

Module 1: Natural Resources Renewable and Non-renewable resources

1.1. Introduction

Simply stated, a resource is any useful information, material or service. A resource is anything obtained from nature to meet our needs and wants. Natural resources are the components of the environment, (i.e. atmosphere, hydrosphere and lithosphere), which can be drawn upon for supporting life. In other words, natural resources are goods and services supplied by our environment (including sinks for wastes). These include energy, mineral, land (soil) food, forest, water, atmosphere (air), plants and animals. Human resources refers to human wisdom, experience, skill, labour and enterprise

1.2. Definition

Natural resources are the materials, which living organisms can take from nature for sustenance of their life or any component of the natural environment which can be utilized by man for his living is called natural resource. These include energy, mineral, land (soil) food, forest, water, atmosphere (air), plants and animals. Human resources refers to human wisdom, experience, skill, labor and enterprise

1.3. Classification of natural resources

Depending upon the availability and abundance, natural resources are of two types:

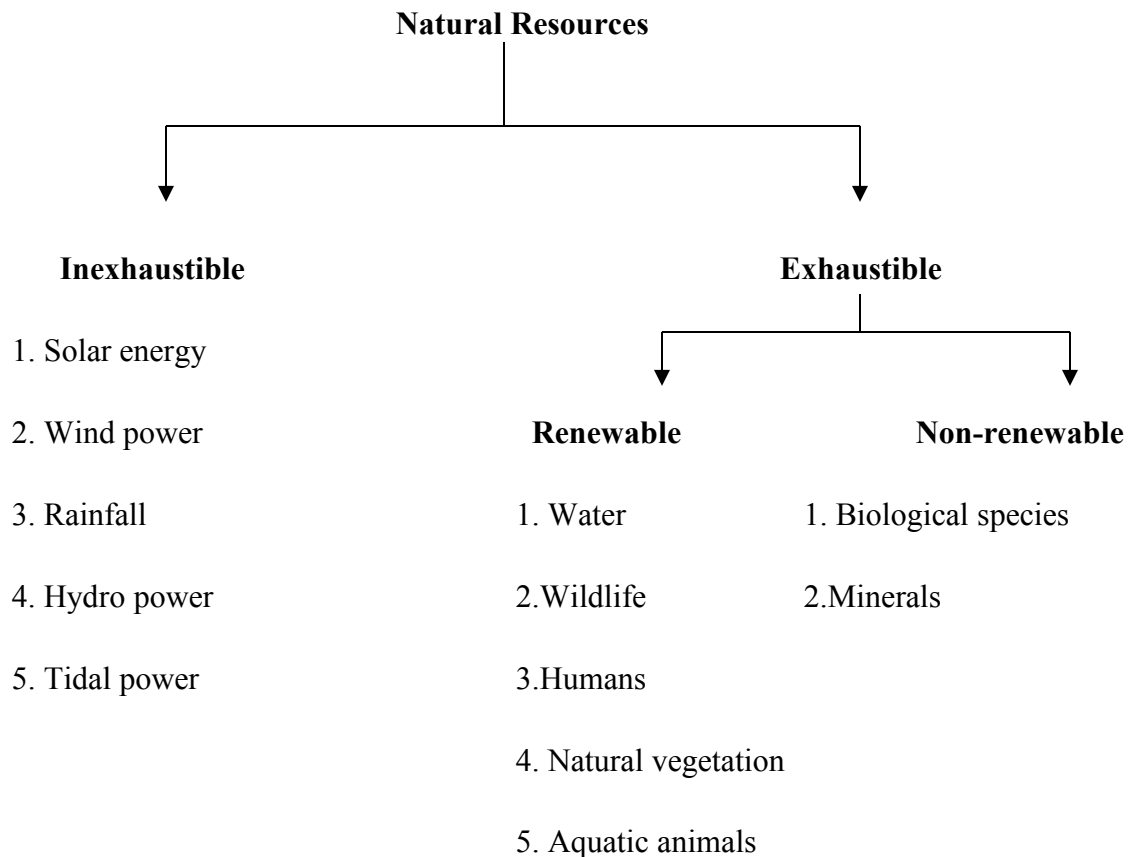
A) Inexhaustible Resources: The resources which are present in unlimited quantity is called inexhaustible resources and they are not likely to be exhausted by the human activities and thus would last for fairly long period. These include Air, water and sunlight.

B) Exhaustible Resources: These occur in limited amount in nature and therefore, likely to be exhausted if used continuously. These include minerals, fossil fuels, forests and wildlife.

Renewable resources (inexhaustible Resources): These have the inherent ability to reappear or replenish themselves by recycling, reproduction or replacement. These include sunlight, plants, animals, soil, water and living organisms. Biological organisms are self renewing.

Non renewable resources (Exhaustible resources): The non-renewable resources are the earth's geologic endowments, i.e., minerals, fossil fuels, non mineral resources and other material which are present in fixed amounts in the environment.

