NATURAL RESOURCES

Nature has provided a large number of materials and services that are essential for life on Earth. These natural substances are known as natural resources. Natural resources are materials for all human requirements. Hence, any thing that can be transformed to a form that becomes valuable and useful in human beings is termed as a resource.

CLASSIFICATION OF NATURAL RESOURCE

Resources can be classified on the basis of their origin as well as their continual utility. Natural Resources are classified into Inexhaustible and Exhaustible resources.

Inexhaustible natural resource: Those resources which cannot be exhausted. Eg: Solar, wind, OTEC.

Exhaustible natural resource: The resources which can be restored and regained but it takes some time. Some of them gets exhausted easily once utilized. These are classified as Renewable and Non-Renewable resources.

Renewable resource: The resources that can be harvested continuously with proper planning and management. Eg: Plants, animals, forest etc.

Non-Renewable resource: The resources that cannot be replenished by natural means. Eg: Minerals, fossil fuels, salts etc.

FOREST RESOURCES

The word forest came from Latin word ‘foris’ meaning outside. A forest, a biotic community with predominance of trees, is an important renewable natural resource. India is rich in forest resources with a great diversity of flora and fauna. Indian forests range from evergreen tropical rain forests (in north-eastern parts of the country, western ghats and Andaman and Nicobar Islands) to dry alpine shrubs (in Himalayas) with a wide variety of other forest types between these two extremes.

USES OF FORESTS

Uses of forests are classified into three categories:

PROTECTIVE USES:

- It decreases soil erosion
- Due to high humus contents nutrients are present in the soil
- Acts as a natural dam
- Increases soil fertility

REGULATORY USES

- It regulates biogeochemical cycles
- It maintains hydrological cycle making seasonal rainfall

- Forest absorb carbon dioxide and decreases global warming
- Increase in oxygen content
- Reduces pollution levels
- Recharges the ground water and increases ground water table
- Habitat to wildlife
- It decrease floods, drought, landslides

PROTECTIVE USES

- Timber used for the construction purposes, used for furniture and making paper
- Edible oils, essential oils, perfumes
- Sandal wood
- Honey, fruits, vegetables
- Alkaloids, dyes
- Resins, rubber
- Perfumes, lac
- Fire wood, charcoal
- Medicine

DEFORESTATION

The cutting of trees on a large scale for the developmental activities and industries is called deforestation. The growing population and rapid industri9alization and many related activities are responsible for forest area exploitation.

CAUSES

Increase in population: Due to population increase large areas of forests have been turned into agricultural land to meet the growing demands. Similarly house settlements and some of the developmental activities also increase results into deforestation.

Shifting cultivation: Many parts of the world have become deforested due to unsustainable agriculture, leading to sever soil degradation. In many cases, it has lead farmers to leave the area and search for other options.

Road construction: To transport logs of wood from forest to industry roads has to be constructed. In this course many trees were cut down.

Urbanization: Owing to the growing population, there is an ever-increasing demand for providing housing facilities. Large areas of forests are being cleared across the world in order to provide accommodation to more and more people.

Construction of dams, canals, and highways: Developmental activities such as construction of dams, and bridges have caused large scale cutting of trees. Construction of dams also causes submergence of land containing forests which can lead to loss of several endangered species of flora and fauna.

Establishment of industrial areas: Forests provide raw materials for several small and large scale industries. Hence with rapid industrialization across the world, there is an increasing threat to the forests. Industrial operations cut countless trees each year for the raw materials that are provided by the forests.

Over grazing: Grazing by the cattle leads to the degradation of land. Some times the soil gets compacted by the hooves of the cattle which make soil hard and unable to germinate.

Demand for firewood: Rural people who depend on forest for fuel wood are responsible for large scale cutting of trees. This problem is worst in drier regions of the tropics, especially in the drier areas of Africa.

Mining: Mining activities promote the deforestation process. Mining leads to direct forest loss due to the clearing of land to establish projects and also contributes in displacing the native people. Mining activities lead to irreparable damage to the environment since they cause soil erosion and loss of biodiversity.

Commercial logging: The forests are cut for industrial purposes and other commercial activities and for house hold purposes.

EFFECTS OF DEFORESTATION

- Loss of natural habitat of wild animals and plants.
- Biodiversity is lost and along with that genetic diversity is eroded.
- Increased intensity and frequency of floods.
- Land degradation, increase in soil erosion and loss of soil fertility.
- Loss of forest products.
- Siltation of rives and lakes.
- Decrease in humus content.
- Increase in pollution.
- Sedimentation and silt deposition in dams.
- Disturbance in hydrological cycle.
- Increase in carbon dioxide content in turn increases global warming.
- Un seasonal and uneven rainfall.
- Loss of revenue.
- Increased socio-economic problems in the long run.
- In hilly areas it often leads to land slides.

Timber Extraction:

Extraction of timber is done for industrial and other commercial activity. It is classified as follows:

Clear Felling: It means complete destruction of native forest, modifying it by harvesting commercial trees to create an even aged group and removing non-commercial trees, if required.

Selective logging: Only large individual trees of a few economically marketable species are harvested. The other trees are left untouched till the next harvesting.

Mechanized logging: Heavy machineries are used to pull, lift and transport the trees. This process can be used in clear felling or selective logging operations.

Hand logging: The felling of trees by hand-held chain saws and then transporting the logs manually. This method is used in peat swamp forests which are regularly water logged and where heavy machinery movement is not possible.

Case Study:

Chipko Movement

On March 26, 1974, a group of men arrived stealthily in the forest next to Renni Village in the Garhwal district of the Himalayas. They had been sent by a contractor to begin cutting down 2500 trees in the forest. Anticipating resistance from the people, the contractor had ensured that all the men of the village were away on that day. About 25 of the women led by Gaura Devi pleaded with the men not to start the felling operations, but the men responded with threats and abuses. The women started to embrace the trees and dared the axe-men to cut them before cutting the trees, has inspired environmentalists the world over. This movement is called Chipko Movement.

WATER RESOURCES

Characterized water resources:

- It exists as a liquid over a wide range of temperature form 0 to 100°C.
- It has the highest specific heat, due to which it warms up and cools down very slowly without causing shocks of temperature jerks to the aquatic life.
- It is an excellent solvent for several nutrients.
- Due to high surface tension and cohesion it can easily rise through great heights through the trunk even in the tallest of the trees.
- It has a high latent heat of vaporization. Hence, it takes a huge amount of energy for getting vaporized. That's why it produces a cooling effect as it evaporates.
- It has an anomalous expansion behavior, it freezes, and it expands instead of contracting and thus becomes lighter. It is because of this property that even in extreme cold, the lakes freeze only on the surface. Being lighter the ice keeps floating where as the bottom waters remain at a higher temperature and therefore, can sustain aquatic organisms even in extreme cold.

