UNIT-III

NATURAL RESOURCES

3.1 INTRODUCTION

Natural resources are the sources which are useful to man or it can be transformed into a useful Product.

Two types

Renewable resources:

These resources are capable of being regenerated by ecological processes within a reasonable time period. Example Soil, water, air

Non Renewable resources

These resources are not capable of being regenerated by ecological processes.

Example: coal, natural gas

RESOURCES

1. Forest Resources
2. Energy Resources
3. Water Resources
4. Land Resources
5. Mineral Resources
6. Food Resources

3.2FOREST RESOURCES

One of the important renewable natural resource on this earth is forest. 1/3 of the world's land surface is covered with forest. Forest covering the earth likes a green blanket. Forest not only produces innumerable material goods, but also provides several environmental services.

3.2.1Types of forest:

Ever green forest: Generally found in equatorial region, where temperature and rain fall is high, due to heavy rain the forest are ever green. (e.g.) silent valley in Kerala

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Important trees like teak and rosewood are found here

Deciduous forest:

These forests receive only seasonal rainfall. Therefore they lose their leaves during summer Season.

Important Trees: sandal wood, teak

Coniferous trees: Trees contain needle shaped leaves which helps to preserve moisture. The snow slides down the sloping of the trees (e.g.) pine tree, spruce tree

3.2.2 Functions of forest:

1. It performs very important function both to human and to nature.
2. They are habitats to millions of plants, animals and wild life.
3. They recycle rain water.
4. They remove pollutant from air.
5. They control water quality.
6. They moderate temperature and weather.
7. They influence soil condition and prevent soil erosion.
8. They promote tourism.

3.2.3 Uses of Forests

Commercial uses:

Man depends heavily on a larger number of plant and animal products from forests for his daily needs.

The chief product that forests supply is wood, which is used as fuel, raw material for various industries as pulp, paper, newsprint, board, timber for furniture items, other uses as in packing articles, matches, sports goods etc.

Indian forests also supply minor products like gums, resins, dyes, tannins, fibers, etc.

Many of the plants are utilized in preparing medicines and drugs; Total worth of which is estimated to be more than $300 billion per year.

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Many forests lands are used for mining, agriculture, grazing, and recreation and for development of dams.

Ecological uses:

The ecological services provided by our forests may be summed up as follows:

Production of Oxygen: The main green house gas carbondioxide is absorbed by the forests as a raw material for photo synthesis. Thus forest canopy acts as a sink for corbondioxide thereby reducing the problem of global warming caused by green house gas CO_2

Wild life habitat: Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.

Regulation of hydrological Cycle: Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff. They control climate through transpiration of water and seed clouding.

Soil Conservation: Forests bind the soil particles tightly in their roots and prevent soil erosion. They also act as wind breakers.

Pollution moderators: Forests can absorb many toxic gases and can help in keeping the air pure and in preventing noise pollution.

Aesthetic value:

Forest also have aesthetic value and serve as gene reserve of important species.

Touristic value:

Ecotourism provides a growing income for those who have facilitated it. Several are now attracting the tourists.

Over Exploitation of Forests

Man depends heavily on forests for food, medicine, shelter, wood and fuel.

With growing civilization the demands for raw material like timber, pulp, minerals, fuel wood etc. shot up resulting in large scale logging, mining, road-building and clearing of forests.

Our forests contribute substantially to the national economy.

The international timber trade alone is worth over US $ 40 billion per year.

Causes

Increasing agricultural production

Increasing industrial activities

Increase in demand of wood resources

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Effects

Over Exploitation of Forests resources led to migration of the farmers.

Environmental damage caused by over Exploitation is heavy.

The tropical forests are destroyed at very fast rate.

Countless plant species and animals are endangered

Marine populations will go in to extinction

Deforestation

Deforestation means destruction of forests.

The total forests area of the world in 1900 was estimated to be 7,000 million hectares which was reduced to 2890 million ha in 1975 fell down to just 2,300 million ha by 2000.

Deforestation rate is relatively less in temperature countries, but it is very alarming in tropical countries.

Deforestation is a continuous process in India where about 1.3 hectares of forest land has been lost.

The per capita availability of forest in India is 0.08 hectares per person which is much lower than the world average of 0.8 hectares.

The presence of waste land is a sign of deforestation in India.

Causes of deforestation:

1. Developmental projects:

Developmental projects causes deforestation through two ways.

Through submergence of forest area.

- Destruction of forest area.

(e.g.) big dams, hydro electric projects, road construction etc.

2. Mining operations:

It reduces forest areas. (e.g.)Mica, coal, Manganese and lime stone.

3. Raw materials for industries:

Wood is an important raw material for various purposes.

(e.g.) making boxes , furniture and paper etc.

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4. Fuel requirement:

Wood is the important fuel for rural and tribal population.

5. Shifting cultivation: Replacement of forest area by mono specific tree plantation. (E.g.) teak

6. Forest fires: Forest fire destructs thousands of forest area.

7. Over grazing: Over grazing by cattle reduces the cultivation land.

Consequences of deforestation:

Some of the effects of deforestation are listed below:

a) Effect on climate

Global warming

Less rainfall

Hot climate and others.

b) Effect on biodiversity

Loss of medicinal plants.

Loss of timber, fuel wood and others.

c) Effect on resources

Loss of land resource

Loss of soil fertility

Soil erosion

Drastic changes in biogeochemical cycles

d) Effect on economy

Increase in medicinal values

Demand of industrial products and others

e) Effect on food

Loss of fruit production

Loss of root based foods

CONSEQUENCES OF DEFORESTATION (or) ILL EFFECTS (or) IMPACT OF DEFORESTATION

1. Economic loss

2. Loss of biodiversity

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3. Destructs the habitats of various species

4. Reduction in stream flow

5. Increases the rate of global warming

6. Disruption of weather patterns and global climate

7. Degradation of soil and acceleration of the rate of soil erosion.

8. Induces and accelerates mass movement / landslides.

9. Increases flood frequency, magnitude / severity.

10. Breaks the water cycle

11. Breaks the nutrient cycle

12. Loss of forests put additional pressure on the pristine forests.

Preventive Measures (Or) Avoid Of Deforestation (Or) Methods of Conservation of Forests

1. New plants of more or less of the same variety should be planted to replace the trees cut down for timber

2. Use of wood for fuel should be discouraged.

3. Forest pests can be controlled by spraying pesticides by using aero planes

4. Forest fire must be controlled by modern techniques.

5. Over grazing by cattle must be controlled.

6. Steps should be taken by the government to discourage the migration of people into the islands from mainland.

7. Education and awareness programmers must be conducted.

8. Strict implementation of law of Forest conservation Act.

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CASE STUDIES

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 trees since they are strongly interlocked with each other by vines etc.

Also road construction for making approach to the trees causes further damage to the forests.

In India, firewood demand would continue to rise in future mostly consumed in rural areas, where alternative sources of energy, are yet to reach.

Mining

Mining is the process of removing deposits of ores from substantially very well below the ground level.

Mining is carried out to remove several minerals including coal.

These mineral deposits invariably found in the forest region, and any operation of mining will naturally affect the forests.

Mining from shallow deposits is done by surface mining while that from deep deposits is done by sub-surface mining (under ground) .

More than 80,000 ha of land of the country is presently under the stress of mining activities.

Effects of mining resources:

Mining operation require removal of vegetation along with underlying soil mantle and overlying rock masses. This results in destruction of landscape in the area.

Large scale of deforestation has been reported in Mussorie and Dehradun valley due to mining of various areas.

Indiscriminate mining in Goa since 1961 has destroyed more than 50,000 ha of forest land.

Mining of radioactive mineral in Kerala, Tamilnadu and Karnataka are posing similar threats of deforestation.

Dams and their effects on forests and tribal people

Big dams and river valley projects have multi-purpose uses and have been referred to as "Temples of modern India".

India has more than 1550 large dams, the maximum being in the state of Maharashtra (more than 600) followed by Gujarat (more than 250) and Madhya Pradesh (130).