There is also one more category, i.e., "**Intangible resources**" (or abstract resources), such as open space, information diversity, satisfaction, serenity and beauty, which can be both exhaustible and inexhaustible. There is no upper limit to the amount of knowledge, information, or , beauty these can be destroyed easily a single and small piece of trash can destroy the beauty or any place. Two most powerful and largest industries of the world – tourism and information management are based on the intangible resources.



The major natural resources are:

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



A) Forest Resources

Forests are important renewable resources. A forest is a biotic community, predominantly of trees, shrubs or any other woody vegetation usually with a closed canopy. Forest contributes substantially to the economic development of a country. They are the vast natural resources for man that has been providing a broad array of commodities, amenities and environment services. Fuel wood, timber, wildlife, habitat, pasture for livestock, industrial forest products, animal products, recreation, soil moisture retention, climate regulation, production of atmospheric oxygen, a sources of new agricultural or grazing land and spiritual renewal.



As per the State of Forest Report the total forest cover of India is 637,239 sq km which is 19.23% of the total geographical area of the country. Among the 16 different forest types of the country. The most common is the tropical dry deciduous, moist deciduous and tropical thorn. These three types of tropical deciduous forests account for more than three-fourth (about 76.5%) of forest area in India. Nearly 96% of the forests are owned by the Government, 2.6% by corporate bodies and the rest are in private ownership.

Functions of forest resources:

1. **Productive functions:** Many products are extracted from forests, ranging from timber, wood fuel to food (berries, mushrooms, edible plants, and bush meat), fodder and other NWFPs. By quantity, industrial round wood and wood fuel is the most important products. Among NWFPs, food and fodder are the most significant. Forest dwellers and rural folk use these goods directly, while other people get them indirectly from the market. The productive function of forest resources indicates the economic and social utility of forest resources to national economies and forest-dependent local communities.

2. **Protective functions:** Early assessments of forest resources were focused on the productive functions of forests, particularly wood supply, as this was the main issue identified by policy-makers. In response to increased awareness in many countries of the important role of forests in providing environmental services including protection – and consistent with the overall concept of sustainable forest management – FRA 2005 also evaluates trends in those forest resources with a protective function. These include conservation of soil and water, prevention

of drought and protection against wind, cold, radiation, noise, sights and smells etc. forests control the flow of water in streams and rivers. Forests also prevent the soil erosion.

3. Regulative functions: The regulative functions include absorption, Storage and release of gases (like CO & CO₂), water, minerals elements and radiant energy. Floods, droughts and global biogeochemical cycles are also regulated by forests.

Importance /Users of Forests

Forests are of immense value to the life and prosperity of human beings and of nations. The uses of forests includes-

Wood : Wood is the major forest produce. In developing countries, the heaviest demand on forest is for fuel wood for cooking and heating. About 58% of the total energy used in Africa and 42% in South-East Asia comes from fuel wood,



Timber : Industrial timber and round wood (unprocessed logs) obtained from forest are used to make lumber, plywood, veneer, boards, doors, windows, furniture, carts, ploughs, tool handles sports goods, etc. It is also a raw material for the manufacture of paper, rayon and film. Together, they account for slightly less than one-half of the worldwide wood consumption.

Minor forest products: Besides timber, the contribution of minor forest produce to economy is not negligible. Forests provide resins, rattan, fruits, nuts, herbs, medicinal plants, pharmaceuticals, oil, forage, commercial flowers, spices and syrups. Bamboos (also called the poor man's timber) are used in rafters, roofing, flooring, matting, basketry and cart wood. And also used as a raw material in paper and rayon industry. Canes are used for making

furniture, ropes, walking sticks, umbrella handles and sports goods, Oils obtained from a variety of used in the manufacture of cosmetics, soaps, pharmaceuticals, tobacco, confectionery and incense, Several types of tanning materials, dyes, gums and resins obtained from forest plants are utilized in many industries, Lac, honey, wax and silk are items of economic value obtained from forest insects . Forest plants also provide hundreds of drugs, spices, insecticides and poisons. Another forest products of economic value include – Tendu leaves for wrapping bidis (Indian Cigar) Ritha and Shikakai as soap substitutes, Rudarksha are important commercial forest products.

Vital role in the life and economy of Tribals : Forest play a vital role in the life and economy of forest dwellers and tribes living in forests. Forests provide food, medicine and many other commercial products that are necessary for forest based subsistence pattern.

Ecological significance of forests : Forest ecosystems provide a host of environmental services including maintaining biological diversity, providing wildlife habitat, cycling nutrients, producing oxygen, reducing atmospheric pollution by collecting the suspended particulate matter and by absorbing carbon dioxide and affecting regional rainfall patterns.

Forest prevent erosion of soil by wind and water and provide shade which prevents the soil from becoming too dry and friable (easily crumbled) during the summer . Further they improve the quality of soil by increasing its porosity and fertility by contributing humus to it.

Aesthetic and other values: Forest have a great aesthetic value. There is hardly any part of earth where people do not appreciate the beauty and tranquility of forests.

