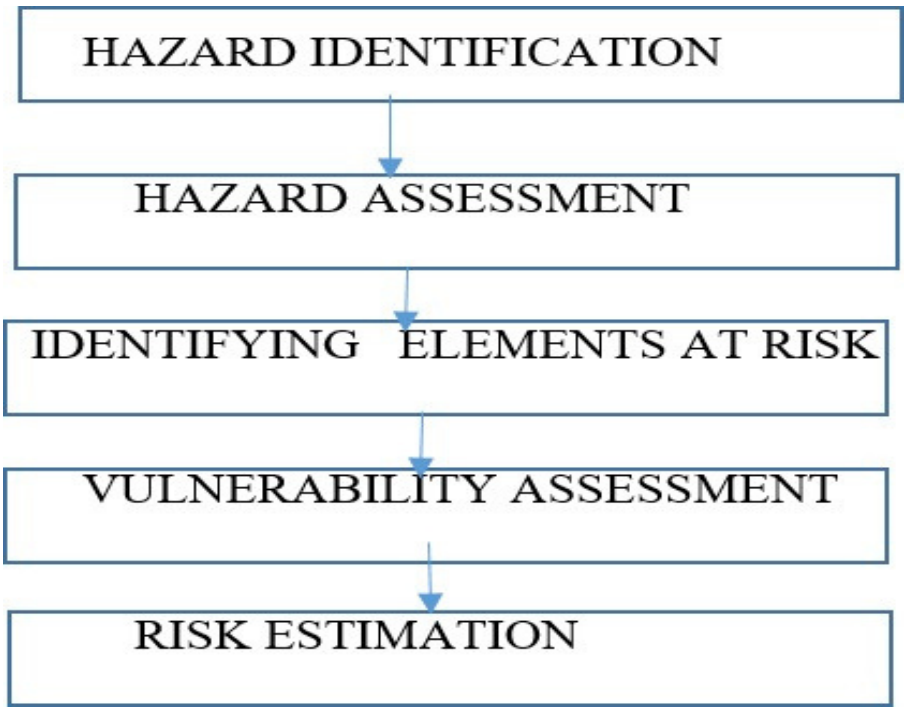
1) Risk Analysis.

2) Risk Evaluation:

1) Risk Analysis:

The use of available information to estimate the risk caused by the hazard to individuals, population.

It contains the following steps:



2) Risk Evaluation

This is the stage at which values and judgements are entered for the decision making process.

It includes all the results of risk associated with social, economic and environmental.

RELATIONSHIP BETWEEN HAZARD VULNERABILITY AND DISASTER

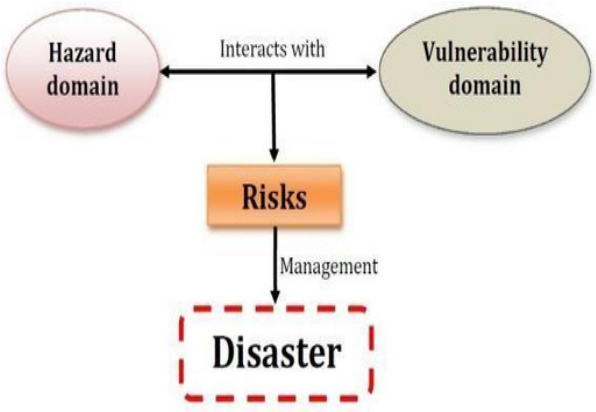


Figure 1.3.1: Conceptual relationships between hazard, vulnerability, risk and disaster

8) RISK REDUCTION

All the structural and non-structural measures for reducing disaster

It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.

It includes 2 measures:

1) ***Structural measures:***

Use of engineering solution to avoid disaster.

Eg:construction of floodwall to reduce flood

2) Non-structural measures:

It includes awareness and education.

Expert people in disaster management will take awareness class among the people in vulnerable areas.

9) DISATER RISK MANAGEMENT

Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengtheningof resilience and reduction of disaster losses.

10) CAPACITY

Refers to all the strengths, attributes and resources available within a community, organization or society to manage and reduce disaster risks and strengthen resilience.

It is the ability to rescue from a disaster.

It is important to emphasize people's capacity to anticipate, resist and recover from disasters,rather than simply focusing on the vulnerability that limits them.

Like vulnerability, capacity depends on social, economic, political, psychological, environmental and physical assets.

The starting point for capacity developmentis the existing knowledge, strengths, attributes and resources individuals, organizations or society has.

Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.

- ***Capacity development*** is the process by which people, organizations and society systematically stimulateand develop their capacities over time to achieve social and economic goals
- ***Types of capacity:*** 1) Physical Capacity 2) Socio-Economic capacity

11) RESILIENCE

Ability of individuals, communities, organisations and states to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development. It is opposite to vulnerability.

Resilience is a term shared by many disciplines (e.g. psychology, engineering and ecology) and has been used in disaster studies since the 1970s.

Resilience also emphasizes the importance of not only effectively managing change but also improving well-being in the face of multiple risks and shocks.

There are different types of resilience that we need to develop in order to support ourselves during challenging times. These include ***physical resilience, mental resilience, emotional resilience and social resilience***.

12) EARLY WARNING SYSTEM

EWS is a socio-technical system designed to generate and circulate meaningful warning information in a timely manner to take a proactive response to a hazardous threat in order to avoid disaster or reduce its impacts.

It is an integrated communication systems to help communities prepare for hazardous climate-related events.

A successful EWS saves lives and jobs, land and infrastructures and supports long-term sustainabilit y.

Early warning systems will assist public officials and administrators in their planning, saving money in the long run and protecting economies.

TYPES OF EARLY WARNING SYSTEM

1) Signal early warning system 2) Social early warning system 3) Formal early warning system

13) DISASTER PREPAREDNESS

It consists of the knowledge and capacities of institutions, communities and individuals to effectively respond and recover from the impacts due to a hazard.

Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response to sustained recovery.

Preparedness is based on a sound analysis of disaster risks and with early warning systems, and includes activities such as contingency planning, the stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associatedtraining and field exercises.

The related term "readiness" describes the ability to quickly and appropriately respond when required.

14) DISASTER PREVENTION

Disaster Prevention is the elimination or reduction of the occurrence of natural hazard event, or their adverse impacts.

Examples of disaster prevention actions include flood protection embankments.

It is defined as those activities taken to prevent a natural phenomenon or potential hazard fromhaving harmful effects on either people or economic assets.

Delayed actions drain the economy and the resources for emergency response within a region. For developing nations, prevention is perhaps the most critical components in managing disasters.

Prevention planning is based on two issues: hazard identification (identifying the actual threats facing a community) and vulnerability assessment (evaluating the risk and capacity of a community to handle theconsequences of the disaster).

Disaster prevention refers to measures taken to eliminate the root causes that make people vulnerable to disaster.

15) DISASTER MITIGATION:

It refers to a set of measures to reduce or neutralise the impact of natural hazards by reducing social, functional, or physical vulnerability.

Primary mitigation refers to reducing the resistance of the hazard and reducing

vulnerability.

Secondary mitigation refers to reducing the effects ofthe hazard (preparedness).

Mitigation includes recognizing that disasters will occur; attempts are made to reduce the harmful effects of a disaster, and to limit their impact on human suffering and economic assets.

16) DISASTER RESPONSE

Disaster response (relief) is the provision of assistance or intervention through the emergency services during or immediately after a crisis in order to save lives, reduce further impacts on health and public safety and to meet the basic subsistence needs of affected populations.

17) DAMAGE ASSESSMENT

Damage Assessment is the process for determining the nature and extent of the loss, suffering, and/or harm to the community resulting from a natural, accidental or human-caused disaster.

Damages are normally classified as:

Severe: The target facility or object cannot be used for its intended purpose. Complete reconstruction is required.

Moderate: The target facility or object cannot be used effectively for its intended purpose unless major repairs are made.

Light: The target facility or object can be used for intended purpose but minor repairs would be necessary.

18) CRISIS COUNSELLING

Process of eliminating the emotional and psychological disturbances of people, affected by a disaster

It can be carried out by psycho educational counselling classes.

It is a crucial part of recovery and reconstruction.

It enables people to take right decisions.

NEEDS OF CRISIS COUNSELLING

1) Providing support and guidance

The purpose of crisis counselling is to decrease emotional pain, provide emotional support, make sure that the person in crisis is safe, and help develop a plan for coping with the situation. Sometimes it also involves connecting a person to other community or health services that can provide long-term support.

2) Crisis counselling can be linked to health education.

It is used to increase knowledge of how to avoid or cooperate with a crisis in the future. It can also be used to change people's attitudes and beliefs about people in crisis, and to provide people with information about help available in their community.

3) Crisis counselling is related to health promotion.

Skills, information, and support services gained through crisis counselling can also help a person or a group of people to improve their health and quality of life. Crisis counselling can also be tied to health promotion through the development of health-related public policy and supportive environments.

4) A valuable tool for public health

It is relatively low-cost and simple to provide, and it is flexible and easy to learn. A wide variety of health professionals, including doctors, nurses, psychologists, and social workers, can be taught to help people through the application of crisis counselling techniques.

5) New technologies--Internet based crisis counselling.

By using these resources people can sometimes get the help they need without using more expensive health care services, and they can often take advantage of twenty-four-hour crisis services.

6) Used by any professionals.

People working in public places such as stores and airline terminals are also learning how to do crisis counselling in order to deal with unhappy or violent customers.

Some Characteristics of Effective Crisis Counsellors

Effective crisis counsellors should possess characteristics such as:

- *Self-Awareness*: knows him/her self and empathise with clients without becoming personally involved or emotional when people who have gone personal experiences come to them.
- *Non-judgemental*: willing to listen all through to the client without casting judgement on those in crisis.
- *Non-Reactive*: does not react to client's outbursts or threats but be completely supportive when client shows strong emotions.
- *High Tolerance*: remain calm when placed in tense and stressful situations
- *Specific Training*: receive specific skills and techniques in crisis counselling that are quite different from normal counselling.

19) NEEDS ASSESSMENT

Needs assessment is a process of estimating the financial, technical, and human resources needed to implement the agreed-upon programmes of recovery, reconstruction, and risk management.

The Post-Disaster Needs Assessment (PDNA) is an internationally accepted methodology for determining the physical damages, economic losses, and costs of meeting recovery needs after a natural disaster through a government-led process.

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MODULE 2

HAZARDS AND VULNERABILITY

SYLLABUS

Various Hazard types, Hazard mapping; Different types of Vulnerability types and their assessment.
Vulnerability assessment and types, Physical and social vulnerability.
Economic and environmental vulnerability, Core elements of disaster risk assessment.
Components of a comprehensive disaster preparedness strategy approaches, procedures.
Different disaster response actions.

I. HAZARD AND ITS TYPES

HAZARD:

Hazard is defined as a potential harm or an adverse effect.

Sometimes the resulting harm is referred to as the hazard instead of the actual source of the hazard.

Example: The scarcity of water is considered as a hazard-drought

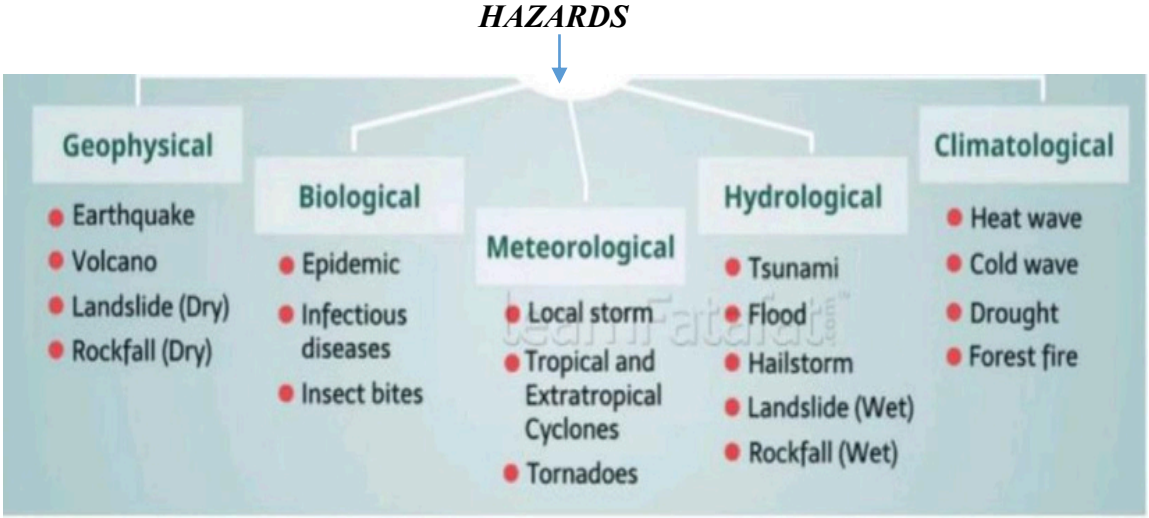
The abundance of water is also a hazard – flood

Basically, hazard is any object or situation which causes damage to property and environment.