Uses

- Life began in water; it is the basic component of every living cell.
- Water is the basic input required for agriculture.

- Industries consume water for cooling, heating, and other purposes.
- Electricity can be generated using hydel power.
- Water may be used for obtaining common salt.
- Water ways are used for inland transport.
- Water provides habitat to aquatic flora and fauna.

Effects of over-utilization of water:

- Reduced surface water flow.
- Aridity.
- Desiccation due to over usage of water.
- Lowering water table.
- Subsidence.
- Water stress.
- Degradation of water quality.
- Intrusion of salt water to ground water.
- Increased power cost.

FLOODS

Causes

Natural causes

1. Heavy rainfall: When heavy snow gets melted or heavy rainfall occurs in the upstream flood occurs in low lying areas.
2. Windling course of river: Generally rivers have several turns and twists and due to the shallowing of river it overflows on the banks of the river causing floods.
3. Landslides: Due to heavy rainfall in mud mountains landslides occurs which cause mud floods.

Man made causes

1. Deforestation: Due to lack of trees the rain water cannot seeped down to the earth, instead it flows with high speed along with surface soil.
2. Urbanization: In urban areas concrete roads and pavements do not allow water to seep to ground. The water gets flooded through drainage pathways.
3. Agricultural Practices: In certain time period the land is left as vacant and during that time if heavy rain occurs flood results.
4. Dams: Due to heavy rain fall when dams get shallower, all the gates were opened and flash flood occurs.
5. Mining: One of the development activity is mining due to which flood occurs. After mining the space is left without any vegetation making it to flood prone areas.

Effects:

- Loss of life (human and animal).

- Loss of property.
- Loss of Communication.
- Lack of transport.
- Lack of food facility.
- Resettlement issues.

Preventive measures

- Channelization for water flow.
- Construction of flood pathways.
- Concrete for flood pathways.
- Embankments and check dams.
- Afforestation.
- Construct flood proof buildings.
- Life insurances for people residing in flood prone area.
- Not allowing constructing dams or mining activity in flood region.
- Frequent alters regarding floods through media for people residing in flood region.
- Medical kits for people in flood region.

DROUGHT

Causes:

- Deforestation.
- Un seasonal rainfall.
- Un even rainfall.
- Overgrazing.
- Abuse of water.
- Improper utilization of rainwater.
- El-Nino years.

Preventive measures:

Adopting drip irrigation and sprinkling irrigation instead of flooding irrigation.

Abuse of water should be restricted.

Dry land farming

Increasing drought resistant variety of seeds

Planting sand binders

Afforestation

WATER CONFLICTS

Cauvery water dispute

The Cauvery water dispute has been a serious issue since 1974 when a 50 year old agreement, signed in 1924 between Madras Presidency (Tamil Nadu) and Mysore state (Karnataka), expired compounding a century old dispute. According to Karnataka, the 1924 agreement entailed a discontinuation of the water supply to Tamil Nadu after 50 years. In 1991, the Supreme Court reassigned a tribunal to settle the dispute. The tribunal gave the decision that Karnataka must release 205 TMCF of water from the Cauvery reservoirs to Tamil Nadu on a monthly basis. Karnataka declined to implement the order arguing that if more than 100 TMCF of water is released to Tamil Nadu, it would cause distress to its people.

The Sutlej-Yamuna Link (SYL) canal dispute

The issue of sharing Sutlej-Yamuna link between Punjab and Haryana was being discussed in Supreme Court. The tribunal 1985 based on allocation of water on the basis of time inflow of about 17.17 MAF was available. After 17 years Punjab argued that they have 14.34 MAF of water. In 2002 Punjab was directed by Supreme Court to complete the commission but till now the dispute was not solved.

Indus water treaty

The dispute started with the partition in 1947 when the Indus water basin was divided between India and Pakistan. Indus, Jhelum and Chenab was allocated to Pakistan and Sutlej, Ravi, Beas to India. Pakistan disputed India's share of irrigation water from the Indus river. The dispute ended in 1960 when the Indus water agreement was signed by the two countries after 12 years of World Bank led negotiations.

Water conflict in Middle East

The river Jordan is shared between Jordan, Syria and Iraq, the dispute raised due to improper distribution of water. Turkey is planning to built 22 dams on the river Tigris-Euphrates

for hydroelectric power generation. This will affect Syria and Iraq lying down stream. Ethiopia controls the head waters of river Nile about 80% and Sudan too trying to divert water. This led Egypt with a thin strip of river Nile.

Dams

Advantages:

- Generation of electricity
- Improved irrigation
- Drinking water supply
- Employment benefits
- Reduction in famines
- Reduction in floods
- Tourist spot
- Promotion in navigation
- Increase food productivity in lower areas

Disadvantages:

- Loss of forests, flora and fauna
- Displacement of tribal people
- Sedimentation and siltation of reservoirs
- Water logging and stagnation of water
- Growth of aquatic weeds
- Breeding of vectors and spread of vector-borne diseases like malaria and filaria
- Flash floods
- Loss of non-forest land
- Effect to migratory birds
- Changes in fisheries
- Reservoir induced seismicity (RIS) causing earthquakes

Case study

Hydel power in Western Ghats

The first hydroelectric power dams were built in the late 1800s and early 1900s by the Tatas in the Western Ghats of Maharashtra. Jamshedjee Tata wished to have a clean source of energy to run cotton and textile mills in Bombay as he found people were getting respiratory infections due to coal-driven mills. He therefore asked the British Government to permit him to develop dams in the Western Ghats to generate electricity. The four dams are the Andhra, Shirowata, Valvan and Mulshi hydel dams. The electricity which is generated is used for Mumbai and it giant industrial belt.

