BHARAT INSTITUTE OF ENGINEERING & TECHNOLOGY

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

POLYTECHNIC
MOHADA,BERHAMPUR,GANJAM

LECTURE NOTES ON

ENVIRONMENTAL STUDIES
(TH-5)

2nd Year, 3rd Semester

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- Environmental studies is a systematically studies of human interaction with the environment in the interest of solving complex problem.
- ~~It brings the~~ (The sum of all surrounding of a living organism including natural forces & other living things & Non-living things which provide conditions for development & growth as well as of danger & damage known as environment)
- Environmental studies deals with every issue that affects a living organism. It is essentially a multi-disciplinary approach that brings about an appreciation of our natural world and human impact on its integrity.
- Its components include biology, zeology, chemistry physics, Engineering, sociology, health, anthropology, economics, statics, computer & philosophy.

Environment is not a single subject that include both science and social studies.

The scope of environmental studies is extremely wide & covers of some aspects of nearly every measure discipline to understand different aspects of our environment. We need to understand biology, chemistry, physics, zeology, resource management, economics and population issues.

* Environment means 'surrounding' comes from a french word known as 'Environner'.

i) Developing an awareness & sensitivity about the environment & its related problem.

ii) Motivating people for active participation in environmental protection & improvement.

iii) Developing skills for active identification & development of solution to the environment problem

iv) To study the necessity for conservation of Natural Resource.

v) Evaluation of environment programmes in terms of social, economic, ecological & aesthetic factors

To minimize the problem of environmental pollution knowledge of environmental studies is essential.

1. We will begin to appreciate an idea of development with out destruction of the environment.
2. knowledge about 'Various types of environment & different environmental Hazards'
3. play an important role in protecting the environment by demanding changes in law & enforcement system.
4. Having positive impact on quality of life.
5. Creating Awareness, Concern & Respect for environment.

N:

1. Increasing population, organisation, property have generates pressure on the natural Resources and lead to a degradation of the environment.

2. To prevent environment from further degradation & initiate environmental protection, awareness through government & non-government agencies. to take part in protecting environment.

3. Environment pollution cannot prevent by law only, Public participation is equally important with regard to environmental protection.

4. Environment education is a process of learning by giving an overall knowledge and Awareness of the environment &

Aware/Educate the society about the issues & Challenge & to develop skills ~~through one~~ by providing appropriate solution.

5. Climate change loss of biodiversity, ozonelayer depletion, land degradation, depletion of ground water level, supply, Destruction of habitats, Illegal trade of endangered species, solid waste disposal, sewage, storm, flood etc.

6. Both formal & informal education on the environment will give the interested individual knowledge value's skills needed to face the environmental challenges in global, local Level.

Life on the earth depends upon a large number of things & services provided by the Nature, is known as Natural Resource.

eg: Water, Soil, Air, coal, Minerals, forest crops, Wild life etc.

Natural Resources are of two types.

Renewable Resources.

Which can be regenerated with in a given period of time.

Biomass, Hydro power, wind power, Solar energy, Tidal energy etc.

Non-Renewable Resources:

These resources cannot be regenerated once, we exhaust these resource the same can't be replaced. (It take a very long period to recover)

eg: Coal, Petroleum.

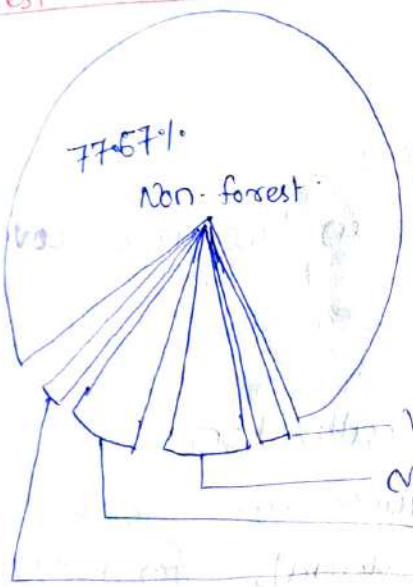
Temperature Regulation

- Absorption of solar heat during evapotranspiration
- Maintaining CO_2 levels for plant growth
- Maintaining local climatic conditions

Threats on forest Resources

Scientists estimate that India should ideally have 33% of its land under forests but it is 12% now. Thus we need to not only protect our existing forests but also to increase our forest cover.

Forest cover in India:



→ Area not included in any of the below classes.

* Very dense forest – All lands with tree canopy density of 70% and above.
* Moderately dense forest: All lands with tree canopy density b/n 40% & 70%.
* Open forest: All lands with tree canopy b/n 10% & 40%.
* Shrub: Degraded forest lands with canopy density less than 10%.

Over- Exploitation

Humans are dependent on forest for food, Medicine, shelter, wood & fuel. With growing civilization the demands for raw material like timber, pulp, minerals, fuel, wood etc shoot up resulting in large scale logging, Minining, road- building and clearing of forests.

Excessive use of fuel wood and charcoal, Expansion of urban, agricultural and industrial areas & overgrazing have together led to over - exploitation of our forests leading to their rapid degradation.

Deforestation

Deforestation involves a loss in the area covered by the forests.

Causes

- Shifting cultivation.
- fuel requirement
- Raw materials for industrial use
- Developing / Development project
- Growing food needs.
- Over grazing.

Timber Extraction

Logging for valuable timber such as teak and Mahogany not only involves a few large trees per hectare but about a dozen more tree since they are interlocked with each other by vines etc. Also road construction for making approach to the trees causes further damage to the forests.

Mining

- Mining operations for extracting minerals and fossil fuels like coal often involves vast forest areas
- Mining from shallow deposites is done by surface mining for deep deposites sub surface mining is used
- More than 80,000 hacter area in our country is presently under stress of mining activities.
  This results in destruction of the landscape in the area

Dams and their effect on forest & people

Big dams and reiver valley projects have multi-purpose uses and have been referred to as "Temples of Morden India"

There are Big dams in India.

It is responsible for the destruction of vast areas of forest for building big dams, large scale devastation of forest takes place which breaks the natural ecological balance of the region.

floods, droughts and landslides become more prevalent in such areas. The Tribal people lost their shelter, food as they direct depends on the forest.

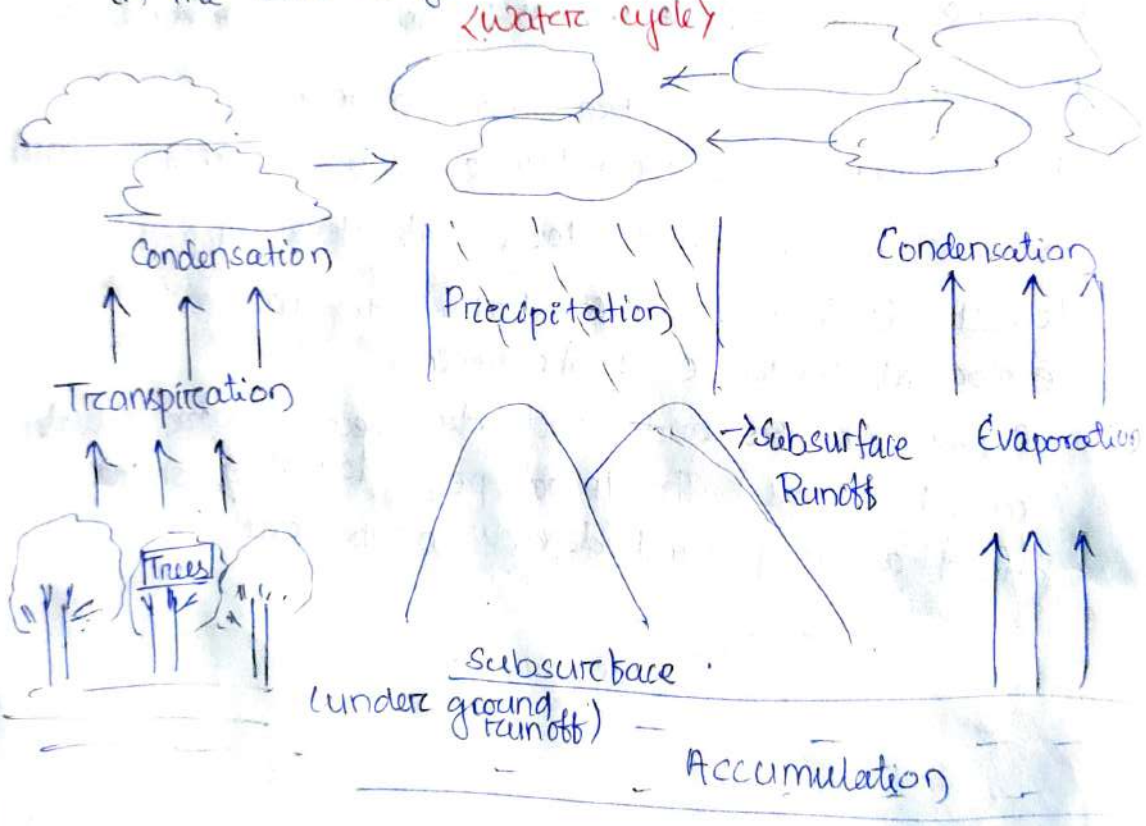
Water Resource:

Water is an indispensable natural resource on this earth on which all life depends

About 97% of the Earth's surface is covered by water & most of the animals & plants have 60-65% water in their body

Out of the total water reserves of the world, about 97% is salty water & 3% is fresh water

from this fresh water, most are locked up in polar ice caps and just 0.003% is readily available to us in the form of ground water & surface water.



Uses.

Watere withdrawl - Taking watere from ground watere or surface watere resource.

Watere Consumption - Here is watere taken up but not return for reuse.

- watere is absolutely essential for life. Most of the life processes take place in the body in the watere contained. Uptake of nutrients, their distribution in body, regulation of temperature, and removal of waste are all mediated through waters.
- watere is used for drinking, irrigation, transpiration, washing, cooking & waste disposal in industries & used as a coolant for power plant.

Over use of Ground watere & Surface watere

Over use of ground watere in various regions (drinking, irrigation & domestic purposes) leading to lowering of watere table and drying of wells
- Pollution of Ground water, made many of these wells unfit for consumption.

- Rivers and streams have been long used for discharge waste
Most of the civilization have grown & flourished on the bank of rivers. but growth in turn has been responsible for pollution of rivers using more chemical products, pesticides also pollute surface water.

Flood

Floods have been a serious environmental hazards for centuries.

This caused by rivers overflowing their banks has become progressively more damaging as people have deforested catchments & intensified the use of river flood plains that once acted as safety valve.

- The wetlands in flood plains are nature's flood control system which act as temporary sponge holding the water and preventing fast flowing water from damaging the surrounding land.

- Rivers change their course during floods and tons of valuable soil is lost to the sea.
As the forests are degraded, rain water no longer percolates slowly into the subsoil but runs off down the mountain side, bearing large ~~animals~~ amount of top soil. This blocks or 'silts' up the rivers temporarily, but eventually gives way as the pressure mounts, allowing enormous quantities of water to suddenly wash down into the plains below. There, the rivers swell, burst their banks and flood waters spread to engulf people's farms & homes.

Drought:

In most arid regions, the rains are unpredictable. This leads to periods when there is a serious scarcity of water to drink, use in farms or provide for urban & industrial use.

- Drought prone areas are thus forced with irregular period of famine. Agriculturists have no income in these years and as they have no steady income they have a constant fear of drought.

Under these schemes, people are given wages in years of water scarcity to build roads, minor irrigation work & plantation programmes.

* It is happen especially in arid & semi-arid regions of our county.

* It is an unpredictable climatic condition & occurs due to the failure of one or more monsoons.

Problems caused by Dams.

- The fragmentation and physical transformation of rivers.
- Serious impact on riverine ecosystems.
- Social consequences of large dams due to the displacement of people.
- water-logging & salinisation of the surrounding lands.
- Dislodging animal populations, damaging their habitat & cutting off their migratory routes.
- Disruption of fishing & water way traffic.

Mineral Resource

Mining is the extraction of valuable minerals or other geological materials from the earth usually from an ore body, lode, vein, seam, reef, or placer deposits. These deposits form a mineralized package that is of economic interest to the miner.

→ Mining is required to obtain any material that cannot be grown through agricultural processes or created artificially in a laboratory or factory.

→ Mining in a wider sense includes extraction of any non-renewable resource such as petroleum, natural gas or even water.

Uses & Exploitation

Minerals find use in a large number of ways in everyday use in domestic, agricultural, industrial & commercial sectors & thus form a very important part of any nation's economy.

1. Development of industrial plants & machinary.
2. Generation of Energy. e.g. coal, lignite, Uranium.
3. Construction, housing, settlements.
4. Defence equipments. weapons. ornaments.
5. Transportation means.
6. Communication. Telephone wires, cables, electronic devices.
7. Medical System. Particularly in Ayurvedic system.
8. formation of alloys for various purposes.
   eg: phosphorcite.
9. Agriculture - As fertilizers. seed dressing & fungicides.
   Maneb containing Manganese.
   eg: Zineb, containing Zinc.
10. Jewellery. Gold, Silver, platinum, diamond

- **Critical Minerals** are essential for the economy of a nation.
  eg: Iron, Aluminium, copper, Gold etc.

- **Strategic Minerals**: are those required for the defence of a country.
  eg: Manganese, cobalt, platinum, chromium etc.

Environmental impacts of Mineral extraction

1. Ecological
   - Deforestation
   - Loss of flora & fauna
   - Ecosystem degradation
2. Pollution (Air, water, soil, & Noise)
3. Socio Economic

   +Ve:
   - Provides employment
   - Infrastructure facilities increase.
   - Economic gains

   -ve
   - Encroachment & evacuation.
   - Resettlement.
   - Rehabilitation.
4. Physical
   - Land subsidence
   - Underground fires
   - Landscape destruction
   - Soil erosion.
5. Occupation
   - Health hazards due to long term exposure to hazardous chemicals.
   - Accidents such as oil spills.

6(b) World food Problem

During the last 30 years world grain production increased 3 time, there by increasing per capita prod by about 50%

But at the same time population growth increased at such a rate in LDCs (less developed countries) that it outstripped food production)

- Every year 40 million people (50% of which are you children between 1 to 5 years) die of under nourish & Malnutrition
- Every year our food problem is killing as many people as were killed by the atomic bomb dropped on Hiroshima during world war-II.
- So there is need to increase our food production equitab distribute it & also to control population growth.
- The world food Summit, 1996 has set the target to reduce the number of undernourished to just half by 2015, which still means 410 million under nourished people of the earth.

Indian Scenario

Although India is the third largest producer of staple crops, an estimated 300 million Indians are still undernourished.

India has only half as much land as USA, but it has nearly three times population to feed.

Our food problems are directly related to population.

Impact of overgrazing & Agriculture

Overgrazing

The huge population of live stock needs to be feed and the grazing lands or pasture areas are not adequate

Carrying capacity of any system is the maximum population that can be supported by it on a sustainable basis.

Most often the grazing pressure is so high that its carrying capacity is crossed & the sustainability of the grazing lands fails.

Impact of over grazing.

1. Land degradation : Overgrazing removes the vegetal cover over the soil & the exposed soil gets compacted due to which the operative soil depth declines. So the roots can't go much deep into the soil & adequate soil moisture is not available.

2. Soil Erosion: Due to overgrazing by cattle, the cover of vegetation almost get removed from the soil/land. The soil becomes exposed and gets eroded by the action of strong wind, rain fall etc.

- Eutrophication.

A large proportion of nitrogen & phosphorus used in crop fields is washed off & along with runoff water reach the water bodies causing over nourishment of the lakes. a process known as Eutrophication (Eu = More, trophic = nutrition).

- Due to eutrophication the lakes get involved by algal blooms. These algal species grow very fast by rapidly using up the nutrients. They are often toxic & badly affect the foodchain.

The algal species quickly complete their life cycle & die there by adding a lot of dead organic matter

The fishes are killed & there is a lot of dead matter that starts getting decomposed. Oxygen is consumed in the process of decomposition & very soon the water gets depleted of dissolved oxygen. This further affects the aquatic fauna.

Pesticide Related Problems

a) Creating Resistance in pests & producing new pests

b) death of non target organism
↓
useful species

c) Biological Magnification

Many of the pesticides are non-biodegradable & keep on accumulating in the food chain; a process called biological Magnification. Since human beings occupy a high trophic chain in the food chain. Hence they get the pesticides in a bio-magnified form which is very harmful.

Water logging

Over-irrigation of crop lands by farming on good growth of their crop usually leads to water logging.