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The highest one is Tehri dam, on river Bhagirathi in Utttaranchal and the largest in terms of capacity is Bhakra dam on river Sutlej.

Effects of dam on Tribal people

The greatest social cost of big dam is the widespread displacement of local people.

It is estimated that the number of people affected directly or indirectly by all big irrigation projects in India over the past 50 years can be as high as 20 millions.

The Hirakud dam, one of the largest dams executed in fifties, has displaced more than 20,000 people residing in 250 villages.

Effects of dam on forests

Thousands of hectares of forests have been cleared for executing river valley projects which breaks the natural ecological balance of the region. Floods, landslides become more prevalent in such areas.

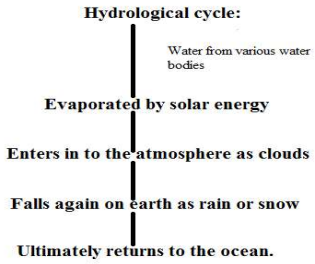
For example

The Narmada sagar project alone has submerged 3.5 lakh hectares of best forest comprising of rich teak and bamboo forests.

The Tehri dam submerged 1000 hectares of forest affecting about 430 species of plants according to the survey carried out by the botanical survey of India.

3.3 WATER RESOURCES:

Water is essential component of all living things. 80% of earth surface is covered with water. All organisms are made up of mostly by water. Water exists in three phases solid, liquid and gases. It is circulated in the hydrological cycle.



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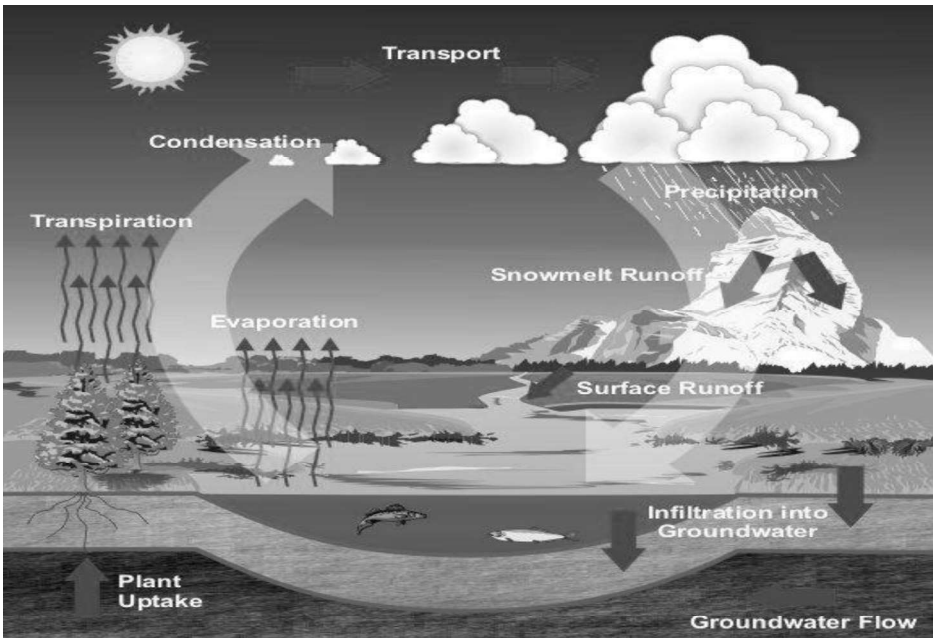
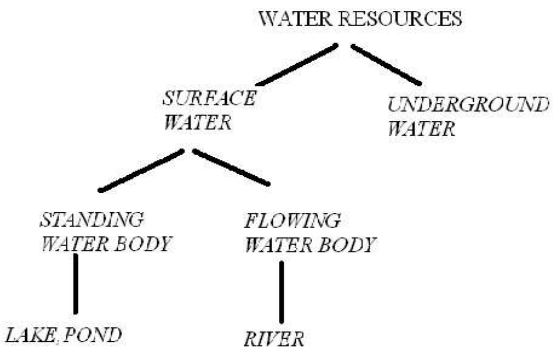


Distribution of water resources:



Over utilization of water

Surface and ground water: Water stored on the surface of earth.

Standing water bodies

Lakes:

Oligotrophic lakes:

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These lakes are deep and clear. The nutrients amount is deficient. Biological reactions are less.

Eutrophic lakes:

More nutrients and more turbid. It supports more life.

Dystrophic lakes:

Shallow coloured lakes and low PH.

Reservoirs: Generally larger than lakes.

Estuaries: These are deltas formed at the mouth of rivers, where they join the ocean. The mixing of fresh and salt water gives estuaries.

Flowing water bodies:

Water flows in streams and rivers. It carries sedimentary materials and dissolved minerals. e.g.) river

Under ground water:

Water available deep in the ground due to percolation of surface water. It is the major source. It is very pure and used for almost all purposes in the world.

Uses of water:

Irrigation

Domestic requirements

Industries

Fisheries

Effects of over utilization of water:

1. Decrease of ground water:

Increased usage decreases the ground water.

Insufficient rain fall

Building construction activities sealing the permeability of the soil.

2. Ground subsidence:

Ground water withdrawal is greater than its recharge rate; the sediments in the aquifers get compacted. As a result shrinkage of land surface takes place.

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Problems:

a. Structural damages in the buildings

b. Fracture in pipes.

c. Reversing the flow of canals.

3. Lowering of water table:

Over utilization of ground water in arid and semi arid regions for agriculture disturbs the state of equilibrium of the hydrological cycle.

Problem:

lowering of water table
decrease the number of aquifers
Change the speed and direction of water.

4. Intrusion of salt water:

In coastal area over exploitation of ground water leads to the intrusion of salt water from sea. Therefore that water cannot be used for drinking and agriculture.

5. Over utilization of water causes earth quakes, landslides and famine

6. Drying up of wells:

Due to over utilization, ground water level decreases much faster than can be regenerated. It leads to drying up of dug well and bore wells.

7. Pollution of water:

Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollutes the ground water. Problem: Water which contains excess nitrate content is not suitable for drinking.

BIG DAMS –BENEFITS AND PROBLEMS

Most of the dams are built to serve for more than one purpose such as irrigation, hydroelectric power generation are called “multipurpose dams”

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Benefits of dams:

Irrigation during dry periods

Hydroelectricity generation

Flood control

Navigation

Problems of dams

Displacement of tribal people

loss of non forest land

Loss of flora and fauna

FLOOD:

It is an over flow of water. It happens when the magnitude of flow of water exceeds the Carrying capacity of the channel within its bank.

Causes of flood:

1. Heavy rainfall, melting of snow (i.e.) sudden release of water from dams.

2. Reduction in the carrying capacity of the channel.

3. Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

Effect of flood:

1. Water spreads in the surrounding area and submerges them.

2. Cultivated land affected.

3. Extinction of civilization.

Flood Management:

1. Floods can be controlled by dams.

2. Channel management and embankment also control flood.

3. Flood hazards reduced by forecasting or flood warning.

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4. Flood may also be reduced by reduction of run off by increasing infiltration through appropriate Afforestation in the catchment area.

DROUGHT:

Drought is nothing but scarcity of water, which occurs due to

1. Inadequate rain fall

2. Late arrival of rain fall

3. Excessive withdrawal of ground water.

Lack of water for the narrow needs of agriculture, livestock, industry or human population may be termed as a drought. Drought causes serious damages to plants, animals and human life.

Types of drought:

1. Meteorological drought:

It occurs when the total amount of rain fall is less than 75% of the normal rain fall. It will be severe if the rain fall is less than 50%.

2. Hydrological drought:

It occurs when the total amount of rainfall is less than the average rain fall. It is generally associated with reduction of water in aquifers, lakes and reservoirs.

3. Agricultural drought:

It occurs due to the shortage as well as timing of overall rain fall, which intern reduce the ground water level and reservoir level. Agricultural drought affects cropped plants.

4. Socio economic drought:

It occurs due to reduction in the availability of food and social security of the people in the affected areas. Socio economic drought leads to famine.

