UNIT-1

DISASTER MANAGEMENT: Definition

Disaster Management is the aggregate of all measures taken to reduce the likelihood of damage that will occur related to a hazard, and to minimize the damage once an event is occurring or has occurred and to direct recovery from the damage. The effectiveness of disaster management determines the final result of the impact of the event on the environment and society impacted. Management of the damage/disaster either may be productive in minimizing the damage or it may be negative and, as such, contribute to the damage. The training of medical response personnel, as part of preparedness, and the actual responses of medical personnel to the persons injured by the event are both parts of management.

STRUCTURE OF THE ATMOSPHERE

The atmosphere is a reasonably well-mixed envelope of gases roughly 80 km (54 mi) thick called the HOMOSPHERE. Above 80 Km the gases are stratified such that the heavier gases decrease much more rapidly than the lighter ones; this is the HETEROSPHERE. In addition, we can identify four layers in the atmosphere that have distinct characteristics. The four layers of the atmosphere, in order from lowest to highest elevation, are:

ATMOSPHERIC COMPOSITION TODAY

Table 1–2 Principal gases of dry air

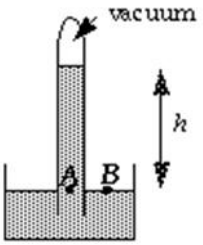
Constituent	Percent by Volume	Concentration in Parts Per Million (PPM)
Nitrogen (N_2)	78.084	780,840.0
Oxygen (O_2)	20.946	209,460.0
Argon (Ar)	0.934	9,340.0
Carbon dioxide (CO_2)	0.036	360.0
Neon (Ne)	0.00182	18.2
Helium (He)	0.000524	5.24
Methane (CH_4)	0.00015	1.5
Krypton (Kr)	0.000114	1.14
Hydrogen (H_2)	0.00005	0.5

The Atmosphere is divided into layers according to major changes in temperature. Gravity pushes the layers of air down on the earth's surface. This push is called air pressure. 99% of the total mass of the atmosphere is below 32 kilometers.

Troposphere - 0 to 12 km - Contains 75% of the gases in the atmosphere. This is where you live and where weather occurs. As height increases, temperature decreases. The temperature drops about 6.5 degrees Celsius for every kilometer above the earth's surface.
Tropopause - located at the top of the troposhere. The temperature remains fairly constant here. This layer separates the troposphere from the stratosphere. Jet stream is found here. These are very strong winds that blow eastward.
Stratosphere - 12 to 50 km - in the lower part of the stratosphere. The temperature remains fairly constant (-60 degrees Celsius). This layer contains the ozone layer. Ozone acts as a shield for in the earth's surface. It absorbs ultraviolet radiation from the sun. This causes a temperature increase in the upper part of the layer.
Mesophere - 50 to 80 km - in the lower part of the stratosphere. The temperature drops in this layer to about -100 degrees Celsius. This is the coldest region of the atmosphere. This layer protects the earth from meteoroids. They burn up in this area.
Thermosphere - 80 km and up - The air is very thin. Thermosphere means "heat sphere". The temperature is very high in this layer because ultraviolet radiation is turned into heat. Temperatures often reach 2000 degrees Celsius or more. This layer contains:
Ionosphere - This is the lower part of the thermosphere. It extends from about 80 to 550 km. Gas particles absorb ultraviolet and X-ray radiation from the sun. The particles of gas become electrically charged (ions). Radio waves are bounced off the ions and reflect waves back to earth. This generally helps radio communication. However, solar flares can increase the number of ions and can interfere with the transmission of some radio waves.
Exosphere - the upper part of the thermosphere. It extends from about 550 km for thousands of kilometers. Air is very thin here. This is the area where satellites orbit the earth.
Magnetosphere - the area around the earth that extends beyond the atmosphere. The earth's magnetic field operates here. It begins at about 1000 km. It is made up of positively charged protons and negatively charged electrons. This traps the particles that are given off by the sun. They are concentrated into belts or layers called the Van Allen radiation belts. The Van Allen belts trap deadly radiation. When large amounts are given off during a solar flare, the particles collide with each other causing the *aurora borealis* or the northern lights.

ATMOSPHERIC PRESSURE

The atmospheric pressure is the weight exerted by the overhead atmosphere on a unit area of surface. It can be measured with a mercury barometer, consisting of a long glass tube full of mercury inverted over a pool of mercury:



Mercury barometer

When the tube is inverted over the pool, mercury flows out of the tube, creating a vacuum in the head space, and stabilizes at an equilibrium height h over the surface of the pool. This equilibrium requires that the pressure exerted on the mercury at two points on the horizontal surface of the pool, A (inside the tube) and B (outside the tube), be equal. The pressure PA at point A is that of the mercury column overhead, while the pressure PB at point B is that of the atmosphere overhead. We obtain PA from measurement of h:

$P_A = \rho_{Hg} g h$ (2.1)

where rHg = 13.6 g cm-3 is the density of mercury and g = 9.8 m s-2 is the acceleration of gravity. The mean value of h measured at sea level is 76.0 cm, and the corresponding atmospheric pressure is 1.013x105 kg m-1 s-2 in SI units. The SI pressure unit is called the Pascal (Pa); 1 Pa = 1 kg m-1 s-2. Customary pressure units are the atmosphere (atm) (1 atm = 1.013x105 Pa), the bar (b) (1 b = 1x105 Pa), the millibar (mb) (1 mb = 100 Pa), and the torr (1 torr = 1 mm Hg = 134 Pa). The use of millibars is slowly giving way to the equivalent SI unit of hectoPascals (hPa). The mean atmospheric pressure at sea level is given equivalently as P = 1.013x105 Pa = 1013 hPa = 1013 mb = 1 atm = 760 torr.

ATMOSPHERIC TEMPERATURE

1. Temperature is defined as the degree of hotness or coldness of a substance measured on some definite scale.
2. Hotness (and coldness) result from molecular activity. As molecules take up energy, they start to move faster, and the temperature of the substance increases. Thus we can say that temperature is a measure of the average kinetic energy of the molecules of a substance.
3. In order to compare the hotness (temperature) of two substances, we need to define a scale of relative temperatures. This is done by assigning values to two points and dividing up the interval between the fixed points into smaller intervals called "degrees".
4. A temperature is an objective comparative measure of hot or cold. It is measured by a thermometer, which may work through the bulk behavior of a thermometric material, detection of thermal radiation, or particle kinetic energy. Several scales and units exist for measuring temperature, the most common being **Celsius** (denoted °C; formerly called *centigrade*), **Fahrenheit** (denoted °F), and, especially in science, **Kelvin** (denoted K).

PRECIPITATION

Precipitation is any product of the condensation of atmospheric water vapor that falls under gravity. Precipitation occurs when a portion of the atmosphere becomes saturated with water vapor, so that the water condenses and "precipitates". It has following forms

1. **Rain**:

- liquid deposits falling from the atmosphere to the surface
- with a diameter > 0.5 mm
- < 0.5 mm: drizzle
- max. size: about 5 - 7 mm(too large to remain suspended)
- beyond this size, inter-molecular cohesive forces become to weak to be held in the mass of water together as a single drop

2. **Sleet / ice pellets:**

- Transparent / translucent spheres of frozen water with a diameter > 5 mm
- Develop first as raindrops in relatively warm atmosphere (Temp: > freezing), then raindrops descend into a colder layer of the atmosphere (Temp:<0^{o}C) causing the freezing into ice pellets while reaching the ground surface like freezing rain, an air temperature inversion is required.

3. **Snow:**

1. Commonly found in the mid- and high- latitudes
2. It develops when water vapour deposits itself directly to a six-sided (hexagon) deposition nuclei as a solid crystal, at temperature below freezing.

4. **Hail**

- A frozen form of precipitation with a diameter > 5 mm
- Hailstones: concentric shells of ice with alternating white cloudy appearance & those that are clear
- Cloudy white: contain partially melted snowflakes that freeze on to the to the surface of the growing hailstone
- Clear shell: develops when liquid water freezes onto the hailstone

CLOUD CLASSIFICATION

Clouds are classified into a system that uses Latin words to describe the appearance of clouds as seen by an observer on the ground. The table below summarizes the four principal components of this classification system

1. **LOW LEVEL CLOUD**

Cumulus: These clouds usually form at altitudes between 1,000 and 5,000ft, though often temperature rises after formation lead to an increase in cloud base height. These clouds are generally formed by air rising as a result of surface heating and may occasionally produce light showers.

Stratus: Usually forms between the surface and 2,000ft, but cloud base can be up to 4,000ft. Thick stratus can produce considerable precipitation, particularly in hilly or coastal regions, though in some cases this precipitation may be falling from higher

clouds such as nimbostratus. While thick stratus will obscure the sun or moon, they are clearly visible through thin stratus.

Stratocumulus: This cloud often occurs at altitudes between 1,000 and 4,000ft, though sometimes may be higher. While not generally producing precipitation these clouds may produce drizzle, particularly in hilly or coastal areas, and may be thick enough to obscure the sun or moon. These clouds consist entirely of liquid drops and are often formed close to the top of the planetary boundary layer.

Cumulonimbus: Cloud base is typically between 2,000 and 5,000ft. These clouds are formed when conditions are such that deep convection is able to develop, and may have a huge vertical extent particularly in the tropics, sometimes reaching the tropopause. These clouds produce heavy showers, thunderstorms and hail. At lower levels these clouds consist of liquid drops, but as altitude increases the cloud progresses through mixed phase and fully glaciated conditions. A fully developed cumulonimbus cloud may have a classic anvil appearance as the upper levels of the cloud spread out on reaching the tropopause. These systems may produce a considerable amount of cirrus cloud as the anvil spreads out.

2. MID LEVEL CLOUDS

Altostratus: Cloud base ranges between 10,000 and 20,000ft. Thicker forms of these clouds often produce continuous light precipitation and hide the sun or moon, though thinner forms show the sun or moon with a ground glass appearance.

Altocumulus: This type of cloud typically occurs between 6,500 and 20,000ft and is generally broken in appearance, though can occasionally produce precipitation and be thick enough to hide the sun or moon.

Nimbostratus: Cloud base ranges from the surface to 10,000ft. These clouds always hide the sun or moon, and normally produce continuous precipitation which is often moderate to heavy.

3. LOW LEVEL CLOUDS

Cirrus: Cirrus clouds do not produce precipitation which reaches the ground. Various halos and other optical effects may be produced by cirrus cloud. In some cases these clouds are also thick enough to hide the sun.

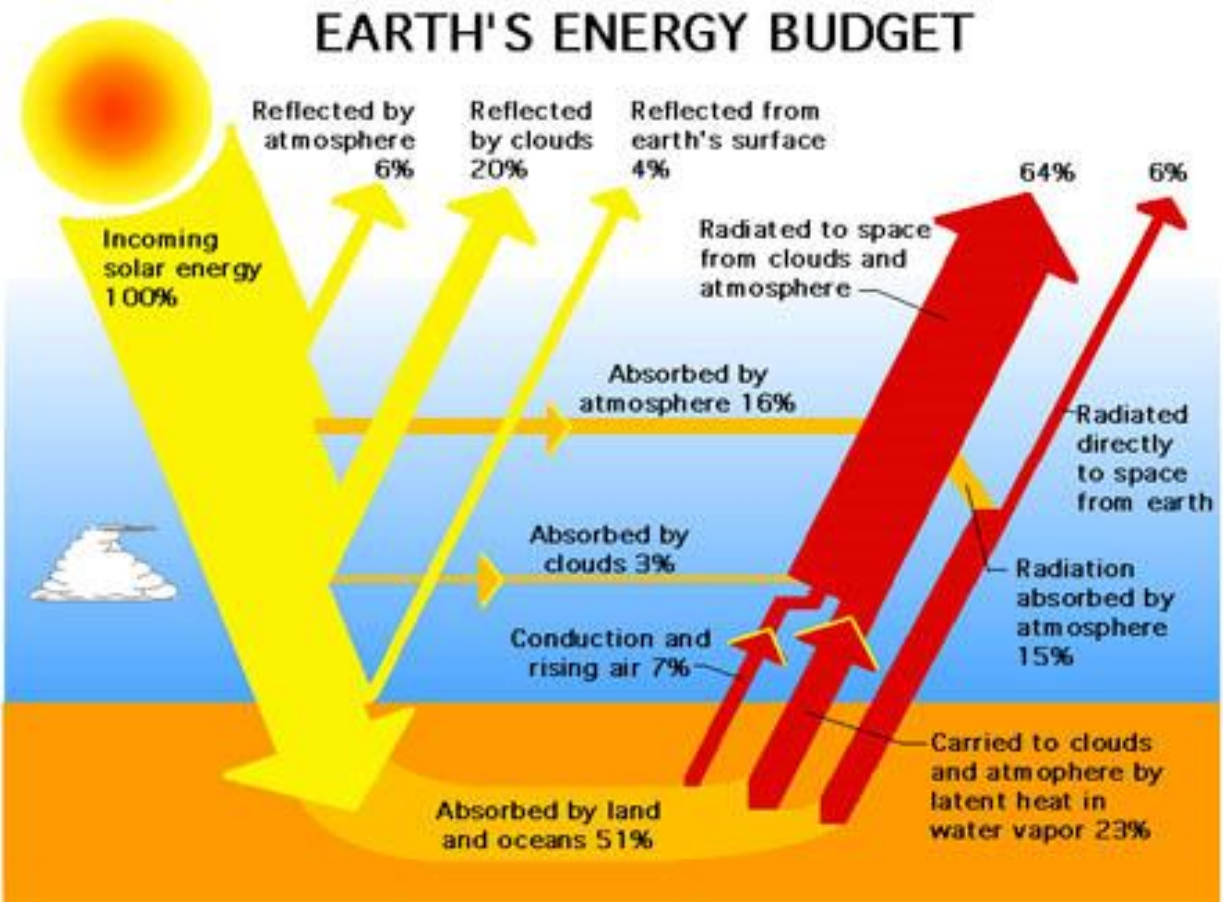
Cirrostratus: A thin layer cloud, which often produce halos and through which the outline of the sun is generally visible. These clouds are often the first visible indication of an approaching weather front, and may progressively thicken to altostratus and then nimbostratus with lowering of cloud base as the front approaches.