TYPES OF HAZARDS:

Hazards are classified into 6 major categories

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



1.Geophysical Hazard

Hazard which is originating from the earth

Also known as geological hazard

Eg:earthquake,volcanic eruption, landslides..

2.Hydrological Hazard

Hazard which is caused by the occurrence, distribution and movement of water.

It includes both ground water and surface water

It includes both fresh water and saline water

Due to extra scarcity or extra abundance of water

Eg: tsunami, flood etc…

3.Meteorological Hazard

Hazard which is caused by weather and atmospheric conditions.

Short lived, micro to meso- scale hazard.

Lasts from minutes to days.

Eg: cyclones, local storm etc…

4.Climatological Hazard

Hazard which is caused by extreme weather and climate change.

Long lived, meso to macro scale hazard.

Lasts from seasons to decades.

Eg: Heat wave, cold wave drought…

5.Biological Hazard

Hazard which is caused due to biological agents.

Caused by the exposure to living organisms or toxic substances

Also caused by pathogens or vector borne diseases.

Eg: covid , nipah etc…

6.Extra terrestrial Hazard

Caused by asteroids, meteoroids and comets ,when they passes near the earth, enter the earth's atmosphere or strikes the earth.

II. HAZARD MAPPING

Hazard mapping involves graphical representation of the location, magnitude and temporal characteristics of the hazard on 2 or 3 dimensional surfaces.

Objectives of hazard mapping:

1) To represent spatial and temporal characteristics of the hazard.
2) To represent the magnitude of hazard using graphical symbols.

Data Requirements of Hazard Mapping:

Spatial characteristics such as location, distribution and dimension ; temporal characteristics and magnitude are the major data requirements for hazard mapping.

Such information can be obtained through the following sources:

1) Base maps
2) Remotely sensed images
3) Field Data.

1) Base Maps:

- Base maps represent topographic layers of the data such as elevation, roads, water bodies, cultural features and utilities.
- Creation of a base map is a time consuming activity.
- It is therefore desirable to use an existing map.
- It must also have sufficient geographical information and about the location of the hazard.

2)Remotely sensed images:

- Satellite images are becoming preferred sources of readily available information of locations on the earth's surface as compared to conventional ground survey methods of mapping, that are labour intensive and time consuming.
- Geo Eye,QuickBird and ALOS-PRISM are preferred sensors for visual mapping as they are high spatial resolutions.

3)Field Data:

Through the advances in technology, ground surveying using electronic systems like total station, global positioning system (GPS), and laser scanners have increased opportunities for data capture in the field.

- ***APPROACHES TO HAZARD MAPPING***

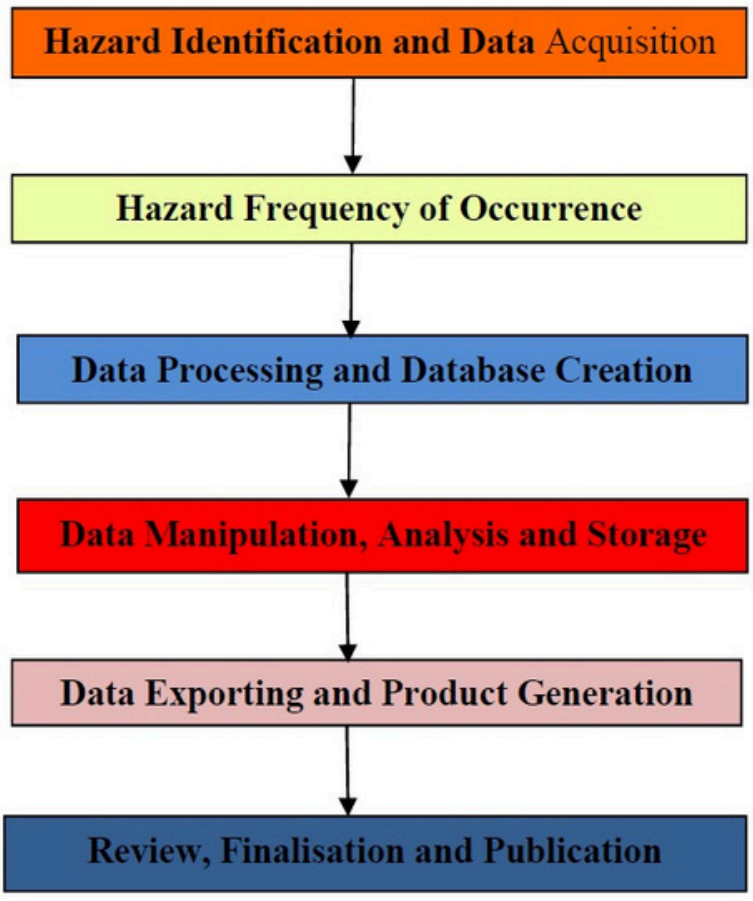
1)Hazard Mapping using geographical information system:

GIS is increasingly used for hazard mapping and analysis , as well as for the application of disaster risk management measures.

The nature and capability of GIS provides excellent basis for processing and presenting hazard information in the form of maps.

GIS is very useful in arranging a high volume of data to produce a hazard map.

Flowchart represents general procedures for the mapping of hazards in GIS.



GIS mapping of hazards

2) Participatory mapping

- Participatory mapping is a technique that allows for the integration of local level participation and knowledge in the map production and decision taken process.
- It is an interactive process that draws on local people's knowledge and allows them to create visual and non-visual data to explore social problems, opportunities and questions.
- In participatory mapping, the main objectives are to:

collect evidence of the study area

Interpret the study area mapping experience and related experience to answer questions that have been developed about the study area.

develop a presentation that synthesises the participatory mapping experience

Present the conclusion and possible questions for further investigation.

How to Conduct Participatory Mapping

Stage 1: outline the nature and essence of activities to be done.

Stage 2: preparation and implementation.

The preparation involves 'scouting' and 'designing survey instrument, materials and directions'.

The implementation may be organised into sessions (usually four) -

Preparation of participants or people involved in the participatory mapping activity; undertake participatory mapping field trip; make presentations and carry out debriefing exercises.

Applications of Hazard Maps:

Spatial planning: Hazard maps provide a basis for communal and district spatial planning processes

Risk reduction measures: Hazard maps assist in the localisation and dimensioning of hazard protection measures.

Emergency planning: Hazard maps indicatewhere the biggest risksarise and the events most likely to occur. This information can be used as a source of orientation inemergency planning.

Raising awareness among the population: Hazard maps help to demonstrate potential risks to the population and to increase awareness of eventual protective measures.

III. VULNERABILITY.

Vulnerability is ***the inability to resist a hazard or to respond when a disaster has occurred***. For eg:, people who live on plains are more vulnerable to floods than people who live higher up.

It the degree to which a system is exposed and susceptible to adverse effect of a given hazard

Vulnerability = Exposure + Resistance + Resilience.

Exposure: property and population at risk

Resistance : measures taken to prevent, avoid or reduce loss

Resilience: ability to recover prior state or achieve post disaster state.

- ***Types of Vulnerability:***

There are mainly 4 types of vulnerability, they are:

1) Physical Vulnerability
2) Social Vulnerability
3) Economic Vulnerability
4) Ecological or environmental vulnerability

1) Physical Vulnerability

This refers to the potential losses to the physical infrastructure such as roads, bridges, railways, radio and telecommunication mast and other features in the built environment.

It also includes impacts on human population, in terms of injuries or death.

In short, the vulnerability which occurs physically to property and lives is known as physical vulnerability.

2) Social Vulnerability

Social vulnerability refers to the losses experienced by the people and their social, economic and political systems.

It refers to the extent to which, elements of the society such as children, aged, pregnant and lactating women, single parents, family systems, social systems, caste ,gender, cultural values etc.. Will degrade after being exposed to a hazardous condition.

3)Economic Vulnerability

Refers to the potential impacts of hazards on economic assets and processes and also includes vulnerability of different economic sections.

4) Ecological / Environmental Vulnerability

Refers to the degree of loss that an ecosystem will sustain to its structure, function and composition as a result of exposure to a hazardous condition.

- ***Quantifying Vulnerability***

Used to estimate how much mitigation and preparedness measures will be applied.

It is based on the data about,previous hazard events and their severity.

It is expressed as 0 to 1

0- indicates lowest degree of vulnerability.

1-indicates highest degree of vulnerability.

- ***Vulnerability Assessment***

Vulnerability assessment is the process of assessing degree of loss.

Variation exist in the method of assessing vulnerability, based on the following factors.

1) Type of vulnerability being measured.

2) Scale at which the vulnerability is measured.

3) Type of hazard.

Types of vulnerability assessment:

1) Physical vulnerability assessment

2) Socio economic vulnerability assessment

3) Environmental or ecological vulnerability assessment

1)Physical vulnerability assessment:

There are many ways to assess physical vulnerability.

Two main methods are empirical method and analytical method.

Empirical method can be applied to groups of related structures.

Analytical method are based on the use of geotechnical engineering software and are limited to individual structures.

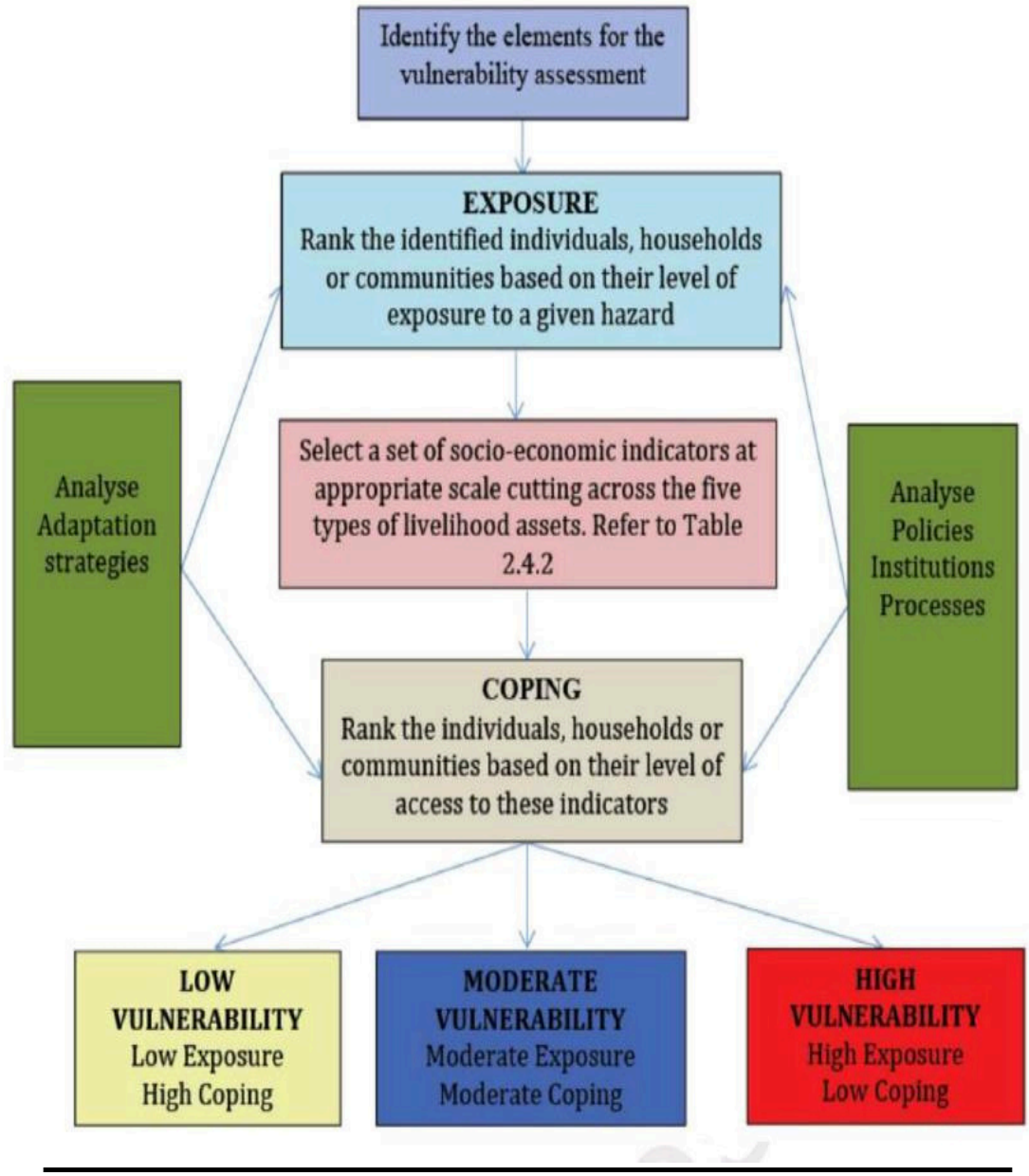
Group	Method	Description
	Analysis of observed damage	Based on the collection and analysis of statistics of damage that occurred in recent and historic events. Relating vulnerability to different hazard intensities.
Empirical methods	**Expert opinion**	Based on asking groups of experts on vulnerability to give their opinions, e.g. the percentage damage they expect for the different structural types having different intensities of hazard. This is meant to come to a good assessment of the vulnerability. Method is time consuming and subjective. Re-assessments of vulnerability after building upgrading or repair are difficult to accommodate.
	Score Assignment	Method using a questionnaire with different parameters to assess the potential damages in relation to different hazard levels. The score assignment method is easier to update, e.g. if we think about earthquake vulnerability before and after application of retrofitting.
Analytical models	**Simple Analytical models**	Studying the behaviour of buildings and structures based on engineering design criteria, analysing e.g. seismic load and to derive the likelihood of failure, using computer based methods from geotechnical engineering. Using, e.g. shake tables and wind tunnels, as well as computer simulation techniques.
	Detailed Analytical methods	Using complex methods. It is time consuming, needs a lot of detailed data and will be used for assessment of individual structures.