Inadequate drainage causes excess water to accumulate underground & gradually forms a continuous column with the water table.

- Under water-logged conditions, pore-spaces in the soil get fully drenched with water & the soil-air gets depleted. The water table rises, while the roots of plants donot get adequate air for respiration. Mechanical strength of the soil declines, the crop plants get lodged & crop yield falls

Prevention

1. Preventing excessive irrigation.
2. Sub-surface drainage Technology
3. bio-drainage with tree like Eucalyptus.

Salinity Problem

One-third of total cultivable land area of the world is affected by salts.

In India about 7 million hectares of land are salty affected which may be saline or sodic

* Saline soil having Sodium chloride, sodium sulphate calcium chloride, magnesium chloride etc
* Its electrical conductivity is more than 4 ds/m.
* PH value more than 8.0.

Causes

Excessive irrigation: about 20% of the world's croplands receive irrigation with canal water or ground water which unlike rain water often contains dissolved salts.

Under dry climates, the water evaporates leaving behind salts in the upper soil profile.

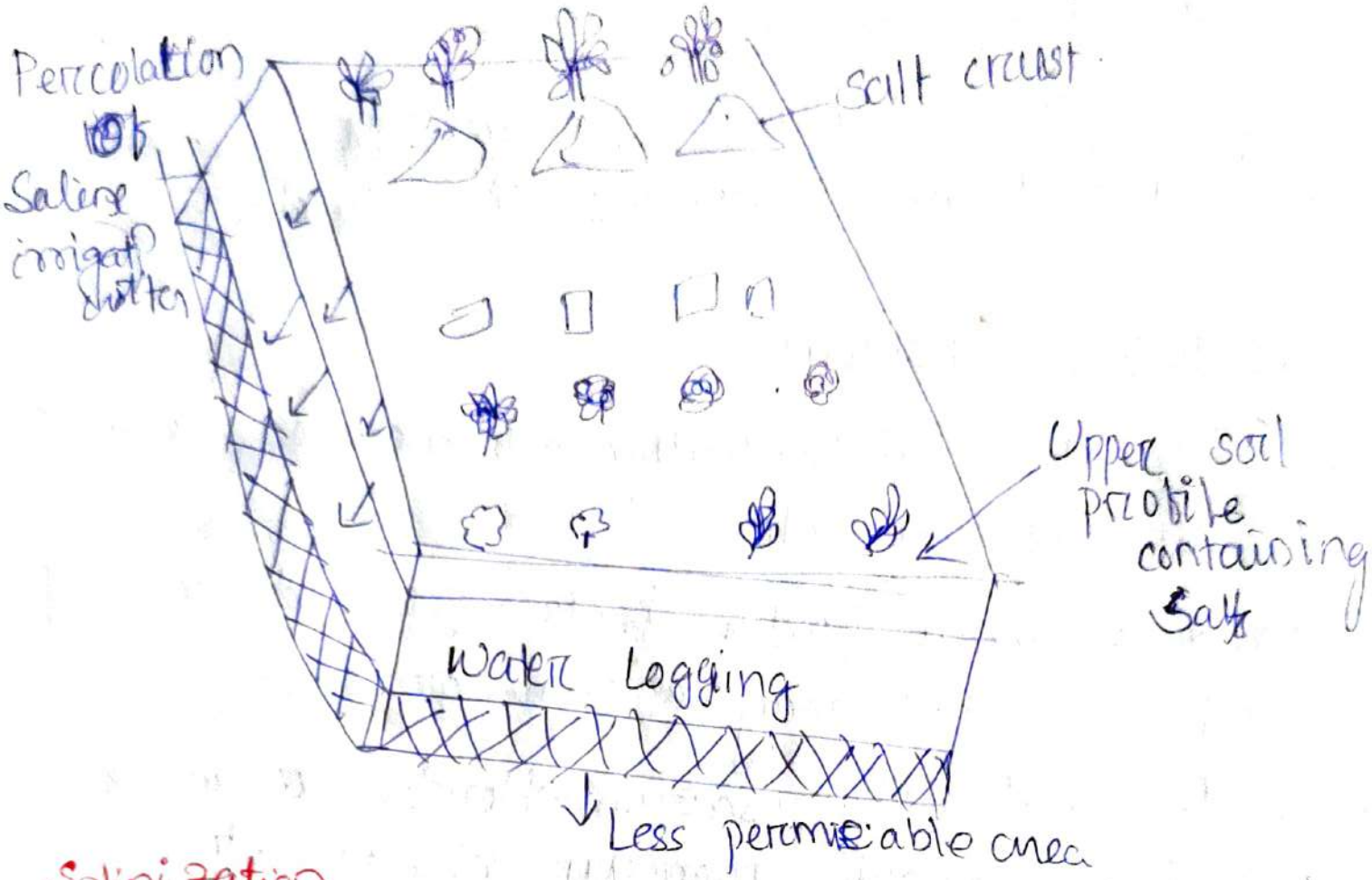
Effect

i) Salinity causes stunted plant growth & lower crop yield.

ii) Most crop cannot tolerate high salinity.

Remedy

1. flush salts out by applying more good quality water to such soils.
2. Laying under ground network of perforated drainage pipes for flushing out the salts slowly
3. Use of sub-surface drainage system.



Salinization

- Addition of salts with saline irrigation water
- Evapo-transpiration leaves behind salts.
- Salt-build up occurs in upper soil profile.

Water logging

- Rain water & irrigation water percolate down.
- water table rises.

Energy Resource

Energy consumption of a nation is usually considered as an index of its development because almost all the developmental activities of a nation directly or indirectly depend upon energy.

* The first form of energy technology probably fire which produce heat.

Energy Source

* A source of energy is one that can provide adequate amount of energy in a usable form over a long period of time.

Renewable Resource

Also known as non-conventional energy.

Solar Energy

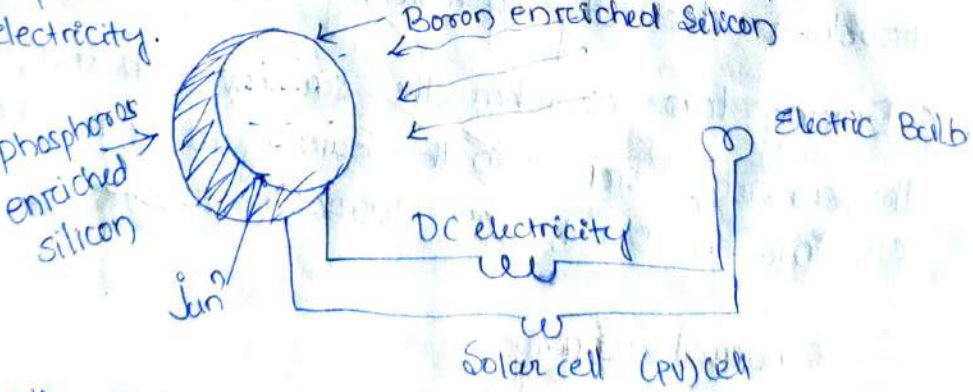
Sun is the ultimate source of energy. The nuclear reactions occurring inside the sun releases enormous quantities of energy in the form of heat & light.

The solar energy received near the earth's space is approx. 1.4 kJ/sec/m² known as solar constant.

PV Cells

PV cells are made of thin wafers of semiconductors materials like silicon & gallium.

When solar radiations fallon them, a potential difference is produced which causes flow of electrons & produces electricity.



Other uses:

Solar heat collectors, Solar cooker, Solar water heater, Solar furnace, Solar power plant

Wind Energy

The high speed winds have a lot of energy in them as kinetic energy due to their motion.
The driving force of the winds is the sun.
The wind energy is harnessed by making use of wind mills.
The blades of the windmill keep on rotating continuously due to the force of the striking wind. The rotational motion of the blades drives a number of machines like water pumps, flourmills & electric generators.

Hydro power Energy

Fierce kinetic energy of waters is used to produce electricity.

Tidal Energy

Ocean tides produces by gravitational forces of sun & Moon contain enormous amounts of energy.
The 'high tide' & 'low tide' refers to the rise & fall of water in the oceans. A difference of several meters to the rise & fall of water in the oceans.
A difference of several meter is required between the height of high & low tide to spin the turbines.
The tidal energy can be harnessed by constructing a tidal barrage.

→ During high tide the sea water flows into the reservoir of the barrage & turns the turbine, which in turn produces electricity by rotating the generators.

→ During low tide, when the sea level is low, the sea water stored in the barrage reservior flows out into the sea & again turns the turbines.

Geothermal Energy

The energy harnessed from the hot rocks present inside the earth is called Geothermal Energy.

Ocean Thermal Energy (OTE)

The energy available due to the difference in temp of water at the surface of the tropical oceans & at deeper levels is called ocean Thermal Energy

A difference of 20°c or more is required between surface water & deeper water of ocean for operating OTEC

Biomass Energy

It is the organic matter produced by the plants or animals which include wood, crop residues, cattle dung, manure, sewage agricultural waste, etc.

i. Energy Plantations.
ii. Petro-crops
iii. Agricultural & urban waste biomass.

Bio gas

A mixture of methane, carbon dioxide, hydrogen & hydrogen sulphide, the major constituent of Methane
It is produced by aerobic degradation of animal wastes

Biofuel

Hydrogen as a fuel.

Non renewable energy Resource

These were fossil fuels like coal, petroleum, natural gas & nuclear fuels. These were formed by the decomposition of the remains of plants & animals buried under the earth millions of years ago.

Coal.

It is the most abundant fossil fuel in the world.
At the present rate of usage, the coal reserves are likely to last for about 200 years & if its use increases by 2% per year, then it will last for another 65 years.

* while burning produces CO_2, which effects greenhouse also have resistives.

Petroleum

It is the life time of global economy. There are 13 countries world having 67% of the petroleum reserves, which together form the OPE (Organisation of petroleum exporting countries) About one fourth of the oil reserves are in Saudi Arab

Petroleum is a cleaner fuel as compared to coal as it burns completely & leaves no residue. It is easier to transport & use. That is the reason why petroleum is preferred amongst all the fossil fuels.

LPG (Liquified Petroleum Gas)

The main component of Petroleum is butane, the other being propene & ethane. The petroleum gas is easily converted to liquid form under pressure as LPG. It is odour less, but the LPG in our domestic gas cylinders gives a foul smell. This is in fact due to ethyl mercaptan, a foul smelling gas, added to LPG, so that leakage of LPG from the cyllinders can be detected instantaneously

- Used in thermal power plant generating electricity.
- A source of hydrogen gas in fertilizer industry & as a source of carbon in tyre industry.

CNG (Compressed Natural Gas)

It is being used as an alternative to petrol & diesel for transport of vehicle. Delhi has totally switched over to CNG where buses & auto rickshaw run on this new fuel.

CNG use has greatly reduced vehicular pollution in the city.

SNG (Synthetic Natural Gas)

- It is a mix of carbon monoxide & hydrogen
- It is a connecting link bet? a fossil fuel & substituted natural gas

Low grade coal is initially transformed into Synthetic Gas by gasification followed by catalytic conversion to methane

Nuclear Energy

Nuclear energy is known for its high destructive power as evidenced from nuclear weapons
The nuclear energy can also be harnessed for providing commercial energy
It can be generated by 2 types

Nuclear fission

It is the nuclear change in which nucleus of certain isotopes with large mass numbers are split into lighter nuclei on bombardment by neutrons & a large amount of energy is released through a chain reaction.

$$_{92}U^{235} + {}_{0}n^{1} \longrightarrow {}_{36}Kr^{} + {}_{56}Ba^{141} + 3\,{}_{0}n^{1} + \text{Energy}$$

Nuclear fusion

Here two isotopes of a light element are forced together at extremely high temp (1 billion°C) until they fuse to form a heavier nucleus releasing enormous energy in the process
It is difficult to initiate the process but gives more energy

$$_{1}H^{2} + {}_{1}H^{2} \longrightarrow {}_{2}He^{2} + {}_{0}n^{1} + \text{Energy}.$$

Land Resource

Land as a Resource

Land is a finite & valuable resource on which we depend for our food, fibre & fuel & the basic amenities of life.

The top soil is classified as renewable resource because it is continously regenerated by natural process through at avery slow rate.

About 200-1000 years are needed for the formation of one inch or 2.5 cm soil depending upon the climate condition & soil type.

When rate of erosion is greater than rate of renewal than soil become non-renewable energy.

Land Degradation

Due to population growth more pressure on the limited Land resource, which are getting degraded due to over-exploitation. soil degradation is a real cause of alarm because soil formation is an extremely slow process & the average annual erosion rate is 20-100 times more than the renewal rate.

Soil erosion, water logging, salinization and contamination of the soil with industrial wastes like fly-ash, press-mud, heavy metal all causes degradation of land.

Land Slides

- Various anthropogenic activities like hydro electric projects large dams, reservoirs, construction of Roads & Railways lines, construction of buildings, mining etc are responsible for clearing of large forrest areas.

- Earlier there were few reports of landslide between Rishikesh & Byasi on Badrinath highway area. But after highway constructed 15 landslides occurred in a single year.

→ During construction of Roads, mining activities etc huge portions of fragile mountain areas are cut, or destroyed by dynamite & thrown into adjacent valleys and steams.

→ These land masses weakens the already fragile mountain slopes & lead to landslides.

They also increase the turbidity of various nearby streams there by reducing their productivity.

Soil Erosion

Meaning of soil erosion is wearing away of soil.

→ It may defined as the movement of soil components especially surface-litter & top soil from one place to another.

→ It results to loss of fertility as the top soil layer is fertile.

1. Normal erosion or Geologic Erosion

It is caused by gradual removal of top soil by natural processes which bring an equilibration bet^n physical, biological & hydrological activities & ~~mountain~~ maintain a ~~natural~~ a Natural balance between erosion & Renewal.

2. Accelerated Soil erosion.

This is mainly caused by anthropogenic (man-made) activities & the rate of erosion is much faster than the rate of formation of soil.

Overgrazing, deforestation & mining are some imp. activities causing accelerated erosion.

2 Agents causing soil erosion

(i) Climatic agents

Water & wind are the climatic agents of soil erosion. Water affects soil erosion in the form of torrential rains. rapid flow of water along slopes, run-off waves action & melting & movement of snow.

(ii) Biotic Agents

Excessive grazing, mining & deforestation are the major biotic agents responsible for soil erosion.

Due to these processes the top soil is disturbed or rendered devoid of vegetation cover.

So land is directly exposed to the action of various physical forces facilitating erosion, other causes overgrazing, Deforestation.

Water induced soil erosion

1. Sheet erosion: when there is uniform removal of a thin layer, of soil from a large surface area, it is called sheet erosion.
This is usually due to run-off water.
2. Rill erosion: when there is rainfall & rapidly running water produces finger-shaped grooves or rills over the area, it is called rill erosion.
3. Gully erosion: It is more prominent type of soil erosion. when the rainfall is very ~~high~~ heavy, deeper cavities or gullies are formed, which may be U or V shaped.
4. Slip erosion:
The occurs due to heavy rain-fall on slopes of hills & mountains.
5. Stream Bank Erosion: During the rainy season when fast running streams take a turn in some other direction, they cut the soil & make caves in the banks.

Wind erosion

1. Saltation: This occurs under the influence of direct pressure of stormy wind and the soil particles of 1-15 mm diameter move up in vertical dirn.
2. Suspension: Here fine soil particles (<1mm) which are suspended in the air are kicked up & taken away to distant places.
3. Surface creep: Here largest particles (5-10 mm dia) creep over the soil surface along with wind.

Desertification

Desertification is a process whereby the productive potential of arid or semiarid lands falls by 10% or more. This leads to the conversion of rangelands or irrigated croplands to desert like conditions in which agricultural productivity falls.

Desertification is characterized by de vegetation & loss of vegetal cover depletion of ground water, salinization & serve soil erosion.

Causes

- Natural phenomena like climate change or maybe due to abusive use of land.
- Deforestation.
- Over grazing.
- Mining & quarrying.

Conservation of Natural Resources : Role of an Individ

Conserve Water

- Don't keep water taps running while brushing, shavi washing or bathing
- In washing machines fill the machine only to the level required for your clothes.
- Install water-saving toilets & use not more than 6 l per flush
- Check for water lakes in pipes & toilets & repair them promptly.
- Reuse the soapy water of washing from clothe for washing of the courtyards, drive ways etc.
- Water the plants in your kitchen-garden & Lawn in the evening when evaporation losses are min
- Use drip irrigation & sprinkling irrigation to improve irrigation efficiency & reduce evaporation.
- Install a small system to capture rain water & collect normally wasted used water from sinks, cloth washers, bath tubes etc. which can be used for watering the plants.
- Build rain water harvesting system in your house.