Cirrocumulus: Typically found in a similar altitude range to cirrus, these clouds do not produce precipitation and are usually more broken in appearance than cirrus, with the position of the sun or moon being visible.

EARTH'S ENERGY BUDGET

Earth's energy budget is an accounting of how much energy enters the Earth's climate system from the Sun, how much energy is lost to space and accounts for the remainder as stored on the Earth and its atmosphere. Quantifying changes in these amounts is required to accurately model the Earth's climate. Received radiation is unevenly distributed over the planet, because the Sun heats equatorial regions more than polar regions. Energy is absorbed by the atmosphere, hydrosphere, and lithosphere, and, in a process informally described as Earth's heat engine, the solar heating is redistributed through evaporation of surface water, convection, rainfall, winds, and ocean circulation. When the incoming solar energy is balanced by an equal flow of heat to space, the Earth is said to be in radiative equilibrium and under that condition, global temperatures will be stable.

Disturbances of Earth's radiative equilibrium, such as an increase of greenhouse gases, will change global temperatures in response. However, Earth's energy balance and heat fluxes depend on many factors, such as atmospheric composition (mainly aerosols and greenhouse gases), the albedo (reflectivity) of surface properties, cloud cover and vegetation and land use patterns. Changes in surface temperature due to Earth's energy budget do not occur instantaneously, due to the inertia of the oceans and the cryosphere. The net heat flux is buffered primarily by becoming part of the ocean's heat content, until a new equilibrium state is established between radiative forcings and the climate response.



EI NINO PHENOMENON

El Nino : Mass of warm surface water moving west to east across equatorial Pacific Ocean. Part of larger phenomenon called El Nino – Southern Oscillation **(ENSO)**

El nino conditions

- Normally, temperatures of surface waters in the western Pacific are 6 to 8 degrees Celsius (10 to 15 degrees Fahrenheit) warmer than in the east. But during an El Niño, the temperature differential reverses.
- The nutrient-poor warm water forces the fish that normally thrive off the west coast of South America to go elsewhere to find food. Birds that would feed on the fish die off, and the local fishing economy suffers.
- El Niño causes far-reaching weather events as well, including drought and heatwaves across Australia, torrential rainfall in Central and South America, and heavy winter snows and floods in the southern United States -- all of which affect water resources and food supply.

Normal situation over Pacific Ocean (non-El Nino year):

- low pressure over Asia
- high pressure over South America
- winds blow east to west
- shallow thermocline along South America, lots of upwelling, cold water at surface
- deeper thermocline near Asia, warm surface water piles up

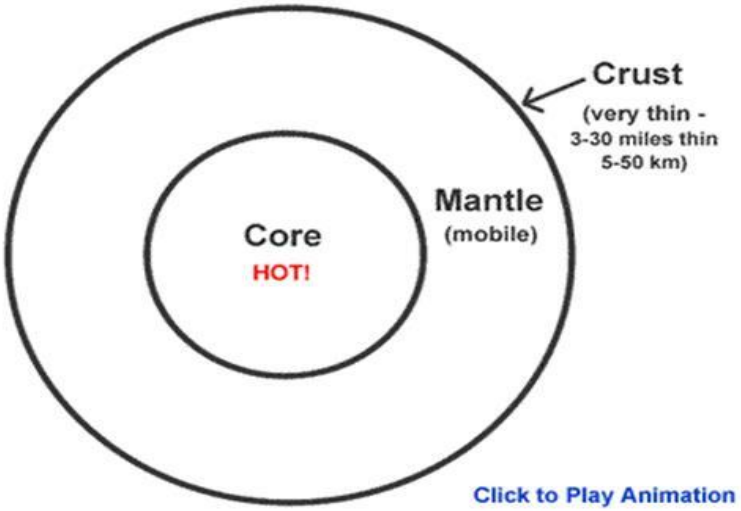
El Nino years over Pacific Ocean:

- pressure change = Southern Oscillation
- higher pressure over Asia
- lower pressure over South America
- winds weaken or blow west to east
- thermocline deepens along South America, little upwelling, warmer water at surface
- warm surface water sloshes back along equatorial Pacific

EARTH'S STRUCTURE-FORMATION OF CRUST-MANTLE-CORE

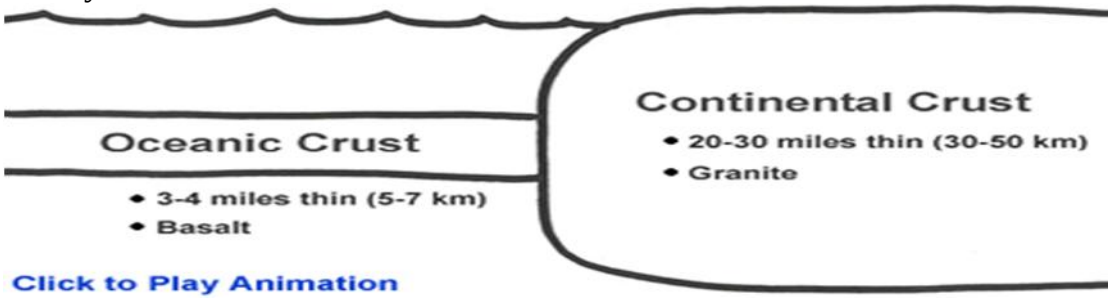
Earth's Structure

Knowledge of earth's interior is essential for understanding plate tectonics. A good analogy for teaching about earth's interior is a piece of fruit with a large pit such as a peach or a plum. Most students are familiar with these fruits and have seen them cut in half. In addition the size & features are very similar. If we cut a piece of fruit in half we will see that it is composed of three parts: 1) a very thin skin, 2) a seed of significant size located in the center, and 3) most of the mass of the fruit being contained within the flesh. Cutting the earth we would see: 1) a very thin crust on the outside, 2) a core of significant size in the center, and 3) most of the mass of the Earth contained in the mantle.



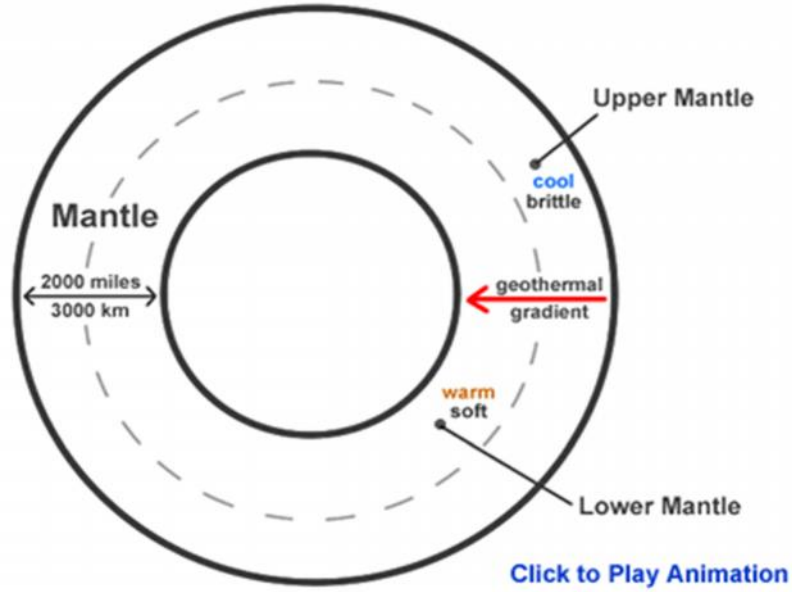
1. **Crust**

There are two different types of crust: thin oceanic crust that underlies the ocean basins and thicker continental crust that underlies the continents. These two different types of crust are made up of different types of rock. The thin oceanic crust is composed of primarily of basalt and the thicker continental crust is composed primarily of granite. The low density of the thick continental crust allows it to "float" in high relief on the much higher density mantle below.



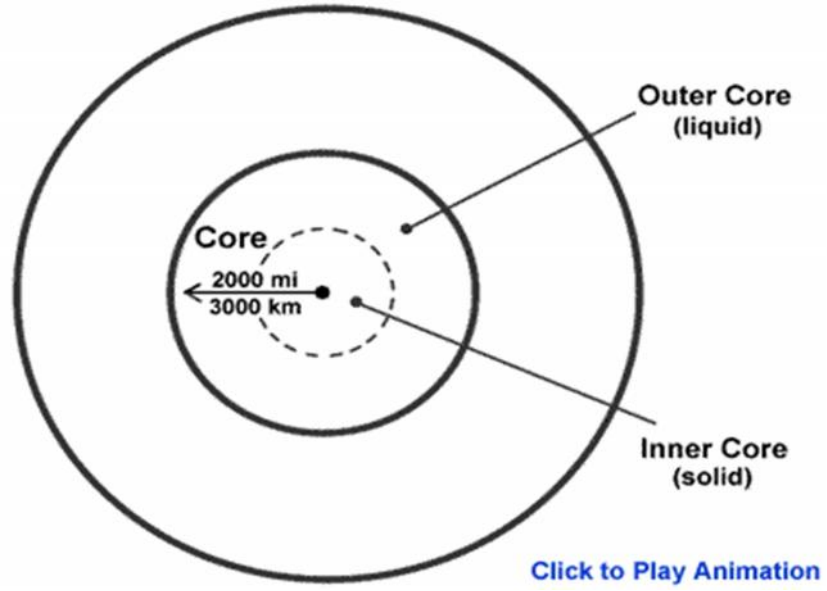
2. **Mantle**

Earth's mantle is thought to be composed mainly of olivine-rich rock. It has different temperatures at different depths. The temperature is lowest immediately beneath the crust and increases with depth. The highest temperatures occur where the mantle material is in contact with the heat-producing core. This steady increase of temperature with depth is known as the geothermal gradient. The geothermal gradient is responsible for different rock behaviors and the different rock behaviors are used to divide the mantle into two different zones. Rocks in the upper mantle are cool and brittle, while rocks in the lower mantle are hot and soft (but not molten). Rocks in the upper mantle are brittle enough to break under stress and produce earthquake. However, rocks in the lower mantle are soft and flow when subjected to forces instead of breaking. The lower limit of brittle behavior is the boundary between the upper and lower mantle.



3. **Core**

Earth's Core is thought to be composed mainly of an iron and nickel alloy. This composition is assumed based upon calculations of its density and upon the fact that many meteorites (which are thought to be portions of the interior of a planetary body) are iron-nickel alloys. The core is earth's source of internal heat because it contains radioactive materials which release heat as they break down into more stable substances. The core is divided into two different zones. The outer core is a liquid because the temperatures there are adequate to melt the iron-nickel alloy. However, the inner core is a solid even though its temperature is higher than the outer core. Here, tremendous pressure, produced by the weight of the overlying rocks is strong enough to crowd the atoms tightly together and prevents the liquid state.



MAGMA GENERATION AND FORMATION OF IGNEOUS ROCK

Rocks are divided into 3 categories

- Igneous- crystalline- forms as liquid cools
- Metamorphic- crystalline-forms as rocks are heated and squeezed
- Sedimentary- non-crystalline- smaller pieces or chemicals from other rocks

Igneous formed from Magma and Lava

- Magma: molten rock below Earth's surface
- Lava: magma on the Earth's surface.

General characteristics of magma

- Parent material of igneous rocks
- Forms from partial melting of rocks
- Magma at surface is called lava
- Rocks formed from lava = extrusive, or volcanic rocks
- Rocks formed from magma at depth = intrusive, or plutonic rocks
- Magma consists of three components: Liquid portion = melt; Solids, if any, are silicate minerals; Volatiles = dissolved gases in the melt, including water vapor (H_2O), carbon dioxide (CO_2), and sulfur dioxide (SO_2)
- Crystallization of magma
    1. Cooling of magma results in the systematic arrangement of ions into orderly patterns
    2. The silicate minerals resulting from crystallization form in a predictable order.
    3. Texture - size and arrangement of mineral grains

Composition of Igneous rocks

- **Felsic or Sialic magma**
    1. Si-rich (> 65%)
    2. rich in K, and Al
    3. little Ca, Fe, and Mg.
- **Intermediate magma:** Between the two extremes in Si content and other atoms.
- **Mafic magma**
    1. Si - poor (< 35%)
    2. richer in Ca, Fe, and Mg.

FORMATION OF IGNEOUS ROCKS

Igneous rocks comprise the bulk of the Earth, Moon, and other terrestrial planets. They form by the solidification of magma or “molten rock.” This chapter introduces the reader to magma and igneous rocks. It deals with the nature of magma and some of the fundamental descriptive aspects of igneous rocks, primarily their mineralogy and textures.

Magma: Fundamentals

Magma may be thought of as a molten rock. Magma is not often a simple liquid but rather a complex mixture of liquid, solid materials (crystals and rocks), and dissolved vapor. Magma's chemical composition and physical properties, such as viscosity and density, are all important factors that control magma's overall behavior—how fast or slow it will move, how explosive it will be, what minerals will form in it, and their grain sizes and physical interrelationships (i.e., texture). Below mentioned are some of these aspects of magma.