Deforestation

Deforestation is defined as the reckless felling of trees by human beings for their ulterior ends. Deforestation means destruction of forest. Deforestation of forests is a formidable threat to the quality of life, country's economy and future development. Forests are burned or cut down for various reasons, like clearing of land for agriculture, harvesting or timber, expansion of cities, and many more; but the aim behind all these reasons is economic gains, but we forget that these economic gains are short lived, while the long term demanding effects of deforestation are disastrous and irreversible..

Causes of deforestation

The main causes of deforestation are as follows:

- (i) **Shifting cultivation** (also called jhum cultivation) that is slash and burn agriculture practices by landless indigenous people or tribals who clear trees to grow subsistence crops is the principal cause of deforestation in the tropics.
- (ii) **Overgrazing.** Deforestation also occurs due to overgrazing and conversion of forest to pastures for domestic animals.
- (iii) **Fuel wood** gathering is also an important deforestation agents in dry forests
- (iv) **Commercial logging** is another deforestation agent. It may not be a primary cause of deforestation in the tropics (except in parts of West Africa) because the number of trees left after logging may be sufficient to classify the site as forested.
- (v) **Mining Operations.** Deforestation also occurs due to mining, quarrying and irrigation and industrial projects.
- (vi) **Expansion of agribusiness.** Agribusiness that grows oil palm, rubber, fruit trees and ornamental plants has also resulted in deforestation.
- (vii) **Explosion of human population.** Due to overpopulation of human beings, requirement of timer, fuel, paper, wood etc has been increased which leads to deforestation.
- (viii) **Construction of roads.** Construction of roads along the mountains which cover nearly 30,000 km in ecologically fragile area is another cause of deforestation.
- (ix) **Pests.** Many kinds of insects and pests destroy trees by eating up leaves, boring into shoots and spreading diseases.
- (x) **Weather.** extreme weather conditions such as frost, storms and heat also destroy forests
- (xi) **Dams and hydroelectric projects.** Dams and hydroelectric projects submerge forest, displace local people causes water logging and siltation and may result in earthquake.

Effect of Deforestation

Deforestation adversely and directly affects and damage the environment and humans both. Some of the ill effects of deforestation are

- (i) **Soil erosion:** In the absence of forests/trees especially on slopes, the soil gets washed away with rain water.
- (ii) **Expansion of deserts :** Denuded land mass gradually gets converted into sand deserts due to the action of strong winds laden by fragmented rock dust. This effects is more pronounced in rain scared areas.
- (iii) **Decrease in rain fall :** Forests bring rains due to high rate of transpiration and precipitation. In the absence of forests, rainfall declines considerably.
- (iv) **Loss of fertile land :** Less rainfall results into the loss of fertile land owing to less natural vegetation growth.
- (v) **Effect on climate :** The climate of a region is mainly controlled by the rainfall , snowfall, etc. Deforestation cause decrease in rainfall which in turn increases the climate temperature.
- (vi) **Lowering of water table :** Decrease in rainfall results into a lowered water table due to lack of recharging of underground reservoirs.
- (vii) **Economic losses :** Deforestation will cause loss of industrial timber and non timber products, and loss of long term productivity on the site.
- (viii) **Loss of flora and fauna :** Certain species of flora and fauna are getting extinct from the face of planet, mainly due to deforestation.
- (ix) **Loss of biodiversity:** Loss of flora and fauna has resulted into loss of biodiversity, leading to disturbance in ecological balance worldwide.
- (x) **Loss of medicinal plants:** There are many species of plants which have medicinal and other advantages, like Neem (Indian Margosa) which has been used in India for centuries as insecticide, fungicide in medicine and in bio fertilizers. As Deforestation may lead to the extinction of such types of valuable plants.
- (xi) **Environmental changes:** The air we breathe is purified by forests. So deforestation will lead to increase in carbon dioxide and other air pollutants

concentration. This will lead to global warming which is a serious effect as well as threat.

- (xii) Agriculture may be negatively impacted if deforestation causes soil loss or compaction, or sedimentation of irrigation systems.
- (xiii) Indigenous people may be forced into a new way of life for which they are unprepared.
- (xiv) Human life and downstream structures may be endangered by floods that may be intensified by clearing forests on separated by great distances.

Case Studies

1. Deforestation in Colombia. Colombia loses 2,000 km² of forest annually to deforestation, according to the United Nations in 2003, although some suggest that this figure is as high as 3,000 km² due to illegal logging in the region. Deforestation results mainly from logging for timber, small-scale agricultural ranching, mining, development of energy resources such as hydro-electricity, infrastructure, cocaine production, and farming. Around one-third of the country's original forest has been removed as a result of deforestation. Deforestation in Colombia is mainly targeted at primary rainforest which covers more than 80% of the country. This has a profound ecological impact in that the country is extremely rich in biodiversity with 10% of the world's species, making it the second most biologically diverse country on Earth.