Conserve Energy

- Turn off lights, fans & other appliance when not in use
- Obtain as heat from natural source as possible as it can
- Dry clothes in sun instead of driver
- Use solar cooker in sunny day instead of LPG.
- Build your house with provision for sunspace which will keep your house warm & will provide more light.
- Grow deciduous trees & climbers.
- Drive less, make fewer trips & use public transportation wherever possible.
- Instead of head convertor using, wear adequate woolen
- Recycle, & Reuse of glass, Metals & paper.

Protect the Soil

- While constructing house, don't uproot the trees as far as possible
- Grow different types of ornamental plants, herbs & trees
- Make compost from your kitchen waste & use it for kitchen garden or flower-pots
- Donot irrigate the plants using a strong flow of water as it would wash off the soil.
- Donot over-irrigate field.
- Use mixed cropping sothat some specific soil nutrients donot get depleted.

Promote Sustainable Agriculture

- Donot waste food.
- Reduce the use of pesticides
- Fertilize your crop primarily with organic fertilizers
- Use drip irrigation to water the crops.
- Eat local & seasonal vegetables. This saves lot of energy on transport, storage & preservation.
- Control pests by a combination of cultivation & biological control methods.

Equitable use of Resources for sustainable life-Style

- Reducing the unsustainable & unequal use of resources & controlling our population growth are essential for the survival for our nation.
- The soil, water, climate & solar energy, which from the abio~~tic~~ support that we drive & from nature.. are not distributed evenly throughout the worldly or within countries.
- A new economic order at the global & at national level must be based on the ability to distribute benefits of Natural Resources by sharing them more equally among the countries as well as among communities with in countries such as our own.
- Rural / undeveloped people are often accused of exploiting natural resources. They must be adequately compensated for the removal of the resources to distant regions. They should educate environmentlly.
- As the rich nations are developing more, they are also leading to more pollution & sustainability of the earth's life support system is under threat.
- Poor nations, are still struggling hard with their large population & poverty problems. Their share of resources is too little leading to unsustainability.
- The solution is to have more equitable distribution of resources & wealth. A caring for the earth in all respects.
- The rich countries will have to lower down their consumption levels while the basic minimum needs of the poor have to be fulfilled by providing them resources.
- A love & respect for nature is the greatest sentiment that helps bring about a feeling for looking at how we use natural resources in a new & caring way.

ECO SYSTEM

An Ecosystem is a region with specific & recognisable landscape form such as a forest, grassland, desert, wetland or coastal area

→ The nature of the ecosystem depends on its geographical features such as hills, mountains, plains, rivers, lakes, coastal areas or islands & is also controlled by climatic conditions, the amount of sunlight, temperature & rainfall in the region.

→ The geographical, climatic & soil characteristics form its non-living or abiotic components. These features create condition that support a community of plants & animals that evolution has produced to live in these specific conditions.

→ The living part of the Ecosystem is refered to as the biotic component.

* An Ecosystem is a group of biotic communities of species interacting with one another & with their non-living environmental exchanging energy & Matter.

The study of ecosystem - Ecology.

Ecology comes from a greek word oikos = home & Logos = study. So Ecology deals with the study of organisms in their natural home interacting with their surroundings.

Structure & function of an Ecosystem

Structural Aspects

This refers to all the elements that make up an ecosystem

- The individuals & Communities of plants & animals as well as the non living natural resources present in the ecosystem.

1. Inorganic compounds - C, N, CO_2, H_2O
2. Organic compounds - Proteins, carbohydrates, lipids, which link the abiotic to biotic aspects
3. Climatic Regimes - Temp, moisture, Topography etc.
4. Producers - Plants
5. Macro-consumers - phagotrophs, that is large animals.
6. Micro-consumers - Saprotrophs, That is absorbers like fungi.

Functional Aspects

This refers to all the services processes & interactions performed by the organisms in an eco system

- Energy cycles
- Food chains
- Diversity interlinks between organisms
- Nutrient cycles - biogeo chemical cycles
- Evolution

Producers, Consumers & Decomposers

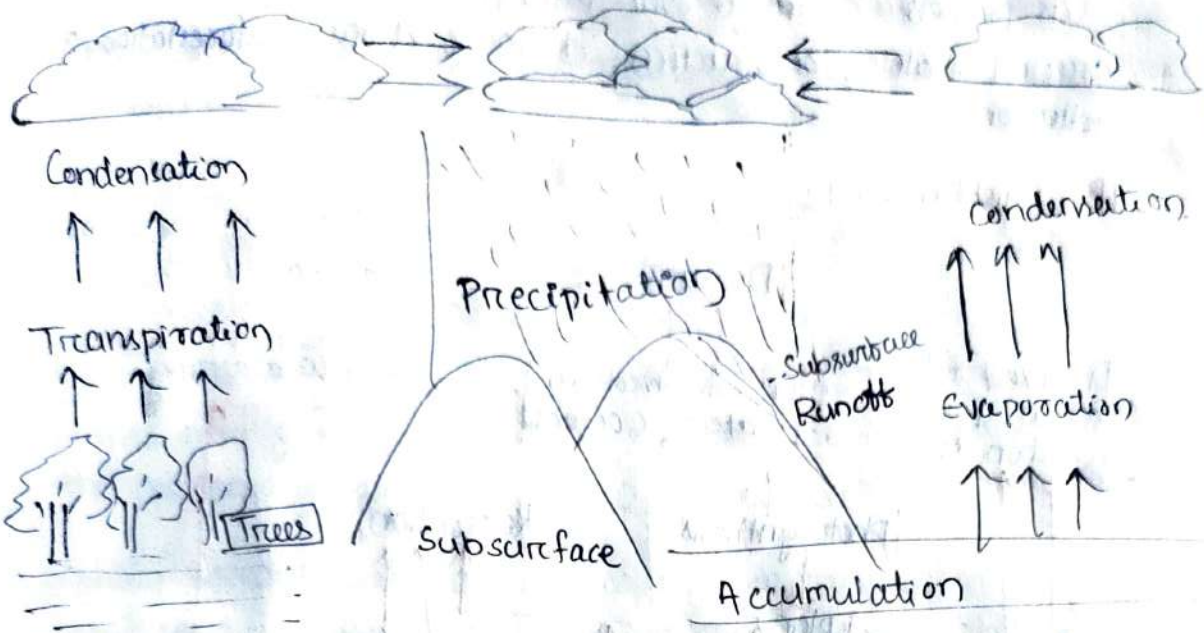
- Every living organism is in some way dependent on other organ
→ Plants are the producer in the ecosystem as they manufacture their food by using energy from the sun.
→ In forest these form communities of plant life.
In Sea. These range from tiny algal forms to large sea w
→ Consumers who depends for their food & energy upon other living organisms.
- Herbivorous animals are primary consumers as they feed on the producers.
eg: insects, amphibians, Reptiles, birds & Mammals
Hare, elephants & deer that live on plant life
- At higher tropic level, there are carnivoros animals or secondary consumers.
eg: Tigers, leopards, jackel foxes & small wild cats.
In sea, carnivoros fish live on other fish & marine animals

The animals live in the seacange in size from microscopic forms to giant mammels such as the whale.

- Decomposers or detrivores are group of organism consisting of small animals such as worms, insects, bacteria & fungi, which break down into simpler substances that are used by plants as nutrition.
- Thus. decomposition is a vital fun^{n} in nature as without this all the nutrients would be tied up in dead matter & no new life would be produced.

Energy flow in the ecosystem

Every Ecosystem is controlled by some cycles. each ecosystem abiotic & biotic features are distinct from each other



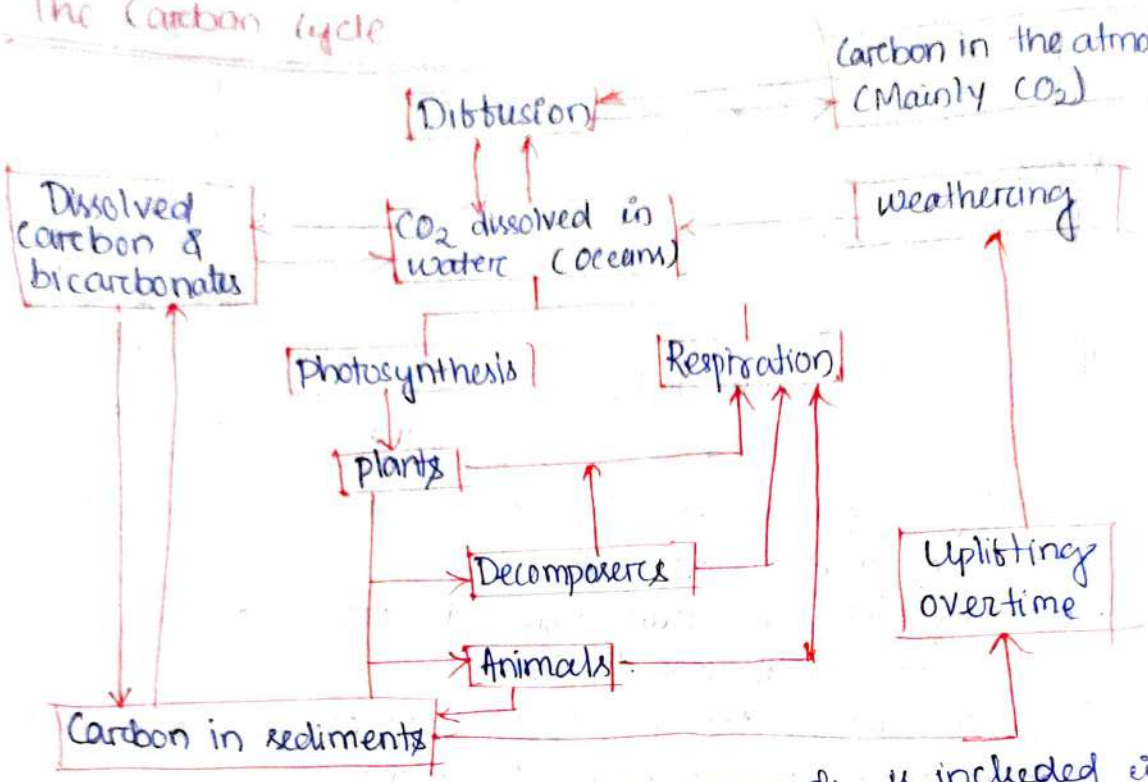
- The hydrologic cycle known as water cycle collects, purifies & circulates the earth's finite water supply.
  When it rains, the water runs along the ground & flows into rivers or falls directly into the sea.
- A part of rain water that falls on land percolates into the ground, thus recharging ground water aquifiers.
- water is drawn up from the ground by plants along with nutrients from soil. The water then transpires from the leaves as water vapour & returns to the atmosphere. As it is lighter than air, water vapour rises & forms cloud
- The winds blow the cloud for long distances & when the cloud rise higher, the vapour condenses & changes into droplets & which fall on the land as rain.

→ Part of this rain gets locked in glaciers. Thus, the process of evaporation from water bodies. transpiration from plant leaves. condensation of watervapour, precipitation & percolation form an endless cycle that replenishes Streams Lakes & wet lands.

→ The above natural processes of the water cycle also remove impurities in water.

→ While this is an endless cycle on which life depends, human activities are making drastic changes in the water cycle & its process e.g through over-extraction of surface water & ground water, construction of large dams, deforestation & pollution.

The Carbon cycle



The carbon found in organic compounds is included in both the biotic & abiotic parts of the ecosystem. Carbon is a building block of both plant & animals tissues. The carbon cycle is based on CO_2 gas

→ In terrestrial ecosystems CO_2 is removed from the atmosphere & in aquatic ecosystem, CO_2 is removed from water.

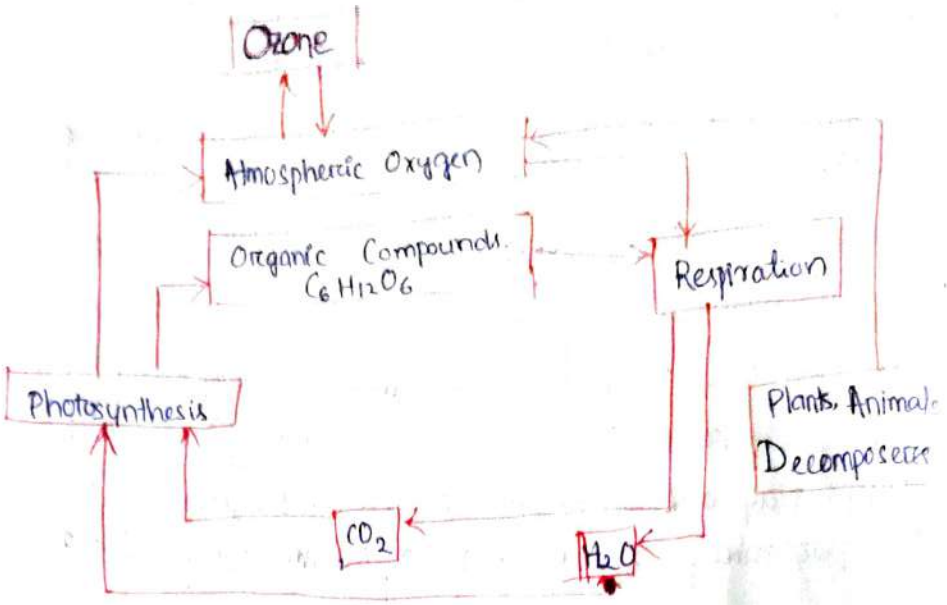
→ In the presence of sunlight, plants take up CO_2 from the atmosphere through their leaves. The plants combine CO_2 with water, which is absorbed by their roots from the soil.

→ In the presence of sunlight they are able to produce carbohydrate that contain carbon.

This process is known as photo synthesis.

- Plants use this complex mechanism for their growth and development. In this process plants release oxygen into the atmosphere on which animals depend for their respiration
- Herbivores feed on plant material which is used by them for energy & for growth
- Both plants & animals release CO_2 during respiration. They also return fixed carbon to the soil in the waste they excrete. When plants & animals die, they return their carbon to the soil, thus completing the carbon cycle. Plants play a very important role in regulating & monitoring the percentage of oxygen & CO_2 in the earth's atmosphere
- Equally oceans play a crucial role in the carbon cycle. some CO_2 is removed by marine species during photosynthesis. some stays dissolved in sea water (making it a major carbon storage sink), and finally some of the CO_2 reacts with sea water to ~~form~~ form carbonate & bicarbonate ions
- Cold sea water can hold more carbon than warmer sea water. Just like cold soft drinks.
  As the temperature of the oceans rise, it becomes less able to absorb CO_2 & thus more CO_2 is released in to the atmosphere.
- The carbon cycle ensure that CO_2 is at acceptable levels. This in turn moderates the temp too, like to exist. If the carbon cycle removes too much carbon, the atmosphere will become cool & if too much carbon is added to the atmosphere, the atmosphere will get warmer
- Current climate ~~eq~~ models show an increased concentration of CO_2 in the atmosphere. This resulting climate change phenomenon is at the forefront of the environment.

The Oxygen cycle



Oxygen is absorbed by plants & animals from the air during respiration. The plants return oxygen to the atmosphere during photosynthesis. This links the oxygen cycle to the carbon cycle.

Deforestation is likely to gradually reduce the oxygen level in the atmosphere. Thus, plant life plays an important role in our lives, the enormity of which we frequently fail to appreciate.