Causes of drought:

1. When annual rain falls below normal and less than evaporation, drought is created.

2. High population.

3. Intensive cropping pattern

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(e.g.) Maharashtra

There has been no recovery from drought for the last 30 years due to over exploitation of water by sugarcane crop.

Effects of drought:

1. Drought causes hungry, malnutrition and scarcity of drinking water an also changes the quality of water.

2. Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and live stock population.

3. Worst situation of drought causes desertification.

4. Raw materials of agro based industries are critically affected during drought time, hence industrial and commercial growth decreases.

5. Drought increases the degradation of natural resources.

6. Drought causes large migration of people and urbanization.

Drought management:

1. Indigenous knowledge is essential.

2. Rain water harvesting system.

3. Construction of reservoir to improve ground water level.

4. Modern irrigation technology (drip irrigation) very useful to conserve water.

5. Afforestation activities also improve the potential of water in the drought area.

6. Crop mixing and dry forming are the suitable methods which minimize the risk of crop failures in dry area.

CONFLICTS OVER WATER:

Water is so essential for our existence and is fast becoming scarce resource. Nearly 1.2 billion people do not have access to safe drinking water

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Causes of water conflict:

1. Conflict through use: Unequal distribution of water led to interstate and international disputes.

National conflicts:

a. Sharing of Cauvery water between Karnataka and Tamil Nadu.

b. Sharing of Krishna water between Karnataka and Andrapradesh

c. Siruvani – Tamil Nadu and Kerala

International conflicts:

a. Indus – India and Pakistan

b. Colorado river – Mexico and USA

c. Bhramaputra – India and Bangladesh

2. Construction of dams or power stations:

For hydro electric power generation, dams are built across the river. It creates the conflicts between the states.

3. Conflicts through pollution:

Water reservoirs like lakes and rivers are also used for industrial purposes, therefore removal industrial wastes creates conflicts.

Management of conflicts over water:

1. Efforts to implement laws to check these practices to control water pollution.

2. Conflicts over sharing of river water in the country are studied by many organisation and several solutions are suggested. (The inter linking of rivers has been one such solution)

Case study: Conflicts on Indian River:

According to UN report, fresh water is a serious problem

1 billion people – don't have fresh drinking water

2 billion people – no water for proper sanitation.

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(e.g.) Damodhar River: Most polluted river, which receive pollution from 45 major industries

WATER RESOURCE MANAGEMENT

S.No	Organisation	Source
1	Central water commission	Surface water
2	Central ground water board	Ground water
3	Indian meteorological department	Precipitation
4	Central pollution control board	Water quality
5	Ministry of agriculture	Water for irrigation, Water supply, sanitation and sewage disposal

3.4 MINERAL RESOURCES:

Naturally occurring substances contain with different physical and chemical properties.

Ores:

These are minerals or combination of minerals from which metal can be extracted. Concentration of minerals at one particular spot is called **mineral deposit.**

Classification of mineral resources:

U.S geological survey divides non renewable mineral resources into 3 categories.

1. Identified resources:

Location, existence, quality and quantity of the mineral are known by direct geological evidence and measurement.

2. Undiscovered resources:

Assumed to exist on the basic of geological knowledge, but their specific location, quality and quantity are unknown.

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3. Reserves: Minerals are identified. Usable materials can be extracted profitably.

Uses and exploitation of minerals:

1. Development of industrial plants and machinery. - Fe, Al & Cu

2. Construction work – Fe, Al &Ni

3. Generation of energy - coal, lignite, uranium

4. Designing defense equipments like weapons and ornaments

5. Agricultural purposes – fertilizers and fungicides – Zn & Mn

6. Jewellery –Au, Ag & Pt

7. Making alloys for various purposes – phosphoresces

8. Communication purposes – telephone, wires, cables and electronic devices

9. Medicinal purposes, particularly in ayurvedic system – sulphur pyrites

Classification of minerals:

Metallic minerals: From which metals can be extracted. E.g. Fe, Al & Cu

Non metallic minerals

Non metallic compounds can be extracted.e.g Quartz, potash, stone

Formation of mineral deposits:

Various biological processes:

Formation of minerals due to the biological decomposition of dead animals and organic matters
They are formed due to cooling of molten rock
Minerals deposit are also formed due to evaporation of sea water
Formation of minerals due to oxidation –reduction reaction
Concentration of minerals during weathering ,transport and sedimentation

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Mineral wealth of India

S.No	Mineral Available	state
1	Iron	Tamil nadu
2	Coal	Orissa, west Bengal
3	Manganese	M.P
4	Copper	Bihar
5	Gold	Karnataka
6	Aluminium	Tamil nadu
7	Lime stone	M.P
8	Mica	Bihar
9	Monazite	Kerala
10	Lead and zinc	Gujarat & Rajasthan
11	Precious stones	Rajasthan
12	Magnesite	Tamil nadu
13	Petroleum	Gujarat, Assam

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Distribution and uses of major metallic minerals

Metal	Major world	Major uses
Alluminium	Australia, Jamaica	Packing food items, transportation
Copper	U.S.A, Canada	Building construction
Iron	South America, Canada	Steel production, heavy machinery
gold	South Africa	Ornaments, medical use

Mining:

It is the process of extraction of minerals from the earth.

Types of mining:

1. Surface mining

2. Underground mining

Types of underground mining

a. Open pit mining:

Machines dig holes and remove the ores.

b. Dredging:

Chained buckets are used to extract minerals.

c. Strip mining:

Bulldozers are used to extract minerals.

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Environmental damages caused by mining activities:

1. Devegetation:

Topsoil and vegetation are removed
deforestation leads to several ecological losses
landscape badly affected

2. Ground water contamination:

Mining pollutes ground water, for e.g. sulphur is converted into sulphuric acid which enters into the soil.

3. Surface water pollution:

Radioactive wastes and other acidic impurities affect the surface water, which kills many aquatic animals.

4. Air pollution:

Smelting and roasting are done to purify the metal which emits air pollutants and damage the nearby vegetation. It causes many health problems.

5. Subsidence of land:

Mainly underground mining results in cracks in houses, tilting of buildings and bending of rail tracks.

Effects of over exploitation of minerals:

1. Rapid depletion of mineral deposits

2. Wastage

3. Environmental pollution

4. Needs heavy energy requirements.

Management of mineral resources:

1. The efficient use and protection of mineral resources.

2. Modernization of mining industries

3. Search for new deposit

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4. Reuse and recycling of the metals.

5. Environmental impacts can be minimized by adopting eco friendly mining technology.

Case studies;

Mining and quarrying in Udaipur:

200 open cast mining and quarrying in Udaipur. But 100 mining's are illegal. 150 tones of explosives are used per month. It pollutes air, soil and water. It affects irrigation and wild life.

Quarrying thorium and uranium in kanya kumari district

Indian Rare Earths Corporation is quarrying sands, which is enriched with uranium and thorium, near the sea shore in manali, kanya kumari district. It leads to the loss of many coconut plantation and sea shore beauty.

3.5 FOOD RESOURCES:

Food is an essential requirement for survival of life. Main components are carbohydrates, fats, proteins, minerals and vitamins.

Types of food supply:

1. Crop plants:

Mostly produce grains and provide 76% of the world's food. E.g. rice, wheat and maize

2. Range lands:

It produces 17% of world's food from trees and grazing animals. e.g. fruits, milk and meat

3. Ocean: Fisheries – 7% of world's food

World food problem:

1. In the earth's surface 79% water out of total area, 21% land (forest, desert, mountain and barren land). Less % cultivated land, at the same time population explosion is high therefore world food problem arises.

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2. Environmental degradation like soil erosion, water logging, water pollution, salinity affects agricultural land.

3. Urbanization affects agricultural land. Hence production of rice, wheat, corn and other vegetable is difficult.

4. There is the imbalance between the supply and demand for food in developing countries many people die due to starvation

Types of nutrition:

1. Nutritious nutrition

To maintain good health and disease resistant, we need large amount of carbohydrate, proteins, fats and smaller amount of micronutrients such as vitamins and minerals such as Fe, Ca and iodine. Food and agricultural organisation (FAO) of United Nations estimated that on an average, the minimum calorie intake on a global state is 2500 calories/day.