Chemical Composition of Magma

In terms of chemical composition, all magmas (except rare carbonatites that are rich in a carbonate component) are silicate magmas in which the dominant component is silica (SiO2), which generally comprises 45 % or more by weight. Alumina (Al2O3), with its abundance in common igneous rocks somewhere between 13 and 18 %, is a distant second.

SiO2, TiO2, Al2, O3, Fe2, O3, CaO, MgO, MnO, FeO, Fe2O3, Na2O, and K2O are often referred to as major oxides because together they comprise 99 % of any igneous rock. (Actually, the term "major element" is generally used, which is a bad practice that has been perpetuated through decades of geochemical practice.

RIVER MEANDERING

What is a meander?

1. A meander is a winding curve or bend in a river. They are typical of the middle and lower course of a river. This is because vertical erosion is replaced by a sideways form of erosion called LATERAL erosion, plus deposition within the floodplain.
2. The meander cross-section is **asymmetrical**. The **river cliff** is formed on the **outer bend** of the meander. This is where the water is **deeper** and moves **faster**. **Hydraulic action** and **abrasion** wear away at the side of the channel, **undercutting** the river bank to form a **river cliff**.
3. On the **inside bend** of the meander, the water is **shallower** and **moves more slowly**. As a result the river's load is **deposited** to form a **gentle** slope called a **slip-off slope** composed of alluvium.

FEATURES :

1. The major features found on a meander are river cliffs and slip-off slopes.
2. A river cliff forms on the outside of a river bend as a result of faster flowing water and its load causing erosion and undercutting the river bank.
3. A slip off slope forms on the inside of a river bend where the river is flowing more slowly and deposition takes place.

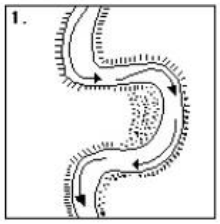
RIVER EROSION ACROSS ITS BED AND BANKS

1. Hydraulic action, abrasion and corrosion/solution are the relevant processes.

2. Hydraulic action is the removal of material by the sheer force of water. The turbulent flow of the water picks up loose material due to frictional drag. The higher the velocity – the more effective the process.
3. Abrasion occurs when material being carried by the river hits the bed and banks and so wears them away via a scouring/sandpapering effect. The load used for this purpose will vary in size.
4. Corrosion is the removal of certain rocks in solution – such as chalk and limestone where the mineral mixes with the rainwater and is carried away within it.

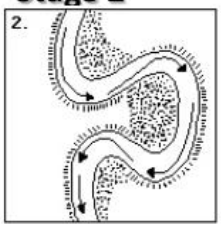
OX-BOW LAKE FORMATION

Stage 1



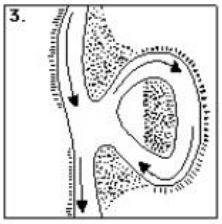
-When rivers flow over flatter land, they develop large bends called **meanders**.
-As the river gets bigger, it can carry larger amounts of material in **suspension**, which will erode the river banks by **corrasion**.
- the river is now eroding **sideways** into its banks rather than downwards into its bed, a process called **lateral erosion**.

Stage 2



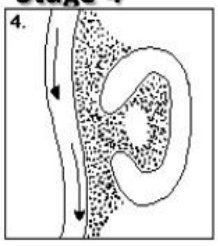
-On the **inside** of the bend there is much less water, making the river **shallow** and **slow-flowing**.
-Due to **erosion** on the **outside** of the bend and **deposition** on the **inside**, the shape of a meander will change over a period of time. Erosion narrows the neck of the land within the meander

Stage 3



-In time, and usually during a **flood**, the river will cut right through the neck.
-The river will take the new, shorter route

Stage 4



- With the fastest current in the centre of the river, deposition occurs next to the banks. Eventually, deposition will block off the old meander to leave an **ox-bow lake**.

UNIT-2

DEPLETION OF NATURAL CAPITAL

Natural Capital is defined as the natural resources that support lives and livelihoods.its depletion occurs due to following reasons:

1. Depletion of natural resources or assets due to high degree of exposure to a shock or disaster.
2. Conflicts over grazing rights, water, and
3. Depletion of natural resources due to unsustainable activities impact women's ability to engage in livelihoods and care for their families

DEVELOPMENT AS CAUSES OF DISASTER

Disasters are not inevitable. The way that governments manage and regulate both public and private investment will determine the degree of hazard, exposure to those hazards and vulnerability of people and property. Disasters have a devastating impact on development. Families lose homes, livelihoods and loved ones, communities lose businesses, jobs and services, children and particularly girls miss school and are at risk of early marriage – the list of impacts goes on. The drive for economic growth can expose countries to more risk5 – cities can be engines of growth, but unplanned urbanisation exposes many people to risk. Flood destruction in parts of Asia and Central America has been significantly exacerbated by major development – new hotels, roads, and dams – in fragile ecological systems. In this way, disasters can reveal the boundaries and limits to development. The incidence of disasters from natural hazards is increasing in every region of the world; reported weather-related disasters have tripled in 30 years.The numbers of people exposed to floods and tropical cyclones have doubled and tripled respectively since 1970.

Disaster risk is not shared equally between rich and poor. People are vulnerable because they are politically, socially or economically excluded, with little access to resources, influence, information or decision making. Poverty and inequality often push people to live on the margins, in places that are risky, such as alongside rivers, floodplains, marginal land and hillsides. This perpetuates a vicious cycle of disaster, debt and destitution. One very important driver of disaster risk is climate change. The latest IPCC report is clear that the climate is changing, with serious consequences. Another driver of disaster risk is population growth and migration. In particular, cities concentrate risk through high population density, inadequate urban planning, and poor infrastructure. Problems are particularly acute in slums, where around one billion people currently live, and this number is projected to double by 2030.

The Hyogo Framework for Action (HFA) – a global commitment made in 2005 to reduce disaster losses – has encouraged a more systematic and pre-emptive approach to disaster risk management. But addressing disaster risk separately from core frameworks like the MDGs has perpetuated its isolation and limited its impact.

In most governments, disaster risk management is undertaken by a standalone agency. It is therefore divorced from mainstream concerns, such as stimulating economic growth, boosting employment and managing food prices, or in the case of local governments; supplying water, power, transport and waste management. Yet these activities are not risk

neutral; done well, they can reduce disaster risk, but undertaken with little consideration of risk, they can exacerbate vulnerabilities. The failure of governments to adequately prioritise and invest in good risk management of disasters – whether from natural or man-made hazards – across all areas of work is the biggest driver of disaster risk.

Disaster risk reduction is often poorly funded. Whilst some governments – including Indonesia, Mexico, Guatemala, and Bangladesh – have made considerable investments, many countries struggle to find sufficient resources and capacity. This is partly because the deep extent of losses is not understood, as disaster losses are not properly accounted for, as well as lack of political visibility for DRR measures. Disasters have a devastating impact on development. Families lose homes, livelihoods and loved ones, communities lose businesses, jobs and services, children and particularly girls miss school and are at risk of early marriage – the list of impacts goes on.

CONSEQUENCES OF RAPID POPULATION GROWTH

A). SOCIO-ECONOMIC EFFECTS

- **Health services and facilities**

1. The in-migrants who come to settle in the destination can bring the new type of disease in the destination which can cause new type of health problem for the place where they have settled.
2. It affects in the distribution of health resources. The government or other concerning agencies and organization may not be able to provide or make the provision of better health facilities.
3. Medicines, vaccines and medical tool may become scarce which can affect in the health delivery process.
4. The doctor or the medical personnel may not be able to pay proper attention towards their patients if the pressure of patients in the hospitals or health centers becomes more.
5. The volume of wastes keeps on increasing along with the increase in the population size which ultimately affects the health of the common people.
6. The government and health concerned agencies need to increase the number of hospital and health centers along with the increase in population but because of the limited resources of government and country it is unable to manage enough health resources. This situation has caused serious health problems for many Nepalese people.

- **Education**

1. These days with the increase in population the education has begun to move away from the common people's children reach. The education is becoming more and more expensive and the common people are becoming unable to afford better education.

2. Skilled manpower essential to provide quality education can become scarce.

3. Arrangement of physical facilities, availability of educational materials and tools also become scarce along with the increase in population size.

4. The classes and colleges are becoming crowed with the more number of students and it is causing difficulty in smooth running of educational process.
5. Along with the increase in the demand of better education, many private schools and colleges are being established with the goal of providing better education, quality education and in the name of modern education, which are unnecessarily increasing the economic burden for many Nepalese parents.
6. Much education's associated negative practices and unhealthy competition among school has also increased which has affected in the overall educational system of the country.

- **Culture and cultural heritage**

1. The people lifestyle has changed with the increase in population size. People have become busier with their life and they have forgotten their culture, values and norms.
2. Many sites of cultural heritages have become the victim of human triggered pollution problems. Many cultural heritage sites have come under the threat of destruction by the human activities.
3. The increased concentration of harmful gases like carbon dioxide and sulfur dioxide has increased the chances of acid rainfall. The acid rain has potentiality to cause a serious threat on various cultural heritages (it mainly affects the monuments made up of lime, cement, marble and metals.
4. The land area of cultural heritage sites are being encroached by some greedy individuals of our society. The land is becoming scarce so the people have begun to settle around such places also which is causing the depletion of values associated with such sites.
5. People have begun to adopt western way of life. Young generations are becoming more attracted towards other culture and way of life. In the search for easier and convenient life style our unique culture, values and norms are being shadowed by the culture of so-called developed countries.
6. Due to the loss of our cultural values and norms the younger generations are becoming moredisturbed, hopeless, immoral and frustrated. The problems like drug addiction and crime is increasing in our society along with the decline in our cultural values and norms.

- **Employment**

1. With the increase in population unemployment problems are also increasing which have affected directly upon the exploitation of natural resources. Natural resources are becoming over exploited in order to fulfill the needs and demands of the people.
2. People are unable to get their job according to their qualification. Even the highly skilled manpower is found to be involved in lowly paid job.
3. Increasing unemployment problem can cause serious impact on the economic development of the nation.
4. If the society will be full of many unemployed youths than the crimes like robbery, burglary, rape and other various immoral activities start to occur more.

5. If the youths do not get a proper employment within the country it can result to brain drain andloss of valuable manpower to the country which can cause distress in the overall economic and infrastructural development of the nation.
6. Employment obtaining procedures have become tough and many social evils like bribery and corruption have increased in the society. Many Nepalese people are being cheated by the foreign employment agents with the false promise of promising job and placement.

- **Supply of drinking water**

1. The supply of clean and pure drinking water in both rural and urban areas have become for both the government and local agencies.
2. The water sources are drying up because the increasing population dependence on forest resource is increasing rapidly.
3. The quality of drinking water is declining because of the pollution created by increasingpopulation around the water resources.
4. People are filling up the wetland areas, encroaching water sources and destroying the waterbodies with the unplanned development and constructional activities.
5. Disposal of solid wastes in improper way have begun to pollute under-ground water which used to be considered as safe source of water. Over use of chemical fertilizers and pesticidesto increase the production of crops are poisoning water sources and is creating a serious problem in the safe supply of water.
6. People in rural areas have to spend a longer part of their time in fetching drinking water which has affected the health of mother and life style of people living in village areas. The global problems like global warming resulted by global increase of population have caused serious impact in the snowfall in the Himalayan region. Many people living in downstream of Himalayan region are likely to suffer from serious scarcity of water in the days to come.

- **Food grains**

1. Because of the growing population, it has become more difficult to obtain nutritious food. Food resources have become scarce and they have to survive on minimum amount of food.
2. The poor people who are unable to grow enough food or buy enough food are suffering from the problem of malnutrition. The children and women are becoming inevitable victim of malnutrition.
3. As the population is increasing it is decreasing the area of food cultivation because larger areas of fertile land are being converted in to settlement areas, which have seriously affected in the food production. In past our country used to export food grains but now its production cannot sustain the average food needs of its own people.
4. The organic methods of cultivation have been replaced by the inorganic methods of collections. Various chemical fertilizers, pesticides and antibiotics are being used in the process of production of food. These chemicals are being transferred to human bodies which have resulted to various health problems.

5. Uneven distribution of food resources is increasing. Some limited countries around the world are consuming more food resources and many countries around the world are facing food crisis. A large amount of grains produced in America is used for making a bio-fuel where as the people living in Africa and Asia are deprived from the grains.
6. People have begun to cultivate even in the slope land and marginal areas in order to fulfill the need of increasing population which have caused a serious impacts on the soil fertility and the rate of soil erosion is increasing.

- **Housing**

1. There is a shortage of space. Whatever the number of the members in the family, all have to live in the same space, which is unhygienic and anti-social in nature. It can create problem in privacy of the couple.
2. Due to thick and unorganized settlements, there are no proper dumping sites. Wastes are piled at random and environmental pollution grows.
3. The areas of cultivable land are diminishing because settlements and houses are built.
4. Houses are not built hygienically because the land is becoming scarce in urban areas. Drainage system and wastes disposal system have become unmanaged which have affected the beauty and meaning of urban areas.
5. As the population growth rate is high, the town planning and city planning system has become only in the book. Unmanaged urbanization is increasing even in the heart of nation's capital which is affecting the prestige of the whole nation.
6. More number of houses is being made means more trees are being cut down. It has resulted to the rapid deforestation of forest which has resulted to environmental degradation.