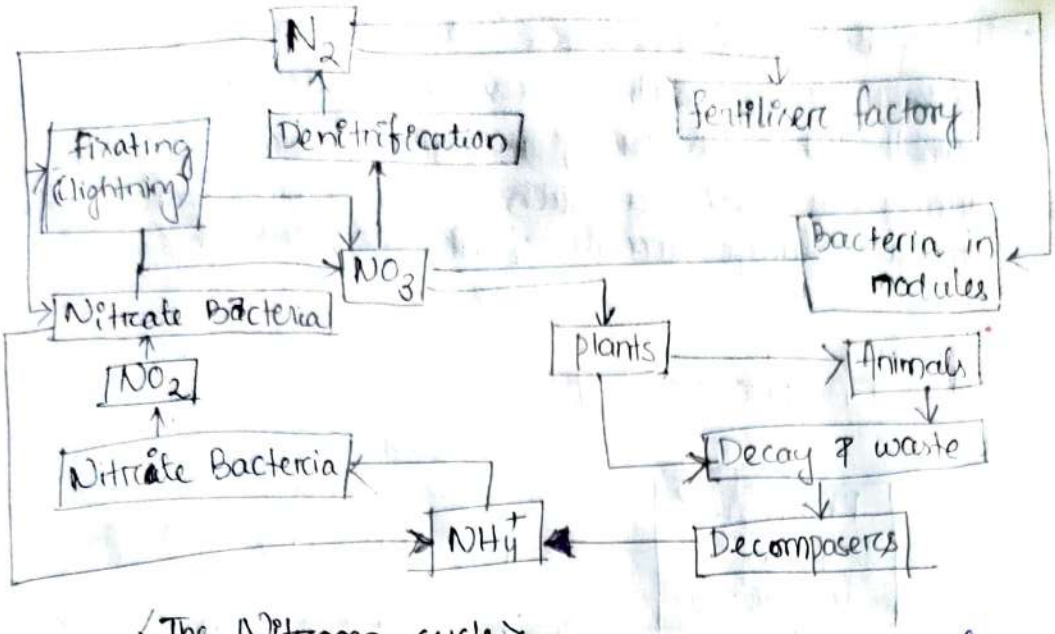
The Nitrogen Cycle

Nitrogen (N_2) in the atmosphere can't be directly used as a nutrient by plants or animals.

It must be converted in to its compound form of Ammonia (NH_4) nitrates or nitrites. This occurs through 4 steps.

i) fixation
ii) Nitrification
iii) Ammonification
iv) Denitrification.

- Nitrogen fixing bacteria feed off the root nodules of certain plant species such as beans, peas, & alfalfa while they fix Nitrogen.
- This Nitrogen is then converted into Ammonia (NH_4) to be used by those plants.
- Any unused Ammonia undergoes nitrification.



<The Nitrogen cycle>

→ In the ammonification step, specialized bacteria and fungi feed & convert dead material (from animals) into compounds such as ammonia & water soluble salts containing ammonium ions.

These compounds are absorbed by plants for growth. In this manner nutrients are recycled back from animals to plants.

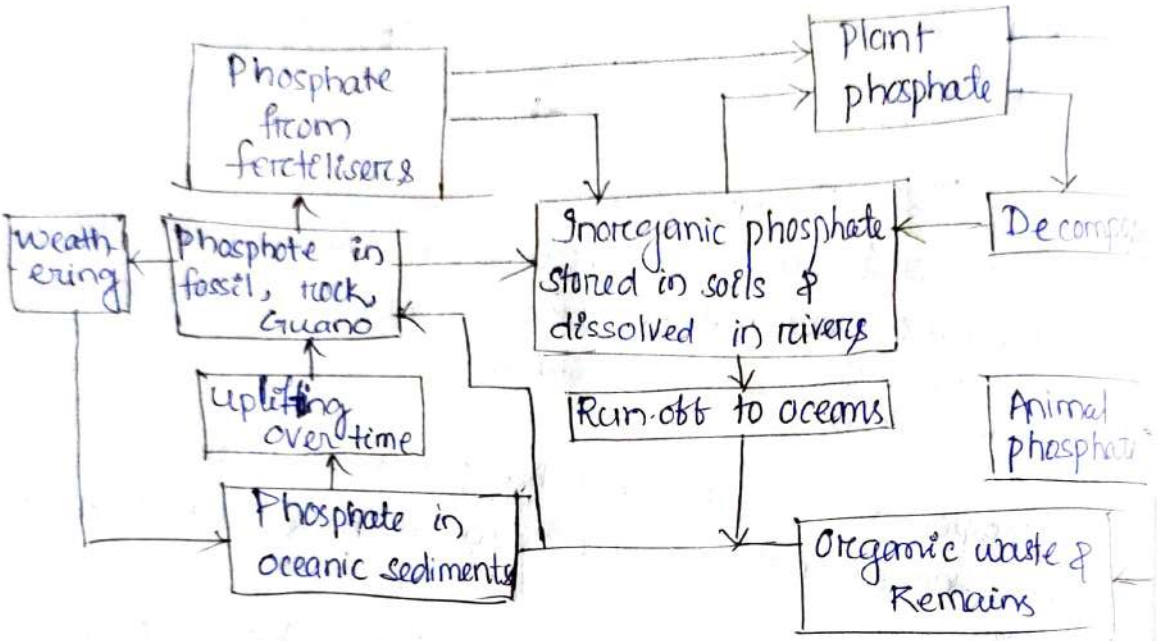
→ Finally the denitrification step completes the nitrogen cycle as nitrogen leaves the soil & is released into the atmosphere as nitrogen or nitrous oxide gas.

→ It is important to realise that nitrogen fixing bacteria and fungi in the soil give this important element to plants which absorb it as nitreates. This is used by the animals the feed on the plants. The nitrogen is then transferred to the carnivores when they feed on the herbivores. So, our own lives are closely interlinked to soil animals, fungi & even the bacteria in the soil.

When we think of food webs, we usually think of large mammals & other large forms of life. But we need to understand that it is the unseen forms of life that are of great value for the functioning of the ecosystem.

- The global nitrogen cycle has been altered due to nitrogen-rich fertilisers used in agriculture. pollut emitted by vehicles & industries & from sewage treatment facilities such as ~~the~~ septic tanks wh release large amounts of nitrogen into the ground

The Phosphorus Cycle

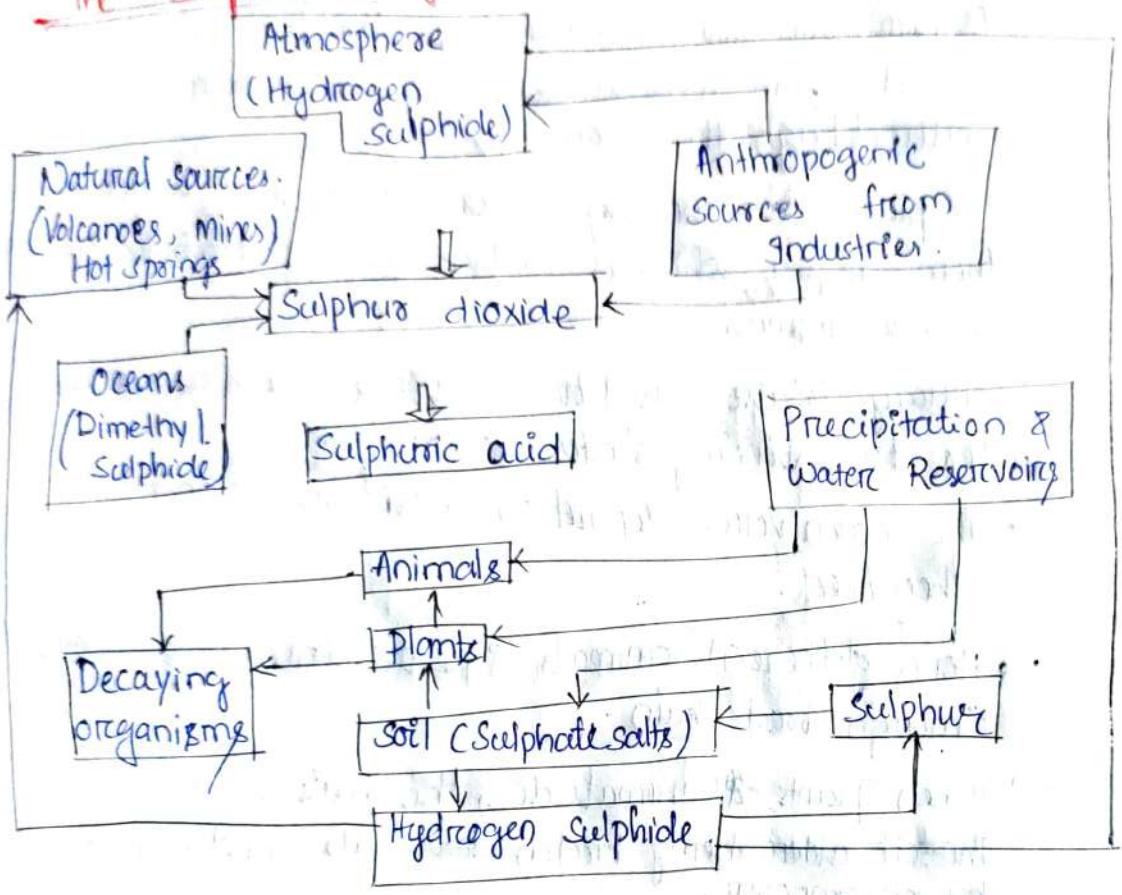


- Very little phosphorus enter the earth's atmosphere, it is usually found as part of a phosphate ion in terrestrial rocks or as deposits in ocean bottom sediment
- Overtime, weathering of rock brings phosphates into the so which is then absorbed by plants. Then, the phosphorus cycle is completed in both land & water.
- Most soil contains very little phosphate so it is mined from the earth & added to soil as a fertiliser
  - Once utilised by plants, it enters the food chains animals may consume these plants, after death plant & animals decay allows phosphate to return to the soil
- Run-off from rain carries phosphorus back to the ocean or deposits it in rocks, thus completing the cycle.
- Human activities such as ~~aquatic~~ phosphate rock mining for commercial fertiliser & detergent

have a significant impact in altering the phosphorus cycle

- Run-off of excess phosphate from the soil pollutes aquatic ecosystems by over loading them with nutrients, which in turn minimises the amount of oxygen available & causes toxic algal blooms.

The Sulphur cycle



Sulphur enters the earth's atmosphere in the form of hydrogen sulphide (H_2S) & Sulphur dioxide (SO_2) H_2S & SO_2 are both emitted from active volcanoes.

Additionally, H_2S is released from organic Matter that decomposes anaerobically (with out oxygen) found in swamps & the Tidal flow. Other sources of sulphur are sulphate salts that can be found buried under ocean sediments & in under ground rocks & Minerals.

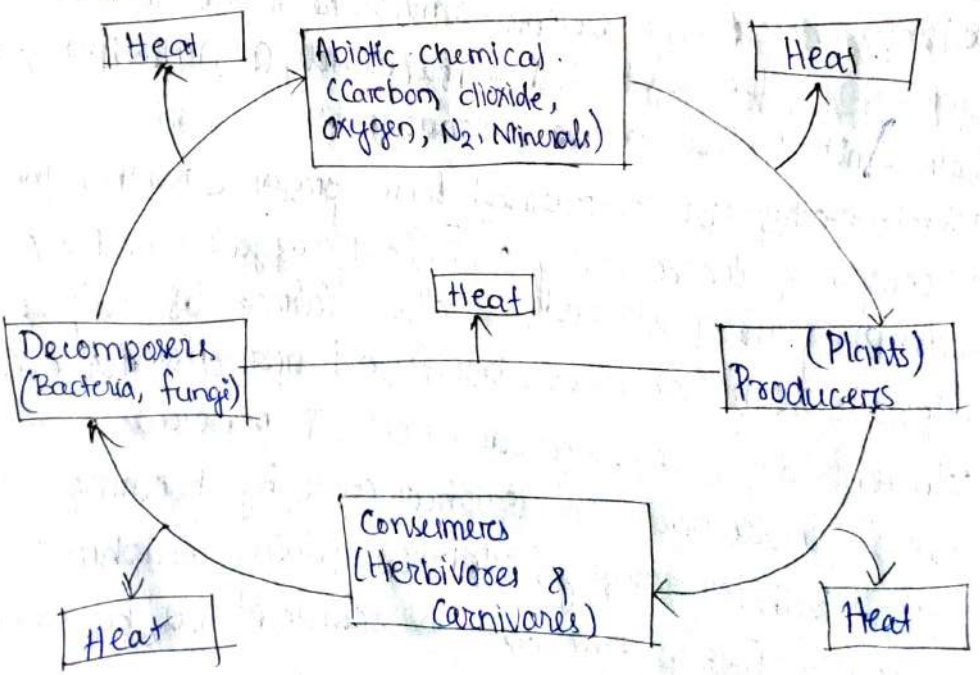
Human influences the sulphur cycle by burning coal & oil, both containing sulphur, refining sulphur contain petrol & finally through the release of SO_2 by smelting for the extraction of copper lead & zinc.

Energy flow cycle

- The energy cycle is based on the flow of energy through the ecosystem
- The energy from Sunlight is converted by plants into growing new plant material, which includes the leaves, flowers, fruit, branches, trunks & roots of plants.

As plants can grow by converting the Sun's Energy directly into their tissues, they are known as producers in the ecosystem.

- The plants are used by herbivores, as food which gives them energy which is used up for the metabolic function of these animals.
- Energy is also used for activities such as looking for food, finding shelter, breeding etc.
- The carnivores depend on the herbivores on which they feed.
- Hence different animals & plants linked to one another through food chain.
- When plants & animals die, this material is returned to the soil after being broken down into simpler substances by decomposers.



sothat plants can absorb the nutrients through their roots. Thus Animals excrete waste product after digesting which goes back to the soil. This links energy cycle to Nitrogen cycle.
After getting abiotic chemical this completes one cycle & again start the energy cycle.

Ecological Succession.

Ecological Succession is a process through which ecosystem tend to change over a period of time.
Succession can be related to seasonal environmental changes, which create change in the community of plants & Animals living in the Ecosystem.

- Other successional events may take much longer period of time, extending to several decades.
- If a forest is cleared it is initially colonised by a certain group of species of plants & animals, which gradually change through an orderly process of community development.
- One can predict that a cleared or open area will gradually be converted into a grassland, a shrub land & finally a wood land & a forest : If permitted to do so without human interference.
- There is a tendency for succession to produce a more or less stable state, at the end of environmental change.

The food chains

- The transfer of energy from the source in plants through a series of organisms, by eating & being eaten constitutes the food chain.
- The most obvious aspect of nature is that energy must pass from one living organism to another.
- When herbivorous animals feed on plants, energy is transferred from the plants to the animals.

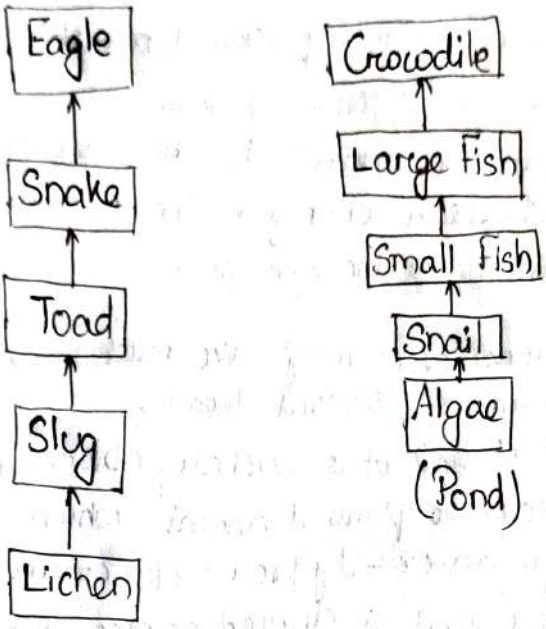
In an Ecosystem some of the animals feed on other living organisms, while some feed on dead organic matter

the latter from the detritus of the food chain.

→ At each link in the chain, a large part of energy fro the food is lost through daily activities

→ Each chain usually, has only four to five such links.

→ However, a single species be linked to a large no Species.