2. under nutrition

People who cannot buy enough food to meet their basic energy needs suffer from under nutrition. They receive less than 90% of this minimum dietary calorie.

Effect of under nutrition:

Suffer from mental retardation and infectious diseases.

3. Mal nutrition:

Besides minimum calorie intake we also need proteins, minerals, vitamins, iron and iodine. Deficiency leads to malnutrition resulting in several diseases.

Effect of mal nutrition:

S.No	Deficiency of nutrients	Effects
1	Protein	Growth
2	Iron	Anemia

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3	Iodine	Goiter
4	Vitamin –A	Blindness

India 3 largest producer of crops, nearly 300 million Indians are still under nourished.

World food summit 1996:

The world food summit, 1996 has set the goal to reduce the number of under nourished and mal nourished people to just half by 2015.

Over grazing: It is a process of eating the forest vegetation without giving a chance to regenerate.

Effects of over grazing:

1. Land degradation

over grazing removing the cover of vegetation
OG leads to poor, dry and compacted soil.
Land cannot be used for further cultivation.

2. Soil erosion: When the grasses are removed the soil becomes loose and gets eroded by the action of wind and rain fall.

3. Loss of useful species:

OG affects the plant population and their regenerating capacity. OG replaces the plant of high nutritive value with plant of low nutritive value.

Agriculture:

Agriculture is an art, science and industry of managing the growth of plants animals for human use. It includes cultivation of the soil, growing and harvesting crops, breeding and raising livestock, dairying and forestry.

Types of agriculture:

1. Traditional agriculture

2. Modern (or) industrialized agriculture

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Traditional agriculture:

Small plot, simple tools, surface water, organic fertilizer and a mixture of crops are enough. They produce enough food to feed their family and to sell it for their income.

Modern agriculture:

Hybrid seeds of single crop variety, high tech equipments, lot of fertilizers, pesticides and water to produce large amount of single crops.

Effects of modern agriculture:

1. Problems in using fertilizers:

a. **Micronutrient Imbalance**

Excess of fertilizers causes micronutrient imbalance. Most of the chemical fertilizers used in modern agriculture contain nitrogen, phosphorous and potassium (N, P, and K) which are macro nutrients. When excess of the fertilizers are used in the fields, it causes micro nutrient imbalance

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b. Blue baby syndrome (nitrate pollution)

Nitrate present in the fertilizer causes blue baby syndrome, when the nitrogenous fertilizers are applied in the fields, they leach deep into the soil and contaminate the ground water, and the nitrate concentration in the water gets increased.

When the nitrate concentration exceeds 25mg/lit, they causes serious health problem called "blue baby syndrome". This disease affects infants and leads even to death

c. Eutrophication:

Nitrogen and phosphorus used in the crop fields washed out by runoff water and reaches the water bodies causing over nourishment of the lakes called eutrophication. Hence algal species increases rapidly. Life time of the species is less and they decompose easily and pollute the water which affects the aquatic life.

2. Problems in using pesticides:

First generation pesticide: Sulphur, arsenic, lead and mercury.

Second generation pesticide: DDT (dichloro diphenyl tricholoro methane)

Side effects:

1. Death of non target organism.

2. Producing new pest

3. Bio magnification – Most of the pesticides are non bio degradable, keep on concentrating in the food chain and it is harmful to human beings.

4. Risk of cancer:

a. It directly acts as carcinogen

b. It indirectly supports immune system.

3. Water logging:

Land where water stand for most of the year.

Causes of water logging:

1. Excessive water supply

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2. Heavy rain

3. Poor drainage

Impacts of water logging

Poor soil quality
Water pollution

4. Salinity

Now a day in order to get high yield, formers use more fertilizers. This change the chemical properties of the land .most of the lands have turned unproductive because of salinity

Case study:

Pesticides in India:

In Delhi the accumulation of pesticide in the body of mother causes premature delivery and low birth weight infant.

Pesticides in Pepsi and coca cola:

India has reported that Pepsi and coca cola companies are selling soft drinks with pesticide content 30-40 times higher than EU limits. This damages the nervous system,.

3.6 ENERGY RESOURCES:

It is defined as, "the capacity to do work"

Development of energy

The first form of energy is the fire .the early man discovered fire and used it for cooking and heating purposes. Wood is the main source of energy, which is later displaced or replaced by coal. Coal is now being replaced by oil and gas. Now due to insufficient availability and price hike, people started of thinking and using several alternate sources of energy

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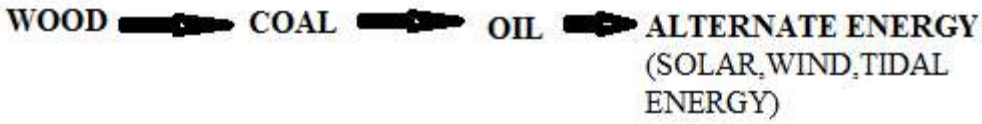

Energy distribution in the world:

Developed countries like USA and Canada constitute only 5% of the world's population but consume 25% of the world's available energy. Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year.

Growing energy needs:

All industrial process like mining, transporting, lighting, heating and cooling require energy

- By using this energy our life style is also changing from a simple way of life to a luxurious life style

Types of energy resources:

1. Renewable energy resource (or) Non conventional energy resources

2. Non renewable energy resources (or) Conventional energy resources

Merits of renewable energy resources:

1. Unlimited supply

2. Provides energy security.

3. Fits into sustainable development concept.

4. Reliable and the devices are modular in size.

5. Decentralized energy production.

3.6.1 RENEWABLE ENERGY SOURCES:

Energy which can be regenerated by some ecological process

Solar energy: The energy that we get directly from the sun is called solar energy

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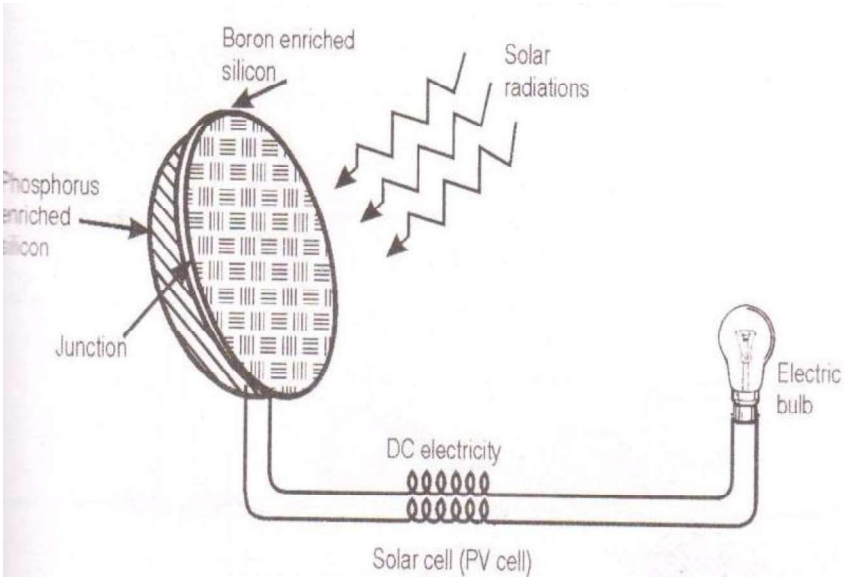
Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy.

Solar cell (or) Photovoltaic cell (or) PV cell:

Solar cell consists of p- type semi conductor (Si doped with B) and n-type semi conductor (Si doped with P). P-type forms top layer and n-type forms bottom layer. Solar rays fall on the top layer, the electrons from valence band promoted to the conduction band which crosses the p-n junction into n-type semi conductor. Potential difference between the two layers is created which causes flow of electrons.



Solar cell Uses: It is used in calculators, electronic watches, street light, water pumps etc.

Solar battery:

Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem.