MINERAL RESOURCES

Uses:

- Generation of energy with the coal, lignite, uranium
- Construction , housing and settlements
- Development of industrial plants and machinery
- Defence equipments-weapons, armaments.
- Transportation means
- Communication-telephone wires, cables, electronic devices
- Medicine purpose
- Formation of alloys for various purposes
- Agriculture as fertilizers, seed dressings and fungicides
- Jewellery

Minerals	Uses
Metallic elements	
Aluminum	Structural material, packaging, transportation, utensils
Chromium	Chrome plate, steel alloys, textile and tanning industry
Gold	Jewellery, density, alloys, medicines, aerospace
Iron	Primary component of steel
Manganese	Alloys steels, disinfectants
Copper	Pipes, cooking vessels, brass bronze, electric wiring material in gold jewellery, silver ware
Silver	Titing of glass, nuclear bombs, electricity, Photography
Lead	Pipes, battery electrodes, pigments, paints, leaded gasoline
Platinum	Automobiles, catalytic converters, electronics, medical use and jewellery
Non-Metallic elements	
Phosphorus	Medicines, fertilizers, detergents
Sulphur	Insecticides, rubber tyres, medicines
Silicon	Semiconductor material, construction, paving
Gypsum	Plaster wall board, in agriculture
Potash	fertilizer

Various environmental effects due to mining

- **Devegetation and defacing**: Large scale deforestation occurs to extract minerals. This will affect the landscape and also the top soil which is fertile in nature. The huge quantities of debris were left after mining which leads to big scars and change in topography.
- **Subsidence of land**: Under ground mining leads to land subsidence results in tilting of buildings, cracks in houses, buckling of roads, bending of rail tracks.

- **Ground water contamination**: Mining effects groundwater. Sulphur seeps to the ground water and with microbial action it converts into sulphuric acid, making water acidic. Similarly other metal ores percolate and cause severe health hazard.
- **Surface water contamination**: Due to the surface water runoff from mine areas the surface water gets contaminated. Sometimes radioactive substances like uranium also contaminate the water bodies which lead to serious health hazards.
- **Air Pollution**: During the extraction of minerals and purification process large quantities of air pollutants were released in to the air damaging the vegetation. The Particulate matter (PM), Suspended particulate matter (SPM), Respirable suspended particulate matter (RSPM) were spelled into the air causes several lung diseases.
- **Occupational hazards**: Several respiratory and skin diseases occur due to constant exposure to SPM leads to black lung disease, silicosis, and asbestosis.

Impacts of mining in different areas of India

- **Jaduguda uranium mine, Jharkand:** Local people were exposed to radioactive substances leading to health hazard.
- **Jharia coal mines, Jharkhand**: Underground fire accidents leading to land subsidence and forced displacement of people.
- **Sukinda chromite mines, Orissa**: Hexavalent chromium into river causing contamination leads to severe health problems.
- **Kudremukh Iron ore mine, Karnataka**: Threat to biodiversity and river contamination.
- **East coast bauxite mine, Orissa**: Rehabilitation issues which was unsettled.
- **North eastern coal fields, Assam**: Sulphur contamination of ground water.

Case study

Sariska Tiger Reserve

The forest department has leased land for mining in the Sariska Tiger Reserve area. The local people have fought against the mining and filed a Public Interest Litigation (PIL) in the Supreme Court in 1991 along with an NGO TBS (Tarun Bharat Sangh). The decision came on 31st December 1991 that all mine works should shut immediately. Nearly 400 mines were closed.

FOOD RESOURCES

World food problems:

- Population growth: Food resources are diminishing with the increase in population. Both population and food supply have increased, but food production has varied greatly, and on an average there has been no gain in the amount of food available per person.
- Lack of rainfall: Sometimes, crop failure takes place due to failure of monsoons and other vagaries of weather and climate. Hence the agricultural land fails to produce the desired amount of crops.
- Insufficient production: Today many countries are facing acute problems of food shortage and starvation.
- Lack of irrigation facility: Scarcity of water in some areas and improper irrigation techniques impede production of food grains.
- Over dependence of developing countries: Some of the developing nations import food grains form various developed countries. If any natural calamities occur in developed nations than starvation occur in developing nations.
- Geographical conditions: In many countries geographical conditions do not favour agricultural yield.
- Natural hazard: Calamities such as floods, drought, earthquakes, storms, etc damage agriculture on a large scale.
- Inadequate distribution system. Today there is enough food production in the world to feed all the people. Starvation and malnutrition occur because the available food is not equally distributed. Lack of transportation, high cost of grains, insufficient distribution system, human greed etc are important factors affecting the distribution system.
- Poor quality of soil: Infertile soil is not productive and hence causes a decline in food production.

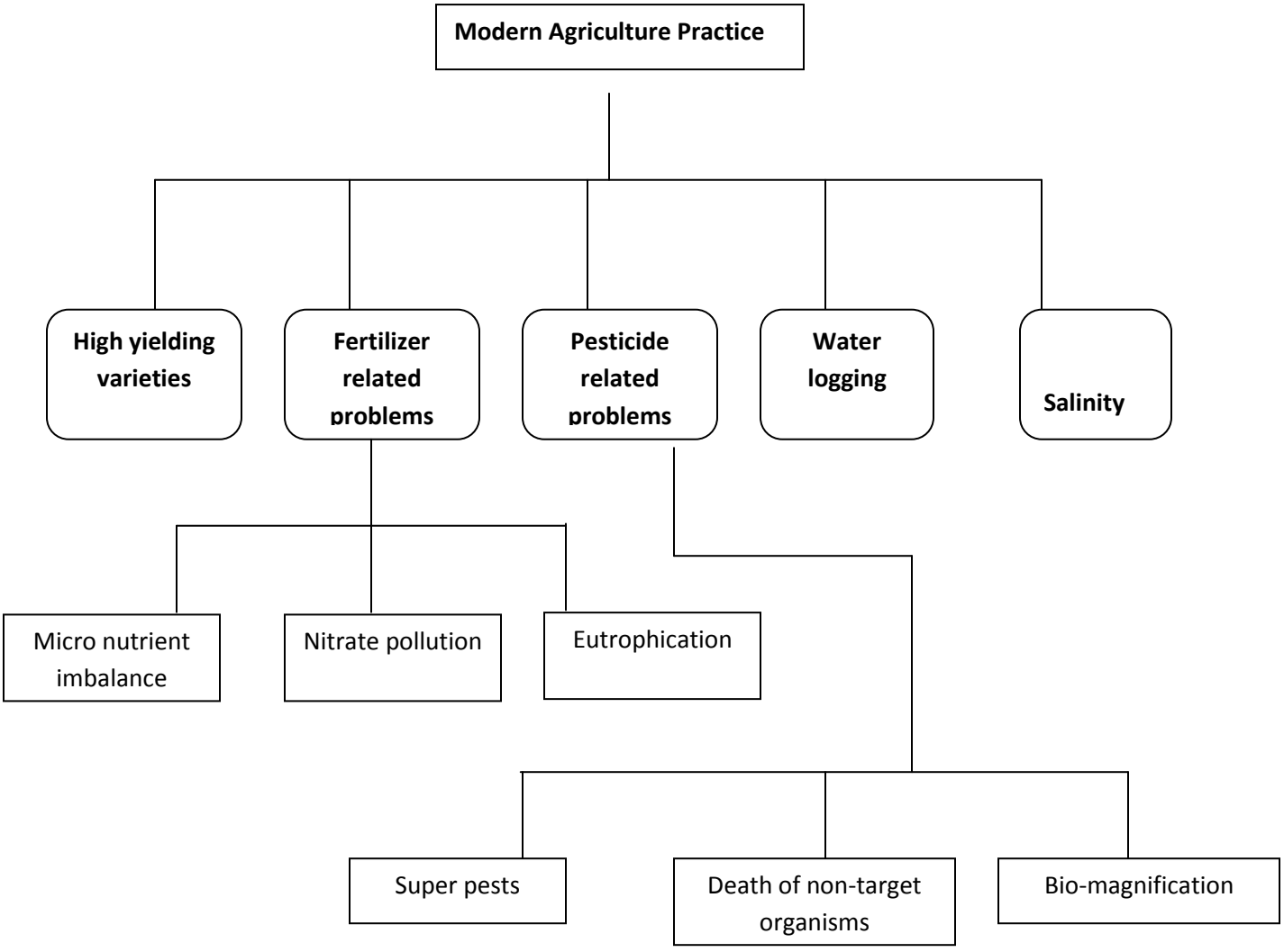
Impacts of Overgrazing:

Land degradation: Overgrazing removes the vegetal cover over the soil and the exposed soil gets compacted due to which the operative soil depth declines. So the roots cannot go much deep into the soil and adequate soil moisture is not available. The humus content of the soil decreases and overgrazing leads to organically poor, dry, compacted soil. Due to trampling by cattle the soil loses infiltration capacity, which reduces percolation of water into the soil and as a result of this more water get lost as surface runoff.

Soil erosion: Due to overgrazing the vegetative cover is removed and the soil becomes exposed and gets eroded by the action of strong wind and rainfall.

Loss of useful species: Overgrazing adversely affects the composition of plant population and their regeneration capacity. Due to overgrazing the good quality pasture land gets converted into poor quality thorny vegetation.

IMPACT OF MODER AGRICULTURAL PRACTICES



High yielding varieties:

It encourages monoculture, where one crop is grown in a vast area. In some cases when some pathogen attacks, there will be complete devastation of the crop.

Fertilizer related problems:

a) **Micronutrient imbalance**: Some essential macronutrients such as Nitrogen, phosphorus and potassium (NPK) when used excessively by the farmers to grow crop, it leads to micronutrient imbalance such as zinc.
b) **Nitrate pollution**: Nitrogenous fertilizers seep down and contaminate the ground water. When the concentration of nitrate exceeds 25mg/lit, then it causes Blue baby syndrome or methaemoglobinemia in infants and jaundice in adults.
c) **Eutrophication**: A large proportion of nitrogen and phosphorus used in crop fields is washed off and mixed with lakes and ponds leads to the addition of excessive nutrients called eutrophication. Due to eutrophication the lakes get invaded by algal blooms and they use nutrients rapidly. As the algal have short life span, they complete and die adding dead organic matter. The bacteria will act on these algal blooms and start decomposing completing all the oxygen present in water. This creates pathogenic anaerobic conditions in the lake or pond which makes it unfit for use.

Pesticide related problems

a) **Super pests**: Some pests survive even after pesticide spray. The survivors give rise to highly resistant generations. The pests which become immune to all types of pesticides are known as super pests.
b) **Death on non-target organisms**: Several insecticides not only kill target species but also several non-target species which are useful to crops like earthworms and snakes.
c) **Biological magnification**: The increase in toxicity of pesticide through food chain and accumulates high at top trophic level of food chain is called biological magnification.

Water logging:

Inadequate drainage causes excess water to accumulate underground and gradually forms a continuous column with the ground water table. Under water logged conditions, pore spaces in the soil get fully occupied with water and the soil air gets depleted and roots of the crop does not get adequate air for respiration. To prevent water logging drainage technology can be used to remove excess water.

Salinity:

Excessive application of fertilizer starts accumulating soluble salts like sodium chloride, sodium sulphate, calcium chloride, magnesium chloride in the soil which results into stunted plant growth and lowers crop yield. To prevent salinity flushing of salts with the excessive water supply and implying underground network of perforated drainage pipes for removing salts slowly.

Case study

Israel's drip-irrigated farming

The small and arid state of Israel began using drip irrigation systems, as it is short of water. With this technique, Israel farmers have been able to improve the efficiency of irrigation by 95%. Over a 20 year period Israel's food production has doubled without an increase in the use of water for agriculture. Today, Israel is one of the major suppliers of fruits and vegetables in the world.

ENERGY RESOURCES

Growing energy needs:

The economic growth and development of a nation constantly needs more energy to be generated and consumed, irrespective of the increase in energy efficiency due to technological development. The world energy consumption increased four-fold in the 40 years from 1950 to till date. The form of energy consumed also changes with the passage of time, geographic location and technological development. Oil is the most widely consumed energy source in the world, then coal, natural gas, nuclear energy and hydro/renewable energy. In case of India the predominant commercial energy source was coal, then oil, natural gas, hydro-energy and nuclear energy. The energy resources need to be preserved for our future generations keeping in mind the increasing population load, economic development and consumption demand. It is necessary to harness other forms of energy like solar, wind, nuclear to enhance our energy efficiency with technological development and restrict overuse of energy.