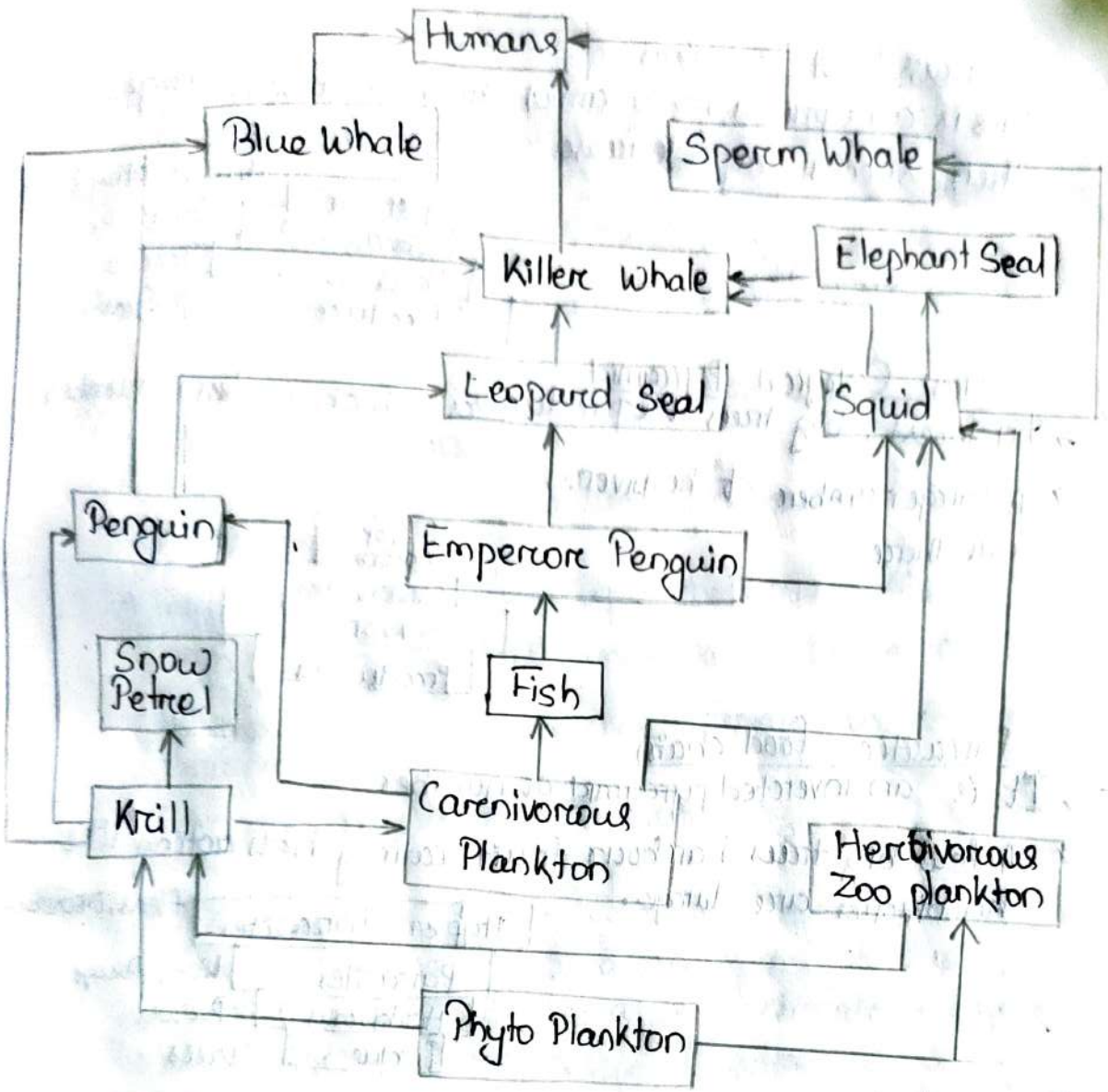
FOOD WEB :

Food web is a network of food chains where different types of organisms are connected at diff trophic levels, so that there are a no. of options eating & being eaten at each trophic level.

→ A simplified food web in Antractic ecosystem. (Steps of food

→ Tropical region ecosystem, are much more complicated

→ In the food web, there are a number of options available at each trophic level. So if one species is affected, it does not effect other trophic levels so seriously. Also less chance of extinction of one speci



* A Simplied ~~Ecosystem~~ Food Web in Antarctic Ecosystem

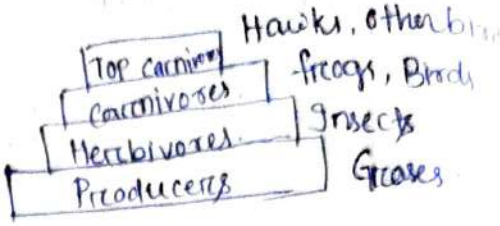
The Ecological Pyramids

Graphic representation of trophic structure and function of an ecosystem, starting with producers at the base and successive trophic levels forming the apex is known as an ecological pyramid.

1. Producers.
2. Primary consumers.
3. Secondary consumers.

Grass land Ecosystem

This is an upright no pyramid. Here the base is large. Then successively decreases



Forest Ecological Pyramid

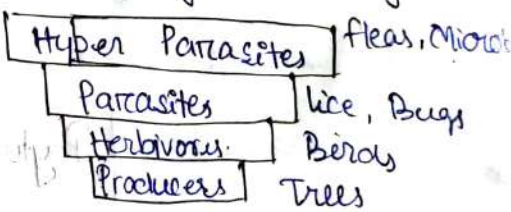
→ In forest, big trees are producers which is less in number

→ A large number of herbivores are there.

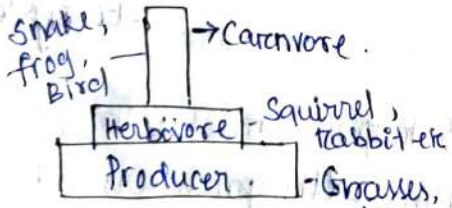
Parasitic food chain

→ It is an inverted pyramid of number.

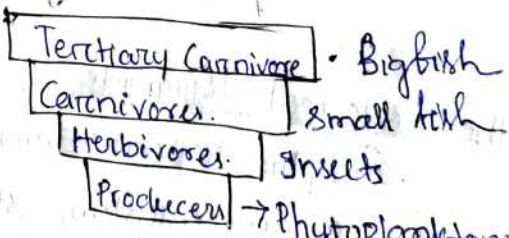
→ A few big trees harbour fruit eating birds acting like herbivores are large.



Pyramid of Biomass

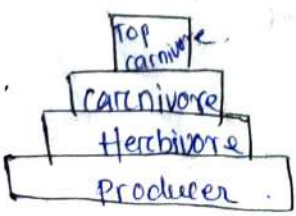


〈Grass land〉



〈Pond〉

Pyramid of Energy



Forest Ecosystem

These are the ecosystems having a predominance of trees that are interspersed with a large number of species of herbs, shrubs, climbers, lichens, algae and a wide variety of wild animals and birds.

Types

a) **Tropical Rain forests:**

They are evergreen broadleaf forests found near the equator.

→ They are characterised by high temperature, humidity high & high rainfall, which favour the growth of trees.

→ All through the year the climate remains less or more uniform.

→ They are the richest in biodiversity.

b) **Tropical deciduous forests:**

They are found a little away from the equator and are characterised by a warm climate the year round. Rain occurs only during monsoon.

→ A large part of the year remains dry and therefore different types of deciduous trees are found here which loss their leaves during dry season.

c) **Tropical scrub forests:**

They are found in areas where the dry season is even longer. There are small deciduous trees & shrubs.

d) **Temperate rain forests:**

They are found in temperate areas with adequate rainfall. These are dominated by coniferous trees like pines, firs, red woods etc.

They also consist of some evergreen broad-leaf.

e) Temperate deciduous forests

They are found in areas with moderate temperature. There is a marked seasonality with long summers, cold but not too severe winter and abundant rainfall throughout the year.

→ The major trees include broad leaf decidelous trees like oak, hickory, poplar etc

f) Evergreen Coniferous forests (Boreal forests).

→ They are found just south of arctic tundra

→ Winters are long, cold & dry.

→ Sunlight is available for a few hours only.

→ Major trees - Pines, spruce, fir, cedar etc which have tiny, needle-shaped leaves having a waxy coating so that they can withstand severe cold.

→ Soil is found to get frozen during winter.

→ Species diversity is rather low in these forest.

Aquatic Ecosystems

This deals with water bodies and the biotic communities present in them are either fresh water or marine.

fresh water is 2 type

1. Lentic (standing)
2. Lotic (free-blowing)

a Pond ecosystem

- It is a small freshwater aquatic ecosystem where water is stagnant. Ponds may be seasonal in nature.
- usually shallow water bodies which play a very important role in the villages where most of the activities centre around ponds.
- contains several types of algae, aquatic plants, insects, fishes & birds.
- Exposed to tremendous Anthropogenic (human generated) pressure.

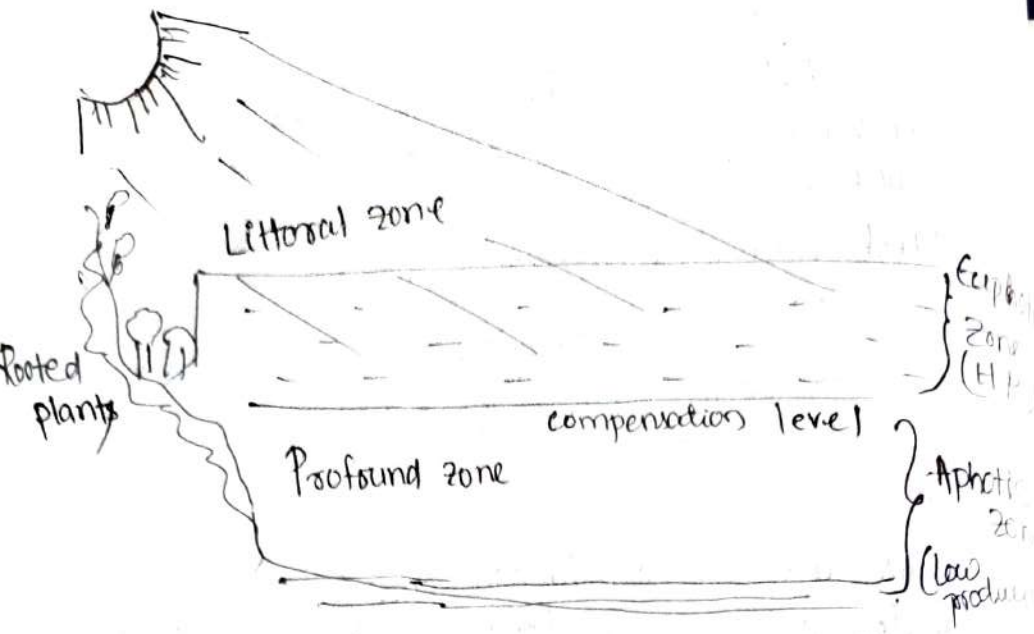
b Lake Ecosystem

- Usually big freshwater bodies with standing water.
- They have shallow water zone called littoral zone.
- An open water zone where effective penetration of solar light takes place called limnetic zone. And a deep bottom area where light penetration is negligible known as profundal zone.

Energy cycle in lake

Sunlight → plants in water → herbivores → Carnivores → wastage → Nutrient for plants

eg: Dal lake, Naini lake, Loktak lake etc.



Stream ecosystem

- Here water current is a major controlling factors oxygen & Nutrient in the water is more uniform. and land-water exchange is more extensive.
- Surface is exposed to air, so more oxygen compare to pond.
- Less green plants. The animals usually have a narrow range of tolerance to oxygen.

River Ecosystem

Rivers are large streams that flow downward from mountain highlands and flowing through the plains falls into the sea.

- The mountain highland part has cold, clear waters rushing down as water falls with large amounts of dissolved oxygen.
- Plants attached to rock and high oxygen required fish (trouts) are present here.
- In the second phase on the gentle slopes the waters are warmer & support a luxuriant growth of plants & less oxygen requiring fishes

→ In the 3rd phase, the river waters are very rich in biotic diversity. Moving down the hills rivers shapes the land. They bring with them lots of silt rich in nutrients which is deposited in the plains & in the delta before reaching the ocean.

Ocean

- 70% of our earth's surface.
- 250000 marine species act as food for human & other organisms
- huge variety of sea products & drugs.
- Provides. iron, phosphorus, magnesium, oil, natural gas, sand and gravel.
- Oceans are the major sinks of CO_2 & plays an important role in regulating many biological & hydrological cycles. Thereby regulating earth's climate.

(i) Coastal Sea
Coastal zone with relatively warm, nutrient rich shallow water. Due to high nutrients and ample sunlight this is the zone of high primary productivity.

(ii) Open Sea
It is the deeper part of the ocean, away from the continental shelf (Sub-merged part of the continent)

Estuary

- An estuary is a partially enclosed coastal area at the mouth of ariver where fresh water & salty water meet
- These are the transition zone which are strongly affected by tidal action.
- A wide variations in the stream flow and Tidal currents at any given location Monthly, yearly or seasonally.

So, the organisms present in estuaries show a wide range of tolerance to temperature & salinity. such organisms are known as Eurythermal & euryhaline.
eg: Coastal bays, tidal Marshes.

→ Estuaries have a rich Biodiversity & many of the species are endemic.
There are many migratory species & depend on fishers.
Also get abundant food.
It is highly productive ecosystem.

→ There are many migratory species of fishes also get abundant food

→ Highly productive ecosystem.

Biodiversity & its conservation

Def^n:

Biological Diversity or biodiversity is that part of nature which includes the difference in genes among the individuals of a species.
The variety and richness of all the plants and animal species at different scales in space locally in a region, in the country and the world; and the types of ecosystems both terrestrial and aquatic with in a defined are.

What is Biodiversity?

Biological diversity deals with the degree of nature's variety in the biosphere. This variety can observed at three levels - The genetic variability with in a species, the variety of species with in a community, and the organisation of species in an area into distinctive plants and animal communities.

Genetic Diversity

It is the basic source of biodiversity. The genes found in organisms can form enormous number of combinations each of which gives raise to some variability. Genes are the basic units of hereditary information transmitted from one generation to others.

- When the genes with in somespecies show different versions due to new combinations, it is called Genetic biodiversity.

Eg: All rice varieties belong to the speies oryza sativa, but there were thousands of wild and cultivated varieties of rice which show variations

At the genetic level and differs in their color, size, shape aroma & nutrient content of the grain. This is the genetic diversity of rice.

Species Diversity

This the variability formed with in the population of a species, are between different species of a community. It represents broadly the species richness and their abundance in a community.
There are two popular indices of measuring species diversity known as Shannon-wiener index & Simpson index.

What is the number of species on the biosphere? The estimates of actual number varey widely due to imlete and indirect data. The current estimates given by wilson in 1992 put total number of living species in a range of 10 million to 50 million. Till now only about 15 million living & 300,000 fossil species have been actually described & given scientific names.

→ It is quite likely that a large fraction of these species may become extinct even before they are discovered and enlisted.

→ Areas that are rich in species diversity are called hotspots of diversity.

→ India is among the 15 nations that are exceptionally rich in species diversity.

Ecosystem Diversity

This is the diversity of ecological complexity showing variations in ecological niches, trophic structures, food webs, nutrients cycling.
The ecosystems also show variation w.r.t. physical parameters, like moisture, temperature, altitude, precipitation etc.

Thus, there occur tremendous diversity with in the ecosystems along these gradients we can't even replace the diversity of ecosystem by that of another.

Distinctive ecosystems include landscapes like forests grass lands, deserts and mountains as well as aquatic ecosystems like rivers, lakes & sea.

- An ecosystem is refered to as 'natural' when it is relatively undisturbed by human activities or 'modified' when it is converted to other types of uses such as farmlands or urban areas. Ecosystem are most natural in wilderness. If Natural ecosystems are over used or mis used, their productivity eventually decreases and they as then said to be degraded.

Biogeographically classification of India

India has a rich heritage of biological diversity and occupies the 10th position among the plant rich nations in the world.

India can be conveniently divided en to 10 major regions based on the geography, climate, patterns of vegetation and communities of mammals, birds, reptile, amphibians, insects & other invertebrates that live in them. Each of these regions control a variety of ecosystem such as forests, grass lands, lakes, rivers, wet lands, mountains & hills which have specific plant & animal species.

1. The cold, mountains, snow-covered trans Himalayan region of Ladakh).
2. The Himalayan ranges & valleys of Kashmir, Himachal pradesh, Uttarakhand, Assam & other North eastern states.
3. The Terai, the low limit where the Himalayan rivers flows into the plains.

4. The gangetic & Brahma putra plains.
5. The Thar desert of Rajasthan.
6. The semi-arrid grassland region of the Deccan plateau Gujarat, Maharashtra, Andhra pradesh, karnataka & Tamil Nadu.
7. The North eastern states of India.
8. The western ghats in Maharashtra, karnataka & kerala.
9. The Andaman & Nicober islands.
10. The long western & eastern coastal belts with sandy beaches, forests & Mangroooves.

Value of Biodiversity

Biodiversity provides a variety of environmental services from its species and ecosystems that are essential at the global, regional & local levels.

1. Consumptive Use value

The Biodiversity contained in the ecosystem provides forest dwellers with their daily needs, foods, building material, fodder, Medicines and a variety of other products. They know the qualities and different uses of wood from different species of trees and collect a large number of local fruits, roots and plant material that they use as food, construction material and Medicines.

Fisher folk ~~com~~ are completely dependent on fish and where & how to catch fish & other edible aquatic animals & plants.