2. Desertification in hilly regions of the Himalayas: Degradation of one fertile land into desert like land is called desertification. A large cutting of trees and plantation of trees like *Pinus roxburghii* and *Eucalyptus* have disturbed the ecosystem by changing the physical and biological properties of the soil. It also causes damage to the areas like West Khasi Hill district of Meghalaya in north east Himalaya, Ladakh and part of Garhwal and Kumaon.

Effects of Timber Extraction

There has been unlimited exploitation of timber for commercial use. The major effects of timber extraction on forests and tribal people include:

- Poor logging results in degraded forests.
- Soil erosion, especially on slopes.
- Sedimentation of irrigation systems.
- Floods may be intensified by cutting of trees on upstream watersheds.
- Loss of biodiversity.
- Climate changes such as lower precipitation.
- New logging roads permit shifting cultivators and fuel wood gatherers to gain access to logged areas and fell the remaining trees.

Effects of Mining

The major effects of mining operations on forests and tribal people include :

- Degradation of lands.
- Loss of top soil due to deforestation.
- Pollution of surface and ground water resources due to the discharge of highly mineralized mine waters.
- Lowering of ground water table.
- Air pollution due to release of greenhouse gases and other toxic gases during mining e.g. release of CH₄ during coal mining.
- Deforestation including loss of flora and fauna.
- Sediments production and discharge.
- Ore transport hazards.
- Fire hazards.
- Subsidence above and near mine areas can change local hydraulic gradients and drainage basin limits, and creates numerous ponds.
- Drying up of the perennial sources of water life springs and streams in hilly areas.
- Tribal people may be forced into a new way of life for which they are unprepared.
- Migration of tribal people from mining areas to other areas in search of land and food

CASE STUDY

Tehri dam: This dam across river Bhagirathi about 1.5 km downstream of the town (Tehri) has been a subject of much controversy. When the project was started, deforestation and use of explosives during tunneling process has disturbed the natural setup in that area. The cause against the ecological damage and deforestation due to Tehri dam was taken up by Sunderlal Bahuguna, a noted activist and environmentalist who has fought for the preservation of forest as a member of **the Chipko Movement**. Chipko movement was a campaign in which some environment-conscious people opposed the cruelties of man on the forest trees. The first foremost movement against indiscriminate felling of trees in India was fought in 1931 by a Bishnoi woman, Amrita Devi, her husband and her three daughters of Khejrali village, 25 km from Jodhpur, sacrificed their lives for protecting their beloved Khejri trees. They were axed to death while they were hugging the trees. In Karnataka, Chipko movement is known as Appiko movement.

Forest conservation and management

Forest conservation is the practice of planting and maintaining forested areas for the benefit and sustainability of future generations. Forest conservation involves the upkeep of the natural resources within a forest that are beneficial to both humans and the ecosystem. Forest conservation acts to maintain, plan, and improve forested areas. Forests provide wildlife with a suitable habitat for living along with filtering groundwater and preventing runoff.

The commercial use of forests nowadays has reached such an extent that it has become a threat to the environment in the form of:

- (i) Increase in temperature,
- (ii) Lesser precipitation,
- (iii) Increased rate of soil erosion,
- (iv) Increase in frequency and volume of floods,

- (v) Loss of soil productivity,
- (vi) Extinction of several species,
- (vii) Non-availability of several essential forest products, and
- (viii) Imbalance in ecosystem.

Following measures should be adopted to conserve forests:

1. Regulated and Planned Cutting of Trees:

One of the main reasons of deforestation is commercial felling of trees. According to an estimate, about 1,600 million cubic metres of wood have been used for various purposes in the world. Although trees are considered as perennial resource, when exploited on a very large scale, their revival cannot be possible.

Therefore, cutting should be regulated by adopting methods like:

- (i) Clear cutting,
- (ii) Selective cutting, and
- (iii) Shelter wood cutting.

2. Control over Forest Fire:

Destruction or loss of forest by fire is fairly common; because trees are highly exposed to fire and once started it becomes difficult to control. Sometimes, the fire starts by natural process, i.e., by lightning or by friction between trees during speedy winds, while in most cases it is started by man either intentionally or unintentionally.

3. Reforestation and Afforestation:

The sustained yield concept dictates that whenever timber is removed, either by block cutting or by selective cutting, the denuded area must be reforested. This may be done by natural or

artificial methods. Similarly, any forested land which has been destroyed by fire or mining activities should be reforested. In rugged terrain aerial seeding is the method of choice. Besides all this, fresh afforestation programmes should be started. New plantations will not only increase the forest cover but also help in making up the eco-balance. For afforestation, selection of trees should be done according to local geographical conditions and care must be taken during initial growth of the trees.

4. Check over Forest Clearance for Agricultural Purposes:

Most of the present-day agricultural land was once forested and then cleared for the use of agriculture. But now it has reached the stage where further clearance will be dangerous for the entire ecosystem. There are tribals in some parts of Asia, Africa and South America, where shifting cultivation is still a part of their system of land procurement. According to an estimate, about 40 million sq km of land is used for this purpose by 200 million tribals of the world. For the conservation of forest, this should be checked and an alternative system should be suggested to them. Similarly, for the development of villages, towns and cities, forest lands have been cleared and this process continues to this day causing loss of forest cover. This also should be checked and green belts around cities should be developed.