2)Socio-Economic vulnerability assessment.

Socio-economic vulnerability is indicator based.

It can be assessed by analysing the level of exposure and coping mechanisms of individuals, households and communities.

- Assessment procedure:

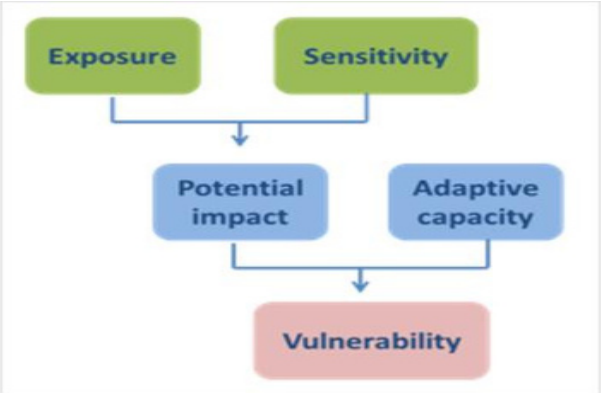


 Socio-economic indicators:

Human Capital	Natural Capital	Social Capital	Physical Capital	Financial Capital
Health	Land and produce	Networks and connections	Infrastructure • Transport - roads, vehicles, etc. • Secure shelter & buildings water supply & sanitation	Savings
			• Energy communications	
Nutrition	Water & aquatic resources	Patronage	Tools and technology • Tools and equipment for production • Seed, fertiliser, pesticides • Traditional technology	Credit/debt - formal, informal, NGOs
Education	Forest products	Neighbourhoods		Remittances
Knowledge and skills	Wildlife	Kinship		Pensions
Capacity to work	Wild foods & fibres	Relations of trust and mutual support		Wages
Capacity to adapt	Biodiversity	Formal and informal groups		Dividends
	Environmental services	Common rules and sanctions		Return on Investments

3)ecological or environmental vulnerability assessment:

The environmental vulnerability assessment is used for the comprehensive evaluation of the resource system affected by natural conditions and intervened by human activities .



 Data's needed for vulnerability Assessment:

Historical Data: previously occurred hazard datas,represents the magnitude of a hazard and the level of damage it caused.

Socio-Economic Data: such as level of education, social networks,sanitation,land income, etc…

Level of exposure data's, on hazard condition.

Data's on policy, institution and process, which influence capacity of individuals, households and communities.

 Methods of representing Vulnerability:

1) Vulnerability indices: based on indicators of vulnerability.

2) Vulnerability Table: tabular representation of vulnerability, which indicates relation between hazard intensity and degree of damage.

3) Vulnerability Curves: graphical representation of vulnerability, which indicates relation between hazard intensity and degree of damage.

Relative curves: shows percentage of property value as the damaged share of total value to hazard intensity.

Absolute curves: shows the absolute amount of damage depending on the hazard intensity

Fragile curves: provides probability of a particular group of elements at risk.

IV. DISASTER RISK ASSESSMENT:

 Disaster risk

It is the probability of serious damages, death and injuries occurring as a result of a potentially damaging hazard, when interacting with vulnerable elements such as people and properties.

 Disaster Risk Assessment:

A qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend.

Components of risk Assessment:

There are 2 main components:

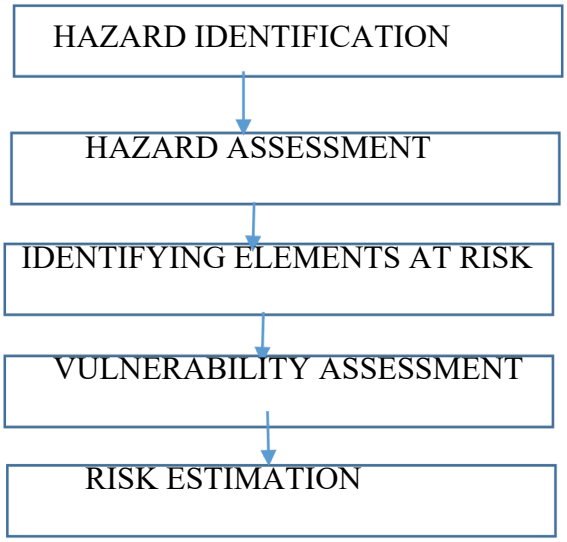
1) Risk Analysis.

2) Risk Evaluation:

1) Risk Analysis:

The use of available information to estimate the risk caused by the hazard to individuals, population.

It contains the following steps:



2)Risk Evaluation

This is the stage at which values and judgements are entered for the decision making process.

It includes all the results of risk associated with social, economic and environmental.

 Contemporary approaches to risk assessments

1) MULTI-HAZARD:

Same area may be threatened by different types of hazards.

Each hazard types are impacted by different hazard scenarios. Each of the hazard scenarios also might have different magnitudes.

E.g.: water depth and velocity in the case of flooding, acceleration and ground displacement in the case of earthquakes.

These hazard magnitudes would also have different impacts on the various elements at risk, and therefore require different vulnerability curves.

2) MULTI-SECTORAL:

Hazards will impact different sectors of elements at risk.

3) MULTI-LEVEL

Risk assessment can be carried out at different levels.

Different levels include national, regional, district and local policies.

It also defines what resources are available at the different levels to reduce risks.

4) MULTI-STAKEHOLDER

Risk assessment should involve the relevant stakeholders, which can be individuals, businesses, organisations and authorities.

5) MULTI PHASE

It consist of various phases of risk assessment such as response, recovery, mitigation and preparedness.

 Risk Assessment Methods:

1) Qualitative methods
2) Semi –quantitative methods
3) Quantitative methods.

1) Qualitative Risk Assessment

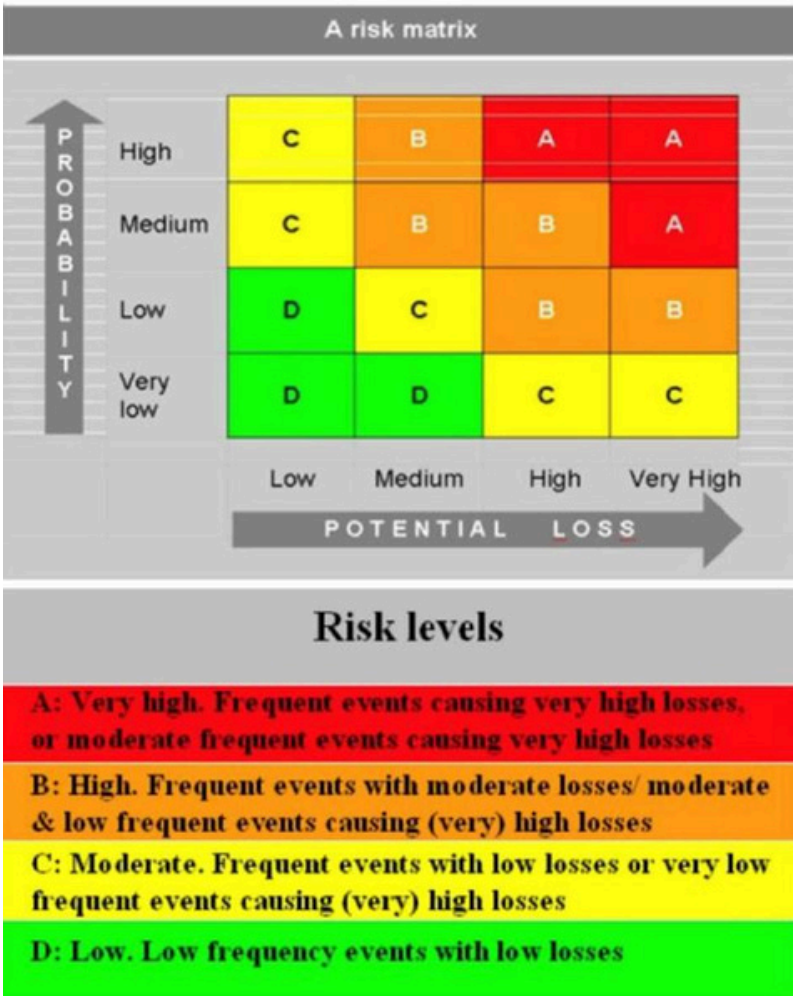
This involves qualitative descriptions of risk in terms of high, moderate and low.

These are used when the hazard information does not allow us to express the probability of occurrence, or it is not possible to estimate the magnitude.

This approach has widespread application in the profiling of vulnerability using participatory methodologies.

Risk matrices can be constructed to show qualitative risk.

A risk matrix shows on its y-axis probability of an event occurring, while on the x-axis potential loss.



2) Semi-Quantitative Risk Assessment.

These techniques express risk in terms of numerical values.

Ranging between 0 and 1

They do not have a direct meaning of expected losses; they are merely relative indications of risk.

The semi quantitative estimation for risk assessment is found useful in the following situations:

As an initial screening process to identify hazards and risks

When the level of risk (pre-assumed) does not justify the time and effort

Where the possibility of obtaining numerical data is limited

The semi-quantitative approach could be adapted to cover larger areas.

3) Quantitative methods.

This aims at estimating the spatial and temporal probability of risk and its magnitude.

In this method, the combined effects, in terms of losses for all possible scenarios that might occur, are calculated.

> Risk = Hazard * Vulnerability * Amount of elements-at- risk

The equation given above is not only a conceptual one, but can also be actually calculated with spatial data in a GIS to quantify risk from hazards.

The hazard component in the equation actually refers to the probability of occurrence of a hazardous phenomenon with a given intensity within a specified period of time.

V.DISASTER PREPAREDNESS:

Disaster preparedness involves the knowledge and practices developed by governments, communities and recovery organisations for effectively responding and recovering from the impacts of hazard.

> *Types of Disaster Preparedness*
>
> Disaster preparedness can be studied under three specific categories:
>
> - *Target-Oriented Preparedness*: Preparedness plans may be target specific, for instance, we may require different types of planning for the vulnerable groups of women, children, elderly and disabled.
> - *Task-Oriented Preparedness*: Specific groups jointly develop activities based on one of the community's plans to evaluate the community's capability to activate the preparedness plan in a real emergency. Eventually, these tasks enable the development of plan revisions, employee training and material resources to support readiness.
> - *Disaster-Oriented Preparedness*: This addresses the likelihood of occurrence of a specific disaster. Emphasis is placed on structural and non-structural mechanisms.