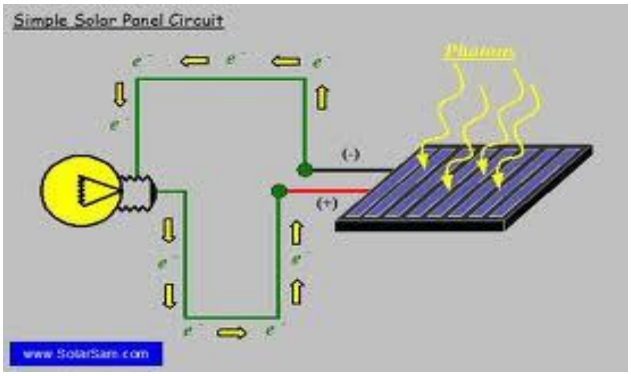
Renewable energy sources:

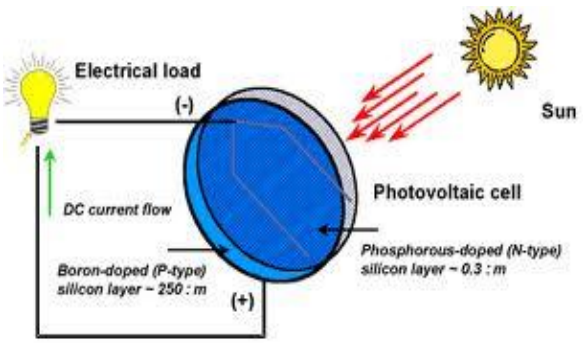
The resources which can be generated continuously in nature and are inexhaustible. Example solar, wind, hydro, ocean thermal energy conversion, biomass, bio-fuels, biogas etc.

SOLAR ENERGY

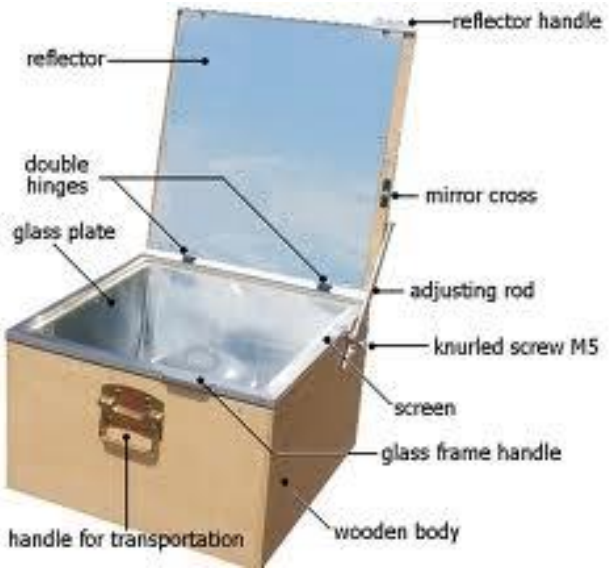
Traditionally solar energy was used for drying clothes, food grains, preservation of eatables and for obtaining salt, observing time etc. Some of important energy harvesting devices from sun is discussed here.

1. Solar heat collectors: These are passive and active heat collectors. Passive collectors absorb hear during the day time and release it slowly at night example glass, stones, bricks. Active collectors absorb and emit immediately example air and water.
2. Solar cells: They were also called as photovoltaic cells or PV cells. These cells are made up of thin wafers of semi conductor materials like silicon and gallium. When solar rays fall on them, a potential difference is produced which cause the flow of electrons and produce electricity. To increase the efficiency of PV cells gallium arsenide and cadmium sulphide are used. One PV cell of 4 cm^2 produce 0.4-0.5 volts and produces 60 milli amperes. A group of solar cells are used to produce electricity to run street-light, irrigation water pump etc. Similarly solar cells are used in calculators, electronic watches, traffic signals, television, radio etc.





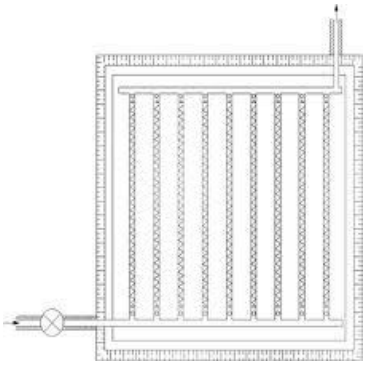
3. Solar cooker: The solar cookers make use of solar heat by reflecting the solar radiations using a mirror directly on to a glass sheet which covers the black insulated box within which the raw food is kept.



The food cooked in solar cookers is more nutritious due to slow heating. As it has limitation that:

- It cannot be used at night or on cloudy days.
- The cooker has to be adjusted according to the direction of the sun rays.

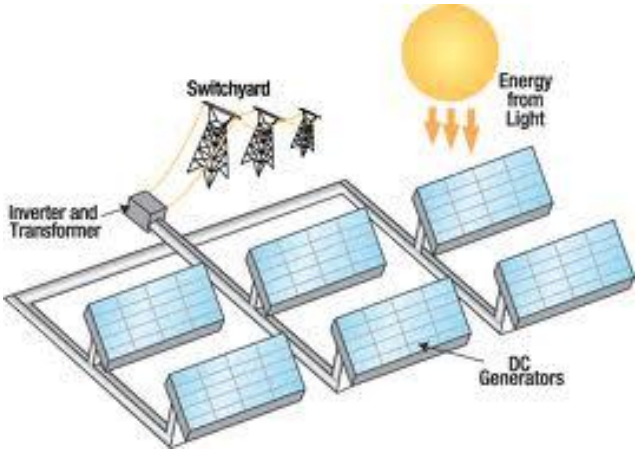
4. Solar water heater:



It consists of insulated box painted black from inside and having a glass lid to receive and store solar heat. Inside the box black painted copper coil is present through which cold water is made to flow in which gets heated and flows out into a storage tank. Many houses of Israel are using water heater and in South Africa, Mali where hospital runs on solar energy.

5. Solar furnace: Here thousands of small plane mirrors are arranged in concave reflectors all of which collect the solar heat and produce as high a temperature as $3000^{o}C$.

6. Solar power plant: Solar energy is harnessed on a large scale by using concave reflectors which cause boiling of water to produce steam. The steam turbine drives a generation to produce electricity.

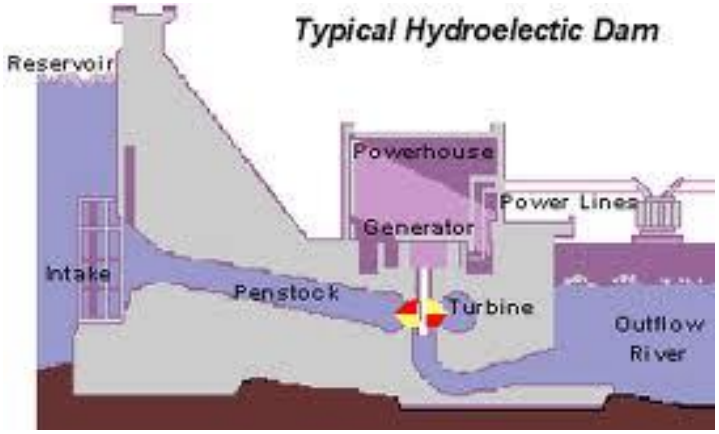


WIND ENERGY

The wind energy is harnessed by making use of wind mills. The high speed winds have a lot of energy in them as kinetic energy due to their motion and the force of the winds is the sun. The blades of the wind mill keep on rotating continuously due to the force of the striking wind which drives number of machines like water pumps, flour mill and electricity generation. A large number of wind mills are installed are called wind farms. These farm lands are located in coastal regions, open grasslands or hilly regions, in mountain passes and ridges where wind are strong and steady. The minimum wind speed required for generation of energy is 15km/hr.