5. Proper Utilization of Forest Products and Forests:

Generally, forests have been cut for logs and rest of the tree – stump, limbs, branches and foliage, etc., are left out in the forest as worthless debris. Further waste occurs at the sawmill. There is a need to use all this waste material. Now several uses have been developed and products like waterproof glues, board, etc., can be obtained. Similarly, forests can easily be used or developed as tourist centres. By using them as tourist centres the country can earn substantial foreign exchange. This practice has been adopted by many countries, both developed and developing.

6. Protection of Forest:

The existing forests should be protected. Apart from commercial cutting, unorganized grazing is also one of the reasons. There are several forest diseases resulting from parasitic fungi, rusts,

viruses and nematodes which cause the destruction of trees. The forests should be protected either by use of chemical spray, antibiotics or by development of disease resistant strains of trees.

7. Selective Logging

This method involves the cutting, gathering and removal from the forest of selected mature, over mature and defective trees in order to leave behind the adequate number of healthy smaller trees especially those of the commercial species for future harvest. Once the number of smaller trees that remain is not enough or insufficient, replanting should be done accordingly.

B) Water resources

Water is literally, the source of life on earth. It is the major constituents of the hydrosphere that consists of the oceans, seas, rivers, streams, glaciers, lakes, reservoirs, polar ice caps and the shallow ground water bodies that inter flow with the surface water. Approximately 70.8% of the earth's surface is covered with water mainly in the form of oceans. Of this about 97% is in the oceans and inland seas, where the high salt content does not permit its use for human consumption. About 2% of the water resources is locked in the glaciers and ice caps; while the rest (less than 1%) is available as fresh water for human consumption and other uses, in surface water sources (such as rivers, streams, lakes and reservoirs) and ground water sources.

Importance of Water

Water is essential for life – not only human life but all life, animal and vegetation. It is a part of life itself. Since it is the medium in which all living processes occur. It dissolves nutrients and distributes them to cells, regulates body temperature, supports structures and removes waste products. About 60% of human body is water. And any substantial reduction in this percentage is disastrous. One can survive for weeks without food, but cannot survive more than a few days without water. Water has occupied an important position in men's life.

Since every activity of man involves some use of water, he is in the search of pure sparkling and palatable water from time immemorial. Man needs water not only for drinking purpose but also for bathing, washing, heating, air conditioning, agriculture, livestock raising,

industrial purposes, hydropower generation, steam power , fire protecting, fishing swimming, navigation recreation, wild life habitat and for disposal of wastes. Lack of water of required quality is a barrier to development also. A community with a limited water supply if a community with a limited growth – because the overall food production and large scale generation of electricity still very much depend on the availability of water and also there is an increasing demand of water by industries.

Freshwater Crisis

Due to its great abundance water is generally a very inexpensive resource compared with other natural resources; water is used in tremendous quantities. On a global scale total water abundance is not the problem; the problem is water's availability in the right place at right time in the right form. Global water is unequally distributed. Irregularity in the duration and intensity of rainfall often cause flood or droughts. Scarcity of freshwater results in serious regional disparities.

Fresh water is the biggest crisis facing the world today. According to an estimate about 2 billion people more than one third of the global population lack access to safe drinking water or sanitation. And about six thousand children die every day from diseases associated with unsafe water and lack of sanitation. About 40 countries in the world fall below the 200 cubic meters of good water per person per year, the minimum quantity of freshwater needed for a healthful life according to WHO. The highest percentage of people in water-poor countries is in Africa and the Middle East.

- I. **Ground water:** After glaciers, ice caps and snowfield, groundwater is the next largest fresh water reservoir. Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. Ground water constitutes about 9.86 % of the total fresh water resource. Precipitation percolates through the soil and either accumulated in underground basin or flows underground in sub-surface streams. Generally ground water is clear and colorless but harder than the surface water of the region in which it occurs. As a result, groundwater is the major source of fresh water for agriculture and domestic use in many areas of the world particularly areas having insufficient surface

water sources. The ground water is contained in aquifers. An aquifer is a highly permeable layer of sediment or rock contains water. Aquifers are of two types:



a) Unconfined Aquifers. These are covered by permeable earth materials and are recharged by seeping down of water from rainfall and snow melt.