- **Clothing**

1. Our textile industry does not produce enough quantity of cloth to meet the requirements of all people living in Nepal. So we have to depend on import. Except for a handful people, majority of people in our country do not have sufficient clothes. Many people are half-clad or ill-clad. There are people who spend winter nights shivering with cold owing to the lack of clothing.
2. Our large amount of national income is drained to other countries for buying the clothes.
3. It has become difficult for the family members to manage enough and good clothes for the family members.
4. The quality of clothes is declining because the industries need to produce more clothes in a less economic value.
5. The cost of clothes is increasing along with the increased demand of clothes of increasing population.
6. Traditional clothes and costumes are being displaced with the modern and western clothes and fashion. Young people are becoming attracted towards such clothes and fashion which have affected in the financial position of the family also.

- **Security and entertainment**

1. Along with the increase of rate of unemployment resulted by population growth, there may be risk of increase in theft, robbery, burglary and affect in the safety of individuals life.
2. The security personnel may be unable to control the crowd of vehicle and people in the urban areas which can increase the rate of road accidents and other undesired happenings.
3. Unnecessary disputes, quarrels, internal conflicts like civil war and riots break out in country. It has been rightly said "Hunger fears no gallows."
4. Flesh and blood require not only diet but also entertainment and recreation. It can help an individual to relieve from tension and mental pressure. But because of the population growth parks, resorts and natural scenery have also been victimized. Forest is being cut down, rivers are being drained with pollution, greeneries are being turned into dull dry land and cultural heritages are being spoilt.
5. The area of entertainment has become highly commercialized. Such areas are not in the common reach of many people as entertainment centers are urban based. Many wrong practices and trend is occurring in the entertainment sectors. These days entertainment sector has become the center for learning negative behaviour than learning positive aspects of life and relieving pain and sufferings.
6. In the lack of proper entertainment and recreation, peace and security, many people are living their life in frustration, distress and fear.

B). ENVIRONMENTAL EFFECTS

- **Forest and vegetation**

1. The condition of forests and vegetation is very frightening now in our country. They are being depleted at a faster rate.
2. Along with the increase in population the human need of firewood as fuel also keep on increasing. Large areas of forest are being cleared every year to fulfill the need of fuel.
3. The need of development and constructional activities also become more along with the increase in the size of population. These activities results to the rapid decline of forest area. More raw materials are being extracted from the forest to support many industries based on forest products.
4. Larger areas of forest is also being cleared to obtain a new land for settlement, cultivation and to make industries.
5. Many unemployed people depend upon forest resources to earn their living.
6. Many valuable resources of forest like medicinal plants, herbs, rare animals, sources of water are also being seriously affected because of the deforestation. The rate of soil erosion and other natural calamities are also increasing because of the deforestation.

- **Aquatic and terrestrial animals**

1. The present environment is in the state of degradation which has also affected the innocent aquatic and terrestrial creatures. The degradation of environment caused

by the most intelligent creature ‘The Human Beings’ are affecting the life of every living species on the face of the planet.

2. To fulfill he selfish end of ourselves we are using more amount of chemical fertilizers and pesticides which is depleting the natural habitat of many species of living creatures.
3. The survivals of many aquatic creatures are in stake because of the pollution created by human beings around the water sources.
4. It has created various kind of pollution around the habitat of wild animals which has caused them difficulty in mobility and food habit.
5. Destruction of forest areas, wetland areas, disposition of wastes around water resources, unplanned and non-environment friendly development activities are causing a serious threat on the existence of animal and birds.
6. Many of the creatures like passenger pigeon, great auk, dodo, dusky seaside sparrow etc have become already extinct from the earth. Many other species are in the verge of extinction. Biologists estimate that the current rate of extinction is at least 1,000-10,000 times the rate before humans arrived on the earth. Research says that at least one- fifth of the world’s current animal and plant species would be gone by 2030. These troubles are the outcome of the culpable activities of human beings and their unrestrained growth in number.

- **Air**

1. Air pollution is very old environmental problem, but it started to occur as a complex problem when population began to grow rapidly and excessive industrialization started.
2. Extension of industrial areas, urbanization, unplanned development activities and constructional works, increasing dependency on fossil fuels, decrease in the area of forest etc. caused the sharp increase in the air pollutants which have equal impact on living beings and earth natural processes.
3. Over the past several years the incidence of a number of diseases has increased greatly. Asthma is perhaps the most important disease with an increasing incidence, but other diseases, such as allergic reactions, bronchitis and respiratory infections also have been increasing. The cause of these increases may be due at least in part to the effects of air pollution.
4. The air pollution is affecting not only the human beings, but the other living beings are also seriously affected. Vegetations can also be affected by the air pollution.
5. The environmental problems like global warming, ozone layer depletion, greenhouse effect etc. are also the negative outcome of air pollution.

- **Water**

1. Water is not immune from the effect of the population growth. The more human population grows, the greater amount of water is used for the human purposes which ultimately increases the rate of water pollution.
2. Agriculture sector release large amount of chemicals in to the water sources in the form of chemical fertilizers, insecticides and herbicides.

3. Industries like textile industries, paper and pulp making, petroleum, refining industries release large amount of chemical wastes into the water sources which causes the maximum impacts on such places.
4. Polluted water can cause water borne diseases to the living beings and may result to the drinking water problem in the human society.
5. Water is a main element that makes the earth as a living planet. If this valuable resource of the earth is affected it can have a serious impact on the existence of the living on this planet.

- **Land**

1. Land pollution is the demolition of Earth's land surfaces often caused by human activities and their misuse of land resources. It occurs when waste is not disposed properly. Health hazard disposal of urban and industrial wastes, exploitation of minerals, and improper use of soil by inadequate agricultural practices are a few factors. Urbanization and industrialization are major causes of land pollution. The Industrial Revolution set a series of events into motion which destroyed natural habitats and polluted the environment, causing diseases in both humans and many other species of animals.
2. Land pollution is caused by farms because they allow manure to collect, which leaches into the nearby land areas.
3. Wastes from Industries: Industrial waste matter that can cause land pollution can include paints, chemicals, and so on. Solids from Sewage Treatment: Wastes that are left over after sewage has been treated, biomass sludge, and settled solids. Ashes: The residual matter that remains after solid fuels are burned. Garbage: This comprises waste matter from food that are decomposable and other waste matter that are not decomposable such as glass, metal, cloth, plastic, wood, paper.
4. Land pollution can seriously affect the terrestrial ecosystem
5. It can affect in the soil fertility affecting in the production of crops for human beings.

- **Flood, landslides and soil erosion**

1. The problem of deforestation resulted by the population explosion has increased the chances of natural calamities like landslide, soil erosion and flood.
2. In the hilly region the chances of soil erosion has increased because they have begun to cultivate even in the slope and weak land forms without making any provision of erosion controlling mechanism.
3. Over-grazing of cattle in the grassland has also affected the physical landform in the Himalayan and Hilly region which has helped to increase the rate of soil erosion and landslide in these regions.
4. During the construction of roads and other constructional activities cracks or fissures are made in the Hilly region. The water enters inside the land through these holes and weakens the soil which can trigger the natural calamity like landslide.

5. Lakes, ponds and water sources are being polluted by the pollutants brought down by soil erosion and landslides. It is causing serious impact on ecosystem and affecting in the environmental balance.

- **Sound**

1. In urban areas number of traffic has increased sharply which have resulted to noise pollution.
2. Industries and factories need to be established more to fulfill the increasing demand of increasing pollution which is also affecting the peaceful environment of our society.
3. There has been increase in the mass media, loud speakers and musical instruments which is also causing disturbance to the peaceful environment of our society. A sound that is pleasant for one individual or group of people can be distressing and disturbing to other people.
4. Nowadays the environment is not quiet. It is full of many anthropogenic undesired noises which are affecting the habitat of many wild animals and birds.
5. Noise pollution causes pathological and psychological disorders. It can seriously affect our health. Noise can cause high blood pressure; affect the ear and cause nausea and dizziness.

MULTIPURPOSE PROJECTS

A multipurpose project is a large scale hydro project often including dams for water retention, canals for irrigation, water processing and pipe lines to supply water to cites and power generation. These often include transportation, improvements and industrial growth. They are also developed to reduce the dangers of flooding.

Positives: 1) Eliminates or reduces flooding 2) impounds water for later use - irrigation, human consumption, industrial consumption 3) lake fisheries 4) power generation 5) transporation 6) recreation

Negatives They lead to the displacement of human, plants, animals, chiefly from small tribal communities; disrupt downstream fisheries; increase the risk of earthquakes; submerge forest land; increase the spread of insect-borne diseases; and threaten the fragile regional ecosystem through reducing, the flow of water from the rivers into the seas. These projects initially devastate human lives and biodiversity by inundating thousands of acres of forests and agricultural land. They degrade the fertile agricultural soils due to continuous irrigation (rather the seasonal irrigation which is dependent on the monsoon), and salinization, making the soil toxic to many plant species. Multi-purpose river valley projects nearly always involve construction of a large dam. That provides flood control, electrical generation, and irrigation water for farms. The disadvantages are often ignored by developing countries. Communities along the river are flooded and must relocate. Excellent fields, orchards and forests may be lost.

RESETTLEMENT ISSUES

People are forced to move out of their land due to both natural and man made disasters. Natural disasters like earthquakes, cyclones, tsunami etc. render thousands of people

homeless and sometime even force them to move and resettle in other areas. Similarly, developmental projects like construction of roads, dams, canals and flyovers displace people form their home. Resettlement refer to the process of settling again in a new area. Rehabilitation means restoration to the former state.

Reasons for displacement of people

1. Natural disasters like earthquake, cyclones, tsunamis, volcanic eruptions, prolonged droughts conditions, floods, hurricanes etc.
2. Man made disasters like industrial accidents (e.g. Bhopal gas tragedy), nuclear accidents(Current disaster in Japan), oil spills(Exxon Valdez oil spill), toxic contamination of sites etc.
3. In search of better employment opportunities.
4. Developmental projects like:
5. construction of dams, irrigation canals, reservoirs etc.
6. Infrastructural projects like flyovers, bridges, roads etc.
7. transportation activities like roads, highway, canal etc.
8. Energy related project like power plants, oil exploration, mining activities, pipelines like HBJ pipeline etc.
9. Agricultural projects
10. Projects related with the conservation of wildlife like national parks, sanctuaries and biosphere reserves.

Resettlement issues

As per the World Bank estimates, nearly 10 lakh people are displaced worldwide for a variety of reasons. Below mentioned are few of the sufferings that these people have to face but we are unable to feel for them:

1. Little or no support: Displacement mainly hits tribal and rural people who usually do not figure in the priority list of any political authorities or parties. Why do you think that the rural people have become the red Robinhoods of today which are the Maoists?
2. Meager compensation: The compensation for the land lost is often not paid, it is delayed or even if paid, is too small both in monetary terms and social changes forced on them by these mega developmental projects.
3. Loss of livelihood: Displacement is not a simple incident in the lives of the displaced people. They have to leave their ancestral land and forests on which they depend for their livelihood. Many of them have no skills to take up another activity or pick up any other occupation. Usually, the new land that is offered to them is of poor quality and the refugees are unable to make a living.
4. Lack of facilities: When people are resettled in a new area, basic infrastructure and amenities are not provided in that area. Very often, temporary camps become permanent settlements. It is also a major problem of displacement or resettlement that people have to face.
5. Increase in stress: Resettlement disrupt the entire life of the people. They are unable to bear the shocks of emptiness and purposelessness created in their life. Payment of compensation to the head of the family often lead to bitter quarrels

over sharing of compensation amount within the family, leading to stress and even withering of family life. Moreover, land ownership has a certain prestige attached to it which cannot be compensated for even after providing the new land. With the loss of property and prestige, marriages of young people also become difficult as people from outside villages are not willing to marry their daughters to the refugees.

6. Increase in health problems: Lack of nutrition due to the loss of agriculture and forest based livelihood, lead to the general decline in the health of the people. People are used to traditional home remedies. But th herbal remedies and plants gets submerged due to the developmental projects.
7. Secondary displacement: Occupational groups residing outside the submergence area but depending on the area for the livelihood also experience unemployment. Village artisans, petty traders, laborers etc, lose their living.
8. Loss of identity: Tribal life is community based. The tribal are simple people who have a lifestyle of their own. Displacement have a negative impact on their livelihood, culture and spiritual existence in the following ways:
9. Break up of families and communities are the important social issues of displacement. The women suffer the most as they are deprived even a little compensation.
10. Inter-community marriages, cultural functions, folk songs and dances do not take place among the displaced people. When they are resettled, it is generally individual based resettlement, which ignores communal character.
11. Resettlement increases the poverty of the tribal due to the loss of land, livelihood, food insecurity, jobs, skills etc.
12. Loss of identity of individuals and the loss of connection between the people and the environment is the greatest loss in the process. The indigenous knowledge that they have regarding the wildlife and the herbal plants are lost.
13. The land acquisition laws do not pay attention to the idea of communal ownership of property which increases stress within the family.
14. The tribal people are not familiar with the market trends, prices of commodities and policies. As such, they are exploited and get alienated in the modern era. My mother often says about the plight of people from Nepal who came newly to the city of Gangtok. Earlier, when they demanded four meters cloth piece, the shopkeeper used to measure the same from all the four sides of the piece. Actually it was only one meter in length but they used to charge the priced of four meter cloth.