 Components of a Comprehensive Disaster Preparedness Strategy:

The essential elements include the following:

- Hazard, risk and vulnerability assessments
- Response mechanisms and strategies
- Preparedness plans
- Coordination
- Information management
- Early warning systems
- Resource mobilisation

- Public education, training & rehearsals
- Community-based disaster preparedness

VI.DISASTER RESPONSE

Disaster responses are the set of activities taken during a disaster or immediately following a disaster, directed towards saving life and protecting property.

The activities that deal with the effect of disaster may include medical care, evacuation, Search and rescue, provision of emergency water, food and shelter, debris removal and stabilisation of unsafe buildings and landforms.

It is the second phase of the disaster management cycle.

- ***Objectives of Disaster Response:***

Aimed at providing immediate assistance to maintain life, improve health and support the affected population.

Focused at meeting the basic needs of the people until more permanent and sustainable solutions can be found.

Preparedness for the first and immediate response is referred to as “emergency preparedness”

- ***Factors affecting Disaster Response:***

The type of disaster

The ability to take pre-impact actions

The severity and magnitude of disaster

The capability of sustained operations

Identification of likely response requirements

- ***Different Disaster Response actions:***

Disaster response actions are classified into 10 types:

1. Search and rescue
2. First aid and emergency medical care
3. Evacuation
4. Evacuation centre management
5. Development of Standard Operation Procedure (SOPs)
6. Immediate repair of community facilities and services
7. Relief Aid
8. Coordination and Communication

9. Psycho-social counselling and stress debriefing
10. Medical services.

1. Search and rescue

This activity is usually conducted by well-trained volunteers in finding disaster victims, that is, lost, sick or injured persons in either a remote to access areas such as water bodies, desert, forest or probably in the course of mass population movement. The search and rescue operations are often directed at, locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility.

Basic Key Steps of Search and Rescue:

The basic steps are:

1. Size up - involves assessing the situation and determining what one is going to do and if yes, then how. The decision whether to attempt a rescue should be based on:

a. The risks involved; and

b. formation of each volunteer teams.

2. Search - involves locating victims and documenting their location.

3. Rescue - involves the procedures and methods of moving victims to safety.

2. First aid and emergency medical care

First aid is the provision of initial care for an illness or injury.

It is usually performed by non-expert, but trained personnel to a sick or injured person until definitive medical treatment can be accessed.

Emergency medical care is immediate paramedic attention to severe wounds and the rapid transportation of the ill or injured to a health facility.

3. Evacuation

Evacuation is an organised movement of people from an area at risk to a safer place.

Types of Evacuation:

- Precautionary evacuation before disaster
- Protective evacuation after disaster
- Evacuations for reconstruction purposes

Services provided during evacuations include:

- Registration
- Assistance with financial and legal queries

- Water, food, clothing
- Rest areas
- Blankets and personal items
- Interpreter services
- Assistance in contacting family/friends
- Services for animals
- Emergency financial assistance
- First aid, medical and health
- Information

4. Standard Operating Procedures (SOPs).

SOPs are the set of standard procedures which could guide the team in effective operation.

SOPs specify the way in which individuals or units will carry out their functions under the plan

It consist of 4 stages:

1) During normal times
2) Alert/warning and
3) During disaster
4) Rehabilitation

During Normal Times:

Formulate and distribute disaster preparedness plans

Produce maps of Wards/Village Tracts showing areas most vulnerable to disasters.

Make a list of vehicles and motor boats that can be used for emergency work

Create shelters and safe locations for use during disasters

Conduct educational talks on natural disasters and rehearse periodically for the local community

Provide organising and training activities.

Alert/warning stage:

Dissemination of news obtained through early warning systems to the community.

Administrative bodies and NGOs to fly warning flags in the vulnerable areas of the Ward/Village Tract.

Alert and mobilise members of the Security services, Auxiliary Fire Brigade, communication agencies, the Red Cross, Youth, members of People's Strength and NGOs.

Make the necessary arrangements to evacuate the public to safe locations

During Disaster Stage:

Safeguard the road and water transport routes

Evacuate the community from vulnerable areas to safe locations

Operate relief camps and supervisory centres

Keep available relief and aid supplies at the ready to launch relief operations quickly and effectively

Make arrangements to evacuate movable property including cattle to designated locations

Ensure that administrative personnel and NGOs in areas vulnerable to disaster and give disaster warnings door to door.

During Rehabilitation Stage:

Conduct field inspections in affected areas as soon as possible and provide the necessary assistance and support.

Make arrangements to provide health care and social protection to disaster victims.

Clear collapsed buildings and trees as quickly as possible;

restoration of transportation, electricity and water supply and telephone and telegraph services as soon as possible.

reclaim contaminated wells and ponds for access to clean water and dig new wells for drinking water.

Submit immediate preliminary reports with population figures, death and injury figures of cattle and animals, data on socio-economic losses, etc.. to get appropriate funds.

Manage and systematically utilise disaster funds and supplies, as well as cash and supplies donated by well-wishers, social organisations and NGOs

5. Relief Aid

provision of assistance during an emergency that is meant to attend to a person's immediate requirements for survival or recovery

It may include food,clothing, housing, medical care, necessary social services and security.

Relief aid must be targeted at the most vulnerable first: Vulnerable children or orphans, females, pregnant women, sick or elderly populations.

6. Coordination and Communication

- Good coordination and communication is crucial for combining resources effectively and efficiently, in order to reach the disaster-affected more rapidly.
- It contributes to better cooperation, reduces the level of duplication and helps to ensure a well-organised operation.
- ***Meetings*** - Plan to hold regular meetings with Movement partners to determine activities and roles;
- ***Information management*** - Information sharing on disaster impact, assessment and needs through input into DMIS (Disaster Management Information System).

7. Psychosocial support:

During a disaster, many may lose not only properties, but also dear ones which cause negative psychological outcomes.

Psychosocial support activities include identifying and referring individuals requiring specialised support through professional mental health services.

8. Public health services:

The public health services required in responding to disasters include:

- Mass casualty management
- Mental health
- Managing and continuation of existing health services.
- Managing and continuation of medication on chronically affected diseases (HIV, TB, Leprosy, etc.)
- Management of the dead and missing.
- Emergency feeding.
- Communicable disease surveillance and response
- Sanitation.

MODULE 3

DISASTER RISK MANAGEMENT

SYLLABUS

- Introduction to Disaster risk management, ***Core elements of Disaster Risk Management***.
- Phases of Disaster Risk Management, ***Measures for Disaster Risk Reduction.***
- Measures for Disaster prevention, mitigation, and preparedness.
- ***Disaster response- objectives, requirements***. Disaster response planning; types of responses.
- Introduction- ***Disaster Relief***, Relief; international relief organizations.

I.INTRODUCTION TO DISASTER RISK MANAGEMENT

DISASTER RISK MANAGEMENT

Disaster risk management is a structured approach to manage uncertainty and potential adverse impacts from a natural hazard event, through a process of risk assessment and the development of strategies and specific actions to control and reduce risks.

It is systematic, institutionalised, and covers both strategic and operational issues related to reducing vulnerability and exposure to hazards while increasing coping and response capacity.

Risk management is about dealing with uncertainty

The purpose of disaster risk management is to prevent, reduce or transfer the adverse effects of hazards.

Itcomprises prevention, mitigation and preparedness

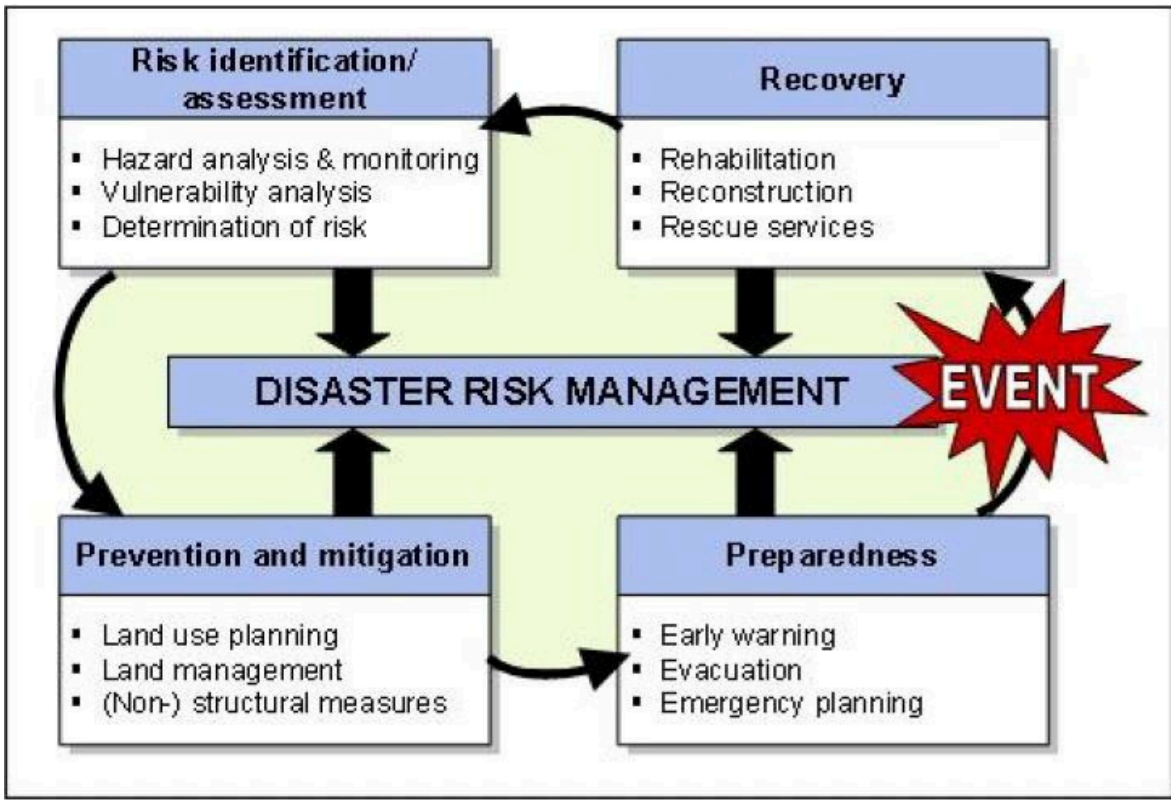
COREELEMENTS/PHASES OF DISASTER RISK MANAGEMENT (UNIV QSTN)

Disaster Risk Management Framework

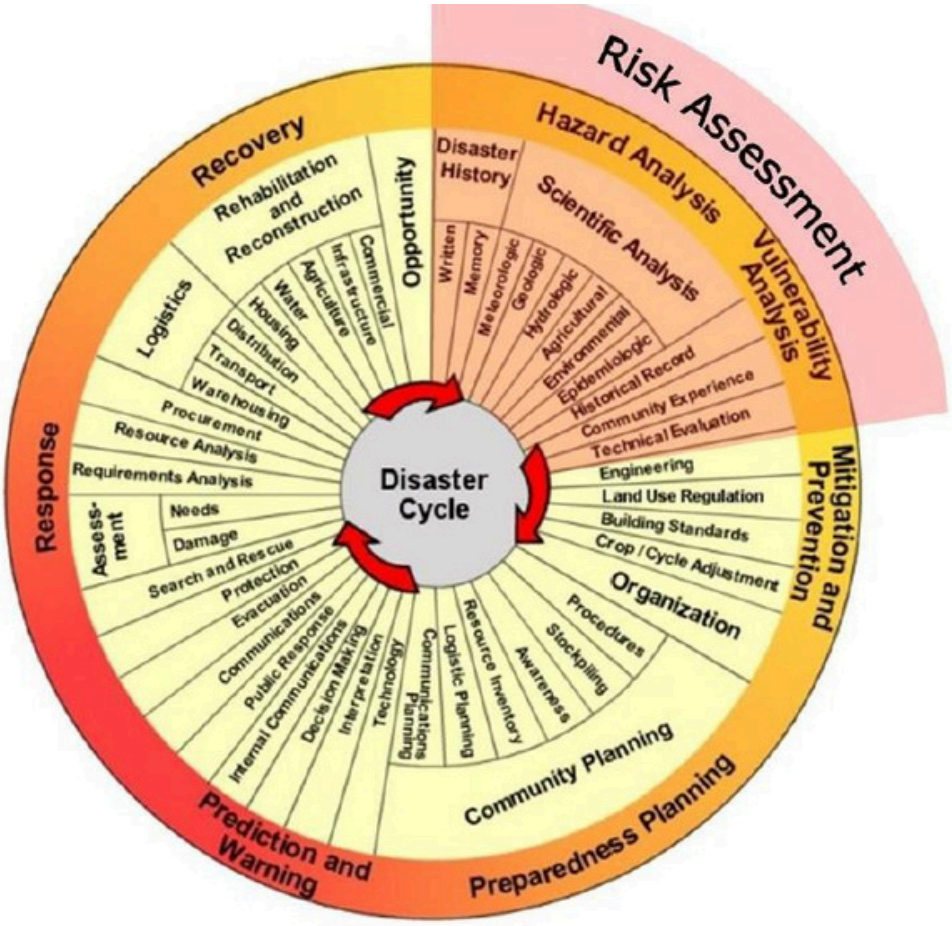
In this framework, the disaster risk management process (cycle) comprises the following main elements:

1. Risk Identification and assessment
2. Prevention and Mitigation.

3. Preparedness. 4. Recovery



1. Risk identification and assessment: This involves determining and analysing the potential, origin, characteristics and behaviour of the hazard – e.g. frequency of occurrence/magnitude of consequences. ***2. Application of risk reduction measures in mitigation***: Planning and implementation of structural interventions (e.g. dams, sea defence) or non-structural measures such as disaster legislation. ***3. Disaster preparedness and emergency management:*** Activities and measures taken in advance to ensure effective response to the impact of a hazard, including measures related to timely and effective warnings as well as evacuation and emergency planning. ***4. Recovery/Reconstruction:*** Decisions and actions taken in the post-disaster phase with a view to restoring the living conditions of the affected population.