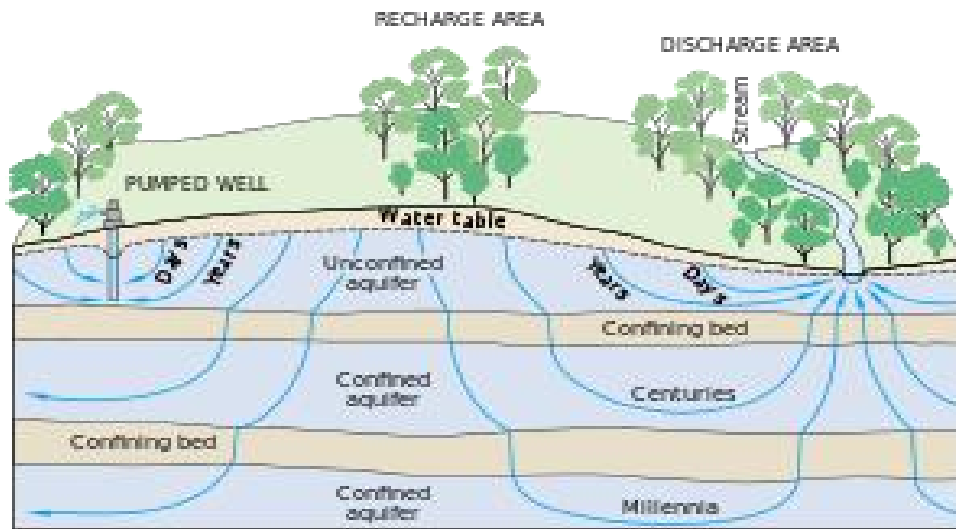
b) Confined aquifers. These are present between two impermeable layers of rock and are recharged only in those areas where the aquifer meets the land surface.

Over utilization of water

Overuse of groundwater sources can cause several kinds of problems if groundwater is being withdrawn from aquifers faster than natural recharge can replace it, such as. . A heavily pumped well can lower the local water table as a result of which shallower wells go dry.

- Heavy pumping on a broader scale can deplete a whole aquifer.
- Excessive pumping of groundwater causes porous formations to collapse, resulting in subsidence or settling of the above surface.
- Overuse of freshwater reservoirs along coastlines often allows saltwater to intrude into aquifers used for domestic and agricultural purposes.

Then there are many aquifers that have slow recharge rates which will take thousands of years to refill them once they are emptied. In a sense, it is a 'fossil water'. When water is pumped out from such a reservoir that cannot be refilled in our lifetime, we essentially are mining a non renewable resource.



2. Surface water sources

Most surface water originates directly from precipitation in the form of rainfall or snow, Groundwater from springs and seeps also contributes to flow of the streams. The various surface water sources are -

- I. **Natural Lakes and Ponds :** Lakes are inland depressions that hold standing fresh water through the year. e.g. Lake superior, the Caspian Sea, etc, Ponds are generally small temporary or permanent shallow water bodies. As their water is much more accessible than groundwater or glaciers, they are considered as an important (though minor) sources of fresh water supply. Water from these sources is more uniform in quality than water from flowing rivers and streams. Total 117 lakes are found in world and 2642 in india.
- II. **Artificial impounding reservoirs :** These are formed by construction hydraulic structure. (life dams) across river valleys. The deeper and narrower the valley is, the easier it is to construct the dam. The water quality is similar to that of natural lakes and ponds.
- III. **Rivers and Streams :** Precipitation that does not evaporate or infiltrate runs off over the surface towards the sea, in the form of streams and rivers. Rivers and streams are important sources of water supply, even though the water from these sources is generally more variable in quality as well as less satisfactory than the water from lakes and impounded reservoirs.

- IV. **Sea Water:** Though the oceans contain about 97% of the total water in the world, but as ocean waters contain high concentration of salts. (Approx 3.5%) in solution, it becomes uneconomical to make this water potable. Still in places, where sea water is the only source available, potable water is obtained from sea water by carrying out desalting or demineralising.

Inland surface water is the major sources of fresh water for agricultural, domestic and industrial use throughout the world. The major environmental issue regarding inland surface water resources is the degradation of these sources by the disposal of sewage and industrial effluents without treatment.

Problems related with water resources

Following are the main problems related to water resources:

1. Aquifers are being extracted at an extraordinary rate - 10% of the world's agricultural food production depends on using extracted groundwater. As a result, groundwater tables fall by up to several meters a year - with the risk of collapse of agricultural systems based on groundwater irrigation in the north China plain, the USA high plains and some major regions depending on aquifers in India, Mexico, Yemen and elsewhere.
2. About 40% of the world's population lives in arid or semi-arid region. These people have to spend substantial amount of time, energy and effort in obtaining water for their domestic and agricultural use.
3. Excessive irrigation can cause salt accumulation in the soil, which may reduce crop productivity.
4. Heavy rainfall on exposed soils results in rapid runoff causing soil erosion. It puts low land area at extreme risk of destruction due to flooding.
5. Half of the world's rivers and lakes are seriously polluted. Pollution of the waterways and surrounding river basins has created millions of environmental refugees.

FLOODS: An overflow of a large amount of water beyond its normal limits, especially over what is normally dry land. The European Union (EU) Floods Directive defines a flood as a

covering by water of land not normally covered by water. In our country rainfall does not occur uniformly throughout the year. Floods usually are short lived events. Floods have been regular features of some parts of India and Bangladesh causing huge loss of agriculture. During the last few decades there has been sharp rise in the incidence of floods .