2. Productive Use value.

- These are the commercially usuable value where the product is marketed & sold.
- Genetic diversity enables scientists & farmers to selectively develop better crops & domestic animals through careful breeding programs.

- These includes ~~the~~ ~~an~~ animal products like milk. tusk of elephants, Musk of deers, Silk from silk-worms all of which are traded in the market.
- Different plants and animals are valued for their value in terms of food or their Medicinal or industrial potential
- It helps to develop the country economically.

3. Social values

These are the values associated with the social life, customs, religion & psycho-spiritual aspects of the people. Many of the plants are considered as holy and sacred in our country like Tulsi (holy basil), peepal, Mango, Lotus, Bael etc.
Some animals also are considered ~~sacr~~ sacred in India and are worshiped like cow, snake etc.

4. Ethical values

Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life. Most religious & secular creeds belive that all forms of life have the right to exist on earth. ~~Human~~ Humans are only a small part of the earth's ~~g~~ varied diversity of species. Do we have the right to destroy life forms or do we have a duty to protect them?
A question for everyone.

Apart from the economic importance of conserving biodiversity. There are several cultural moral & ethical values associated with the sanctity of all forms of life.

5. Aesthetic value

- The Appreciation of the presence of biodiversity, of its inherent value and beauty as well as for the contribution it makes our knowledge, our aesthetics, imagination and creativity is another reason to preserve it.

- Quite apart from killing wildlife for food, it is important as a tourist attraction (known as Eco tourism)
- Biodiversity is a beautiful & wonderful aspect of nature.
- Eco tourism is estimated to generate about 12 billion dollars of revenue annually, that gives aesthetic value of biodiversity.

6. Option Value:

Keeping future possibilities open for their use called the option value. It is impossible to predict which of our species or traditional varieties of crops and of domestic animals will be of greatest use in the future. To continue to improve cultivation & domestic livestock, we need to return to wild relative of crop plants & animals. Thus, the preservation ~~used~~ of biodiversity must also include traditionally used strains already in existance in crops & domestic animals.

Biodiversity at Global

There are 20 billion species in the earth only 1.8 million are known to us & having scientific name. 1992 'Earth Summit' at Rio de janerio is a growing need to know & scientifically name, the huge number of species which are unknown to us.

- Biodiversity is a 'common property Resource' which should shared by all the nations.
- Terrestrial biodiversity of the earth is best described as biomes which are the largest ecological units present in different geographic areas.
- The tropical rain forests are the earth's largest store-house of biodiversity as millions of species of plants, birds, amphibians, insects, mammals are present.
- About 50 to 80% of global biodiversity lies in these rain forest.

- More than one-fourth of the world's prescription drugs are extracted from plants growing in tropical forests
- Marine diversity is even much higher than terrestrial biodiversity.

Biological Diversity at National level

- India has a rich biological diversity of flora & fauna overall 6% of the global species are found here
- It is estimated that India ranks 10th among the plant rich countries of the world. 11th in terms of ~~number~~ member of endemic species of higher vertebrates and 6th among the centres of diversity and origion of agricultural crops.
- The total number of living species identified in our country is 1.5 lakh. Out of a total of 25 biodiversity hotspots in the world, India passes 2, one in the north-east region & one in the western ghats.
- India is also one of the 12 mega diversity countries in the world.

Local / Regional Biodiversity

One of the basis of richness & based upon their spatial distribution is following type.

1. Point Richness - refers to the number of species that can be found at a single point in a given space.
2. Alpha(α) richness refers to the number of species found in a small homogenous area.
   It strongly correlated with physical environmental variables.
3. Beta (β) richness refers to the rate of change in species composition different habitats.
   → Beta richness means that the cumulative number of species increases as more heterogeneous habitats are taken into consideration.
4. Gamma(γ) richness refers to the rate of change across large landscape gradients.

Threats to Biodiversity

1. Loss of Habitat

- Destruction and loss of natural habitat as the single largest cause of biodiversity loss.
- Billions of hectares of forests and grass lands have been cleared over the past 10000 years for conversion into agricultural lands, pastures, settlement areas & for development projects.
- These natural forests and grasslands were the natural homes of thousands of species which perished due to loss of their natural habitat.
- The wetlands are destroyed due to draining, filling and pollution thereby causing huge biodiversity loss.
- Sometimes the loss of habitat is in instalments. so that the habitat is divided into small and scattered patches, a phenomenon known as habitat fragmentation.
- Many wild species such as bears and large cats, get badly threatened as they breed only in the interiors of the forests.
- Due to habital fragmentation many song birds are vanishing.
- There has been a rapid disappearance of tropical forests in our country also, at a rate, of about 0.6% per year.
- With the current rate of loss of forest habital, it is estimated that 20-25% of the global flora would be lost with in.
- Marine biodiversity is also under serious threat due to large scale destruction of the fragile breeding & feeding grounds of our oceanic fish & other species as a result of human intervention.

POACHING

Specific threats to certain animals are related to large economic benefits the skin and bones of tigers, ivory of elephants, horns of rhinos and perfume of the musk deer are extensively used abroad.

- Bears are killed for their gall bladders.
- Corals and shells are also collected for export or sold on the beaches of Chennai, Kanyakumari and Andaman & Nicobar islands.
- Tortises exotic birds & other small animals are packed into tiny containers & smuggled abroad for pet trade.
- A variety of wild plants with real or sometimes dubious medicinal values are being over-harvested.
- The commonly collected plants include Rauwolfia, Nux Vomica, Datura & Rotheca.
- The garden plants collected for illegal trade ~~enclosed~~ include Orchids, ferns & Mosses.

Human Wild life conflict

- Forests & Grass lands are continously being converted to agricultural land.
- Enchroachments have been repeatedly legalised.
- Wetlands systems have been drained to establish croplands resulting in a loss of aquatic species.
- Grass lands that were once sustainably used by a relatively smaller number of human beings and their cattle are either changed to other forms of use or degraded by over grazing.
- Natural forests are being deforested for timber extraction & replanted using teak, sal or other single species for their timber value.

- Such monoculture plantations do not support the same biological diversity as a Multistored natural forest, which has a closed canopy and a rich under growth of vegetation; nor do they nourish the soil.
- When excessive firewood is collected from the forest by lopping the branches of trees, the forest canopy is opened up & this alters the local biodiversity. Foraging cattle retard the regeneration of the forest as young seedling are constantly trampled.

Environmental Pollution

Environmental pollution may be defined as any undesirable change in physical, chemical, Biological characteristics of any component of the environment (air, water, soil) which can cause harmful effect on various forms of life or properties

Air Pollution

The presence of substance in atmosphere which has harmful or poisonous effect on the environment is known as air pollution.

Causes

Natural Causes

Volcanic eruption, forest fires, sea-salt sprays, biological decay, photo chemical oxidation of terpenes, extra terrestrial bodies etc.

Radio active Minerals present in the earth crust are the source of radio activity in the atmosphere.

Man-made causes

- It include thermal power plants, Individual units, vehicular emissions, fossil fuel burning, agricultural activities etc.
- Automobile exhaust is another major source of air pollution.
- fertilizer plants, smelters, textile Mills, tanneries, refineries, chemical industries, paper & pulp mills also cause air pollution.
- Use of fuel like dung-cakes, wood & kerosene in the kitchen.

Effects

1. It causes respiratory problem. lung cancer. Asthma etc.
2. Irritation of eyes. nose and throats.
3. Increase the risk of heart attack
4. Air pollution effect the plants by entering through Stomata, destroy Chlorophyll. and effect photosynthesis.
5. Changes the shape of leaves. Also cause death of plant
6. Air pollutant mixing with rain water, having high acidity in fresh water. This affect the aquatic life. fish & also causes to death.
7. Presence SO_2 & Moisture can accelerate corrosion in the Metalic surface.
8. SO_2 affects the fabric, leather, paint, paper, Marbles etc.
9. Oxides of Nitrogens effects the cotton & Rayon fibres.

Control Methods of Air pollution

1. Silting of Industries after proper environmental impact assisment studies.
2. Using low sulphur coal in Industries.
3. Removing sulphur from the coal.
4. Removing NO_x component during the combustion.
5. Removing particulars from stack exhaust gases by using electro static precipitator, cyclone separators, bag house filters etc.
6. Vehicular pollution can be checked by regular tuned up of engine, replacement of more polluting old vehicles.
7. Slow & cooler burning of fuel to remove NO_x component.
8. Use of Mass Transportation System
9. Shifting to less pollution fuel.
10. Use biological filter & bioscrubbers.
11. Planting more trees.

It is defined as the addition of any substance to water or changing of water's physical & chemical characteristics in any way which interfere with its use for legitimate purpose.

The main sources of water pollution are.

i. Sewage & other waste.
ii. Industrial effluents.
iii. Agricultural Discharge.
iv. Industrial waste from chemical industries & fossilfuel plants & Nuclear plants.
v. Cultivation different aqueatic animals.

Effect of- waterpollution.

1. Polluted water can cause different types of diseases cholera, Typhoid, dysentry etc.
2. Due to polluted water plants also have different type of diseases and even causes to death.
3. Due to pollution the aqueatic animals doesnot get proper oxygen from the water & also causes to death.

- Proper sewage treatment & Management.
- Dispose trash properly.
- Avoid direct dumping into water systems
- Keep out oils, fat or grease from the sink.
- Abstain from flushing contaminated liquids, pills, drugs or medication down the drain.
- Ensure minimal use of bleach or detergents.
- Reduce use of herbicides, pesticide

Marine Pollution

- It is defined as the discharge of waste substance into the sea resulting in harm to the living Resources, hazard to the human, help hindrance to fishery and impairment quality for use of sea water.
- Marine pollution is associated with the ~~technology~~ changes in physical, chemical & biological condition of the sea water.

Causes

1. Pollutant from human activity from urban sewage organise product of agricultural such as pesticide & fertilizer, pollution of industrial waste.
2. Petroleum released from the oil tanker or oil plat by accident or unfair practices.
3. Radio active product released during Nuclear testing.
4. Over heating of coastal water.
5. Over exploitation fish resources which involve the depletion of fish population and in some cases the risk of extinction.
6. Urban sprawl on the east & seaside tourism in the form of uncontrol Mass phenomenon.
7. The land field of plastics & other non-degradable soil waste.

Effects of Marine Pollution

1. Reduction in photosynthesis rate in marine pollution. High pollutant concentration makes the water turbid, decreasing the penetration of light.
2. Decline in volume of dissolved oxygen effecting the survival of Marine organisms.
3. Toxicity of water by heavy metals such as Mercury, Arsenic, Cadmium.
4. Consumption of Marine food, collected from polluted water caused various diseases such as viral hepatitice, cholera, Typhoid, & digestive problem.

Control Measures of Marine Pollution

- Toxic pollution from industries, sewage-treatment plant, should not be discharge in coastal waters.
- Runoffs from where sources should be prevented.
- Sewer over flows should be prevent to reach coastal Areas.
- Pumping of toxic, hazardous wastes & sewage should be banned.
- The disposal of Radioactive material must be safe & secure. The wastes with a very low radiation must be put into the sewage.
- To stop plastic pollution in our oceans.
- Development activities on coastal area, should be minimized.
- Oil & Grease from service stations should not be dumped rather must be processed for Reuse.
- Oil Blasts should not be dumped in to sea.
- Oil spilling must be minimized.

Soil Pollution

Soil pollution is the contamination of soil with harmful substances that can adversely affect the quality of the soil & the health of those living on it.

Causes of Soil pollution

- Seepage from a landfill.
- Discharge of industrial waste into the soil.
- Percolation of contaminated water into the soil.
- Rupture of underground storage tanks.
- Excess application of pesticides, herbicides or fertilizer.
- Solid waste seepage
- Deforestation and Soil erosion.
- Acid Rains
- Unfavorable & harmful irrigatio practices.

Effects of Soil Pollution

- Causes cancers including leukaemia.
- Mercurcy can increase the risk of kidney damage. Cyclodienes can lead to liver toxicity.
- Causes neuro muscular blockage as well as depression of the central nervous system.
- Also causes headaches, nausea, fatigue, eye irritation & skin rash.

- Soil pollution runs off into rivers & kills the fish, plants & other aquatic life.
  - Crops & fodders grown on polluted soil may pass the pollutants on to the consumers.
  - Polluted soil may no longer grow crops & fodder.
  - Soil structure is damaged.
  - Reduced soil fertility, nitrogen fixation.
  - Increase the salinity of soil.

Control Measures of Soil pollution

- Use of pesticides & fertilizers should be minimized.
- Cropping techniques should be improved to prevent growth of weeds.
- Special pits should be selected for dumping wastes.
- Controlled grazing & forest Management.
- Wind breaks & wind shield in areas exposed to wind erosion.
- Ban on use of plastic bags which are major cause of pollution.
- Recycling of plastic wastes to manufacture many 'remake' items.
- Ban on Deforestation.
- Encouraging forest replantation programmes.
- Undertaking many pollution Awareness programmes.

Thermal Pollution

Thermal pollution is basically the form of water pollution that refers to degradation of water quality by any process that changes ambient water temperature.

This condition arises chiefly from the waste heat generated by an industrial process such as certain power generation plants.

effects

1. Reduction in dissolved Oxygen:
The pollutant from various industrial plants are heated decreases the concentration of oxygen with an increase in the temperature of water.

2. Change in water properties.
The decrease in density, viscosity & solubility of gases in water increases the setting speed of suspended particle which seriously affect the blood supplies of aquatic organism.

3. Increase in Toxicity.
The toxcity of poison present in water increases & it will increase the death rate in marine life

4. Disruption of Biological activities.
Temp. change disrupt the entire marine ecosystem because changes in temp. causes change in physioloy, metabolism & biological proces like respiration rate, digestion, excretion & development of aquatic orgamism.

5. Damage to biotic Organism.
Aquatic organisms like (juvenile fish, plankton, fish, eggs, larva, & protozoa) which pass through screens & Condenser cooling system are extremely sensitive to abroupt temperature changes.
They are habitual of warmer water may suddenly face increase or decrease in temp. of water bodies & thus die because of sudden changes in the temp. of water.

- Establishment of cooling towers.
- Constructing ponds for collecting hot water
- Artificial lakes can be made for the hot effluents from where the cool water can be recycled.
- The cold water or air showers may be used in the industries to check out gases, at the source
- The excess heat energy that is produced in the generation of electricity may be utilized in another industry where this energy may be required. This process is called cogeneration.
- In places where residential or commercial buildings are located near the industrial plants the waste hot water may be used for heating purpose.

Social Issues and the Environment

The world looked at economic status as a measure of human development. Countries that are economically well developed and where people are relatively richer are called Advanced nations, while the rest where poverty is wide spread and are economically backward are called developing countries.

From unsustainable to Sustainable Development

Sustainable development is defined as "meeting the needs of the present without comparing the ability of future generations to meet their own needs."

Key aspects for sustainable development.

a) Inter-generational Equity.

We should minimize any adverse impact on resources & environment for future generations ie. we should handover a safe, healthy and resourceful environment to our future generations by reducing over-exploitation, reduce waste discharge, & emission & maintain ecological balance.

b) Intra-generational Equity.

This Emphasizes that the development processes should seek to minimize the wealth gaps with in & betn nations. Technological development will support the economic growth of the poor countries & help in narrowing the wealth gap and lead to sustainability.

Measures for Sustainable Development

- Using appropriate technology.
- Reduce, Reuse, Recycle approach.
- Prompting environmental education & awareness
- Resource utilization as per carrying capacity.

Urban problems related to Energy

- Cities are the main centers of economic growth, trade, education, innovations & employment.
- Now about 50% of the world population lives in urban areas & there is increasing movement of rural folk to cities in search of employment.
- The urban growth is so fast that it is becoming difficult to accomodate all the industrial, commercial & residential facilities with a limited municipal boundary.
- As a result, there is spreading of the cities into the sub-urban or rural areas too, a phenomenon known as urban sprawl.
- The energy requirements of urban population are much higher than that of rural areas.
  This is because urban people have a higher standard of life & their life style demand more energy inputs in every sphere of life.

  The Energy demanding activities are.

1. Residential & commercial lighting
2. Transportation means including automobiles & public transport for moving from residence to workplace.
3. Morden life style using a large no. of electrical gadgets in every day life.
4. Industrial plants using a big proportion of energy.
5. A large number of waste generation which has to be disposed off properly using energy based technologies.
6. Control & prevention of air & water pollution which need energy dependent technologies.