DISASTER MANAGEMENT CYCLE

Disaster Risk Management includes measures:

- *Before* (risk analysis, prevention, preparedness),
- *During* (emergency aid), and
- *After* a disaster (reconstruction).

Sometimes disaster risk management includes only a part of disaster management, focusing on the *before* of the extreme natural event (GTZ, 2004, p. 18)

A holistic approach to disaster risk management is needed in order to enhance resilience and reduce vulnerability to disasters.

II. DISASTER RISK REDUCTION The practice of reducing the risk of a disaster through systematic efforts. It includes analysing and managing casual factors affecting disasters.

Factors affecting the disaster include exposure to hazards, vulnerability of people and property, improved preparedness etc…

MEASURES FOR DISASTER RISK REDUCTION (IMP)

The following measures should be taken for disaster risk reduction:

1. Governance
2. Risk identification, assessment, monitoring and early warning
3. Knowledge management and education
4. Reducing underlying risk factors
5. Preparedness for effective response and recovery.

1. GOVERNANCE:

Governance, as defined by UNDP, is the exercise of political, economic and administrative authority in the management of a country's affairs at all levels.

Governance is the umbrella under which disaster risk reduction takes place.

The existence of public awareness, political will and sufficient capacity are key to making disaster risk reduction (DRR) an underlying principle in all relevant development sectors.

With its significant experience in DRR, democratic governance, and development, UNDP is taking forward the practical and conceptual work on DRR governance and mainstreaming.

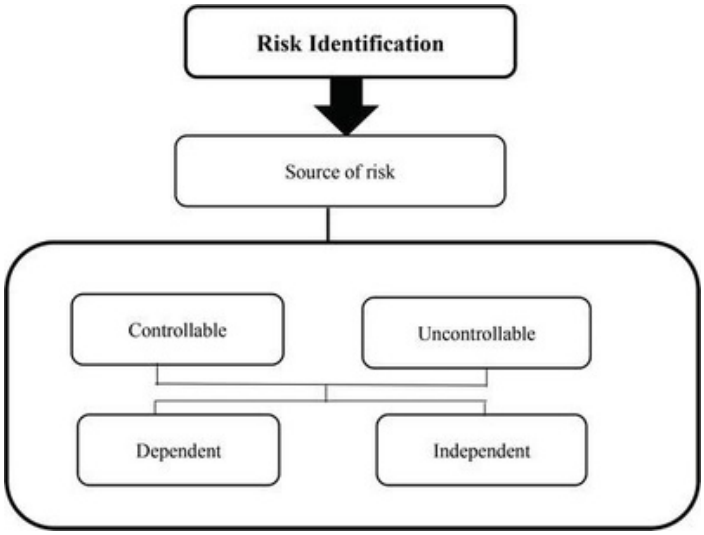
Governance influences the way in which national and sub-national actors (including governments, parliamentarians, public servants, the media, the private sector, and civil society organizations) are willing and able to coordinate their actions to manage and reduce disaster-related risk.

Good governance include broad participation, transparency, accountability, efficiency and responsiveness.

2. RISK IDENTIFICATION, ASSESSMENT, MONITORING AND EARLY WARNING

Risk identification (RI) is a set of activities that detect, and identifies all potential risks that could have a negative impact.

It includes identifying the amount of exposure and vulnerability of a disaster.



- Assessment is the process of identifying potentialhazards and analyse what could happen if a hazard occurs. It is the estimation of expectedlosses during a hazard ***Monitoring*** is a
- continual process of measuring effectiveness of a risk.it contribute to the organisational and global body of knowledge about what works, what does not work and why. Knowledge gained through monitoring and evaluation should be a core part of risk reduction.
- ***Early Warning*** will provide prior signals for the people for preparing against a disaster.

3. KNOWLEDGE MANAGEMENT AND EDUCATION

Knowledge management is ***a process of sharing information within an organization*** and spread among the peoples.

It is the process of acquiring information about a hazard from higher authorities and taking preparedness prior to the hazard.

It can be done through awareness classes.

4. PREPAREDENESS FOR EFFECTIVE RESPONSE AND RECOVERY

Disaster preparedness involves the knowledge and practices developed by governments, communities and recovery organisations for effectively responding and recovering from the impacts of hazard.

Types of Disaster Preparedness

Disaster preparedness can be studied under three specific categories:

- *Target-Oriented Preparedness*: Preparedness plans may be target specific, for instance, we may require different types of planning for the vulnerable groups of women, children, elderly and disabled.
- *Task-Oriented Preparedness*: Specific groups jointly develop activities based on one of the community's plans to evaluate the community's capability to activate the preparedness plan in a real emergency. Eventually, these tasks enable the development of plan revisions, employee training and material resources to support readiness.
- *Disaster-Oriented Preparedness*: This addresses the likelihood of occurrence of a specific disaster. Emphasis is placed on structural and non-structural mechanisms.

Components of a Comprehensive Disaster Preparedness Strategy:

The essential elements include the following:

- Hazard, risk and vulnerability assessments
- Response mechanisms and strategies
- Preparedness plans
- Coordination
- Information management
- Early warning systems
- Resource mobilisation
- Public education, training & rehearsals
- Community-based disaster preparedness

III. DISASTER PREVENTION

Disaster Prevention is defined as those activities taken to prevent a natural phenomenon or potential hazard from having harmful effects on either people or economic assets.

Disaster prevention refers to measures taken to eliminate the root causes that make people vulnerable to disaster

Stop and Reflect 3.4.2

Types of Disaster Prevention

Disaster prevention may be considered as either primary or secondary.

- **Primary prevention** is to reduce, avert or avoid the risk of the event occurring, by getting rid of the hazard or vulnerability, e.g. to avoid overcrowding, deforestation, choked drainage and to provide services.

- **Secondary prevention** means to recognise promptly the event and to reduce its effects, e.g. by staying alert to possible displacements of population; by being ready to provide immunisation, food, clean water, sanitation and health care to the affected population.

MEASURES FOR DISASTER PREVENTION:

There are two measures for preventing a disaster

1. Structural measures
2. Non-structural measures.

1. Structural measures

Structural measures includes all the engineering knowledge for preventing a disaster

E.g.: flood wall, base isolation techniques.

2. Non-structural measures

It includes the awareness class prior to a disaster.

Raising awareness about potential hazards and how to address them

Educating the public about how to properly prepare for different types of disaster

Installing and strengthening prediction and warning systems

THE BASIS OF DISASTER PREVENTION

For disaster prevention to be successful, ***a priori planning is required***. Planning of prevention hinges on two (2) issues:

- ***Hazard Identification*** (identifying the actual threats facing a community) and
- ***Vulnerability Assessment*** (evaluating the risk and capacity of a community to handle the consequences of the disaster).

While natural hazards cannot be prevented, human-made hazards such as those associated with industries, technological failures and pollution can be prevented.

- Although the literature sometimes uses prevention and mitigation synonymously, there is conceptual difference between the two terminologies.
- Prevention has more to do with prohibiting man-made hazards such as chemical accidents, household fires, etc., which are caused by human activities, errors or insufficient precautionary actions.
- However, mitigation and preparedness are considered as key measures of risk reduction for natural hazards.

IV. DISASTER MITIGATION

It refers to a set of measures to reduce or neutralise the impact of natural hazards by limiting the vulnerability.

Primary mitigation refers to reducing the resistance of the hazard and reducing vulnerability.

Secondary mitigation refers to reducing the effects of the hazard (preparedness).

Types of Disaster Mitigation Measures

Broadly, disaster mitigation measures can be categorised into two:

- *Structural Mitigation Measures*

  This refers to any physical construction to reduce or avoid possible impacts of hazards, which includes engineering measures and construction of hazard-resistant and protective structures and infrastructure.

- *Non-structural Mitigation Measures*

  This refers to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk and related impacts.

OBJECTIVES OF DISASTER MITIGATION:

The primary objectives of disaster mitigation are two (2) fold, namely hazard likelihood reduction and risk consequence reduction.

Hazard likelihood reduction

This objective is only appropriate for a few natural hazards, as it is not possible to reduce the occurrence of many hazards.

Eg:, the likelihood of floods occurrence can be reduced by mitigation measures such as sea defence walls.

Risk consequence reduction

This is a reduction in the impact of a hazard, via a reduction in exposure and/or vulnerability.

It involves ensuring that the population, structures, or other systems are able to withstand such an event with as few negative consequences as possible.

An example is the construction of the erosion-resistant sea defence wall in Keta, Volta Region of Ghana

In reducing both ***hazard likelihood*** and ***risk consequence***, the primary aim is to decrease risk of death and injury to the population.

MITIGATION MEASURES BY ECOSYSTEM:

Structural and non-structural disaster mitigation measures are mainly carried out by human beings. However, nature through ecosystem functions also provides several mitigation measures as shown in Table.

Ecosystem	Hazard Mitigation
Mountain forests, vegetation on hillsides	Vegetation cover and root structures protect against erosion and increase slope stability by binding soil together, preventing landslides (Dolidon *et al.*, 2009; Peduzzi, 2010) Catchment forests, especially primary forests, reduce risk of floods by increasing infiltration of rainfall and delaying peak floodwater flows, except when soils are fully saturated (Krysanova *et al.*, 2008) Forests on watersheds are important for water recharge and purification, drought mitigation and safeguarding drinking water supply (see World Bank, 2010)
Wetlands, floodplains	Wetlands and floodplains control floods in coastal areas (Campbell *et al.*, 2009) Marshes, lakes and floodplains release wet season flows slowly during drought periods.
Coastal ecosystems (mangroves, saltmarshes, coral reefs, sand dunes)	Coastal wetlands, tidal flats, deltas and estuaries reduce the height and speed of storm surges and tidal waves. Coastal ecosystems protect against storm surges, flooding and other coastal hazards – combined protection by coral reefs, seagrass beds and sand dunes/ coastal wetlands/coastal forests is particularly effective (Batker *et al.*, 2010).
Drylands	Natural vegetation management and restoration in drylands contributes to ameliorate the effects of drought and control desertification, as trees, grasses and shrubs conserve soil and retain moisture. Prescribed burning and creation of physical firebreaks in dry landscapes reduce fuel loads and the risk of unwanted large-scale fires (PEDRR, 2010).

V.DISASTER PREPAREDNESS Disaster preparedness involves the knowledge and practices developed by governments, communities and recovery organisations for effectively responding and recovering from the impacts of hazard.

Types of Disaster Preparedness

Disaster preparedness can be studied under three specific categories:

- *Target-Oriented Preparedness*: Preparedness plans may be target specific, for instance, we may require different types of planning for the vulnerable groups of women, children, elderly and disabled.
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Components of a Comprehensive Disaster Preparedness Strategy: (IMP)

The essential elements include the following:

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Aimed at providing immediate assistance to maintain life, improve health and support the affected population.