India has several wind farms like Tamil nadu (6007MW), Gujarat (2884MW), Maharastra (2310MW), Karnataka (1730MW), and Andhra Pradesh (200MW). India has potential of generating 20,000 MW of energy but generating 16078 MW of energy.

HYDRO POWER

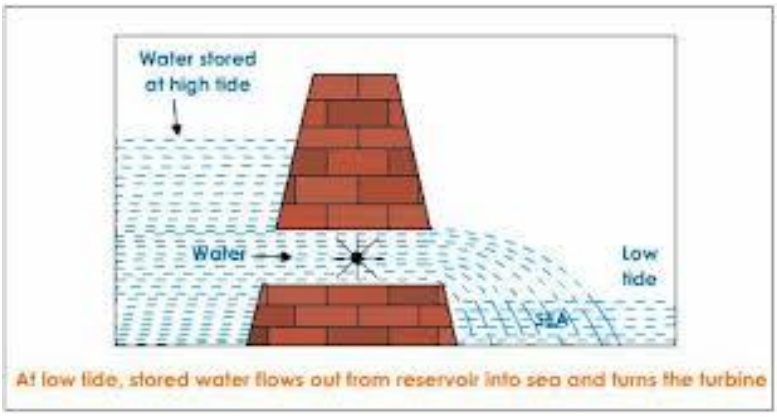


The river water is collected by constructing a big dam where water is stored and allowed to fall from a height. The blades of the turbine located at the bottom of the dam move with the fast moving water which in turn rotates the generator and produces electricity. The minimum height of the water falls should be 10m for constructing mini or major dams. The total installed capacity of India is 36878 MW of energy. At present 15 states of India is harnessing hydro energy. Hydro power does not cause any pollution.

TIDAL ENERGY

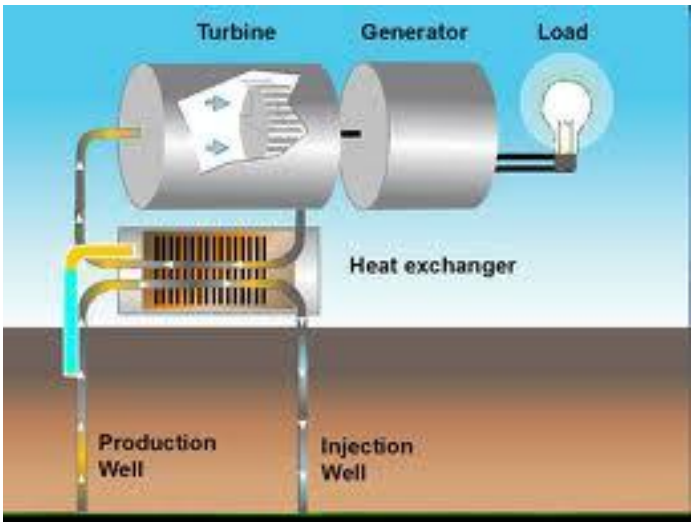
Tidal energy is produced due to the gravitational pull of sun and moon. The high tide and low tide refers to the rise and fall of water in the ocean. During high tide the sea water flows into

the reservoir of the barrage and turns the turbine which produces electricity. In case of low tide when sea level is low, the sea water stored in the barrage reservoir flows out into the sea and again turns the turbine and generates the electricity.



A difference of several meters is required between the height of high and low tide to spin the turbines. The Bay of Fundy, Canada having 17-18 m high tides has a potential of 5,000MW of power generation. Similarly La Rance (France), Shiwa (South Korea), Race rocks (North America). In India proposed sites are Gulf of Cambay, Gulf of Kutch and the Sunderbans deltas.

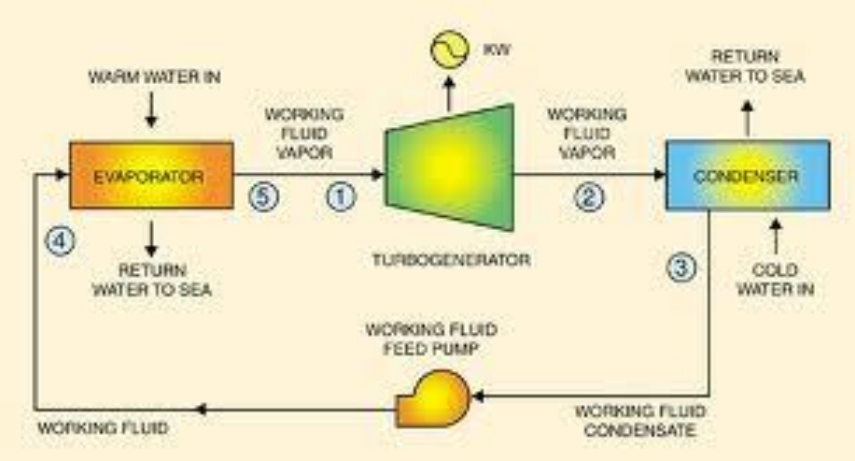
GEOTHERMAL ENERGY



The energy is harnessed from the hot rocks present inside the earth is called geothermal energy. Due to the fission of radioactive material present in rocks and when they come in contact with steam high temperature and pressure exists which naturally comes out of the ground naturally called as natural geysers, Some times the steam or boiling water underneath the earth does not find any place to come out, then artificially holes are drilled up to the hot rocks and

putting a pipe in it hot water or steam is taken out and send to the turbine of a generator to produce electricity. Many plants in USA, NZ were sited along with some places in India as Manikaran, Kullu and Sohana

OCEAN THERMAL ENERGY CONVERSION [OTEC]



The energy available due to the difference in temperature of water at the surface of the tropical oceans and at deeper levels is called Ocean thermal energy. A difference of 20-25^{o}C is required for operating OTEC. The warm surface water of ocean is used to boil a liquid like ammonia and turned into vapours and these vapours are sent to the turbine and through generator to generate the electricity. The vapours are condensed by using cold sea water and send back to the pump. Thus the process keeps on going continuously for 24 hours 365 days.