WATER CONSERVATION

water being on the most precious & indispensible resources needs to be conserved

1. Decreasing run-off losses.
   - Contour cultivation on small furrows & ridges across the slopes trap rain water & allow more time for infiltration
   - Conservation bench terracing involves construction of a series of benches for catching the run-off water.
   - chemical wetting agents (surfactants) increase the water intake rates when added to normal irrigated soils.
   - water spreading is done by channeling or lagoon-levelling
   - Surface crop residues help in reducing runoff by allowing more time for water to penetrate into the land.
   - Chemical conditioners like Gypsum ($CaSO_4, 2H_2O$) when applied to sodic soil improve soil permeability & reduce run-off.
   - water storage structures like farm. Pond etc. built by individual farmers can be useful measures for conserving water through reduction of run-off.
2. Reducing evaporation losses:

   Horizontal barriers of asphalt placed below the soil surface increase water availability and increase crop yield by 35-34%.
3. Storing water in soil:

   Storage of water takes place in the soil root zone in humid regions when the soil is wetted to field capacity.
4. Reducing irrigation losses.
   - Use of lined or covered canals to reduce seepage.
   - By using sprinkling irrigation, & deep irrigation.
   - Irrigation in early morning or late evening to reduce evaporation.
5. Reuse of water.
6. Preventing wastage of water.
7. Increasing block pricing: The consumer has to pay a comparably higher bill with higher use of water.

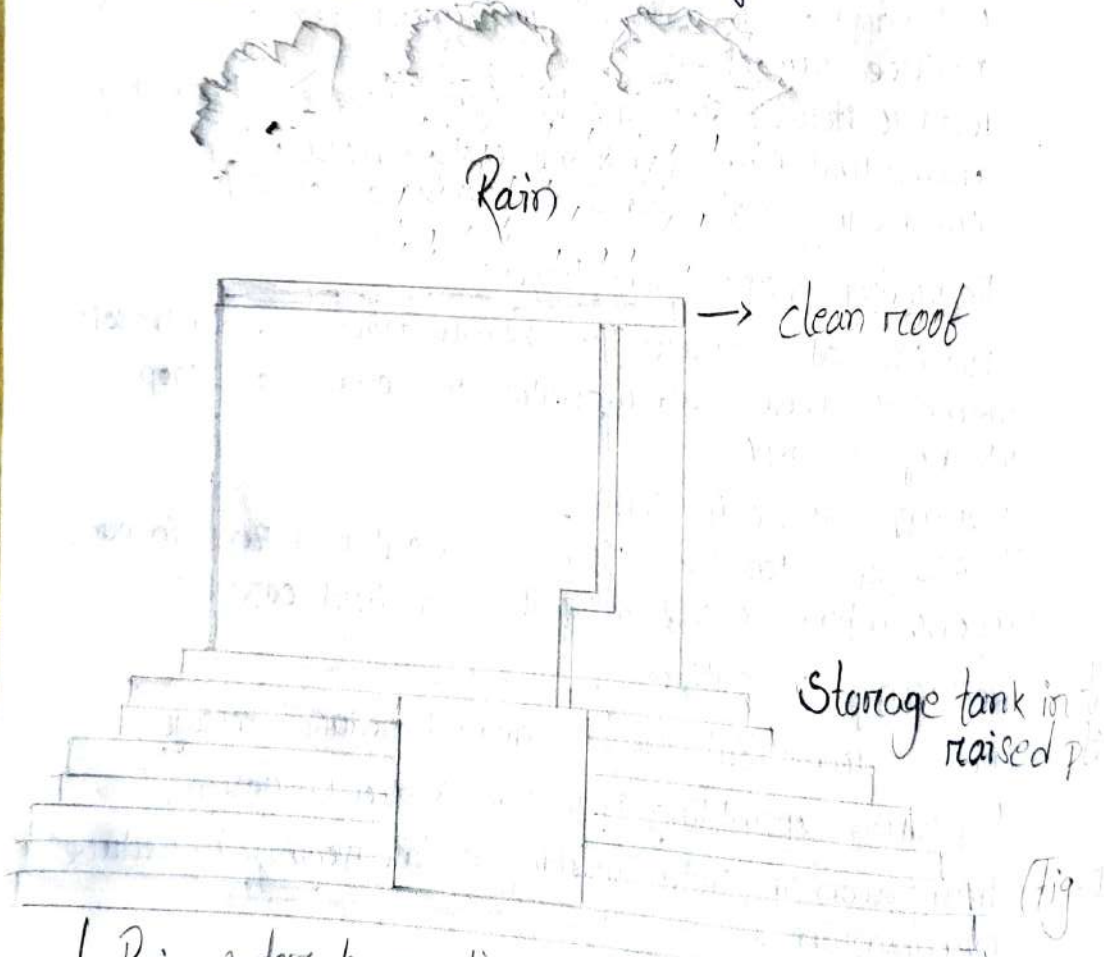
Rain water Harvesting

Rain water harvesting is a technique of increasing the recharge of ground water by capturing & storing rain water. This is done by constructing special water harvesting structures like dug wells, percolation, pits, lagoons, checkdams etc.

Objectives of Rainwater harvesting

1. To reduce run-off loss
2. To avoid flooding of roads
3. To meet the increasing demands of water
4. To raise the water table by recharging ground water
5. To reduce ground water contamination.
6. To supplement groundwater supplies during lean season

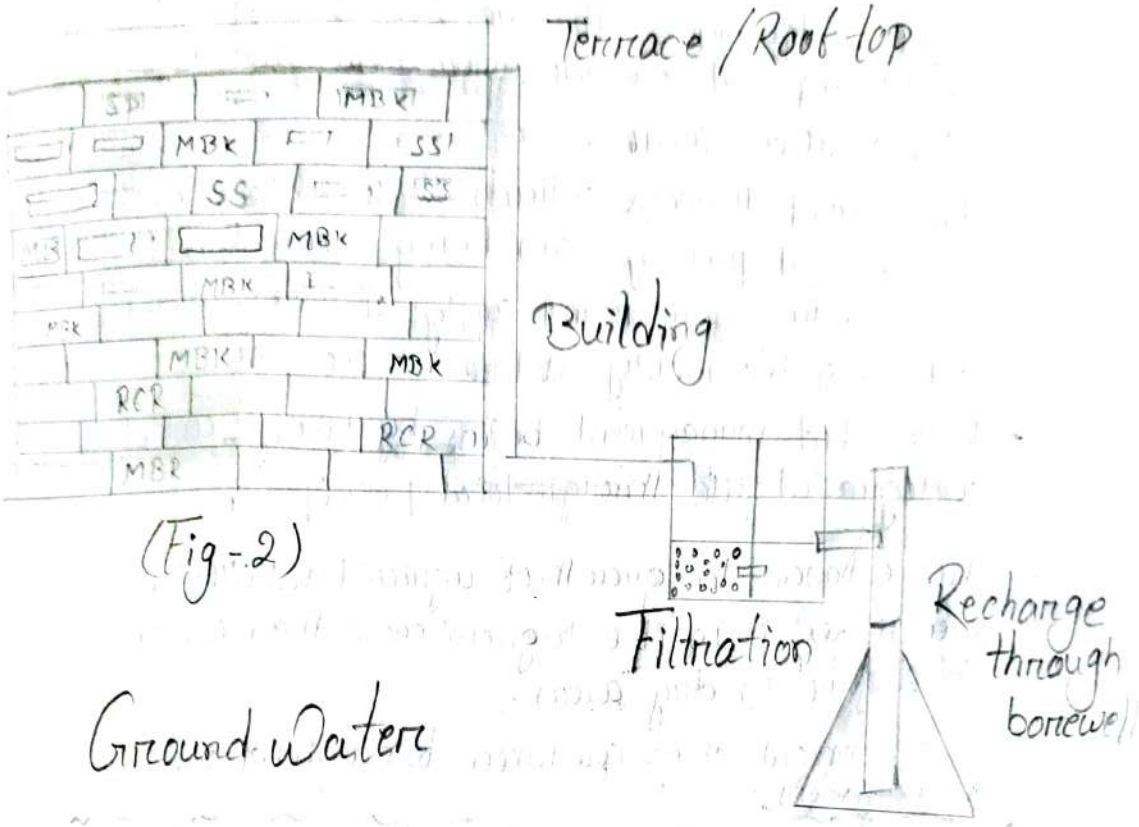
⑥ The stored water has to be kept pollution free and clear so that it can be used as drinking water.



Fig

(Rain water harvesting storage tank below the grou

① Current technologies of rain water harvesting require that all roof & terrace water passes down into a covered tank (below or above ground) where it can be stored for use after the monsoon. This practice is most adv. in arid areas where clean water is very scare. It can be expensive.



(Fig-2)

Rain water harvesting, Recharge of groundwater through Borewell.

② Another way to using roof top rain water harvesting is to collect the rain water sothat it percolates into the ground to recharge wells instead of blowing over the ground in to the riverys (fig-2).

→ Thus, by recharging the ground water by rain water harvesting from roof tops, the water table rises & the surrounding wells retain water throughout the year.

Water shed Management

A group of small streams flow down hillsides to mix larger streams in the valley, which form the tributaries of major rivers. The management of a single unit of land with its water drainage system is called watershed Management

- This is a technique that has several components including soil & water management, and developed a vegetation cover
- The natural drainage pattern of a watershed unit, if managed properly, can bring about local prosperity by providing year round supply of water, thereby improving the quality of life in the area.
- Water shed management begins by taking control of a degraded site through local participation.
- This enhances the growth of agricultural crops & even makes it possible to grow more than one crop in a year in dry areas.
- Some technical steps are taken for a sound watershed management.
- Construction of a series of long trenches and mounds along the contours of hills to hold the rain water & allow it to percolate into the ground.
- Make nalaplugs in the streams so that the water is held in the stream & does not rush down the hill side

Resettlement & Rehabilitation of People
Its problems and Concerns

Any major project such as adam, mine, express way or the notification of a National park, disrupts the lives of the people who lives in that area and often requires relocating them to an alternative site.

Displacing people is a serious issue.

- It reduces their ability to subsist on their traditional natural resource base and also creates great psychological pressures.
- This is especially true of tribal people, whose lives are closely woven around their own natural resources and find it hard to adopt to a new way of life in a new place. Thus no major project that is likely to displace can be carried out without the consent of the local people.
- In India lakhs of people have been arbitrarily displaced by the thousands of dams built since independence to drive the green revolution.
- The dams have been built virtually at the cost of these poor local people who have been powerless to resist the Government's will.
- The Govt is expected to find 'Good' arable land to resettle these displaced persons & provide them with an adequate rehabilitation package to recover from the disruption.
- This rarely gives satisfaction to the individuals who affected by the project.
- This has not been implemented satisfactory for decades. (In many cases)
- Resettlement not only puts pressure on the project affected people, but also on the people who have been living in the area that has been selected for resettlement. Thus, both the communities suffer & conflict over resources is a distinct possibility in the future.

Environmental Ethics issue & possible solution

Environmental ethics refers to the issues principles and guidelines related to human interactions with their environment.

- It deal with issues related to the rights of individual that are fundamental to life & well being.
- "Man is all powerful & the supreme creature on this earth & man is the master of nature & can hareness it at his will." - Human centric Thinking
- "Nature has provided us with all the resources for leading a beautiful life & she nourishes us like a mother, we should respect her & nurcture her." - The Earth-centric thinking.

- Resource consumption patterns & the need for equitable utilisation.
- The Need for gender equity.
- Preserving resources for future genereations.
- The rights of animals.
- The Ethical basis of Environmental education and awareness.
- The conservation ethics & traditional value systems of India.
- Nature exist not for human only but for all the species
- The earth resources are limited ~~also~~ and they doesn't belong only to human being.
- A healthy economy depends upon a healthy environment
- We should love & honour the earth since it is blessed us with life & governs our survival.
- Should not hold ourselfs above living things & have no right to drive them to extinction.
- We should be grateful to the plants & animal which nourish us by giving food.

- We should limit off springs because too many people will overe burden the earth.
- should not waste resources on destructive weapons.
- should not reinafter gains at the cost of nature, rather should strive to restore its damaged majesty.
- We should not steal from future generation their right to live in a clean & safe planet by impoverishing or polleeting it.
- We should consume the material goods in moderate amounts so that all may share the earth's precious treasure of resources.

Climate Change

- Climate means the averrage pattern in which weather varries in time The climate of region depends on the presence of water. the reflection of solar radiation or albedo, the ability to transfer water to the atmosphere (evaporation). the capacity to store heat, topography & texture of the Region.
- The United Nations framework Convention on climate change (UNFCC) defines climate change as a change climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere & which is in addition to natural variability observed ~~for~~ over comparable Time period.

Global warming

- Global warming is heating the planet by regular increase in the average temperature of Earth's surface due to the release of excessive amount of greenhouse gases in the atmosphere.
- Rise in the CO_2 level. deforestation by human being on earth is the main cause of global warming
- Due to global warming melting of Glaciers, climate change, Droughts, Diseases, Rise in sea levels, such problems are faced.
- This effects the agriculture, foodchain, crops, Animal extinction, quality of life environments, econ
- About 75% of the solar energy reaching the earth is absorbed by the earth's surface, which lead to an increase in its temperature, The rest of the heat radiates back to the atmosphere.
  - Some of the heat is trapped by green house gases (GHGs) mostly CO_2. As CO_2 is released by various human activities, the amounts are rapidly increasing This is causing Global warming.
  - The average surface temp is about 15°C, this is 33°C higher than it would be in the absence of the green house effect. without such gases, Most of the earth's surface would be frozen with a mean air temp of -18°C
  - By reducing deforestation, reducing emissions it can be decreased.

Acid Rain

Rain that contains a high concentration of pollutants / acid produced by sulphur dioxide, nitrogen dioxide, & other such gases that result from the combustion of fossil fuels. It has a destructive effect on plant & aquatic life, building etc known as Acid Rain.

The rain water is termed acidic when its PH values fall below 5.6

Effects of Acid Rain

- It causes deterioration of buildings, especially made of marble. eg: Monument like Tajmahal.
- Crystals of calcium & magnesium sulphate are formed as a result of corrosion caused by Acid rain.
- It damages stone statues.
- It damages Metals & car finishes.
- Aquatic life especially fish are badly affected by lake acidification.
- Aquatic animals suffer from toxicity of metals such as Al, Hg, Zn, Mg & Pb which leak from the surrounding rocks due to acid rain.
- It results in reproductive failure and killing of fish.
- It damages foliage & weakness trees.
- It makes trees more susceptible to stresses like cold temp, drought etc. The insects and fungi are more tolerant to acidic conditions. Hence they can attack the susceptible trees and cause diseases.

Control of Acid Rain

Emission of SO_2 & NO_2 from industries and powerplants should be reduced by using pollution control equipments.

- Liming of lakes & soils should be done to correct the adverse effect of acid Rain.
- A coating of protective layer of inlet polymer should should be given in the interior of water pipes for drinking water.

Ozone Layer Depletion

Ozone is formed by the action of sunlight on oxygen. It forms a layer 20-50kms above the surface of the earth.

It is considered a pollutant at ground level & constitutes a health hazards by causing respiratory aliments like asthma & bronchitis.

Ozone in the upper atmosphere plays a vital role as it protects the earth from harmful UV radiations of the sun.

- Low temp, increase in the Levels of chlorine & bromine gas in the upper stratosphere are some of the reasons that leads to ozone layer depletion.

→ The most important Reason for ozone layer depletion is the production & emission of (CFCs) chlorofluorocarbon. This leads to almost 80% of the total ozone layer depletion.

→ Other reasons such as hydrochlorofluorocarbons & volatile organic compounds (VOCs) such substances are found in vehicular emissions by products of industrial processes aerosols and refrigerants.

→ All these ozone depleting substances remain stable in the lower atmospheric region but as they reach the stratosphere. they get exposed to the ultra violet rays. This leads to their breakdown & releasing of free chloride atoms ~~from~~ which reacts with the ozone gas. thus leading to the depletion of the ozone layer.

Effects

- Ozone depletion in the stratosphere will result in more UV radiation ~~reaching~~ reaching the earth (UVB)
- The U.V.B radiations affect DNA & the photosynthesis chemicals. Any change in DNA can result in Mutation & Cancer.
- Easy absorption of UV rays by the lens & cornea of eye will result increase in incidents of cataract.