Focused at meeting the basic needs of the people until more permanent and sustainable solutions can be found.

Preparedness for the first and immediate response is referred to as “emergency preparedness”

 Factors affecting Disaster Response:

The type of disaster

The ability to take pre-impact actions

The severity and magnitude of disaster

The capability of sustained operations

Identification of likely response requirements

 Requirements for Effective Response

Information and resources are two essential requirements for effective response.

a) Information

An ***early warning system provides*** vital information for effective response operation despite the unpredictability of some disaster events.

An effective warning system must be robust to transmit warnings as early as practicable.

Information gained from these systems could help in the planning and decision making as well as inform the general public.

b) Resources

Resources form an essential component of disaster response.

The need for disaster management organisations to be resource ready cannot be over emphasised considering the untimely occurrence of disasters, which most often is on short notice.

The ability to mobilise the needed resources on short notice is most often hampered by many factors. Its effect on systems gives little room for procrastination of actions.

VII.DISASTER RESPONSE PLANNING

Disaster management requires a carefully drawn ***response plan*** which is often prepared in anticipation of emergency and activated in times of urgency.

The response plan as a component of the disaster management plan includes ways of managing human and financial resources, response to supplies availability and communication procedures.

This involves identifying, strengthening, and organising resources and capacities for timely and effective response to a potential disaster.

In disaster response planning, roles and responsibilities are defined, policies and procedures are developed and generic tools for responses are identified and developed.

The response plan is developed based on assumptions of risks and hazards, and does not address specific disaster scenarios - as is the case for contingency plans.

Plans thus, must be monitored, evaluated and adapted to the specific situation in times of disaster.

VIII.TYPES OF RESPONSES (IMP)

Disaster response actions are classified into 10 types:

1. Search and rescue
2. First aid and emergency medical care
3. Evacuation
4. Evacuation centre management
5. Development of Standard Operation Procedure (SOPs)
6. Immediate repair of community facilities and services
7. Relief Aid
8. Coordination and Communication
9. Psycho-social counselling and stress debriefing
10. Medical services.

1. Search and rescue

This activity is usually conducted by well-trained volunteers in finding disaster victims, that is, lost, sick or injured persons in either a remote to access areas such as water bodies, desert, forest or probably in the course of mass population movement. The search and rescue operations are often directed at, locating endangered persons at an emergency incident, removing those persons from danger, treating the injured, and providing for transport to an appropriate health care facility.

Basic Key Steps of Search and Rescue: The basic steps are: ***1. Size up*** - involves assessing the situation and determining what one is going to do and if yes, then how. The decision whether to attempt a rescue should be based on: a. The risks involved; and b. formation of each volunteer teams. ***2. Search*** - involves locating victims and documenting their location. ***3. Rescue*** - involves the procedures and methods of moving victims to safety.

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First aid is the provision of initial care for an illness or injury.

It is usually performed by non-expert, but trained personnel to a sick or injured person until definitive medical treatment can be accessed.

Emergency medical care is immediate paramedic attention to severe wounds and the rapid transportation of the ill or injured to a health facility.

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Evacuation is an organised movement of people from an area at risk to a safer place.

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Services provided during evacuations include:

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SOPs specify the way in which individuals or units will carry out their functions under the plan

It consist of 4 stages:

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During Normal Times:

Formulate and distribute disaster preparedness plans

Produce maps of Wards/Village Tracts showing areas most vulnerable to disasters.

Make a list of vehicles and motor boats that can be used for emergency work

Create shelters and safe locations for use during disasters

Conduct educational talks on natural disasters and rehearse periodically for the local community

Provide organising and training activities.

Alert/warning stage:

Dissemination of news obtained through early warning systems to the community.

Administrative bodies and NGOs to fly warning flags in the vulnerable areas of the Ward/Village Tract.

Alert and mobilise members of the Security services, Auxiliary Fire Brigade, communication agencies, the Red Cross, Youth, members of People's Strength and NGOs.

Make the necessary arrangements to evacuate the public to safe locations

During Disaster Stage:

Safeguard the road and water transport routes

Evacuate the community from vulnerable areas to safe locations

Operate relief camps and supervisory centres

Keep available relief and aid supplies at the ready to launch relief operations quickly and effectively

Make arrangements to evacuate movable property including cattle to designated locations

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Conduct field inspections in affected areas as soon as possible and provide the necessary assistance and support.

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Clear collapsed buildings and trees as quickly as possible;

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reclaim contaminated wells and ponds for access to clean water and dig new wells for drinking water.

Submit immediate preliminary reports with population figures, death and injury figures of cattle and animals, data on socio-economic losses, etc.. to get appropriate funds.

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During a disaster, many may lose not only properties, but also dear ones which cause negative psychological outcomes.

Psychosocial support activities include identifying and referring individuals requiring specialised support through professional mental health services.

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The public health services required in responding to disasters include:

- Mass casualty management
- Mental health
- Managing and continuation of existing health services.
- Managing and continuation of medication on chronically affected diseases (HIV, TB, Leprosy, etc.)
- Management of the dead and missing.
- Emergency feeding.
- Communicable disease surveillance and response
- Sanitation.

IX.DISASTER RELIEF

Relief refers to the provision of essential, appropriate and timely humanitarian assistance to those affected by a disaster

It is defined as the provision of assistance during or immediately after a disaster to meet the life preservation and basic needs of those people affected.

Relief, as a disaster management process, provides timely essential needs such as basic household items, shelter, food, water and sanitation, or health items.

Relief activities provide goods and services to disaster-affected populations in the form of supplies, vouchers or cash transfers, so as to enable those populations to cover their essential needs.

Relief measures differ, depending upon the nature of disaster.

At certain occasions, money may have no value, but certain articles like food, clothes, etc. may be more important.

Principles guiding Relief (IMP)

Response to disasters must have humanitarian imperative.

Aid is provided based on needs alone and must be done without discrimination of any kind (race, creed or nationality of the recipients).

Aid will not be used to further a particular political or religious standpoint.

Aid agencies do not to act as instruments of government foreign policy.

That culture and custom are respected in response and relief activities.

Disaster response is built on local capacities.

Ways be are developed to involve programme beneficiaries in the management of relief aid.

Relief aid would reduce future vulnerabilities to disaster as well as meeting basic needs.

Accountable to both those we seek to assist and those from who we accept resources.

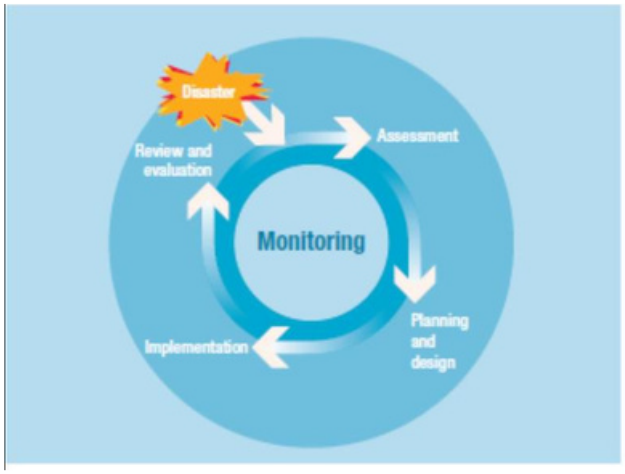
Information, publicity and advertising activities shall recognise disaster victims as dignified human beings and not hopeless objects.

- ***Project Cycle Management Linked to Relief***

The project cycle management (PCM) is a conceptual tool used for the planning and management of programmes and projects leading to the improvement of programme effectiveness and outcome.

It consist of 5 components:

1) Assessment
2) Planning & Designing
3) Implementation
4) Monitoring
5) Review and Evaluation



1.Assessment The first step after the onset of a disaster is to assess the origin, magnitude and effect of

the disaster on the affected population so as to be able to identify humanitarian needs and plan possible interventions.

The purpose of an assessment, therefore, is to ascertain the need for an intervention based on identified needs.

This is done to identify the problem, its source and consequences.

There are four (4) types of assessments that are usually conducted during disasters.

a) Immediate assessments

Conducted within 72 hours after the disaster.

It is generally conducted by in country actors and involves the collection of basic disaster information.

b) Rapid assessments

Conducted immediately after the disaster and take up to a week.

These involve gathering of information on the needs and existing capacities of the affected population.

c) Detailed assessments

Conducted after rapid assessments to obtain further information on the affected population's needs and capacities for programme planning.

They can take up to a month to conduct, more or less depending on the area, the complexity of the issues and resources available.

d) Continual assessments

Conducted once the detailed assessment has been completed and relief programmes are running.

They update information on the situation and involve beneficiaries for recovery programming.

2. Planning/Design

The planning and design process is critical to a relief operation as it helps to set out in clear stages what the operation will do.

It also determines how progress and results will be monitored and defines the duration of relief activities.

The planning process describes the steps and order to undertake when planning relief interventions.

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This phase is aimed at defining the desired future situation of the affected population and

to determining the objectives, strategies and activities needed to achieve it

2. Implementation

The implementation phase is when the activities are carried out to achieve the desired results.

The implementation of relief activities is conducted once the assessment and the planning processes are completed.

This may include the mobilisation and distribution activities.

 SOME INTERNATIONAL RELIEF ORGANIZATIONS: (UNIV 3 MARK)

1. Action Against Hunger (AAH),
2. Catholic Relief Services, (CRS - USCC),
3. Food For The Hungry International (FHI),
4. International Committee of the Red Cross (ICRC),
5. International Federation of Red Cross and Red Crescent Societies (IFRC)
6. International Organisation For Migration (IOM)
7. International Rescue Committee (IRC),
8. Save the Children
9. United Nations International Children's Emergency Fund (UNICEF),
10. United Nations High Commissioner for Refugees(UNHCR),
11. United Nations Office for the Coordination of Humanitarian Affairs(UNOCHA),
12. US Committee for Refugees (USCR),

MODULE 4

PARTICIPATORY STAKEHOLDER ENGAGEMENT

SYLLABUS:

1. Participatory stakeholder engagement
2. Importance of disaster communication.
3. Disaster communication- methods, barriers.
4. Crisis counselling
5. Introduction to Capacity Building. Concept – Structural Measures, Non-structural Measures.
6. Introduction to Capacity Assessment, Capacity Assessment; Strengthening Capacity for Reducing Risk.

1. PARTICIPATORY STAKEHOLDER ENGAGEMENT

Stakeholder ***'participation'***, stakeholder '***engagement' is the*** interactions between two or more stakeholders in policy making, development projects, organisational management and decision making in disaster risk reduction (DRR) education.

In brief, 'stakeholder participation' is the involvement of interest groups in a planning or decision-making process.

Participatory development is defined as a process in which people are proactively and significantly involved in all decision-making processes that affect their lives.

 TYPES OR FORMS OF STAKEHOLDER PARTICIPATION (imp)

The three basic forms of stakeholders are:

1) Primary stakeholder
2) Secondary stakeholder
3) Key stakeholder

1) PRIMARY STAKEHOLDER:

Beneficiaries of a development intervention.

People who are directly affected by a disaster.

In disaster risk reduction, these stakeholders include: homeowners, renters, homeless persons and community-based small-scale businesses.

2) SECONDARY STAKEHOLDER

Refer to those who indirectly influence a development intervention.

They include the government, line ministry and project staff, implementing agencies, local governments, civil society based organisations, private sector firms, and other development agencies.

3) KEY STAKEHOLDER

This group can significantly or directly influence a development intervention

This groups are important to the success of the project throughfinancialresources or power.

E.g.:National Disaster Management Organisation (NADMO)

Ministry of Local Government and Rural Development (MLGRD),

1.1EFFECTIVE WAYS OF PROMOTING STAKEHOLDER PARTICIPATION IN DRR (imp)

In stakeholder participation initiatives some groups - such as the very poor, women, nomadic groups or ethnic minorities – may lack the organisational, social or financial means to make their voices heard and participate effectively.

These are often the exact stakeholders whose needs and interests are critical to the success and sustainability of development interventions.