Causes of floods

Floods are caused by both natural as well as human factors. Floods occur mainly due to:

- Deforestation
- Rapid industrialization
- Overgrazing
- Storms and cyclones
- Sudden increase in temperature, cause fast melting of snow.
- Heavy rain in short time or cloud bursts may cause overflowing of lakes and rivers leading floods.

Effects of flooding

Floods can have devastating consequences and can have effects on the economy, environment and people.

Economic

During floods (especially flash floods), roads, bridges, farms, houses and automobiles are destroyed. People become homeless. Additionally, the government deploys firemen, police and other emergency apparatuses to help the affected. All these come at a heavy cost to people and the government. It usually takes years for affected communities to be re-built and business to come back to normalcy.

Environment

The environment also suffers when floods happen. Chemicals and other hazardous substances end up in the water and eventually contaminate the water bodies that floods end up in. In 2011, a huge tsunami hit Japan, and sea water flooded a part of the coastline. The flooding caused massive leakage in nuclear plants and has since caused high radiation in that area. Authorities in Japan fear that Fukushima radiation levels are 18 times higher than even thought. Additionally, flooding causes kills animals, and

others insects are introduced to affected areas, distorting the natural balance of the ecosystem.

People and animals

many people and animals have died in flash floods. Many more are injured and others made homeless. Water supply and electricity are disrupted and people struggle and suffer as a result. In addition to this, flooding brings a lot of diseases and infections including military fever, pneumonic plague, dermatopathia and dysentery. Sometimes insects and snakes make their ways to the area and cause a lot of havoc.

Diseases:

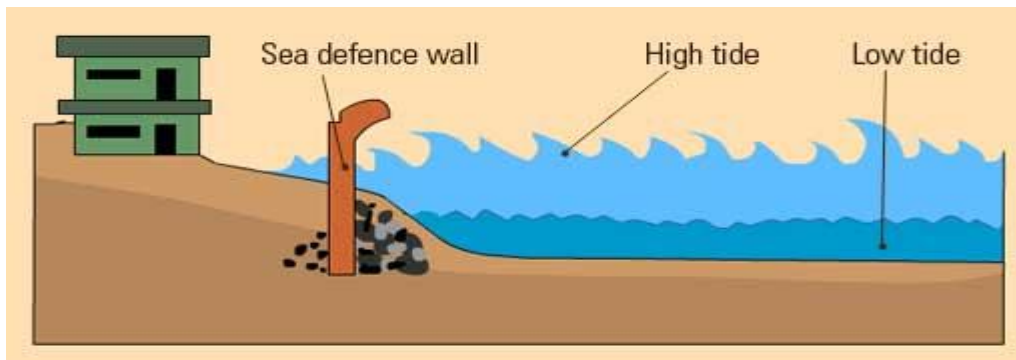
Floods disrupt normal drainage systems in cities, and sewage spills are common, which represents a serious health hazard, along with standing water and wet materials in the home. Bacteria mould and viruses, cause disease, trigger allergic reactions, and continue to damage materials long after a flood.

Case study

In September 2014, Jammu and Kashmir was ravaged by its worst floods in more than 50 years, The Indian administrated Jammu and Kashmir, as well as Pakistan administered Azad Kashmir, Gilgit-Baltistan and Punjab were affected by these floods.^[5] By September 24, 2014, nearly 277 people in India^[6] and 280 people in Pakistan had died due to the floods.

Methods of flood prevention

Humans cannot stop the rains from falling or stop flowing surface water from bursting its banks. These are natural events, but we can do something to prevent them from having great impact. Here are a few.



Sea / Coastal Defence Walls: Sea walls and tide gates have been built in some places to prevent tidal waves from pushing the waters up ashore. In some areas too, sand bags are made and placed in strategic areas to retain floodwaters.

Retaining walls: In some places, retaining walls levees, lakes, dams, reservoirs or retention ponds have been constructed to hold extra water during times of flooding.

Town planning: It is important that builders acquire permission before buildings are erected. This will ensure that that waterways are not blocked. Also drainage systems must be covered and kept free from objects that chock them. This way, water can quickly run through if it rains and minimize any chance of town flooding. Drainage systems should also be covered to prevent litter from getting into them.

Vegetation: Trees, shrubs and grass help protect the land from erosion by moving water. People in low-lying areas must be encouraged to use a lot of vegetation to help break the power of moving flood water and also help reduce erosion.

Education: In many developing countries, drainage systems are chocked with litter and people have little knowledge of the effects that can have during a rain. When it rains, waterways and culverts are blocked by massive chunks of litter and debris, and water finds its way into the streets and into peoples homes. Education is therefore very important, to inform and caution people on the dangers of floods, what causes floods, and what can be done to minimize its impact.

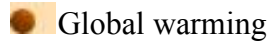
Detention basin: These are small reservoirs built and connected to waterways. They provide a temporary storage for floodwaters. This means in an event of flooding, water is drained into the basin first, giving people more time to evacuate. It can also reduce the magnitude of downstream flooding.