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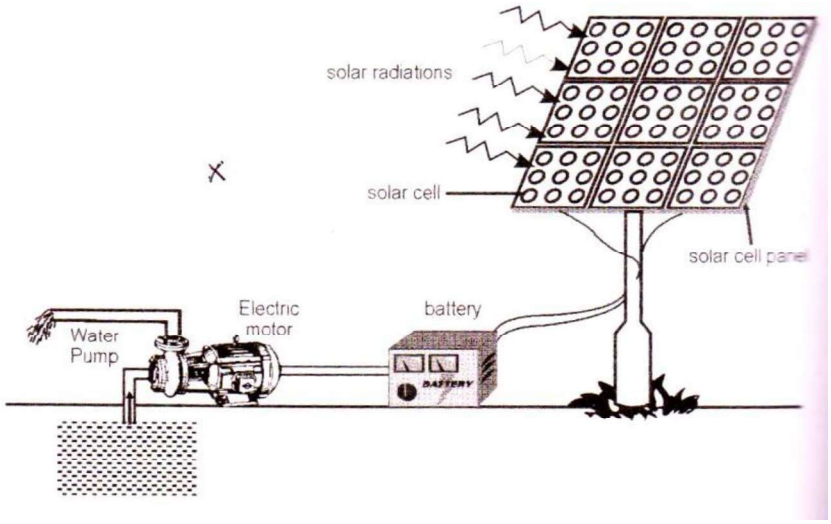
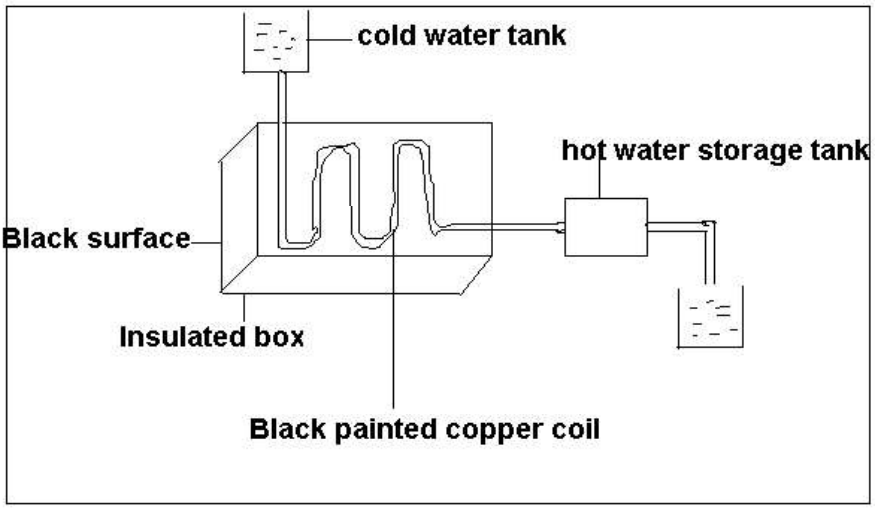


Solar water heater:

It consists of insulated box painted with black paint with glass lid. Glass lid is used to receive solar heat. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.



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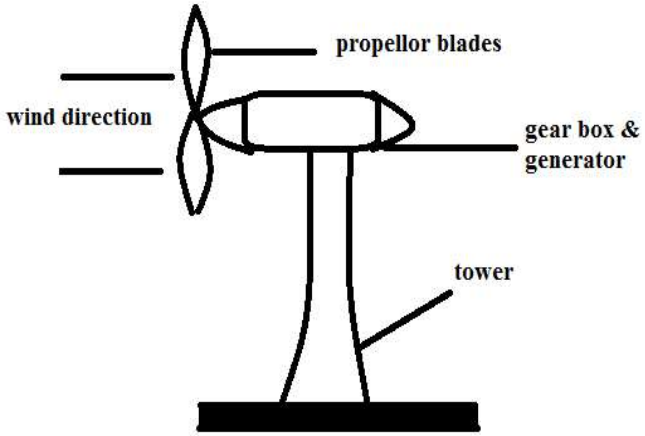
WIND ENERGY:

Moving air is called wind. The energy recovered from the force of the wind is called wind energy its speed is high.

Wind mills:

When a blowing wind strikes the blade of the wind mill, it rotates continuously. The rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.



Wind farms:

When a large number of mills are installed and joined together in a definite pattern , forms wind farm. It produces large amount of electricity.

Condition:

Minimum speed for wind generator is 15 Km/hr

Advantages:

It does not cause air pollution

Very cheap

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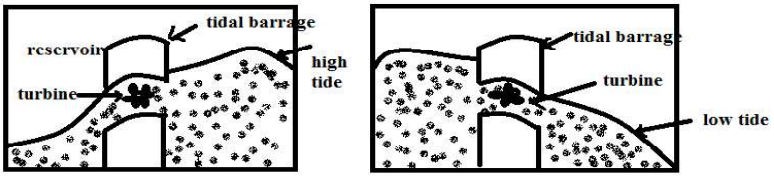
OCEAN ENERGY:

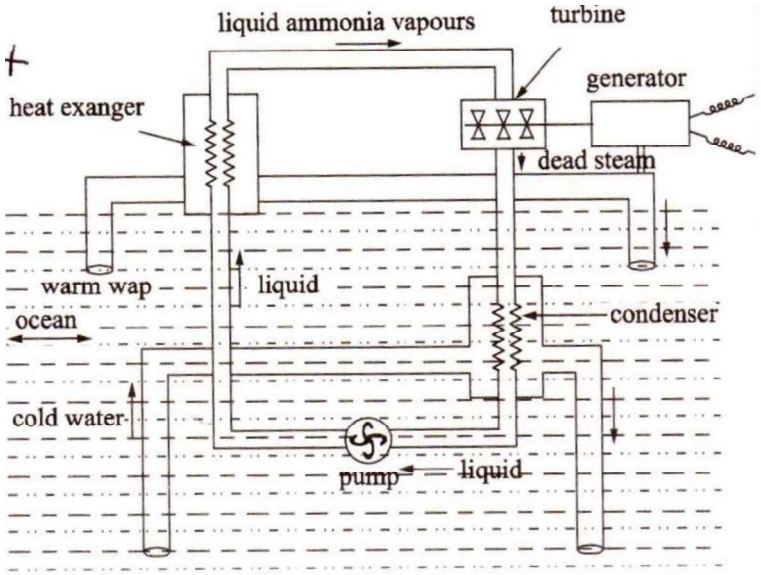
Tidal energy (or) Tidal power:

Ocean tides are formed due to gravitational force of sun and moon which produce enormous amount of energy. High tides – rise of water in the ocean. Low tides – fall of water in the ocean. Tidal energy can be harnessed by constructing a tidal barrage. During high tides sea water enters into the reservoirs and rotates the turbine, produce electricity. During low tides water from reservoir enters into the sea rotate the turbine produce electricity.



Ocean thermal energy:

Temperature difference between surface water and deeper level water in ocean generates electricity. The energy available due to the difference in temperature of water is called ocean thermal energy.



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Condition: Temperature difference should be 20 C.

Process:

Ammonia is converted into vapours on the surface of warm water; it increases the vapour pressure which rotates the turbine and generates electricity. Deeper level cold water is pumped to cool and condense the vapour in to liquid.

Geo thermal energy: Temperature of the earth increases at the rate of 20 –75 C per/km when we move down the earth surface. High temperature and high pressure steam field exist below the earth surface in many places. The energy harnessed from the high temperature present inside the earth is called geothermal energy.

Natural geysers:

Hot water or steam comes out of the ground through cracks naturally is called natural geysers.

Artificial geysers:

Artificially drill a hole up to the hot region and by sending a pipe into it. The hot water or steam is used to rotate the turbine and generate electricity.

Bio mass energy:

Bio mass: Organic matter produced by plants or animals used as source of energy E.g.wood, seeds, sewage, cattle dung

Bio gas:

It is a mixture of gases such as methane, carbon dioxide and hydrogen sulphide. Methane is the major constituent. It is obtained by aerobic fermentation of animal dung (or) plant wastes in the presence of water.