EPIDEMICS

An epidemic is described as seasonal outbreaks of infectious diseases. The primary definition of epidemic continues to be “a widespread occurrence of an infectious disease in a community at a particular time”. Although vague, this account nicely captures the common thought that epidemics have something to do with a spike in infectious disease in a particular population. An even more precise account is found in the first edition of

the Oxford Companion to Medicine, which defines epidemic as an outbreak of disease such that for a limited period of time a significantly greater number of persons in a community or region are suffering from it than is normally the case. The extent and duration of an epidemic are determined by the interaction of such variables as the nature and infectivity of the causal agent, its mode of transmission, and the degree of preexisting and newly acquired immunity, etc. An epidemic is the occurrence of numbers of cases of a disease clearly above normal expectations." In some cases, the primary definition is confined to infectious disease, but the secondary one covers all unexpected adverse events that affect a population. The newer meaning of "epidemic" suffers from three main problems: it lacks precision and explanatory power, it is politically controversial, and it contributes to the increasingly common perception of epidemiology (which began as the study of epidemics) and public health (which began as the branch of medicine charged with treating and preventing epidemics) as fields of study with no clear mission or unique domain.

The first problem with the secondary sense of epidemic is that it is too inclusive to pick out a clear set of issues. For example, if an epidemic occurs whenever an unusually large number of people in a population are adversely affected by an event, we would have to include as epidemics the increase in amputees during World War II, the uptick in children who drown in rivers after Indian monsoons, and deaths and injuries in Indonesia that occurred after the massive 2004 tsunami. These are medically important events, and in some ways the resulting injuries were unexpected, but few would consider them epidemics. The main reason seems to be that they are not caused by infectious agents. In all three cases there is a clear and common cause of injury, but there is no vector or vehicle that transmits the medical event from one person to another.

The second problem with the expansive account of epidemic is that it tends to license a certain amount of political manipulation.8 It is increasingly common for well-meaning journalists, politicians and scientists to label global problems as "pandemics" (epidemics that cross borders) or "public health crises" in order to draw attention to them. Even for infectious disease, controversies have raged over whether to label recent outbreaks of Avian and Swine flu as "pandemics." Some suspect that the main motivation for labeling them pandemics is to raise public awareness and government funding for vaccination rather than to accurately depict the (likely) trajectory of infection.9 Because epidemics and pandemics caused by infectious disease can be scary events that inflict large losses, most people are willing to make significant sacrifices to address them. The relevant sacrifices include foregoing freedom to travel to certain regions, and paying higher taxes to finance vaccination provision and disease surveillance programs. If people are willing to make these sacrifices in order to diminish the threat of traditional epidemics, perhaps activists think they will be more willing to endorse restrictive laws or higher taxes to address obesity, autism, and income inequality, among other issues.

A third problem for the more expansive account of epidemic is that epidemiologists – whose main job is to discover, describe and address epidemics – are not necessarily well-placed to solve the many problems that fall within its scope, such as poverty, rape, and unemployment. Epidemiologists have no special expertise about what causes these

conditions, or how best to treat them. Instead, political scientists, economists, and psychologists are often better equipped to tell us how to improve employment prospects, to create institutions that minimize violence, and so on.

CHEMICAL RELEASES

More than 248 000 chemical products are commercially available (CAS 2011) and subject to regulatory and inventory systems. Chemicals provide valuable benefits to humanity including in agriculture, medicine, industrial manufacturing, energy extraction and generation, and public health and disease vector control. Chemicals play an important role in achieving developmental and social goals, especially for improving maternal health, reducing child mortality and ensuring food security, and advances in their production and management have increased their safe application. Nonetheless, because of their intrinsic hazardous properties, some pose risks to the environment and human health. Simultaneous exposure to many chemicals – the cocktail or synergistic effect – is likely to exacerbate the impacts.

Chemicals are released at many steps in their life cycle, from the extraction of raw materials, through production chains, transport and consumption, to final waste disposal. They are distributed through indoor environments, food and drinking water, and through soils, rivers and lakes. Certain long-lived chemicals such as persistent organic pollutants (POPs) and heavy metals are transported globally, reaching otherwise pristine environments such as rain forests, deep oceans or polar regions, and can quickly pass along the food chain, bioaccumulating to cause toxic effects in humans and wildlife. Products derived from chemicals often become hazardous wastes in their end-of-life phase, generating additional pollution risks that can devalue their initial benefits and counteract development advantages. Pollution from dumping and uncontrolled open burning is common some progress has been made in recent decades. The causes of mismanagement often lie in such factors as deficiencies in institutional and regulatory frameworks. Such shortcomings also have an impact on the growing transboundary movement of hazardous wastes from developed to developing countries, where compliance, monitoring and enforcement of regulations tend to be weak, and the financial and technical capacity to implement improved waste management practices is limited. This leads to a risk of rapidly increasing exposure for greater portions of the population and to related, often serious, health problems, in particular for women and children. Broadly, a two-speed situation exists, with developed countries generally having comprehensive systems for chemical and hazardous waste management, while developing ountries generally do not. Developing countries and economies in transition struggle with basic landfill co-disposal of many types of wastes, with little capacity for their separation and sound management. While many developing countries have ratified the multilateral environmental agreements on chemicals and wastes – such as the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal. In most countries, it is the poorest members of the population that are at particular risk of exposure. This may be due to occupational exposure, poor living conditions, lack of access to clean water and food, domestic proximity to polluting

activities, or a lack of knowledge about the detrimental impacts of chemicals – or a combination of these factors. Radioactive contamination is another source of potential environmental and health hazards, both from controlled emissions and waste management, and from accidental release. The controlled release of radionuclides to the atmospheric and aquatic environments may occur as authorized effluent discharge, while uncontrolled release may occur as a result of accidents and at legacy sites left by nuclear weapons testing. The management and disposal of radioactive waste from industry, research and medicine, as well as from nuclear power, is relevant to almost all countries, requiring different approaches according to the volume, radioactivity and other properties of the waste.

Substances that Deplete the Ozone Layer for example, being effective in reducing the impact of ozone-depleting substances, while the Basel Convention has struggled to reduce the transboundary movement of hazardous waste. There have been significant advances over the past decade, however, and regulatory instruments are now improving with the better and more widespread understanding of the life cycle of chemicals and their association with the generation and processing of wastes. Efforts to bring the work of the Basel, Rotterdam and Stockholm Conventions together constitute a first step towards addressing the entire life cycleof chemicals. This also applies to the establishment of the Strategic Approach to International Chemicals Management (SAICM) and the current negotiation for an international agreement on mercury. Similarly, the Joint Convention on the Safety of Radioactive Waste Management and the Safety of Spent Nuclear Fuel Management is a significant step forward. However, ensuring that these efforts are sustained and fully anchored at the national level requires further investment in better science-based understanding of chemicals and wastes, policy creativity to balance development and sustainability imperatives, public-private partnerships to link technological innovation and societal responsibility, and allocation of funds for comprehensive capacity building.

INDUSTRIAL ACCIDENT

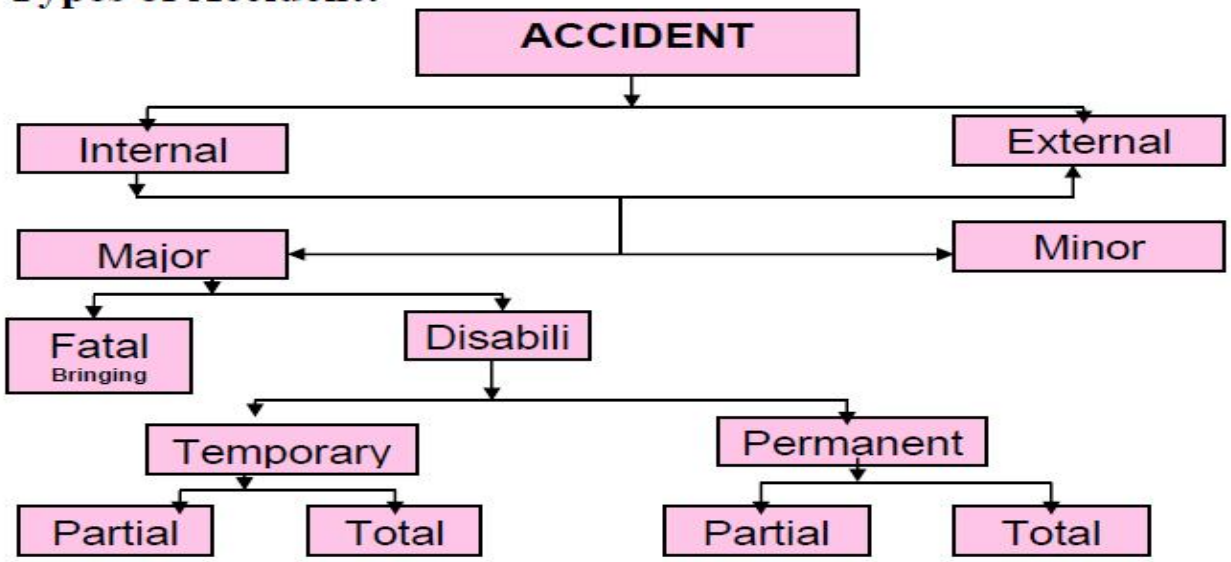
ACCIDENT:

1. An accident which ends in a death, or which results in a prolonged disability to the injured is a major one.
2. A mere incision or a deep scratch , say, on the leg or the shoulder, may or may not immediately disable the worker, but he or she may develop disability later.

SAFETY:

1. Safety, in simple terms, means freedom from the occurrence or risk of injury or loss. Industrial safety or employee safety refers to the protection of workers from the danger of industrial accident.
2. An Accident then, is an unplanned and uncontrolled event in which an action or reaction of an object, a substance, a person or a radiation results in personal injury.

Types of Accident:



Reasons for industrial accidents :

1. Poor leadership from the top
2. Inadequate supervision
3. Insufficient attention to the design of safety into the system.
4. An unsystematic approach to the identification, analysis and elimination of hazards.
5. Poor training facilities and employee motivation

Therefore, safety is required. Because safety increase employee moral, increased productivity, helps to follow the legal instruction and finally save the cost related to accident and after. When an injured worker returns (if he / she is lucky to do so) he/she may operate at less than his / her normal efficiency for sometimes. Co workers, too may become emotionally upset for some time and consequently turnout fewer and inferior goods. Finally, customers may be lost because of the non-execution of orders on time. Safety programmes deals with the prevention of accidents and with minimum the resulting loss and damage to persons and property. **Five basic principles** must govern the safety programmes of an organization:

1. Trace out the root cause of Accident.
2. Identify the potential hazards
3. Continuous monitoring the safety performance
4. Assuring the accountability of employee and employer for safety performance in the working areas.
5. Assuring the continuous training and education on eliminating safety hazards and prevention of accidents.

A safety programme generally contains 6 Elements:

1. Strategic Choice
2. Development of Safety Policy
3. Organization for safety
4. Analysis of Causes for Accidents
5. Implementation of the Programme
6. Evaluation of Effectiveness by Safety inspection And safety audit.

The AXIOMS of industrial accidents are as follows:

1. The accident is caused or permitted directly by an unsafe act of an employee and / or a mechanical or physical hazard.
2. The unsafe acts of employees are responsible for a majority of accidents.
3. The occurrence of an accident that results in an injury is largely preventable.
4. Four basic methods are available for the prevention of accidents – **engineering revision, persuasion and appeal, personal adjustment** and **discipline**.
5. The immediate supervisor or the foreman is the key person in industrial accident prevention.
6. Safety should be driven internally, not externally.
7. Do not count on common sense for safety improvement.
8. Safety incentives programmes should focus on processes rather than outcomes.
9. Behaviour is directed by activators and motivated by consequences.
10. When people feel empowered, their safe behaviour spreads to other situations.

UNIT-3

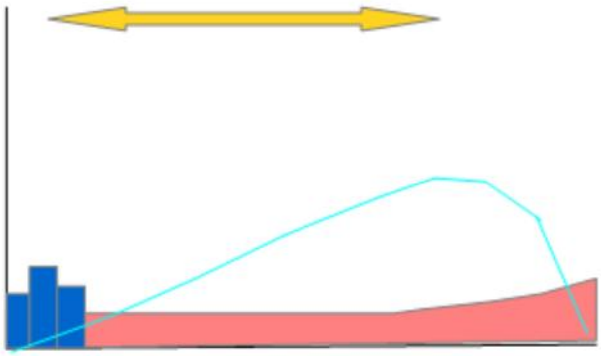
FLOOD :
A flood is a natural event that can have far reaching effects on people and the environment. Put simply, a flood is too much water in the 'wrong' place!

Causes of flood
A flood is caused by a combination of heavy rainfall causing river / oceans to over flow their banks, and can happen at any time of the year, not just in the winter. Floods generally develop over a period of days, when there is too much rainwater to fit in the rivers and water spreads over the land next to it (the 'floodplain'). However, they can happen very quickly when lots of heavy rain falls over a short period of time. These 'flash floods' occur with little or no warning and cause the biggest loss of human life than any other type of flooding. Coastal areas are also at risk from sea flooding, when storms and big waves bring seawater onto the land. The worst cases of flooding may occur if there is a combination of storms, 'spring tides' and low atmospheric pressure.