BIO MASS ENERGY

The energy which is produced by the organic matter of plants and animals is biomass energy. It is classified into the following types:

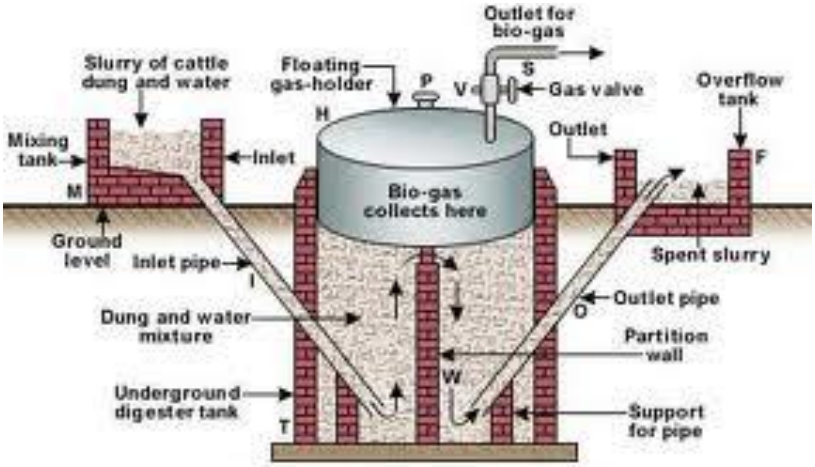
a) Energy plantations: The plants/trees which give energy by burning directly or converted into burnable gas or may be converted to fuels by fermentation are called energy plantations example: cottonwood, poplar, non-woody herbaceous grasses.
b) Petro-crops: Certain latex containing plants are rich in hydrocarbons and can yield oil under high temperature and pressure. This oily material can be burnt as biodiesel or may be refined as gasoline. *Jatropa carcus* of Euphorbia family is used as biodiesel.

c) Agricultural waste: Crop residue, bagasse, coconut shells etc are some agricultural wastes which produce energy by burning. In Brazil 40% of electricity is obtained from burning bagasse. Similarly in rural India animal dung cakes, wood are used for cooking.

BIOGAS

Biogas is produced by anaerobic degradation of animal wastes/plant waste in presence of water. Anaerobic degradation means breakdown of organic matter by bacteria in the absence of oxygen releases hydrogen, hydrogen sulphide, methane, carbondioxide. It is a non-polluting, clean and low cost fuel which is useful for rural areas where a lot of animal waste. Biogas plants used in our country are basically of two types:

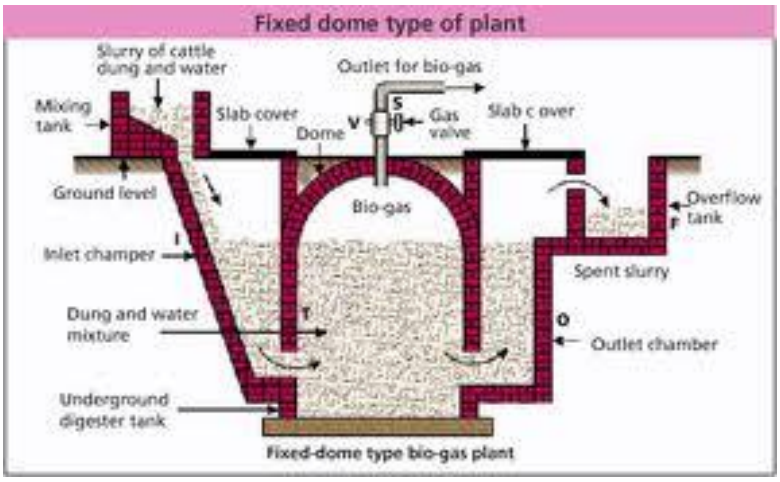
Floating gas holder type biogas plant:



Floating gas-holder type bio-gas plant.

It is a well-shaped digester tank which is placed under the ground and made up of bricks. The digester tank is covered with an inverted steel drum floats to hold the bio-gas produced. The gas holder can move which is controlled by a pipe and the gas outlet is regulated by a valve. The digester tank has a partition wall and one side of it receives the dung water mixture through inlet pipe while the other side discharges the spent slurry through outlet pipe. Sometimes corrosion of steel gas-holder leads to leakage of biogas, so it is required to paint as maintenance which increases cost.

Fixed dome type biogas plant:



The structure is almost similar to that of the previous type. However, instead of a steel gas-holder there is dome shaped roof made of cement and bricks. Instead of partitioning here there is a single unit in the main digester but it has inlet and outlet chamber.

BIOFUELS:

Biomass can be fermented to alcohols like ethanol and methanol which can be used as fuels.

a) Ethanol: It can be easily produced from carbohydrate rich substances like sugarcane, corn and sorghum. It is used as a fuel to run automobiles.
b) Gasohol: It is a mixture of gasoline and ethanol which is used in running cars and buses in Brazil and Zimbabwe. In India in Kanpur gasohol was used on a trial basis.
c) Methanol: It is very useful since it burns at a lower temperature than gasoline or diesel. Thus the bulky radiator may be substituted by sleek designs in our cars. Methanol too is a clean, non-polluting fuel.

HYDROGEN AS A FUEL

As hydrogen burns in air, it combines with oxygen to form water and a large amount of energy is released. Due to its highest calorific value hydrogen can serve as a excellent fuel. Hydrogen gas can be produced by thermal dissociation of water at 3000^{o}K, electrolytic method of dissociation of water, photolysis of water. It is clean and non pollution fuel but the disadvantage, it is highly corrosive, inflammable and explosive in nature. Also it is difficult to store and transport.

Non-renewable energy sources

Those resources which take time to form under the earth and if exhausted it is difficult to replenish. These are coal, petrol, natural gas and nuclear energy.

Coal: It is formed due to the buried plant materials along the banks of rivers and swamps and at high pressure and heat gradually got converted into peat and coal over millions of years of time. It is classified as peat, lignite, bituminous, anthracite. Coal deposits are present in Jharkhand, Odisha, West Bengal, Madhya Pradesh, Andhra Pradesh etc. Generally coal is used for generation of electricity and cooking in rural areas.