Bio fuels:

Biofuels are the Fuels, obtained by the fermentation of biomass.

E.g. ethanol, methanol

Ethanol: it can be produced from sugar cane. Its Calorific value is less compared to petrol

Methanol: Obtained from ethanol or sugar containing plants

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Hydrogen fuel:

Hydrogen produced by thermal dissociation or photolysis or electrolysis of water. It has high calorific value. It is non polluting one because the combustion product is water.

$$2H_2 + O_2 \rightarrow 2H_2O + 150\,KJ$$

Disadvantages:

1. Hydrogen is highly inflammable and explosive.

2. Safe handling is required.

3. Difficult to store and transport.

3.6.2 NON RENEWABLE ENERGY SOURCES:

Energy cannot be regenerated by some ecological process is known as non renewable resources

Coal:

It is a solid fossil fuel formed in several stages as buried remains of land plants that lived 300-400 million years ago were subjected to intense heat and pressure over millions of years. It occurs below a depth of about 600 meters in Indian collieries. In India about 65% of coal is used to produce electricity

Disadvantages: When coal is burnt large amount of CO_2 is released. This causes global warming.

Petroleum:

Crude oil is a liquid consists of more than hundreds of hydrocarbons and small amount of impurities. The petroleum can be refined by fractional distillation. In the world level 25% of oil reserves are in Saudi Arabia. At present rate of usage, the world crude oil reserves are expected to get exhausted in just 40 years.

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Occurrence:

The fossil fuel was formed by the decomposition of dead animals and plants that were buried under lake and ocean at high pressure and temperature for millions of years

Fractional distillation:

From the crude petroleum oil, the various hydrocarbons are separated by purifying and fractionating the crude petroleum oil.

Liquefied petroleum gases (LPG):

Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colourless and odourless gas, but during cylindering some mercaptans are added, which produces bad odour, thereby any leakage of LPG from the cylinder can be detected instantaneously

Natural gas:

These are found above the oil in oil wells. It is a mixture of methane and other hydrocarbons.

It has high Calorific value. There are two types.

Dry gas: If the natural gas contains lower hydrocarbons like methane and ethane, it is called as dry gas

Wet gas: If the natural gas contains higher hydrocarbons like propane and butane, it is called as dry gas

NUCLEAR ENERGY:

Dr.H.Bhabha is a father of nuclear power development in India. 10 nuclear reactors are present in India. It produces 2% of India's electricity. Nuclear energy can be produced by two types of reactions- Nuclear fission, nuclear fusion.

Nuclear fission

It is a nuclear change in which heavier nucleus split into lighter nuclei on bombardment of fast moving neutrons. Large amount of energy is released through chain reaction.

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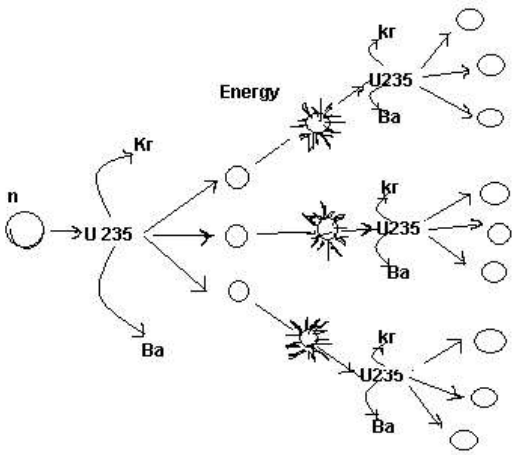
Uranium with fast moving neutron gives barium and krypton in addition to three neutrons; in the second stage it gives nine neutrons and so on. This process of propagation of the reaction by multiplication is called chain reaction.

It is the nuclear reaction in which heavy isotopes are split into lighter nuclei on bombardment by neutrons. Fission reaction of U^{235} is given below.

$$_{92}U^{235} + {}_{0}n1 \rightarrow {}_{36}Kr^{92} + {}_{56}Ba^{141} + 3\ {}_{0}n^{1} + \text{energy}$$



(ii) Nuclear fusion: Here two isotopes of a light element are forced together at extremely high temperatures (1 billion ºC) until they fuse to form a heavier nucleus releasing enormous amount of energy in the process.

$$_{1}H^{2} + {}_{1}H^{2} \rightarrow {}_{3}He^{2} + {}_{0}n^{1} + \text{energy}$$

Nuclear energy has tremendous potential but any leakage from the reactor may cause devastating nuclear pollution. Disposal of the nuclear waste is also a big problem.

Case Study:

Wind energy in India: Our country generating 1200 MW electricity by using wind energy. The Largest wind farm situated near Kanya kumari in Tamil nadu. It produces 380 MW electricity.

Hydrogen fuel car:

General motor company of china discovered an experimental car (fuel H2) can produce no emission only water droplets and vapours come out of the exhaust pipe. This car will be commercially available by 2010.

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3.7 LAND RESOURCES:

Land is the most important valuable resource for mankind, it provides food, fibre, medicine and other biological materials needed for food .It is a mixture of inorganic materials and organic materials.

Uses of land resources:

Land provide ,food, wood,minerals etc
Land is used as watershed
To construct building
It Acts as a dustbin for most of the wastes created by the modern society.

Land degradation:

It is a process of deterioration of soil or loss of fertility of the soil

Effects of land degradation:

1. Soil texture and soil structure are destructed.

2. Loss of soil fertility.

3. Loss of valuable nutrients.

4. Increase in water logging, salinity, alkalinity and acidity problem.

5. Loss of economic, social and biodiversity.

Causes of land degradation:

1. Population:

More land is needed for producing food, fibre and fuel wood. So land is degraded due to over exploitation.

2. Urbanization:

Urbanization reduces the agricultural land. Urbanization leads to deforestation, which in turn affects millions of plants and animals.

3. Fertilizers and pesticides: It affects fertility of the soil and causes land pollution.

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4. Damage of top soil:

Increase in food production generally leads to damage of top soil through nutrient depletion.

5. Water logging, soil erosion, salination and contamination of the soil with industrial wastes and cause land degradation.

Soil erosion:

The process of removal of superficial layer of the soil from one place to another is called soil Erosion.

Types of soil erosion:

Normal soil erosion: it is caused by gradual removal of top soil by the natural processes. The rate of erosion is slower

Accelerated soil erosion: It mainly caused by manmade activities. The rate of erosion is much faster than the rate of formation of soil

Harmful effects of soil erosion:

1. Soil fertility decreases due to the loss of top soil layer.

2. Loss of its ability to hold water and sediments.

3. Sediments run off can pollute water and kill aquatic life.

Causes of soil erosion:

1. Water: water causes soil erosion in the form of rain, run off, rapid flow and wave action.

2. Wind: It is an important climatic agent, which carry away the fine particles of soil create soil erosion.

3. Biotic agent: Over grazing, mining and deforestation are the major biotic agent cause soil erosion. 35% of soil erosion is due to over grazing and 30% is due to deforestation.

4. Land slide: It causes soil erosion.

5. Construction: Construction of dams, buildings, roads removes protective vegetal cover and leads to soil erosion.

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Control of soil erosion (or) Soil conservation practices:

The art of soil conservation is based on following basic principles

1. To slow down the water for concentrating and moving down the slope in a narrow path.

2. To slow down the water movement when it flows along the slope.

3. To encourage more water to enter into the soil.

4. To increase the size of soil particles.

5. Reduction in the wind velocity near the ground by growing vegetation.

Conservational till farming

It is also known as no-till-farming.it causes minimum disturbance to the top soil. Here tilling machine make slits in the unploughed soil and inject seeds, fertilizer and water in the slit. So the seed germinate and crops grow. The process of mixing the residues from previous crops into the soil by ploughing is called conservational tillage. It improves soil permeability and increase organic matter, which in turn improve soil moisture and nutrients.

Contour farming:

It involves planting crops in rows across the contour of gently sloped land. Each row acts as a small dam to hold soil and to slow water runoff

Mulching:

Soil is covered with crop residues and other form of plant litters.