Effects of flooding
Flooding can be very dangerous – only 15cms of fast-flowing water are needed to knock you off your feet! Floodwater can seriously disrupt public and personal transport by cutting off roads and railway lines, as well as communication links when telephone lines are damaged. Floods disrupt normal drainage systems in cities, and sewage spills are common, which represents a serious health hazard, along with standing water and wet materials in the home. Bacteria mould and viruses, cause disease, trigger allergic reactions, and continue to damage materials long after a flood. Floods can distribute large amounts of water and suspended sediment over vast areas, restocking valuable soil nutrients to agricultural lands. In contrast, soil can be eroded by large amounts of fast flowing water, ruining crops, destroying agricultural land / buildings and drowning farm animals. Severe floods not only ruin homes / businesses and destroy personal property, but the water left behind causes further damage to property and contents. The environment and wildlife is also at risk when damage when damage to businesses causes the accidental release of toxic materials like paints, pesticides, gasoline etc. Floodwater can severely disrupt public and personal transport by cutting off roads and railway lines, as well as communication links when telephone lines are damaged.
Unfortunately, flooding not only disrupts many people's lives each year, but it frequently creates personal tragedies when people are swept away and drowned.

Flood Hydrographs
Flood hydrographs are used as a way to predict if a river is more or less likely to flood. The diagrams below show two typical flood hydrographs.

1. **Flood hydrograph A**



This hydrograph has a ***longer lag time***. This means that there is a longer time between the peak rainfall and the peak river discharge. The rain water is taking longer to enter the river so it is ***less likely to flood.*** The hydrograph has a shallow rising and faling limb and a low peak discharge.

2. **Flood hydrograph B**

This hydrograph has a ***shorter lag time.*** This means that there is a shorter time between the peak rainfall and the peak river discharge. The rain water is taking a shorter amount of time to enter the river so it is ***more likely to flood.*** The hydrograph has a steep rising and falling limb and a high peak discharge.

River types

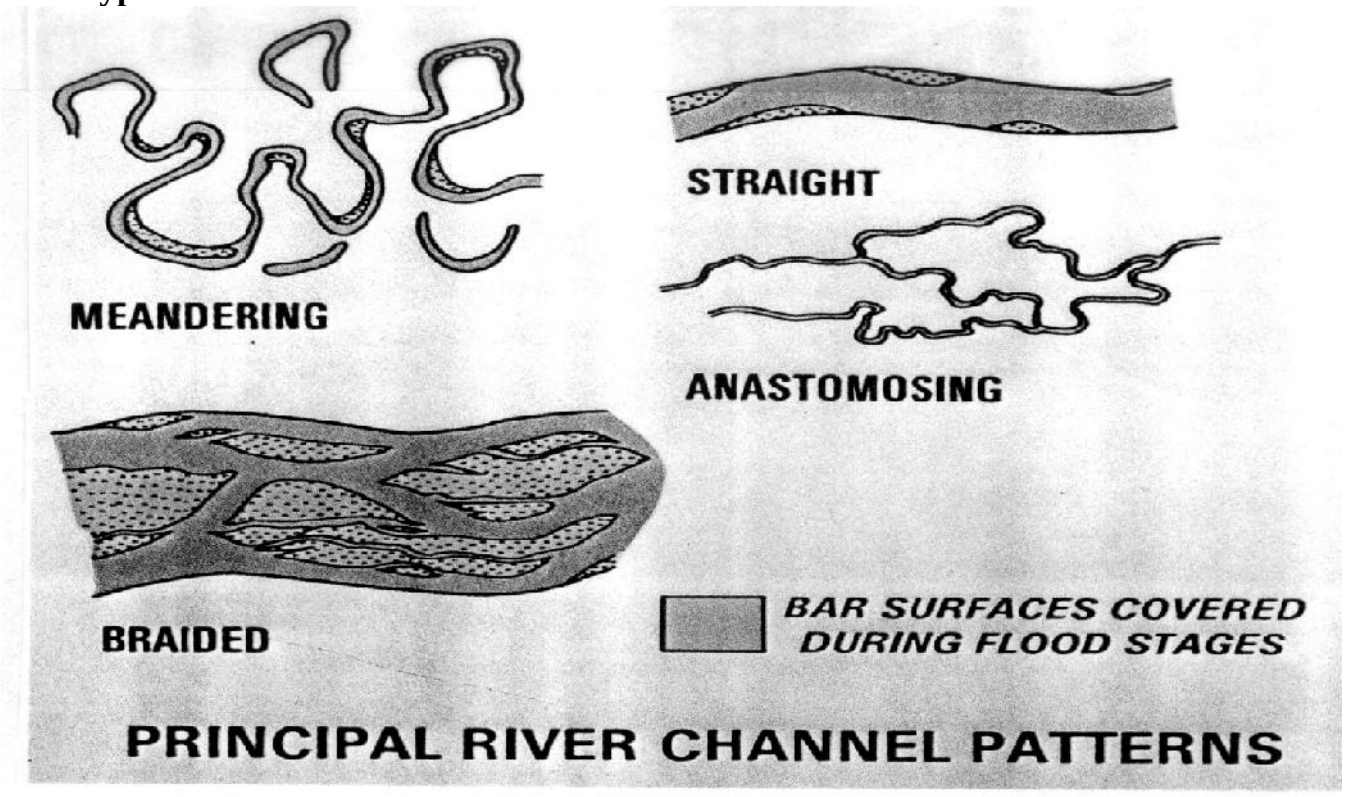


Fig. 1—Illustration of river types in plan view. Deposits of meandering and braided rivers have been most widely recognized in the ancient record. After Miall (1977).

RESERVOIR

A reservoir is an artificial lake where water is stored. Most reservoirs are formed by constructing dams across rivers. A reservoir can also be formed from a natural lake whose outlet has been dammed to control the water level. The dam controls the amount of water that flows out of the reservoir. Service reservoirs are entirely manmade and do not rely on damming a river or lake. These reservoirs, sometimes called cisterns, hold clean water. Cisterns can be dug in underground caverns or elevated high above ground in a water tower. People have been creating reservoirs for thousands of years. The oldest known dam in the world is the Jawa Dam in what is now Jordan. It was built in about 3000 BCE to store water to use for irrigation, or watering crops. People build reservoirs because the amount of water in a river varies over time. During very rainy times or when mountain snow is melting, the water in river rises and sometimes overflows its banks. By limiting the amount of water allowed to continue downriver, reservoirs help control flooding. During droughts, or extended dry periods, the water level in a river may be very low. Under these conditions, more water is released from the reservoir so farmers can water their crops and homes and businesses can function normally. Reservoirs serve other purposes. They are used for boating, fishing, and other forms of recreation. Some of the dams that create reservoirs are used to generate electricity. The largest reservoir in the world by surface area is Lake Volta, which was created by damming the Volta River in the African nation of Ghana. Lake Volta covers about 8,500 square kilometers (3,280 square miles), an area larger than the U.S. state of Delaware. Lake Volta ranks fourth in the world in terms of volume, the total amount of water in the lake. The world's biggest reservoir by volume is also in Africa. Lake Kariba lies on the border between Zambia and Zimbabwe. This lake, which was formed by damming the Zambezi River, stores 185 cubic kilometers (44 cubic miles) of water. The water in reservoirs is very still. Because of this, bits of sand, rock, dirt, and other material, called sediment, sink to the bottom, leaving the water quite clear. But over time, this sediment builds up, greatly reducing the total amount of water in the reservoir.

COASTAL HAZARDS

TROPICAL CYCLONE

Tropical cyclones are intense, cyclonically1-rotating, low-pressure weather systems that form over the tropical oceans. Intense means that near surface sustained2 wind speeds exceed 17 ms¡1 (60 km h¡1, 32 kn). Severe tropical cyclones with near surface sustained wind speeds equal to or exceeding 33 ms¡1 (120 km h¡1, 64 kn) are called hurricanes over the Atlantic Ocean, the East Paci¯c Ocean and the Caribbean Sea, and Typhoons over the Western North Paci¯c Ocean. Typically the strongest winds occur in a ring some tens of kilometres from the centre and there is a calm region near the centre, the eye, where winds are light, but for moving storms, the wind distribution may be asymmetric with the maximum winds in the forward right quadrant. The eye is so-called because it is normally free of cloud, except perhaps near the surface, but in a mature storm it is surrounded by a ring of deep convective cloud that slopes outwards with height. This is the so-called eyewall cloud. The mature tropical cyclone consists of a horizontal quasi-

ymmetric circulation on which is superposed a thermally-direct3 vertical (transverse) circulation. These are sometimes referred to as the primary and secondary circulations. Cyclone, tropical cyclone, hurricane, and typhoon are different names for the same phenomenon a cyclonic storm system that forms over the oceans. The deadliest hurricane ever was the 1970 Bhola cyclone; the deadliest Atlantic hurricane was the Great Hurricane of 1780 which devastated Martinique, St. Eustatius and Barbados. Another notable hurricane is Hurricane Katrina which devastated the Gulf Coast of the United States in 2005.

COASTAL EROSION

Coastal erosion can be defined as the removal of material from the coast by wave action, tidal currents and/or the activities of man, typically causing a landward retreat of the coastline. The effects of coastal erosion can be observed on cliffs, tidal flats and salt-marshes, and beaches. Those most directly at risk from coastal erosion are those living in coastal lowland areas or along 'soft' sediment coastlines where coastal erosion can cause flooding, rock falls, loss of land and damage to infrastructure. Surveying and monitoring of coastal areas helps to gain better understanding of the physical processes involved as well as identifying susceptible locations at an early stage.

Why does it occur?

The occurrence of coastal erosion is dependent upon the balance between the resistance, or erodibility, of the coastline and the strength, or erosivity, of the waves and tides effecting the area. These conditions are, in turn, reliant upon a number of factors, including:

- Topography
- The composition and structure of the geological formations exposed at the coast
- The state of man-made coastal defences
- Local currents and tidal range
- Wave climate (as characterised by wave height, period, direction and fetch)
- Groundwater
- Sediment supply, and
- Relative sea level

Consequently, rates of coastal erosion and accretion are very variable at regional, national and international scales.

Consequences of Coastal Erosion

Coastal erosion typically results in a landward retreat of the coastline. This can increase the risk of coastal flooding and result in loss of land and damage to buildings, infrastructure and agricultural land. Sudden coastal erosion events, particularly those in the vicinity of coastal cliffs, may directly endanger the lives of people. The movement of salt-water into freshwater areas (saline intrusion) can occur during coastal flooding and can impact upon the biodiversity of previously freshwater or terrestrial ecosystems.

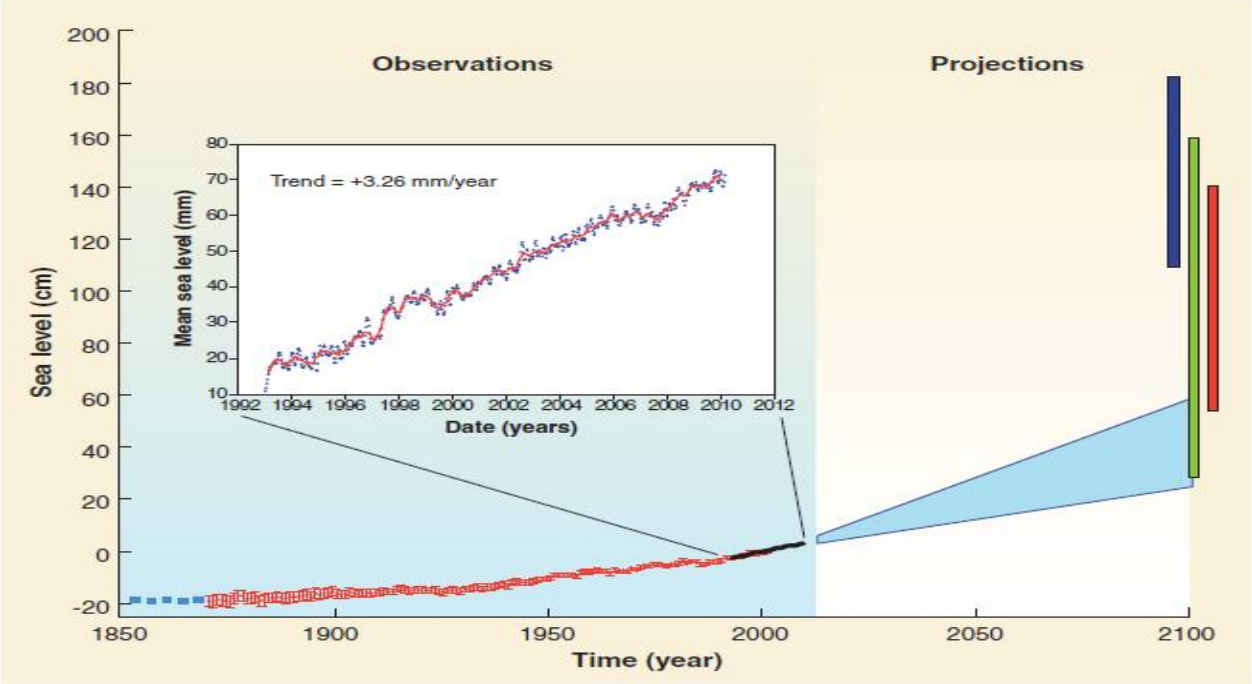
SEA LEVEL CHANGES AND ITS IMPACT ON COASTAL AREAS

Global sea levels have risen through the 20th century. These rises will almost certainly acceleratethrough the 21st century and beyond because of global warming, but their magnitude remains uncertain. Key uncertainties include the possible role of the Greenland and West Antarctic ice sheets and the amplitude of regional changes in sea level. In many areas, nonclimatic components of relative sealevel change (mainly subsidence) can also be locally appreciable. Although the impacts of sea-level rise are potentially large, the application and success of adaptation are large uncertainties that require more assessment and consideration.