Special efforts are needed to address the disequilibrium of power, knowledge and influence among stakeholder groups and to allow weaker, less organised groups to interact effectively with stronger, more established stakeholders. These include:

1. Capacity building
2. Mandated Representation.
3. Separate Events
4. Levelling Techniques.
5. Use of Intermediaries.

1. CAPACITY BUILDING

Providing training, coaching, funds or other resources to marginalised groups to assist them in organising, mobilising support, identifying and articulating their interests;

2. MANDATED REPRESENTATION Where there is a danger of exclusion, it may be useful to establish targets of representation, for example, agreeing that all village committees will include an established number of women or that all ethnic groups in a given community will be represented on a decision-making body;

3. SEPERATE EVENTS:

In some cases, it may be valuable to meet with specific population groups separately, for example, to hold a separate women's meeting to discuss their particular concerns;

4. LEVELLING TECHNIQUES:

Power differentials between stakeholders can be reduced through the use of participatory methods.

A skilled facilitator can use a number of techniques to ensure that all participants have equal opportunity to make their voices heard.

Negotiating systems may need to be developed for handling conflicting interests between different groups of local stakeholders;

5. USE OF INTERMEDIARIES

In circumstances where the direct participation of marginalised individuals themselves is not feasible, intermediaries or surrogates may be identified to represent their views and defend their interests.

For example, if it is not possible for women farmers from isolated areas to participate directly in a national forum on agricultural development, female extension workers might be selected to represent their interests

- BENEFITS OF STAKEHOLDER PARTICIPATION IN DRR (IMP)
- Improved programme/project design by drawing on local knowledge and expertise to ensure that designs accurately reflect stakeholder priorities and needs;
- Strengthened stakeholder commitment to, and ownership of, policies and projects, leading to increased uptake of project services and greater willingness to share costs;

Enhanced sustainability as a result of increased stakeholder ownership;

Opportunity to foresee and/or resolve potential obstacles, constraints and conflicts;

Emphasised means to identify and address potential negative social and environmental impacts;

Opportunity to generate social learning and innovations based on field experience;

Capacity to analyse problems and initiate other development activities

Improved means of ensuring that project benefits are distributed equitably

Strengthened working relations between stakeholders, government and civil society organisations and development partners.

 COST & RISK OF STAKEHOLDER PARTICIPATION IN DRR (IMP)

Each progressive level of stakeholder participation brings with it different costs and risks. The principal cost is the absence of stakeholder participation in programmes and projects. Lack of stakeholder participation can lead to:

Danger of undertaking poorly planned or merely token participatory activities due to limited time, capacity, commitment or resources;

Lack of political will on the part of governments to allow wide stakeholder participation because they fear loss of power or influence;

Difficulty in reaching out to marginalised groups and ensuring that the true priorities and needs of poor and vulnerable groups are represented;

Difficulty in identifying genuine representative non-governmental organisations (NGOs) and civil society organisations (CSOs);

Co-optation of the stakeholder participation process by more powerful or articulate stakeholders, and the exclusion of the poor and disadvantaged;

1.2 BASIC STEPS IN PARTICIPATORY STAKEHOLDER ENGAGEMENT (IMP)

The most fundamental steps in stakeholder analysis can be enumerated as follows:

Step 1: Identify key stakeholders;

Step 2: Assess stakeholder interest and project impacts

Step 3: Stakeholder prioritisation

Step 4: Outline a stakeholder participation strategy.

STEP1: IDENTIFY KEY STAKEHOLDERS:

The first step of stakeholder analysis is to identify relevant stakeholder groups. Key questions to ask in addressing this issue are:

1) Who are the programme or project targeted beneficiaries?

2) Who might be adversely impacted?

3) Who are the projects main supporters and opponents? 4) Who is responsible for carrying out planned activities? 5) Who can contribute financial and technical resources?

An initial list of stakeholders can be drawn up on the basis of a desk review of secondary data (publications and documents) and existing staff knowledge of the project, sector and country.

This preliminary list must then be verified, modified and enhanced through the use of the questions discussed above.

STEP 2: ASSESS STAKEHOLDER INTERESTS AND PROJECT IMPACTS:

Once relevant stakeholder groups have been identified, the next step is to analyse their interests (overt and hidden) and to assess the potential impact of the proposed project on their interests.

Key questions for participants to answer include:

1) How does each group of stakeholders perceive the problem at hand and proposed solutions?

2) What are their key concerns and interests with respect to the project?

3) What are stakeholders' expectations of the project?

These questions are best answered by stakeholders themselves in the context of a stakeholder workshop. Such a workshop requires careful preparation and could require a full day

STEP 3: STAKEHOLDER PRIORITISATION The analysis of stakeholder interests and project impacts should allow the project team to categorise different groups of stakeholders and to determine the relative priority that the project should give to each stakeholder group's interest. Key questions to engage the attention of participants are: 1. Who are the project's targeted primary beneficiaries? 2. What is the importance of each stakeholder group to the success of the project? 3. What is the degree of influence of each stakeholder group over the project? 4. Are special measures needed to protect the interests of primary stakeholder groups that

are weak or vulnerable?

STEP 4: OUTLINE A STAKEHOLDER PARTICIPATION STRATEGY This involves development of a stakeholder action plan that outlines the specific activities

to be carried out by each stakeholder group.

Some stakeholder groups will have active and continuous roles to play, while others may only need to be kept informed of progress or be involved at certain key moments of planning or implementation.

 Stakeholder Analysis Matrices (imp 3 or 7 marks)

Stakeholder matrix is a tabular representation which shows the framework for recording and organising the information generated by a stakeholder analysis in the context of DRR

The three variables used to construct the matrices are listed below:

Interests: the priority concerns of the stakeholder group (or what is 'at stake'for them);

Influence: the degree to which the stakeholder group has power and control over the endeavour and can thus facilitate or hinder its implementation; and

Importance: the degree to which the achievement of programme or project objectives depends on the active involvement of a given stakeholder group

Stakeholder groups	**Interest(s) at stake in relation to program**	**Effect of project on interest(s)**	**Degree of influence of stakeholder over project**	**Importance of stakeholder for success of project**
+ (positive)		U= unknown 0 = neutral - = (negative)	U= unknown 1=little/no importance 2=some importance 3=moderate importance 4=very important 5=critical importance	1=little /no influence 2=some influence 3=moderate influence 4=significant influence 5=very influential

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1.3 METHODS AND TOOLS FOR PARTICIPATORY STAKEHOLDER ENGAGEMENT

1. Participatory meetings and workshops:

It can be done through the following ways:

a) Panel discussions:

Panellists build off each other's answers to elicit different opinions and deepen the discussion.

The discussion can start with an overview presentation and brief comments from each panellist to frame the discussion and provide the audience with an understanding of the experience and viewpoint each panellist brings.

Discussion is richest when the panel members represent different key constituencies, expertise or points of view related to the topic and when advanced preparation clarifies each panel member's role and how one relates to the other panel.

b) Pyramid Schemes

Participants are given a question or problem to think through on their own for a few minutes.

They are then asked to join with a neighbour to discuss the topic in twos, then in a subsequent round in groups of four or six, then in groups of eight or twelve.

Growing the groups larger provides the opportunity for friendly challenging of ideas and cross-fertilising the best of answers across groups.

c) Debates

Speakers present opposing sides of an issue.

This format can liven up a discussion topic that lends itself to debating pros and cons, multiple views, or conflicting opinions around an issue.

As a variation, groups of participants can be assigned opposing sides of an issue and asked to formulate the key debate points as a group.

d) Round Table

Participants form groups around a specific topic area in order to share experiences and discuss ideas.

This format provides an informal setting for starting dialogue, sharing and discussion.

Depending on the purpose, formal questions could be posed to the group to guide their

discussion or the topic could remain open for the group to determine the direction of their conversation.

2. Participatory Research/Data Collection Participatory Rural Appraisal (PRA) is one participatory research approach that offers a 'basket
of techniques' from which those most appropriate for the project context can be selected. The basic principles of PRA tools are:

- ***Participation***: local people serve as partners in data collection and analysis;
- ***Flexibility***: not a standardised methodology, depends on purpose, resources, skills, and time;
- ***Teamwork***: outsiders and insiders, men and women, mix of disciplines, etc..
- ***Optimisation***: optimal cost and time efficient, but ample opportunity for ignorance, analysis and planning, etc.;
- ***Systematic:*** for validity and reliability, partly stratified sampling, crosschecking

2. DISASTER COMMUNICATION

Communication is the act of transmitting information verbally or non-verbally.

Communication is more than exchanging information; it's about understanding the emotions and intentions behind information.

- BASIC STEPS IN COMMUNICATION (IMP):
  1. Forming of communicative intent
  2. Message composition
  3. Message encoding
  4. Transmission of signals
  5. Reception of signals
  6. Message decoding
  7. Interpretation
- IMPORTANCE OF COMMUNICATION IN DRR (IMP)
  1. Communication promote preparedness for disasters
  2. Communications provide early warnings signals of disasters
  3. Communication facilitates proper response to disasters

2.1 EFFECTIVE COMMUNICATION: Effective communication includes non-verbal communication, engaged listening, managing stress in the moment, the ability to communicate assertively, and the capacity to recognise and understand your own emotions and those of the person you are communicating with.

 STEPS TO EFFECTIVE COMMUNICATION (IMP):

1. Use standard terminologies when communicating-risks, disaster, coping,resilience, vulnerable, etc.
2. Request and provide clarifications when needed- allow/encourage the beneficiaries to respond to issues they are not sure of.
3. The communicator should also be well informed about the situation of things within the community where the information is to be disseminated.
4. Ensure statements are direct and unambiguous.
5. Inform appropriate individuals when the mission or the plan changes.
6. Communicate all information needed by those individual or teams external to the team.
7. Use non-verbal communication appropriately.

 BARRIERS TO EFFECTIVE COMMUNICATION:

1. Non-Focus on the issue at hand, not being attentive
2. Avoid interruption, show interest in what is being said
3. Avoid being judgemental but make provision for feedbacks
4. Pay attention to non-verbal communication
5. Be conscious of individual differences
6. Keep stress in check but be assertive

2.2 DIFFERENCE BETWEEN RISK COMMUNICATION AND CRISIS COMMUNICATION (UNIV QSTN)

RISK COMMUNICATION	CRISIS COMMUNICATION
Process of exchanging information among people about nature, magnitude and the control of risk	Process of exchanging information among the people during the crisis stage of a disaster.
It is done during or before the disaster stage	It is done after the disaster stage.

Risk is often more nebulous and evolves over time.	A crisis is a specific incident with a short time frame.
Principles for risk communication include, developing and conveying the messages about the risks during and prior to a disaster.	Principles for crisis communication include, being there first, giving right information, being credible, expressing empathy, promote action to calm the victims and show respect.
Risk communication tends to utilise messages from experts and scientists	Crisis communication typically utilises messages from authoritative sources.

3. CRISIS COUSELLING:

Definition of Crisis

- A crisis is as an acute disruption of psychological homeostasis in which one's usual coping mechanisms fail and there exists evidence of distress and functional impairment (Robert, 2005).
- Any serious interruption in the steady state or equilibrium of a person, family, or group. A temporary disruption of psychological balance wherein usual coping

Types of Crisis

- According to Stone (1993), the two basic kinds of crisis are *developmental* and *situational*.
- Other types of crises include Existential, and Ecosystemtic.

Counselling is a personal, face to face, relationship between two people in which the counsellor, by means of the relationship and his special competencies, provides a learning situation in which the counselee, a normal sort of person, is helped to know himself and his present and possible future situations so that he can make use of characteristics and potentialities in a way that is both satisfying to himself and beneficial to society, and further, can learn how to solve future problems and meet future needs (Tolbert, 1972).

CRISIS COUNSELLING:

Process of eliminating the emotional and psychological disturbances of people, affected by a disaster

It can be carried out by psycho educational counselling classes.

It is a crucial part of recovery and reconstruction.

It enables people to take right decisions.

- ***Crisis counselling occurs when a client who is destabilised engages the services of a counsellor.*** The person is unable to cope with events in his/her life and, consequently, may be wracked by destructive feelings of self-doubt, anxiety, or guilt and may be engaging in hurtful behaviours. This crisis needs immediate attention otherwise there is the risk of further personality or behavioural deterioration.

3.1 GOALS OF CRISIS COUNSELLING

Help the person return to his usual level of functioning; decrease anxiety;

Help people who are in crisis recognise and correct behaviours and cognitive distortions.

Teach crisis-solving techniques;

Give more assistance after immediate help is received.

Safety: ensures the individual is safe, any risk has been reduced and resources, if available, have been provided.

Stability: ensures the individual is stable and has a short-term plan which includes mastery of self and the emergency or disaster situation.

Connection: helps connect the individual to formal and informal resources and support.