Terrace farming:

It involves Conversion of steep slopes into a series of broad terraces, which run across the contour. This retains water for crops and reduces soil erosion by controlling run off.

Agro forestry:

It involves planting crops in strips or alleys between rows of trees or shrubs, which can provide fruits fuel and wood. After harvesting the crops the soil will not be eroded because trees and shrubs will remain on the soil and hold the soil particles.

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Wind break:

Trees are planted in long rows along the boundary of cultivated lands, which block the wind and reduce soil erosion. It helps in retaining soil moisture, supply of some wood for fuel and provides habitats for birds

Desertification:

It is a form of land degradation. It is a progressive destruction or degradation of arid or semi arid lands to desert.

Causes:

1. Deforestation

2. Over grazing

3. over utilisation of water

4. Mining and quarrying

5. Climate change

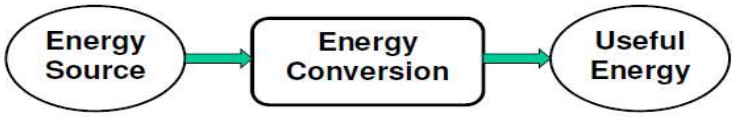
6. Excessive use of fertilizers and pesticides

Effects of desertification:

80% of productive land in the arid and semi arid regions is converted in to desert. Around 600 million people are suffered by desertification.

3.8 ENERGY CONVERSION PROCESSES

Energy Conversion is the process of changing energy from one form to another.



Historic Energy Conversion Sequences

- Biomass → heat (esp. cooking)

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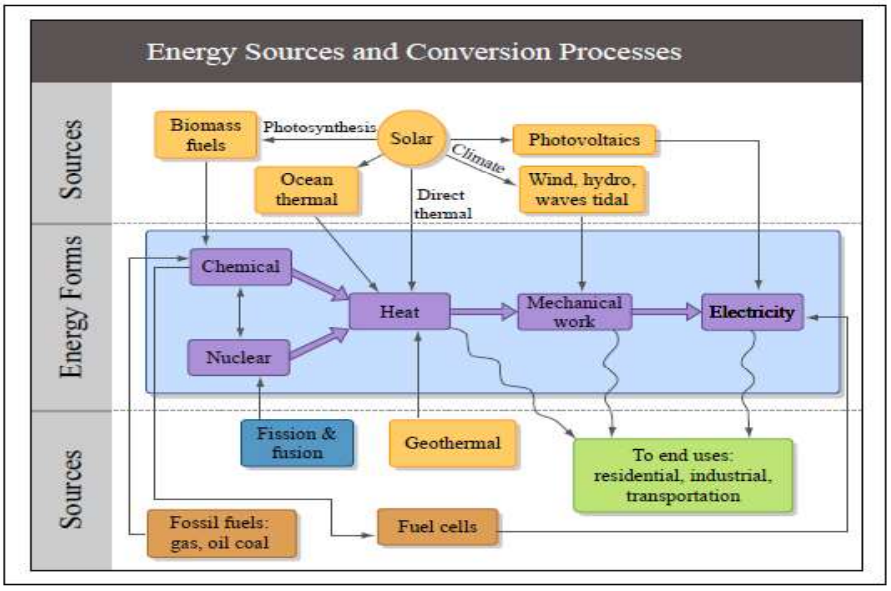
- Solar → heat, dry clothes, dry food
- Solar is still main light source, no need for conversion
- Solar is source of biomass, wind, hydro, etc.
- Biomass → farm animals → horsepower, food

Later, people also did these conversions:

- Coal → heat
- Hydro → milling flour, running machinery
- Wind → pump water

Energy Sources

Sl.no	Type of Energy	Examples
	Potential Energy	Hydro
	Kinetic Energy	Wind, Tidal
	Thermal Energy	Geothermal, Ocean Thermal
	Radiant Energy	Solar
	Chemical Energy	Oil, Coal, Gas, Biomass
	Nuclear Energy	Uranium, Thorium



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ANAEROBIC DIGESTION

Anaerobic digestion is a series of biological processes in which micro-organisms break down biodegradable materials in the absence of oxygen. One of the end product is bio-gas. Anaerobic digestion is used to convert live stock manure, municipal waste water solids, food waste, high strength industrial waste water and residuals , fats, oils and greases in to bio-gas.

Various steps involved in Anaerobic digestion

Anaerobic digestion involves four stages of biological and chemical reactions

Hydrolysis

The digestion process begins with bacterial hydrolysis of the input materials to break down insoluble organic polymers to soluble materials such as carbohydrates and make them available for other bacteria.

Acidogenesis

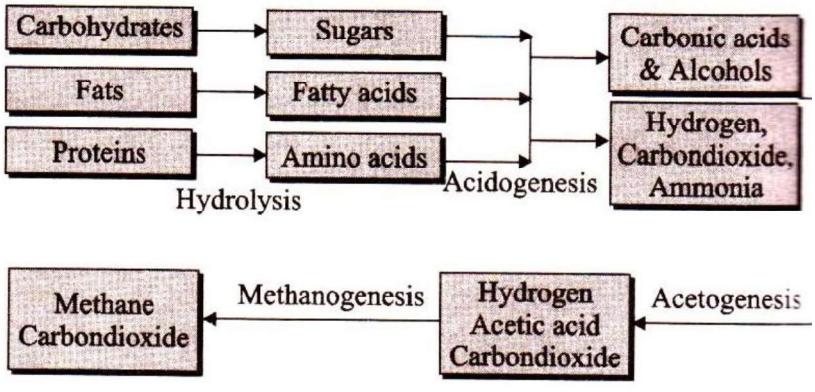
Then Acidogenesic bacteria converts the sugars and amino acids in to carbondioxide , hydrogen , ammonia and organic acids.

Acetogenesis

These organic acids are converted in to acetic along with additional ammonia, hydrogen, and carbon dioxide by the acetogenic bacteria acetic.

Methanogenesis

Finally the above products are converted in to methane and carbondioxide by Methanogenesis



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BIO-GAS (or) GOBAR GAS

It is a mixture of various gases form by anaerobic degradation of biological matter(cow dung)in the absence of free oxygen.

BIOGAS – PRODUCTION AND USES

- **Biogas** means a gas formed by carbon dioxide and methane from breakdown of organic materials such as manure.
- Biogas is an energy carrier which can be used for several energy applications (eg. electricity generation, heat production, combine heat and power production, transport fuel, injection to the natural gas grid).

Biogas can contribute to several sectors:

-Environment(eg.fightagainstClimatechange)

-Energy(eg.energysecurity,localsource)

-Agriculture(eg.sustainablecultivationandanimalbreeding)

-Society(eg.employmentenhancement,ruraldevelopment)

Some Environmental benefits of biogas:

Reduced emissions of greenhouse gases, direct and indirect (eg. CO2, CH4 and nitrous oxide – N2O).

Water and Waste management (Reduced consumption of resources and increased recycling, reduced water environment pollution from leaching of nutrients, environmental friendly solution to the waste disposal problem).

Reduced odour and flies nuisances.