Causes of Contemporary Sea-Level Rise

Although mean sea level remained nearly stable since the end of the last deglaciation tide gauge measurements available since the late 19th century indicate that sea level has risen by an average of 1.7 ± 0.3 mm/year since 1950 (10). Since the early 1990s, SLR has been routinely measured by high-precision altimeter satellites. From 1993 to 2009, the mean rate of SLR amounts to 3.3 ± 0.4 mm/year.

Two main factors contribute to SLR: (i) thermal expansion of sea water due to ocean warming and (ii) water mass input from land ice melt and land water reservoirs. Ocean temperature data collected during the past few decades indicate that ocean thermal expansion has significantly increased during the second half of the 20th century. Thermal expansion accounts for about 25% of the observed SLR since 1960 and about 50% from 1993 to 2003. Since then, upper-ocean warming has been smaller and on average over the satellite altimetry era (1993 to 2009), the contribution of ocean temperature change to the global mean sea level may be ~30%. Numerous observations have reported worldwide retreat of glaciers and small ice caps during recent decades, with an appreciable acceleration of this retreat during the 1990s. The glacier contribution to SLR from 1993 to 2009 may be ~30% (1, 17). Change in land water storage, due to natural climate variability and human activities (e.g., underground water mining, irrigation, urbanization, and deforestation), contributes little (<10%) to current sea-level change. By contrast, intensive dam building along rivers during the second half of the 20th century lowered sea level by ~ −0.5 mm/year. Since the early 1990s, different remotesensing tools air-borne and satellite radar etc have provided good data on the mass balance of the polar ice sheets. These data indicate that Greenland and West Antarctica mass loss is accelerating. Between 1993 and 2003, <15% of the global SLR was due to the ice sheets. However, since about 2003, their contribution has nearly doubled (3–5, 20); increasing glacier and ice sheet mass loss has compensated for reduced ocean thermal.



COASTAL ZONE MANAGEMENT

Coastal zone management involves managing coastal areas to balance environmental, economic, human health, and human activities. (*At the core of the Coastal Zone Management Act are two programs: the National Coastal Zone Management Program and the National Estuarine Research Reserve System (NERRS). The NERRS is a network of 28 protected areas, including the San Francisco Bay National Estuarine Research Reserve, established for long-term research, education and coastal stewardship*.)

The concept of coastal zone management is a relatively new one, emerging less than four decades ago from the need to tackle an array of interconnected problems associated with population growth and development along our nation's coasts.

The Coastal Zone Management Act (CZMA) was passed in 1972 and provided a formal structure to address the challenges of continued growth in coastal areas. Administered by NOAA, the CZMA recognizes that ensuring access to clean water and healthy ecosystems that support a vibrant coastal economy requires effectively integrating science, technology, and public policy. The goals of the CZMA are to "preserve, protect, develop, enhance, and restore where possible, the coastal resources."

One program under the CZMA, the National Coastal Zone Management Program, encourages coastal states and territories to work in partnership with the federal government to design and enforce local programs consistent with the CZMA and accompanying regulations. Today, 34 of the 35 eligible coastal and Great Lakes states and territories have entered into the voluntary partnership.

As a result of the Coastal Zone Management Act and the success of its programs, coastal communities are equipped to better address continued economic development of the coastal zone while accounting for natural resource management. This will ensure the

health and stability of the coast, both environmentally and economically, into the long-term future.

ENVIRONMENTAL DEGRADATION

Environmental degradation is a result of socio-economical, technological and institutional activities. Degradation occurs when Earth's natural resources are depleted. These resources which are affected include:

1. Water
2. Air
3. Soil
4. The degradation also impacts our:
5. Wildlife
6. Plants
7. Animals
8. Micro-organisms
9. How Environmental Degradation Occurs
10. Environmental changes are based on many factors including:
11. Urbanization
12. Population growth
13. Economic growth
14. Intensification of agriculture
15. Increase in energy use
16. Increase in transportation
17. Cutting down massive forests impacts our biosphere.

Our land, water and soil are compromised when people exhaust resources or release harmful chemicals into the air. Deforestation, wasting resources, and pollution all add to the demise of an environmentally-sound and safe planet. For example, when trees in forests are cut down in large quantities, so that more homes can be built on the land, the birds and wildlife who lived in the forest must find a new place to live. The vegetation that once grew on the land is destroyed. Trees that absorbed carbon dioxide to help the biosphere are now unable to do so. If the wood from the trees is used to make products and those products (such as paper) are later recycled, that is one hopeful aspect for the planet. However, sometimes trees are just cut down and burned. This is what is known as *slash and burn*, a practice that only destroys forests and all that live in them.

Unfortunate Impacts of Environmental Degradation

When factories produce harmful chemicals and toxic waste into bodies of water, humans suffer. Pesticides and fertilizers can also get into a region's water system and pollute it. Drinking water is contaminated. Some residing in third-world countries are highly effected by the degradation of our planet and these unhealthy practices cause the following:

1. Illnesses
2. Death in children

3. Death in adults
4. Poverty

In many countries crop harvests are falling as consumption increases. People are finding less nutritious food to eat. One argument held is that while fields in wealthier nations are used to grow crops for biofuel, poorer countries, especially those around the Equator, are vulnerable to weather changes, water shortages, and urbanization. All of these factors are increasing the health and lives of thousands. Some scientists and environmentalists are asking that non-food items and agriculture waste be used as alternative fuel for vehicles instead.

Measures to stop Degradation

There are ways which you can help to decrease degradation in our environment. Some of these include:

1. Purchase recycled products
2. Conserve water
3. Do not litter or toss waste into inappropriate places
4. Conserve energy
5. Join an awareness group
6. Talk with others about the impacts of environmental degradation
7. Be an advocate to save our planet!

UNIT-4

EARTHQUAKES

Earthquakes constitute one of the worst natural hazards which often turn into disaster causing widespread destruction and loss to human life. The effects of earthquake vary upon the magnitude and intensity. Earthquakes occur every now and then all round the world, except in some places where earthquakes occur rarely. The devastation of cities and towns is one of the effects of earthquake.

1. An Earthquake is the result of a sudden release of energy in the earth's crust that creates seismic waves.
2. The seismic activity of an area refers to the frequency,type and size of earthquakes experienced over a period of time.

Important Terms:

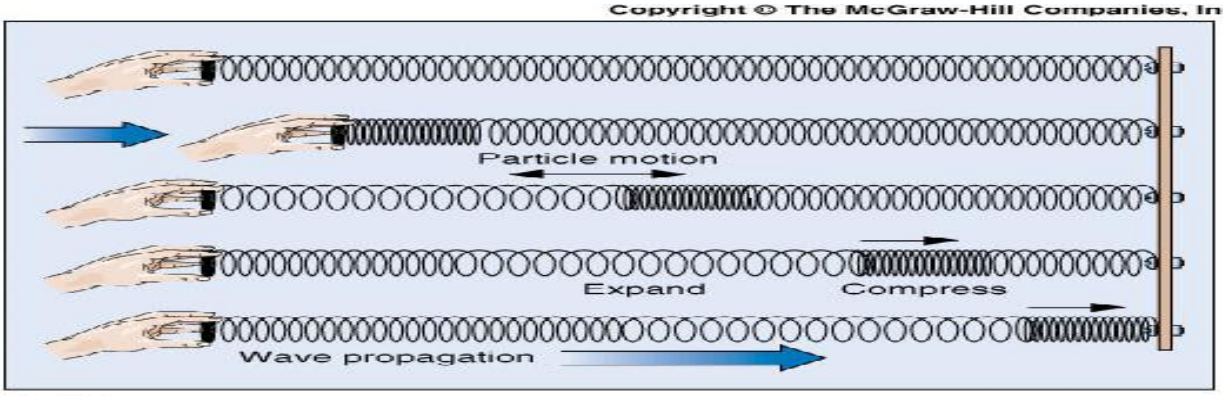
1. **Earthquake**: Vibration of the Earth produced by the rapid release of energy
2. **Seismic waves:**Energy moving outward from the focus of an earthquake
3. **Focus**: Location of initial slip on the fault; where the earthquake origins
4. **Epicenter**: Spot on Earth's surface directly above the focus

Causes Of Earthquake

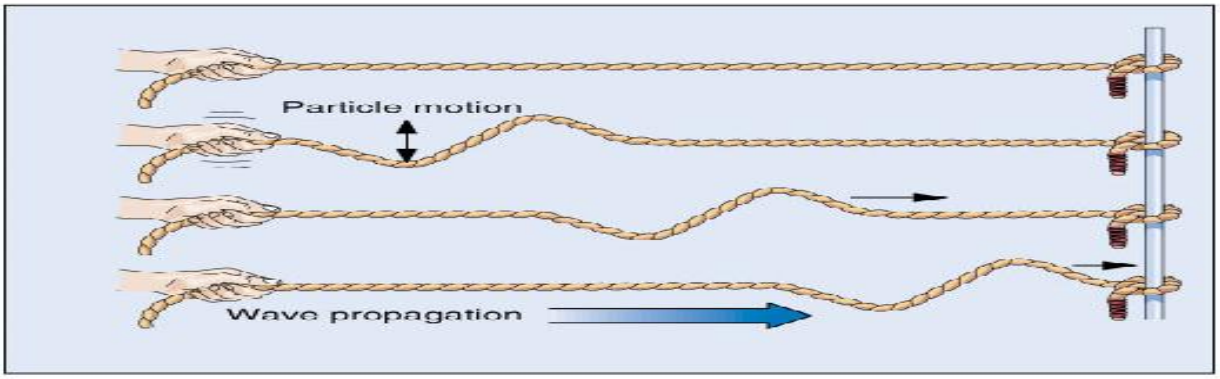
1. The primary cause of an earthquake is faults on the crust of the earth.
2. A Fault is a break or fracture b/w two blocks of rocks in response to stress."
3. This movement may occur rapidly, in the form of an earthquake or may occur slowly, in the form of creep.
4. Earth scientists use the angle of the fault with respect to the surface (known as the dip) and the direction of slip along the fault to classify faults.

Seismic waves

1. **P-waves: (primary or first)**
    - Called compressional, or push-pull waves.
    - Propagate parallel to the direction in which the wave is moving
    - Move through solids, liquids.
    - Fastest moving – reach seismic station first
2. **S-waves: (secondary)**
    - Called shear waves
    - Propagate the movement perpendicular to the direction in which the wave is moving
    - Reach seismic station second
3. **Surface waves (L-waves or long waves).**
    - Complex motion
    - Up-and-down and side-to-side
    - Slowest
    - Most damage to structures, buildings



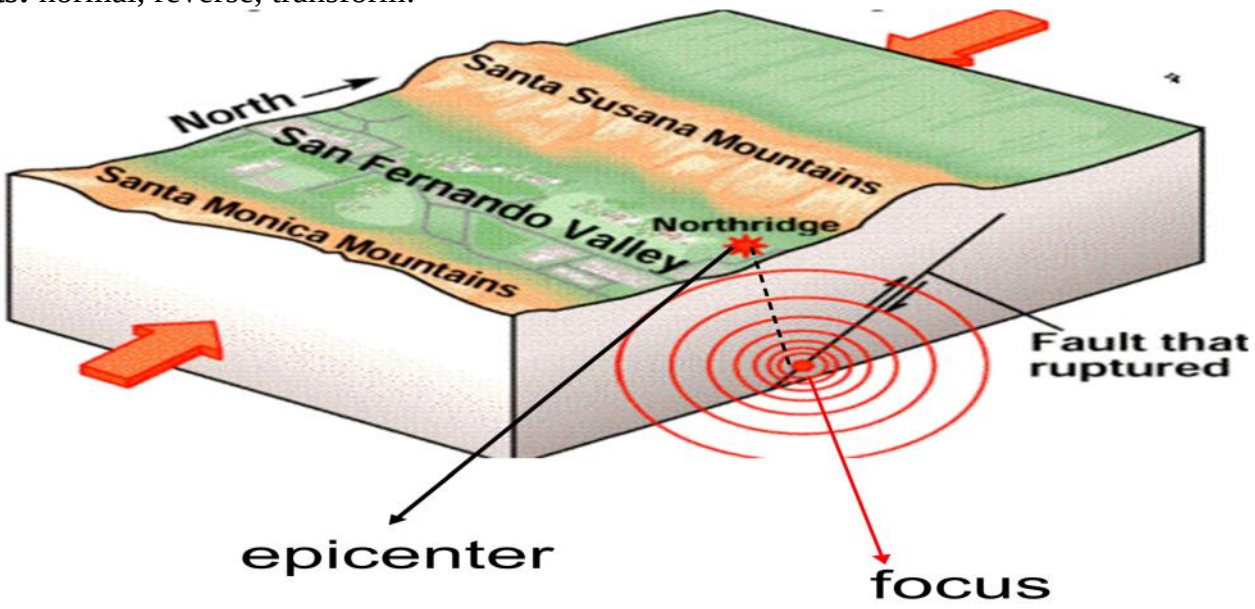
A Primary wave



B Secondary wave

Ocurrence of Earthquake:

Most earthquakes occur along the edge of the **oceanic** and **continental plate**. Along **faults:** normal, reverse, transform.



Measuring earthquakes

1. Seismometers: instruments that detect seismic waves
2. Seismographs: Record intensity, height and amplitude of seismic waves

Location of Epicentre

Measure time between P and S waves on a seismogram. It needs at least 3 seismographs to detect the location of epicenter. Time taken by waves to travel and transform between P and S determines the poinbt of focus where the energy release has started to develop. The area perpendicular to the focus on the earth's crust determines the Epicentre.