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3.2 CHARACTERESTICS OF EFFECTIVE CRISIS COUNSELLOR

Some Characteristics of Effective Crisis Counsellors

Effective crisis counsellors should possess characteristics such as:

- *Self-Awareness*: knows him/her self and empathise with clients without becoming personally involved or emotional when people who have gone personal experiences come to them.
- *Non-judgemental*: willing to listen all through to the client without casting judgement on those in crisis.
- *Non-Reactive*: does not react to client's outbursts or threats but be completely supportive when client shows strong emotions.
- *High Tolerance*: remain calm when placed in tense and stressful situations
- *Specific Training*: receive specific skills and techniques in crisis counselling that are quite different from normal counselling.

3.3 STRENGTH & LIMITATIONS OF CRISIS COUNSELLING:

Strengths of Crisis Counselling

- It is brief and direct
- It has modest and objective goals
- It is more intense than regular counselling
- It is transitional in nature

Limitations of Crisis Counselling

- It is used immediate in situations only
- It does not go very deep with resolution
- It is time-limited

3.4 STEPS IN CRISIS COUNSELLING (IMP)

1. FIRST CONTACT:

In the first contact, it is useful to get personal information of the client and not be subjected to a lengthy intake evaluation.

The counsellor should try to set the person at ease, clarify the task and invite him/her to talk.

A good crisis counsellor is a good listener and more active.

The crisis counsellor clarifies, reassures, educates, and offers advice on anxiety, depression, agitation or sleeplessness since they are at levels that severely impair functioning or make the crisis intervention impossible.

2. SHORT AND LONG TERM GOALS:

Short Term Goals include calming down, trying to come to terms with their intense fear, talking about what has just happened to them, getting shelter for the night, having something to eat, etc.

Long Term Goals include getting into a long-term and normal counselling, looking for a job, finding permanent housing, etc. The crisis counsellor needs to be very active and directive in helping the person sort out these two types of goals and then in attending, in a very practical way, to achieving the short term goals and making a plan to attend to the long-term goals.

3. MAKING A PLAN:

People in crisis have trouble concentrating, thinking straight, using good judgment, and setting priorities. It is often helpful for the counsellor to take notes while talking to the client to keep track of all the information and to have a list of topics to remind him/her (counsellor) to cover during the interview.

At the end of the session, it is often very useful to actually write up a plan for the person to follow and send him/her away with the plan in their hand. It is best to prepare the plan with the person's collaboration to number each of the points and to format it so that it is easy to read.

4. TERMINATION:

Crisis counselling is, by its nature, very brief.

It is important to conduct the session as a single session treatment.

The crisis intervention should end with a concrete plan for the person to follow.

The plan should be written and given to the person and make follow ups.

3.5 THE SAFER-R MODEL (imp) The SAFER-R Model is a much-used model of intervention. The model approaches crisis intervention as an instrument to help the client to achieve his

or her baseline level of functioning from the state of crisis.

This intervention model for responding to individuals in crisis consists of 5+1 stages.

This model is presented in format as follows:

Stabilise	Acknowledge	Facilitate understanding	Encourage adaptive coping	Restore functioning or,	Refer

4. CONCEPT OF CAPACITY BUILDING

- Capacity building is an ongoing process that equips officials, stakeholders and the community to perform their functions in a better manner during a crisis/disaster. In the process of capacity
- building, we must include elements of human resource development, i.e., individual training, organizational development such as improving the functioning of groups and organizations and institutional development.
- At the national level, The National Institute of Disaster Management (NIDM) is the capacity building arm.
- The States have disaster management cells in the State Administrative Training Institutes performs the function of capacity building for effective and efficient disaster management.

- NEED FOR CAPACITY BUILDING:

1. Comprehensive formulation of objectives
2. Conduct training needs analysis
3. Preparation of knowledge skill and attitude
4. Administration of face to face training programme.

VARIOUS ELEMENTS OF CAPACITY BUILDING:

1. Education on disaster prevention and response.
2. Training to vulnerable communities
3. Collaboration with relief agencies
4. Mock drill
5. First aid preparedness.

5. STRUCTURAL AND NON- STRUCTURAL MEASURES: (IMP)

- ***Structural measures*** are any physical construction to reduce or avoid possible impacts of hazards. It is the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems.
- Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers, earthquake-resistant construction and evacuation shelters.
- ***Non-structural measures*** are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.
- Common non-structural measures include building codes, land-use planning laws and their enforcement, research and assessment, information resources and public awareness programmes.

SOME STRUCTURAL MEASURES:

1) RESISTANCE CONSTRUCTION:

- Clearly the best way to maximize a chance that a structure is able to resist the forces inflicted by various hazards is to ensure that it is designed in such a way prior to construction to do just that.
- Designing hazard resistance into the structure from the start is the most cost-effective option.
- Construction styles may incorporate hazard resistant design. This is often seen in areas with annual flooding, where houses are built on stilts.
- An example of a culturally adjusted hazard resistant construction style is the houses built by the Banni in India, which resist the shaking induced by earthquakes.

2) BUILDING CODES AND RESISTANCE MEASURES: (IS1893,IS 13920)

- With sufficient knowledge about the hazards likely to affect a region or a country, engineers can develop building codes that guide builders to ensure that their designs are able to resist the forces of the relevant hazards.

Though simple in theory, inherent problems with codes and regulations can drastically reduce the effectiveness.

- When properly applied building codes offer a great deal of protection from a wide range of hazards.

3) CONSTRUCTION OF BARRIER, DEFLECTION, OR RETENTION SYSTEMS

- ***Barriers*** are designed to stop a physical force dead and its tracks.

Their job is to absorb the impact of whatever force is being exerted. They are, in other words, blocking devices.

- Barrier walls can be made of natural materials, such as trees, bushes, or ever existing soil or they can be constructed of foreign materials, such as stone, concrete, wood, or metal.
- Depending upon the hazard type, barriers may be built on just on side of a structure, or may completely surround it.
- E.g.: Seawalls Floodwalls Natural or synthetic wind and particle movement barriers etc..
- ***Deflection systems*** are designed to divert the physical forces of a hazard, allowing it to change course so that a structure situated in its original path escapes harm.
- Deflection systems may be constructed from a full range of materials, both natural and manmade. Examples of deflection systems and the hazards they are designed to protect against include: Avalanche bridge ,Chutes ,Lava flow channels (volcanic lava) Diversion trenches, Channels, canals, and spillway (floods)
- ***Retention systems*** are designed to contain a hazard, thereby preventing its destructive forces from ever being released.
- These structures generally seek to increase the threshold to which hazards are physically maintained.
- Examples include: Dams (drought, floods) Levees and Flood walls (Floods)

- ***SOME NON STRUCTURAL MEASURES***:

1) REGULATORY MEASURES:

- Regulatory measures limit hazard risk by legally dictating human actions.
- Regulations can be applied to several facets of societal and individual life, and are when it is determined that such action is required for the common good of the society.
- Though the use of regulatory measures is perspective, compliance is a widespread problem because the cost of enforcement can be prohibitive and inspectors may be untrained, ineffective, or susceptible to bribes.
- Eg: Land Zoning Regulations, Open space Preservation.

The public is most able to protect themselves from the effects of a hazard if they are first informed that the hazard exists, and then educated about what they can do to limit their risk.

- An informed public that applied appropriate measures to reduce their risk before a disaster occurs
- Warning systems inform the public that hazard risk which has reached a threshold required certain protective actions

6. CAPACITY ASSESSMENT (IMP)

- capacity is defined as the combination of all the strengths, attributes and resources that enables a community, society or organization to reduce damage and losses from a disaster. It includes infrastructure and physical resources, institutions, societal coping abilities, as
- well as human knowledge, skills and collective attributes such as social relationships, leadership and management. TYPES OF CAPACITY:

CAPACITY ASSESSMENT: (UQ)

Capacity assessment is a process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action.

In other words, it is an analysis of desired capacities against existing capacities, with the end goal of generating an understanding of capacity assets and needs, which should then inform not only the formulation of appropriate capacity development response but more importantly the development of a comprehensive DRRM plan.

 RELEVANCE OF CAPACITY ASSESSMENT: (UQ)

1. Providing a starting point for formulating a capacity development response;
2. Acting as a catalyst for action;
3. Confirming priorities for action;
4. Offering a platform for dialogue among stakeholders;
5. Provide insight into operational hurdles in order to unblock a program or project

 STEPS IN CAPACITY ASSESSMENT (imp)

The capacity assessment consist of 3 fundamental steps:

Step 1: Mobilize actors and design the capacity assessment;

Step 2: Conduct the actual capacity assessment; and

Step 3: Summarize and assess the results of the capacity assessment.

STEP 1:

The participation of stakeholders throughout the process is paramount to foster local ownership and ensure that the different dimensions of capacity

Doing so guarantees that the existing capacities of the community's various elements at risk are properly identified, documented and built upon.

STEP 2:

Conduct of capacity assessment for DRRM should involve the students, faculty, staff and community members residing in or around the area.

The role of NGOs and other external actors, if any, should also be looked into as they could provide invaluable contributions at any point in the disaster cycle

STEP 3:

The outputs of the capacity assessment should inform the identification of DRR capacity gaps and formulation of appropriate interventions before, during and after a disaster.

6.2 METHODS OF ASSESSING CAPACITY (UQ) a) ***Capacity assessment as part of pre-disaster risk assessment:*** It focus on the identification of resources, coping mechanisms and overall capacity of a

community in the face of specific hazards in the area.

It has 2 objectives: first, to understand people's coping mechanisms in dealing with previous hazards, and second, to capture available resources that the community can tap to mitigate the impacts of disaster.

Participatory tools are often employed in community-based capacity assessment exercises. These include focus group discussions, transect walks, disaster timelines, and hazard and resource mapping

b) ***Capacity assessment as part of post-disaster recovery:***

Capacity assessment can also be conducted in the aftermath of a disaster.

In such a case, the objective is not just to evaluate how the community's capacities have fared in a particular disruptive event, but also to identify capacity gaps in order to guide early and long-term recovery.

The VCA tool is often employed for this purpose

Vulnerabilities and capacities are categorized into physical/material, organizational/social, and attitudinal/motivational.

Physical capacity would refer to the ability of the university to have access to materials or resources needed to re-establish its functions and rebuild its facilities.

Social capacity would be indicative of how organized the university is in its response, rehabilitation and reconstruction efforts.

Attitudinal capacity, on other hand, could refer to the behaviour and mind set of the different members of the community, especially the leaders, with respect to coping with the impacts of the disaster.

c) Capacity assessment as part of capacity development programming:

Capacity assessment may also be undertaken as a requisite step in capacity development programming.

Here, the purpose is not just to identify capacities and vulnerabilities, but more importantly, to develop a program that would holistically address the capacity needs of the community. This approach is usually done at the national level

This can be done through the use of participatory approaches such as workshops and focused group discussions.

- It will provide needed political and administrative support not only in the execution of the actual assessment but also in the dissemination of results and agreements to the general public.

7. STRENGTHENING CAPACITY FOR REDUCING RISK:

Strengthening capacity for reducing risk is the process of augmenting the capacity of stakeholders and institutions. The activities will include:

Strengthening capacity building by its institutional and organizational structure, staffing, and resources and funding of training programs and regular drills for the emergency operations centre staff and Disaster Management Officers at various levels; strengthening the Disaster Response Force;

Setting up a Decision Support System (DSS) and Emergency Operation Centers to integrate and analyze information from multiple sources in an integrated geo-spatial system.

Strengthening capacity also includes the Technical support for risk reduction and response preparedness to finance activities such as: Preparation of a Hydro-meteorological Resilience Action Plan focusing on extreme weather events to develop resilience solutions/recommendations and a robust, fail-safe EWS in the region including optimum use of strengthened networks and facilities; River Morphology Study for some key rivers impacted by the disaster and to analyze and identify critical protective infrastructure works needed for river bank strengthening;

Urban vulnerability assessment study with specific focus on seismic risk mitigation to undertake detailed urban vulnerability analysis and model various risks for effective mitigation planning and disaster response preparedness;

Upgrading design guidelines and material specification for construction in seismic zones in order to carry out an update of current construction design standards and material specifications to align them with national and international best practices;

Disaster Risk Financing and Insurance (DRFI) to work out options to increase the resilience of the PIE's financial response capacity to secure cost-effective access to adequate funding for emergency response, reconstruction, and recovery.