Soil and landscape

Sources of Biogas

Wetlands

Sewage Sludge

Landfills

Plant Material

Animal Waste

Biogas – Production

Biogas plant or gobar gas plant consist of a well like underground tank (called digester) covered with dome shaped roof with a gas outlet pipe. The dome of the digester act as gas holder. On the left hand side of the digester there is a sloping inlet chamber through which

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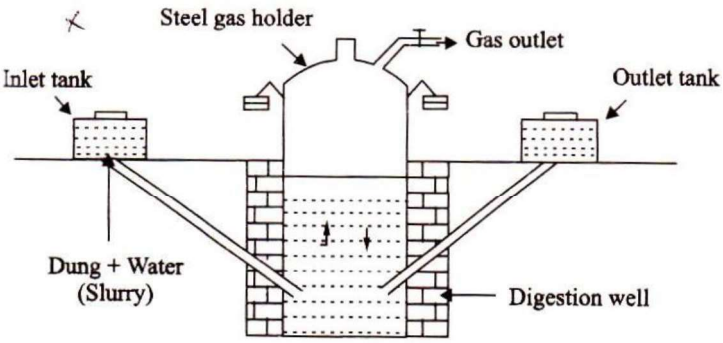
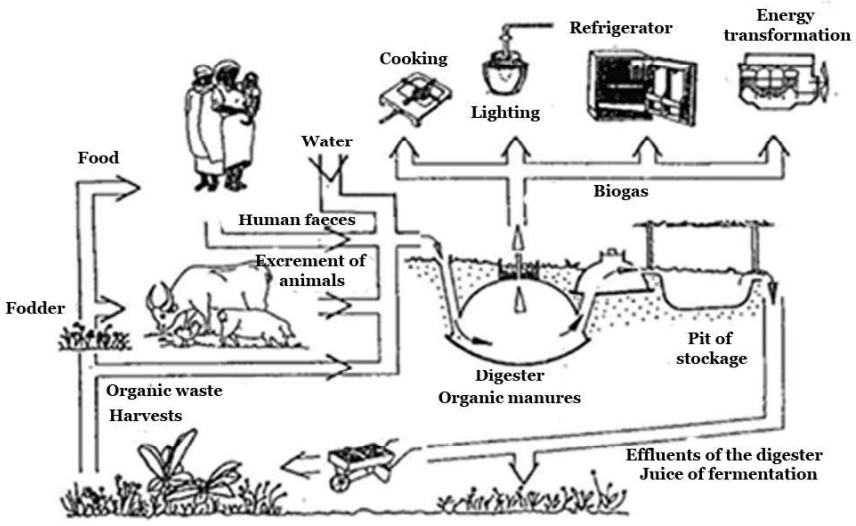
cattle dung + water slurry is introduced on the right hand side there is a outlet chamber through which spent dung slurry gets collected.

A *biogas plant* is the name often given to an anaerobic digester that treats farm wastes or energy crops.

Biogas Process



Slurry(animal dung+water) is fed in to the digester through the inlet chamber. The slurry in the digester is left for about two months for fermentation.Anaerobic micro organism are responsible for this action.As the result of anaerobic fermentation biogas is collected in the dome.When sufficient amount of biogas is collected in the dome, it exerts a large pressure on the slurry and this in turn forces the spent slurry to the overflow tank through the outlet chamber.Once the biogas plant starts functioning more and more slurry may be fed into the digester to get continuous supply of biogas.



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Uses of biogas:

It is used for cooking food and heating water.

It is used to run engines, It is used as an illuminant in villages.

3.9 INTRODUCTION TO ENVIRONMENTAL BIOCHEMISTRY: PROTEINS

Biochemistry has become the foundation for understanding all biological processes. It has provided explanations for the causes of many diseases in humans, animals and plants.

Biochemistry is the application of chemistry to the study of biological processes at the cellular and molecular level.

Environmental biochemistry involves approaches to treat polluted air ,waste water and solid waste using metabolic activities of micro-organisms.

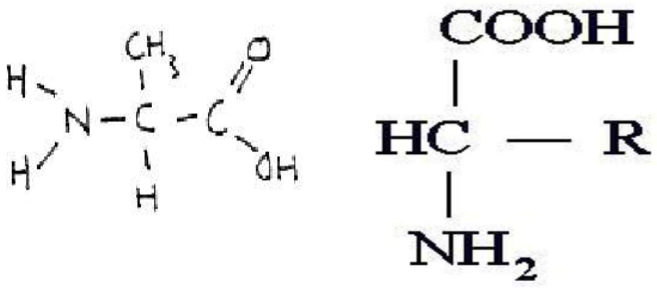
Aim of Environmental biochemistry

It aims to manufacture of products in environmentally harmonious ways which allow for the minimization of harmful solids, liquids or gaseous outputs.

It also aims to create a cleaner ecosystems

PROTEINS

It contain the elements carbon, hydrogen, oxygen, and nitrogen.composed of MANY amino acid subunits.It is the arrangement of the amino acid that forms the primary structure of proteins. The basic amino acid form has a **carboxyl group** on one end, a **methyl group** that only has one hydrogen in the middle, and a **amino group** on the other end. Attached to the methyl group is a **R group**.



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An r group is any group of atoms – this changes the properties of the protein!

Major Protein Functions

Growth and repair

Energy

Buffer -- helps keep body pH constant

BIOCHEMICAL DEGRADATION OF POLLUTANTS

Also known as **Microbiology of Waste Treatment.**

domestic wastewater or concentrated animal waste

organic compounds that would deplete oxygen if discharged into surface water (river, stream, lake, estuary, ocean); in aggregate, referred to as "oxygen demand"

inorganic nutrients (N and P) that would stimulate excessive algal growth (eutrophication) in a surface water body

N species that would deplete oxygen in surface water (NH_4^+) or contaminate groundwater if distributed on land (NO_3^-)

pathogenic microorganisms and viruses

"emerging contaminants" (*e.g.*, pharmaceuticals, "personal care products", flame retardants)

domestic solid waste

industrial waste water

easily degradable organic compounds (*e.g.*, food production, breweries)

specificorgancompounds

(*e.g.*, commercial products such as pharmaceuticals)

inorganic chemicals (*e.g.*, N, P, S, metals)

hazardous waste

metals

specific organic compounds (*e.g.*, chlorinated solvents, pesticides, aromatic hydrocarbons)

Environmental applications of engineered microbial processes

municipal wastewater treatment (ubiquitous in developed countries)

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treatment of some industrial wastewaters

controlled anaerobic decomposition in landfills (“bioreactor landfills”)

composting of solid waste

bioremediation of contaminated soil or groundwater

above-ground (*ex situ*) or in place (*in situ*)

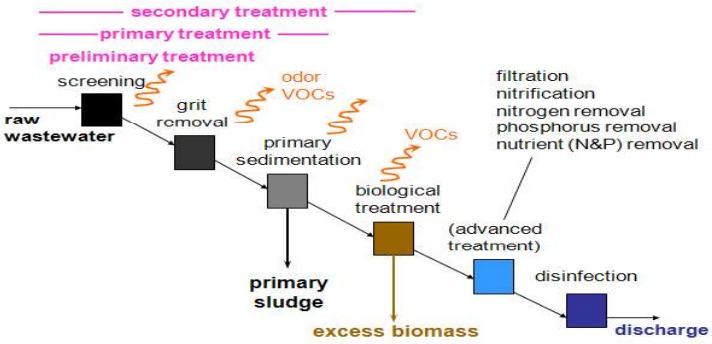
biofiltration of contaminated air

common features of all systems

open systems (anyone can join the party!)

complex communities of naturally occurring microorganisms

Overview of municipal wastewater treatment



Bioconversion of pollutants

Bioconversion is the change of pollutants in to a source of energy by the action of micro-organisms. It is the cheap and safe method.

Types of bioconversion

1.Enzymatic hydrolysis

2.Synthesis gas fermentation

3.composing

1.Enzymatic hydrolysis

A feedstock is mixed with strong enzymes which converts a portion of cellulosic material in to sugar which can then be fermented into ethanol.

2.Synthesis gas fermentation

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A feed stock is mixed with 30% of water and is gasified in a closed environment in to a syn gas using carbon monoxide and hydrogen. The cooled syngas is then converted in to usable products through exposure to bacteria.

3.composing

A feed stock of organic matter is subjected to some organisms to reduce and convert organic waste into high quality feed stuff and oil material for the biodiesel industry.

TWO MARKS

1. Define renewable resources.

The renewable resources are those resources which have the inherent capacity to reappear, or replenish themselves by quick recycling , reproduction, and replacement within a reasonable time ,and to maintain themselves.

Example; air, water, soil (land), and plants, and animals

2. Define non-renewable resources.

The non-renewable resources are those that do not have the ability for recycling and replacement within a reasonable period of time. Example; minerals, coal oil, natural gas, ground water

3. List some of the renewable energy sources.

a. Solar energy

b. Wind energy

c. Hydro energy

d. Geo-thermal energy

e. Ocean thermal energy

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