Frequency of Occurrence of Earthquakes

Descriptor	**Magnitude**	**Average Annually**
Great	8 and higher	1 [1]
Major	7 - 7.9	17 [2]
Strong	6 - 6.9	134 [2]
Moderate	5 - 5.9	1319 [2]
Light	4 - 4.9	13,000 (estimated)
Minor	3 - 3.9	130,000 (estimated)
Very Minor	2 - 2.9	1,300,000 (estimated)
[1] Based on observations since 1900. [2] Based on observations since 1990.		

Earthquake size: there are two ways to measure the size of Earthquake

1. **Magnitude: Richter Scale**
   - Measures the energy released by fault movement
   - related to the maximum amplitude of the S wave measured from the seismogram
   - Logarithmic-scale; quantitative measure
   - For each whole number there is a 31.5 times increase in energy eg. An increase from 5 to 7 on the Richter scale = an increase in energy of 992 times!!
2. **Intensity is a function of:**
   - Energy released by fault
   - Geology of the location
   - Surface substrate: can magnify shock waves e.g. Mexico City (1985) and San Francisco (1989)

Damage caused due to Earthquake

1. Ground Failure - constructions collapse
2. Fires - from broken gas and electrical lines
3. Landslides - EQ's triggered; occur in hilly/mountainous areas.
4. Liquefaction - water-saturated, unconsolidated materials flow
5. Tsunami (seismic sea waves; "tidal" waves) - can grow up to 65 m

Types Of Zones

The earthquake zoning map of India divides India into 4 seismic zones Based on the observations of the affected area due to Earthquake india divided into four types of zones:

1. **Zone - II**: This is said to be the least active seismic zone.
2. **Zone - III**: It is included in the moderate seismic zone.
3. **Zone - IV**: This is considered to be the high seismic zone.
4. **Zone - V**: It is the highest seismic zone.

Earthquake Prediction

Earthquake prediction is usually defined as the specification of the time, location, and magnitude of a future earthquake within stated limits. But some evidence of upcoming Earthquake are following:

1. Unusual animal behavior
2. Water level in wells
3. Large scale of fluctuation of oil flow from oil wells
4. Foreshocks or minor shocks before major earthquake
5. Temperature change
6. Uplifting of earth surface
7. Change in seismic wave velocity

Effect Of Earthquake

1. Loss of life and property
2. Damage to transport system i.e. roads, railways, highways, airports, marine
3. Damage to infrastructure.
4. Chances of Floods – Develop cracks in Dams
5. Chances of fire short-circuit.
6. Communications such as telephone wires are damaged.
7. Water pipes, sewers are disrupted
8. Economic activities like agriculture, industry, trade and transport are severely affected.

TSUNAMI

1. A tsunami is a series of waves created when water is moved very quickly. Underwater earthquakes are the most common causes of tsunamis, but underwater

volcanic activity can also trigger a displacement in the water, and create a mega-wave.

2. Tsunami is a Japanese word meaning ‘harbor wave’. It is constituted with two syllables, Japanese language meaning harbour ("tsu") and wave ("nami").
3. Tsunami is a wave train or series of waves generated, by impulsive disturbance that vertically displaces the water column, in water body. Earthquake, landslides, volcanic eruption, explosion and even the impact of cosmic bodies like meteorites commonly generate tsunami. Tsunami savagely attacks coastlines causing devastating property damage and loss of lives.

Causes of Tsunami

1. Volcanic eruptions
2. Icefalls
3. Heavy rainfall
4. Seismic activities
5. Submarine landslides
6. Cosmic impacts
7. Volcanic eruptions and icefalls create disturbance in water and generate tsunami.
8. Heavy rainfall cause overflows of water and generate tsunamis.

Generation of Tsunami

1. A Tsunami is generated when a large amount of water is displaced which is done mainly by:
   - The Earthquakes.
   - By The Landslides.
   - By Volcanic Eruptions.
   - By Impact Events like Meteorite impacts
2. Tsunami can be generated when the see floor abruptly deforms and vertically displaces the overlying water.
3. Tectonic earthquakes are a particular kind of earthquake that are associated with the earth’s crustal deformation, when these earthquakes occur beneath the see, the water above the deformed area is displayed from its equilibrium position.
4. Waves are formed as the displaced water mass, which acts under the influence of gravity, attempts to regain its equilibrium
5. Ocean waves are normally divided into 3 groups, characterized by depth:
   - Deep water
   - Intermediate water
   - Shallow water
6. Even though a tsunami is generated in deep water (around 4000 m below mean sea level), tsunami waves are considered shallow-water waves. As the tsunami wave approaches the shallow waters of shore, its time period remains the same, but its

wavelength decreases rapidly, thus causing the water to pile up to form tremendous crests, in an effect known as "shoaling".

7. Most tsunamis are caused by earthquakes generated in a seduction zone, an area where an oceanic plate is being forced down into the mantle by plate tectonic forces. The friction between the sub ducting plate and the overriding plate is enormous. This friction prevents a slow and steady rate of seduction and instead the two plates become "stuck". As the stuck plate continues to descend into the mantle the motion causes a slow distortion of the overriding plage. The result is an accumulation of energy very similar to the energy stored in a compressed spring.
8. Energy can accumulate in the overriding plate over a long period of time - decades or even centuries.

Location of Tsunami

Tsunamis occur most frequently in the Pacific Ocean, but are a global phenomenon; they are possible wherever large bodies of water are found, including inland lakes, where they can be caused by landslides. Japan is a nation with the most recorded tsunamis in the world. The earliest recorded disaster being that of the 684 A.D. Tsunami is one of the earth's disasters. It was a Japanese word meaning "harbor wave," used as the scientific term for a class of abnormal sea wave that can cause catastrophic damage when it hits a coastline. Tsunamis can be generated by an undersea earthquake, an undersea landslide, the eruption of an undersea volcano, or by the force of an asteroid crashing into the ocean.

Disturbance in sea floor and release of energy

1. Tsunamis may reach a maximum vertical height onshore above sea level, often called a run up height, of 10, 20, and even 30 meters.
2. For a typical ocean Depth of 4000m, a tsunami moves with a speed about 700km/hr.
3. The fast-moving water associated with the inundating tsunami can crush homes and other coastal structures.
4. Often no advance warning of an approaching Tsunami
5. An earthquake felt near a body of water may be considered an indication that a tsunami will shortly follow.

Impact on fragile coastal environment

1. Tsunamis may cause damage to buildings, infrastructure and utilities and any resulting debris may enter the coastal system,
2. Potentially endangering humans and coastal ecosystems.
3. Disruption to gas utilities may also provide a fire hazard, disruption to water pipes a flooding hazard and disruption of the sewerage network a health hazard.
4. Tsunami may increase flood risk.
5. Finally, it can result to coastal landsliding.

VOLCANO AND VOLCANIC ERUPTION

What is a volcano?

1. A volcano is a vent or 'chimney' that connects molten rock (*magma*) to the Earth's surface. It includes the surrounding cone of built-up material. Magma erupting from a volcano is called *lava*. Gases and pieces of rock erupt from volcanoes too.
2. A volcano is active if it erupts lava, releases gas or shows seismic activity. It is dormant if it hasn't erupted for a long time but could again one day. An extinct volcano will never erupt again.
3. The explosiveness of a volcanic eruption depends on how easily magma can flow and the amount of gas trapped in it. Large amounts of water and carbon dioxide are dissolved in magma. They behave like gas in fizzy drinks. After opening the bottle the gas expands, forming bubbles that escape. This also happens when magma rises quickly through the crust - gas bubbles form and expand up to 1000 times their original size.

Volcanic Eruption

It is the sudden occurrence of a violent discharge of steam and volcanic material like volcanic bombs, lapilli, ash and lava are expelled violently in the land air and water surfaces

Causes of volcanic eruption.

To understand what causes volcanoes, you need to understand how the earth is made up. The earth has three main layers: the crust, the mantle and the core. The crust is made up of solid rock and varies in thickness. It is more than 60km thick under mountain chains like the Alps and Himalayas, but just 5km under the oceans. The mantle is a thick layer of molten rock (called magma), and the core is made up of an outer liquid layer and a solid centre.

Temperatures inside the earth are very high – over 5000’C in the core. This means that the planet on which we live is like a huge fiery ball of hot molten rock, surrounded by a few kilometers of relatively cool, hard rock – the crust. Because heat rises, the magma in the earth’s mantle has to find a way to rise upwards though the crust above it, rather like the way that hot air rises.

- **An erupting volcano**

A volcano erupts when magma escapes from inside the earth. As the magma is escaping from a confined space, a lot of energy is released with it, as happens with any other explosion. This is why many eruptions also produce huge quantities of gases and dust. Magma sometimes rises under enormous pressure, so it not only finds cracks in the earth’s crust, it can also create them. When magma reaches the earth’s surface it is called lava.

- **Tectonic plates and volcanoes**

The earth’s crust is its thinnest layer. It is broken up into large pieces, called tectonic plates. These plates lie above the hot, liquid mantle. Each plate contains some continental

crust (land) and some oceanic crust (sea-bed). Huge currents of molten rock circulate deep in the mantle, causing the plates to move about very slowly on the earth's surface.
If you look at the location of volcanoes in relation to these plates, you will notice some similarities. Many of the world's volcanoes occur along the edges of boundaries of the plates.

Effects of volcanoes

- **Effect on Environment**

The first is how the weather near an erupting volcano is being affected. The second is how large eruptions will affect the weather/climate around the world. I think more people are worried about the second issue than the first. As far as we know, the main effect on weather right near a volcano is that there is often a lot of rain, lightning, and thunder during an eruption. This is because all the ash particles that are thrown up into the atmosphere are good at attracting/collecting water droplets. Another problem in Hawaii is that involves the formation of volcanic fog. The ongoing eruption is very quiet, with lava flowing through lava tubes and then into the ocean.

- **Effect on people**

Volcanoes affect people in many ways, some are good and some are not. Some of the bad ways are that houses, buildings, roads and fields can get covered with ash. As long as you can get the ash off (especially if it is wet), your house may not collapse, but often people leave because of the ash and are not around to continually clean off their roofs. If the ash fall is really heavy it can make it impossible to breathe.

- G**ood part of volcanoes**

The main good effect that volcanoes have on the environment is to provide nutrients to the surrounding soil. Volcanic ash often contains minerals that are beneficial to plants, and if it is very fine ash it is able to break down quickly and get mixed into the soil.

GEOGRAPHICAL DISTRIBUTION OF VOLCANOES

Volcano	Coordinates	Elevation (m)	Province/s	Historical Eruptions	Eruption Description and Current Status
Ambalatungan Group	17.310982°N 121.103668°E	2,329 metres (7,641 ft)	Kalinga	0	Explosions in 1952 is uncertain.[4] Fumarolic with solfataras and thermal springs.
Babuyan Claro	9.523°N 121.940°E	1,080 metres (3,540 ft)	Cagayan	3	Eruptions were recorded in 1831, 1860 and 1913. Askedna Hot Springs is located in the southern base of the volcano.
Banahaw	14.07°N 121.48°E	2,158 metres (7,080 ft)	Quezon	0	Eruptions were uncertain during the mudflows of 1730, 1743, 1843 and 1909.[5]
Biliran	11.558°N 124.513°E	1,301 metres (4,268 ft)	Biliran	1	Phreatic eruption in 1939. Fumarolic with thermal springs
Bulusan	12.770°N 124.05°E	1,565 metres (5,135 ft)	Sorsogon	17	Eruptions years are from 1886 to 2011. Permanently monitored
Cagua	18.222°N 122.123°E	1,133 metres (3,717 ft)	Cagayan	1	Eruption in 1860 and strong solfataric activity in 1907. Thermal areas are located near the summit and NW to NNE flanks.

Iriga	13.457°N 123.457°E	1,196 metres (3,924 ft)	Camarines Sur	0	The eruption in 1628 was discredited.[7]
Jolo Group	6.013°N 121.057°E	811 metres (2,661 ft)	Sulu	0	Uncertain submarine eruption in 1897. Listed as Bud Dajo, a cinder cone on Jolo Island, in the PHIVOLCS list.
Kanlaon	10.412°N 123.132°E	2,435 metres (7,989 ft)	Negros Occidental, Negros Oriental	26	Eruptions were recorded from 1886 to 2006. Permanently monitored.
Leonard Kniaseff	7.382°N 126.047°E	1,190 metres (3,900 ft)	Davao del Norte	0	Last eruption was dated as c.120 AD.[8] Strong thermal features.
Makaturing	7.647°N 124.32°E	1,940 metres (6,360 ft)	Lanao del Sur	2	Eruption recorded in 1865 and 1882. The 1856 and 1858 eruptions was credited to Ragang[9][10]

Matutum	6.37°N 125.07°E	2,286 metres (7,500 ft)	South Cotabato	0	Mountain was fumarolic on March 7, 1911, but if an eruption occurred was uncertain. Thermal springs in Almoan and Linan.[11][12]
Mayon	13.257°N 123.685°E	2,462 metres (8,077 ft)	Albay	50	Eruptions were recorded from 1616 to 2013. Permanently monitored.
Musuan	7.877°N 125.068°E	646 metres (2,119 ft)	Bukidnon	2	Eruptions in 1866 & 1867. Strong seismic swarm in 1976.
Parker	6.113°N 124.892°E	1,824 metres (5,984 ft)	South Cotabato	1	A caldera-forming eruption occurred on January 4, 1641.
Pinatubo	15.13°N 120.35°E	1,486 metres (4,875 ft)	Zambales, Tarlac, Pampanga	3	Reawakened in 1991 producing the 2nd largest eruption in the 20th century. Followed by milder eruptions in 1992 and 1993.

ALL THE BEST