- It also causes damage to certain plankton & crops, thus affecting natural foodchains & foodwebs
- Phytoplanktons are sensitive to UV expose hence ozone layer depletion affecting the population of zooplankton, fish, marine animals. in fact the whole aquatic food chain.
- Melanin producing cells of the epidermis will be destroyed by UV-rays resulting in immuno suppression. Such people will be a greater risk of UV exposure.

Nuclear Accident & Nuclear Holocaust

- Nuclear energy was researched & developed by man as alternative source of clean & cheap energy compared to fossil fuels
- In the short history of nuclear energy, there have been a number of accidents
- A single nuclear accident causes loss of life, long-term illness & destruction of property on a large scale & for a long period of time.

→ Radio activity & its fallout lead to cancer, genetic disorders & death in the affected area for decades after the accident thus affecting all forms of life for several generation.

→ The nuclear power used in war as nuclear bombs (Japanese town 'Hiroshima & Nagasaki' in 1945)

→ Modern fusion bombs are of the explosive force of 500 kilotons & 10 Megatons. (Compare less than world war)

→ Nuclear bombardment will cause combustion of wood, plastics, petroleum, forests etc.

→ Large number of black shoot are carried out, to stratosphere it does allow the sun ray reradiated to the earth & absorb the solar radiations.
Therefore cooling will result. Hence a phenomenon opposite to global warming will occur.

→ Due to a cooling water evaporation reduce. So there won't be significant moisture to reach out the thick shoot. This drastically affect crop production.

Air (Prevention & control of pollution) Act, 1981

Act No 14 of 1984 D 29-03-1981

Air act was enacted on 29th March 1981 the prevention, control & abatement of air pollution by creating central & state Boards.

Functions of control Board

1. To provide guidance & Technical assistance to state boards and the industries
2. To advise central & state Governments about improved methods to check air pollution
3. Provision of training to the persons.
4. Setting up laboratories to check all kinds of samples
5. To aware and educate people with the assistance of Mass India.
6. Section 17 of the Act authorizes them to check weather or not the Industry is strictly following the proper standards about the discharge of air pollutants.
7. Section 20 of the Act ensures emission, standards from the automobiles.

Functions of State Board.

1. To advise state Government to combat with the problems of air pollution.
2. To collect information regarding causes, prevention & control of air pollution.
3. Laying down standards of air quality.
4. Periodical inspection of air quality.
5. With reference to this Act both central & state Boards have been given certain powers to meet the consequences due to air pollution.

These are:

- Declaration of any area as air polluting area
- Every industrial establishment has to take clearance of the Boards before setting up the unit
- The Board has got power to stop industrial operations in air pollution control areas
- Collection of samples of emission from the polluting units
- Cancellation of permission to industries at any time.
- Board officials have got the power to visit & check any industry at any time.
- Boards have powers to prosecute the defaulters.
- Section 31 of the act provides provision for appeal to an appellate Authority.

Air Act was amended in 1987 for.

- Removal of difficulties faced during implementation.
- Provision of more powers
- Imposition of more stringent penalties.
- Inclusion of noise as an air pollutant.

The water (Prevention & control of pollution) Act. 1974.

Act No. 6 of 1917 — Dt:- 23-3-1974

1st Amendment — Dt:- 27-2-1975

2nd Amendment — Dt:- 27-12-1997.

(Act of 36 of 1977)

3rd Amendment — Dt:- 17-4-1978

(Act of 44 of 1978).

4th Amendment

(Act of 53 of 1988)

The water ACT

This Act was enacted on 23rd March 1974 and is aimed to prevent and control water pollution.

It states

1. Maintenance and restoration of quality of both surface and ground water.
2. Establishment of central and state pollution Boards
3. To give powers to central & state pollution Boards to advise, coordinate & provide technical assistance for prevention & control of water pollution
4. To allot funds for various pollution boards or auditing their accounts
5. To find out recent methods for disposal of treated sewage and industrial effluents.
6. To finalise various penalities for the defaulters.

Water Act amended in 1988 under which central pollution control Board (CPCB) and state pollution control Boards have been established.

Functions of Central Pollution control Board (CPCB)

- To advise the central Govt. about issues related to water pollution.
- To provide technical assistance & guidance to state pollution control Boards & industries.
- Lays down standards for water quality parameters
- To educate and aware people through Mass Media.
- To set up laboratories to analyse samples of water, domestic sewage and industrial effluents.

Functions of state pollution control Boards

- To advise state Govt regarding water pollution related issues To provide guidance & training to persons.
- To organise programmes to control waters pollution.
- To find out methods for disposal of domestic sewage and industrial effluents.
- Suggests efficient methods for cultivation, treatment and disposal of various water pollutants.
- Provides guidance for installation of ETP (effluent treatment plants) in all the pollutant industries.

Public Awareness

Environmental awareness needs to be created through formal and informal education to all sections of the society. Every one needs to understand is because 'Environment belongs to all' & 'every individual Matters' when it comes to conservation & protection of environment. Some methods are.

1. Among Students through Education:
Now all over our country we are introducing environmental studies as a subject at all stages including school & college.

2. Among the masses through Mass Media.
Media can play an important role to educate the Masses on environmental issues through Article, environmental rallies, plantation campaigns, steel plays, real eco-disaster stories & success stories of conservation effort.

3. Among the planners, decision-makers & leaders.
This section of the society plays the most important role in shaping the future of the society, it is very important to give them necessary orientation and training through specially organised workshops & training programmes

4. Role of Non-Government Organisations (NGO's)

Voluntary organisations can help by advising the Govt about some local environmental issues & at the same time interacting at the Grass-root level. They act as effective link between the two.

- The "Chipko Movement" for conservation of trees by Dasholi Gram Swarajya Mandal in Gopeshwar or the "Narmada Bachao Andolan" organised by Kalpavriksh, are some examples where NGO's have played a vital role for conservation of Environment.

- The Bombay Natural History society (BNHS) the world wide fund for Nature - India. Kerala Sastra Sahitya parishad, Centre for Science & Environment (CSE) & many others are playing significant role in creating environmental awareness through research as well as extension work.

- Before we can all take up the task of environmental ~~pollution~~ protection & conservation we have to be environmentally educated and aware.

It is said "If you want to act green, first think green".

Human Population & The Environment

Global population Growth:

An increase in the number of people that reside in a country, state, city. To determine whether there has been population growth formula.

Birth rate + immigration = Death rate + immigration

- Population growth is the increase in the number of individuals in a population.
- It is expected to keep growing and estimated have put the total population at 8.4 billion by Mid-2030 & 9.6 billion by Mid-2050.

Annual rate of natural population change (%)

$$= \frac{\text{Birth Rate} - \text{Death Rate}}{1000 \text{ persons}} \times 100$$

Population Explosion: Family Welfare Programme

- In the 20th century, human population has grown much faster than ever before in human. 1950-1990, in just 40 years the population crossed 5 billion Mark with current addition of about 92 million every year.
- In 2000, the world population was 6.3 billion & it is predicted to grow fourtimes in the next 100 years.
- This is an alarming rate is referred to as population explosion.
- Population explosion is causing severe resource depletion & environmental degradation.
- India seriously took up an effective family welfare programme (FWP) in 1952. This programme's objective is to "reduce birth rates to the extent necessary to stabilise the population at a level which is consistent with the requirement of the national economy."

eg: Slogan as "Hum do Hamare do".

Each family should not have more than two children.

- In forming public about the various contraceptive measures that are available is of primary important
- This must be done by Govt & NGOs.
- The media must keep people informed about the need to limit family size & the ill effects of a growing population on the world's resource.
- This can be done by the people who are educated. So they should be educated first.

Family Planning

- Family planning allows to decide their family size & also the time spacing of their offspring. This depends on a couples background & education.
- Almost every culture in the past used to practise some traditional fertility control methods through some traditions, taboos & folk medicine.
- Morden Science has provided several birth control techniques including mechanical Barriers, surgical methods, Chemical pills & physical Barriers to implantation.
- The United Nations family planning Agency provide Funds to 135 countries. The birth control programmes have often used strong opposition from religious groups.
- WHO estimates that today about 50% of the world's married couples adopt some family planning measures as compared to just 10% about 30 years back.

Environment and Human Health

According to world health organisation (WHO) health is "A state of complete physical mental & social well-being & not merely the absence of disease or infirmity." Human health is influenced by many factors like nutritional, biological, chemical or psychological. These factors may cause harmful changes in the body's conditions called disease.

Infectious Organisms

Disease causing organisms pose greater environmental threats to health, more severely in the developing countries especially the tropical ones. Microbes especially bacteria can cause food poisoning by producing toxins in the contaminated food. Some molds grow on food & produce poisonous toxins.

Infectious organisms can also cause respiratory diseases (pneumonia, tuberculosis, influenza etc) and gastrointestinal diseases (diarrhoea, dysentery, cholera etc). There are various type of parasities that cause diseases like Malaria, Schistosomiosis, bilarziasis, etc. Most of these infections take place when the environmental conditions are unclean & unhygenic.

Chemicals

A large number of chemicals are introduced in the environment by anthropogenic activities.

- Hazardous chemicals are the dangerous chemicals like explosives, inflammable chemicals etc.
- Toxic chemicals are poisonous chemicals which kill cells and can cause death.

- Many other chemicals can cause cancer, affect genetic material (DNA) in cells or cause abnormalities during embryonic growth & development.
- Many chemicals like DDT & other chlorinated pesticides bio accumulate in the food-chain & show deleterious effects at the top of the food chain.
- Chemicals present in the water harmful to human & other living beings.

Noise:

If the sound levels beyond the permissible level exist for certain durations. It becomes painful & sometimes irrepairable damage occurs. Besides hearing damage various types of physiological & pshychological changes are induced by noise pollution.

Radiations:

Cosmic rays & ultra-violet rays cause harmful effects on human health which may cause cancer.

Diet

Malnutrition makes human's prone to other diseases food contamination can cause various ill effects. There had been cases of Dropsy in India, a disease which occurred due to contamination of Mustard oil with the poisonous seeds of Argemone Mexicana.

Settlement

Proper environment, availability of basic necessities of like, water, sanitation etc. are essential for healthy living.
Housing is very important from security point of view. Improper settlement & poor physical environment may cause various pshychological problems which affect various vital physiological processes in the body.

HUMAN RIGHTS

Human Rights are the rights that a human body must enjoy on this earth since he/she is a human being.

- Universal Declaration of Human Rights (UNDHR) by the UNO on December 10, 1948.
- UNDHR defines specific rights, civil, political, economic, social as well as cultural.
- It defines the rights to life, liberty, security, fair trial by law, freedom of thought, expression, conscience, association & freedom of movement.
- It emphasizes right to equal pay for equal work, right to form & join trade unions, right to health care, education, adequate rest etc.
- The World Health Organization estimates indicate that one out of every five persons in this world is malnourished, lacks - clean drinking water, lacks proper hygenic conditions & adequate health facilities; one out of three persons does not have enough fuel to cook or keep warm and one out of five persons is desperately poor for whom life is nothing but struggle for survival. Every year 40 million people are dying due to consumption of contaminated drinking water.
- For developed countries, which have already attained a high stage of development in material & economic resources, the social & economic rights are not that important as civil & political rights. where as, the reverse is true for the developing countries where illiteracy, malnutrition & diseases, poverty, ignorance are the main problems.

- In may 16, 1994 at Geneva, the United Nations drafted the first ever declaration of Human Rights & Environment, which embodies the right of every human being to a healthy, secure & ecological sound environment.
- The draft declaration describes the rights as well as duties that apply to individuals, governments, international organizations & transnational corporations.

The principles of the draft declaration are divided into 5 ~~type~~ parts.

Part-I It deals with human rights for an ecologically sound environment, sustainable development & peace for all, It also emphasizes the present generation rights to fulfill its needs to lead a dignified & good quality life. But, at the same time it lays stress on the fact that it should be without impairing the rights of the future generations to meet their needs.

Part-II

It mainly deals with human rights related to an environment free from pollution & degradation. It also emphasizes the rights ~~of~~ to enjoyment of natural ecosystems with their rich biodiversity. It defines right to own native land or home.

- No one can be evicted from one's native place except in emergency or due to a compelling purpose benefitting the society as a whole, which is not attainable by other means.

All persons have the right to timely assistance in the event of any natural or technological disasters.

Part - III

It deals with right of every person to environment information, education, awareness and also public participation in environmental decision Making.

Part - IV

It deals with the duties to protect & preserve the environment & prevent environmental harm. It includes all remedies for environmental degradation & measures to be taken for sustainable resource use.

It emphasizes that states shall avoid using environmen as a means of war & shall respect international law for protection of environment.

Part - V

This lays stress on social justice & equity with respect to use of natural resources & sustainable development.

Value Education

Education is one of the most important tools in bringing about socio-economic & cultural progress of a country. Education doesnot simply mean acquiring a lot of information but also its righteousness & use with in the frame work of aspectrum of ethical values.

- Value education helps in arriving at value-based judgements in life & based on practical unstanding of various natural principals rather than acquiring certain ~~prejudi~~ prejudices.
- Value education encompasses human values social values, professional values, religious values, national values, Aesthetic values & environmental values.
- Value education increases awareness about her national history, our culture heritage, national pride, constitutional rights & duties, national integration, community development & environment.
- The basic aims of value education is to create & develop awareness about the values their significance & role.

Value Based Environmental Education

Environmental education or environmental literacy is something that every person should be well versed with. The principles of ecology & fundamentals of environment can really help to create a sense of earth-citizenship & a sense of duty ~~of~~ to care for the earth & its resources and to manage them in a sustainable way so that our children & ground children too ~~inherit~~ inherit a safe & clean planet to live on.

a. Prepare text book & resource material about E.S. can play an important role in building positive attitude about environment.

b. Social values like love, compassion, tolerance & justice which are the basic techings of most of our religions need to be woven into environmental education. These are the values to be understand / nurtured. all forms of life & the biodiversity on this earth are protected.

c. Cultural & religious values enshrined in Vedas like "Dehi me dadami te" ie (yajur Veda) "You give me & I give you" emphasize that man should not exploit nature without nurturing her. Our cultural customs & rituals in many ways teach us to perform such functions as would protect & nurture nature & respect every aspect of nature, treating them as ~~sec~~ sacred, be it rivers, earth, mountains or forests.

Role of information Technology in Environment and human health

IT has tremendous potential in the field of environment education and health as in any other field like business, economics, politics & culture.

A number of software have been developed for environment & health studies which are user friendly & can help an early learner in knowing & understanding the subject.

Value Based Environmental Education

d. It should encompass the ethical values of earth-centric rather than human-centric world view. The educational system should promote the earth citizenship thinking. Instead of considering human being as supreme, we have to think of the welfare of the earth.

e. Global values stress upon the concept that the human civilization is a part of the planet as a whole and similarly nature & various natural phenomena over the earth are inter connected and interlinked with special bonds of harmony. If we disturb this harmony anywhere there will be an ecological imbalance leading to catastrophic results.

f. Spiritual values high light the principles of self-restraint, self discipline, contentment, reduction of wants, freedom from greed & austerity. All these values promote conservationism & transform our consumeristic approach.

DATA BASE

Database is the collection of inter-related data on various subjects. It is usually in computerized form & can be retrieved whenever required. In the computer the information of data base is arranged in a systematic manner that is easily Manageable & can be very quickly retrieved.

- The Ministry of Environment & forests. Govt of India has taken up the task of compiling a database on various biotic communities.
- The comprehensive database include wildlife database conservation database, forest cover database etc.
  Database is also available for diseases like HIV/AIDS, Malaria, Fluorosis etc.

National Management Information System (NMIS)

of the department of science & Technology has compiled a database on Research & Development Projects along with information about research scientists & personnel involved.

Environmental Information System

- The ministry of environmental & forests created an Information system called with its headquarteres in Delhi it functions 25 different centers all over the country.
- The ENVIS centres work for generating a network of database in areas like pollution control, clean technologies, remote sensing, coastal ecology, biodiversity western & eastern ghats, environmental management. Media related to environment, renewable energy, desertification, Mangroves, wildlife, Himalayan ecology, mining etc.

The National Institute of occupational Health provides computerised information on occupation health ie health aspects of people working in various hazardous & Non-hazardous industries, Safety measures etc.

Remote Sensing & Geographical Information System (G

- Satellite imageries provide us actual information about various physical & Biological resources & also to some extent about their state of degradation in a digital form through remote sensing.
- GIS is a technique of superimposing various thematic maps using digital data on a large no of inter-related or inter-dependent aspects. GIS serves to check unplanned growth and related environmental problems.
- There are several Distribution Information Centres (DICs) in our country that are linked with eachother & with the central information network having access to international database.