S.No	Type of coal	Moisture content (%)	Volatile matter (%)	Carbon content (%)	Heat value(KJ/Kg)
1	Peat	50	40	1	-
2	Lignite	30-40	40-50	40-60	6.980
3	Bituminous	15-20	20-30	70-80	34,050
4	Anthracite	Nil	2-8	86-98	36,900

Petrol: Crude oil is formed due to the decomposition of organic matter at high temperature and pressure in the absence of oxygen. Crude petroleum is a complex mixture of alkane hydrocarbons. Hence it has to be purified and refined by the process of fractional distillation during which different constituents separate out at different temperatures like petroleum gas, kerosene, petrol, diesel, fuel oil, lubricating oil, paraffin wax, asphalt etc. Petroleum products are used in transportation and electricity generation.

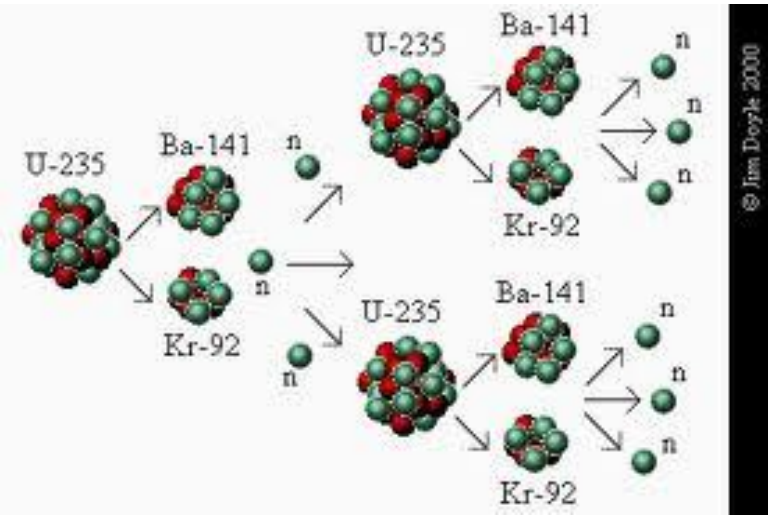
Liquefied ‘petroleum Gas: The main component of petroleum is butane, and the others are propane and ethane. LPG is used in domestic gas. The oil reserves from India are Digboi, Gujarat plains, Bombay High etc.

Natural Gas: The main component is methane (95%) with small amounts of propane and ethane. It is mainly used for transportation, industrial activities, electricity generation.

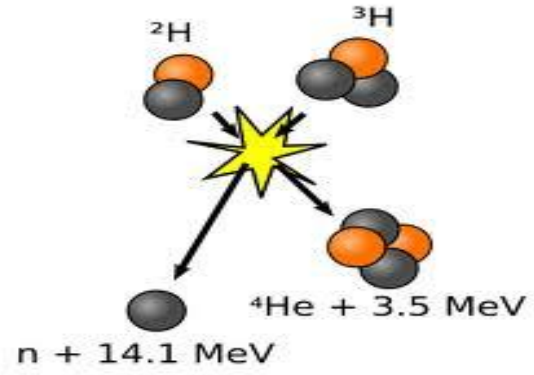
Compressed Natural Gas (CNG) used as an alternative to petrol and diesel for transport of vehicles. Example: Delhi.

Nuclear Energy: This energy is used to generate electricity. It is classified as Nuclear fission and Nuclear fusion.

Nuclear fission: Nucleus of certain isotopes with large mass numbers is split into lighter nuclei on bombardment of neutrons and a large amount of energy is released through a chain reaction.



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



Case Study

Solar powered Hospital

The world's first solar-powered hospital is in Mali in Africa. Being situated at the edged of Sahara desert, Mali receives a large amount of sunlight. Panels of solar cells supply the power needed to run vital equipment and keep medical supplies cool in refrigerator.

LAND RESOURCES

Land as a resource:

Land use involves the management and modifications of natural environment or wilderness into built environment such as fields, pastures, and settlements. It is also used for construction, developmental activities, industries, domestic use, recreations etc.

Due to increase in population and increase in land use pattern leads to land degradation. Hence more and more pressure on the limited land resources which are getting degraded due to over-exploitation. Soil degradation is a real cause because soil formation is an extremely slow process.

Soil Erosion:

Soil erosion is of two types Normal erosion and Accelerated erosion.

Normal erosion: It takes by the gradual removal of top soil by natural processes.

Accelerated erosion: It is mainly caused by man-made activities like overgrazing, deforestation, mining etc.

The agents which cause soil erosion are water and wind.

Water induced soil erosion:

Sheet erosion: Uniform removal of top layer of soil in the form of sheets.

Rill erosion: Finger like grooves are formed during erosion.

Gully erosion: The soil gets eroded forming deeper cavities which may be U or V shaped.

Slip erosion: Erosion takes place in hilly region.

Stream bank erosion: Deeper cavities occur due to river turns and twists.

Wind induced soil erosion:

Saltation: The drifting of soil particles vertically, and the size of the soil particle is 1-1.5mm diameter.

Suspension: The soil particles of less than 1mm diameter are kicked to longer distances.

Surface creep: The particles of 5-10mm diameter are creeped along with the wind.

Conservation methods of soil:

1. **Conservation till farming (no-till farming):** Here special tillers are used to breakup and loosen the subsurface soil. The tilling machines make slits in the unploughed soil and inject seeds, fertilizers, herbicides and little water in the slit, so that seed germinates without competition of weeds.
2. **Contour farming**: On gentle slopes, crops are grown in rows across, rather than up and down and each row planted horizontally along the slope of the land.
3. **Terracing**: For steeper slopes are converted into a series of broad terraces which run across the contour. This technique is also called as step farming.
4. **Strip cropping**: Here strips of crops are alternated with strips of soil saving cover crops like grasses or grass-legume mixture.
5. **Alley cropping**: The crops are planted between the rows of trees or shrubs. This is also called agro forestry.
6. **Wind breaks or shelterbelts**: The trees are planted in long rows along the cultivated land boundary so that wind is blocked.

Case study

Selenium: Punjab

In 1981-82 farmers from Hoshirapur and Nawanshehar Districts approached the scientists in the Punjab Agricultural University, Ludhiana, as their wheat crops had turned white. Soil analysis indicated selenium levels in the area were above toxic limits. Se is a naturally occurring trace element, essential for animal and human health, but the gap between the requirement and excess is narrow. Soils containing 0.5µg of Se per kg or more are injurious to health. In some areas of Punjab, Se levels rang from 0.55 µg/kg to 4.55 µg/kg.