DROUGHTS

The condition of dryness for prolonged period is called drought. Drought like condition develops when the average rainfall for an area drops below the normal amount for a long time. Usually, drought is talked about in one of two perspectives- meteorological and hydrological. A drought in terms of meteorology takes into account deficiencies in measured precipitation. Each year's measurements are then compared to what is determined as a "normal" amount of precipitation and drought is determined from there. For hydrologists, droughts are monitored by checking stream flow and lake, reservoir, and aquifer water levels. Precipitation is also considered here as it contributes to the water levels. In addition, there are agricultural droughts that can impact crop production and cause changes to the natural distribution of various species. The farms themselves can also cause droughts to happen as soil is depleted and therefore cannot absorb as much water, but they can be impacted by natural droughts as well.

Causes of Droughts

-  Less rainfall
-  Deforestation
-  Overgrazing
-  Overutilization of ground water
-  Unplanned use of land
-  Poor water management practice



Global warming

Effects of droughts: The following are the effects of droughts:

- **Economic Impacts**

Many economic impacts occur in agriculture and related sectors, because of the reliance of these sectors on surface and groundwater supplies. In addition to losses in yields in crop and livestock production, drought is associated with insect infestations, plant disease, and wind erosion. The incidence of forest and range fires increases substantially during extended periods of droughts, which in turn places both human and wildlife populations at higher levels of risk. Income loss is another indicator used in assessing the impacts of drought. Reduced income for farmers has a ripple effect. Retailers and others who provide goods and services to farmers face reduced business. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and eventual loss of tax revenue for local, state, and federal governments. Prices for food, energy, and other products increase as supplies are reduced. In some cases, local shortages of certain goods result in importing these goods from outside the drought-stricken region. Reduced water supply impairs the navigability of rivers and results in increased transportation costs because products must be transported by alternative means. Hydropower production may also be significantly affected.

- **Environmental Impacts**

Environmental losses are the result of damages to plant and animal species, wildlife habitat, and air and water quality, forest and range fires, degradation of landscape quality, loss of biodiversity, and soil erosion. Some of these effects are short-term, conditions returning to normal following the end of the drought. Other environmental effects last for some time and may even become permanent. Wildlife habitat, for example, may be degraded through the loss of wetlands, lakes, and vegetation. However, many species eventually recover from this temporary aberration. The degradation of landscape quality, including increased soil erosion, may lead to a more permanent loss of biological productivity.

- **Social Impacts**

Social impacts involve public safety, health, conflicts between water users, reduced quality of life, and inequities in the distribution of impacts and disaster relief. Many of the impacts identified as economic and environmental have social components as well. Population migration is a significant problem in many countries, often stimulated by a greater supply of food and water elsewhere. Migration is usually to urban areas within the stressed area, or to regions outside the drought area. Migration may even be to adjacent countries. When the drought has abated, the migrants seldom return home, depriving rural areas of valuable human resources. The drought migrants place increasing pressure on the social infrastructure of the urban areas, leading to increased poverty and social unrest.

Control measures of droughts:

- By opting mixed cropping.

- Afforestation and plantation of trees around ponds and water bodies. Plantation of eucalyptus (safeda), which lowers the ground water table due to heavy transpiration, should be avoided.

- By using methods like social forestry and waste land reclamation.

- Water shed management and rain water harvesting helps in conservation of water .

Conflicts over water

Water conflict is a term describing a conflict between countries, states, or groups over an access to water resources.

Dams- Benefits and Problems

Water is a precious resource that is becoming an increasingly scarce commodity worldwide. To assuage scarcity, there is a growing pressure to harness and utilize surface water sources, (like rivers) by constructing dams. The potential use could be for irrigation, hydroelectricity,

water transport to deficit areas, etc. and storage reservoirs so as to impound huge amount of rain water. The various benefits of dams are :

- Hydroelectricity generation.
- Ensuring a year round water supply.
- Transfer of water from areas of excess to areas of deficit using canals.
- Flood control and soil protection.
- Irrigation during dry periods.
- Multi-purpose river valley projects also provide for inland water navigation and can be used to develop fish hatcheries and nurseries.

Though dams have been useful over the centuries, but in recent years tapping of rivers through big dams has created a lot of human as well as environmental issues. In many cases they reduce water availability and destroy both natural and human values. Some of the disadvantages/problems of dams are

- Some dams lose so much water through evaporation and seepage into porous rock beds that they waste more water than they make available.
- Salts left behind by evaporation increase the salinity of the river and make its water unusable when it reaches the downstream cities.
- Accumulating sediments in the storage reservoir not only makes dams useless but also represents a loss of valuable nutrients to the downstream agricultural lands.
- Growth of snail population in the shallow permanent canals that distribute water to fields may lead to an epidemic of schistosomiasis.
- The enormous weight of water behind the dam could trigger seismic activity that might crack the dam and unleash a flood of biblical proportions.
- Submergence of large areas of land that might include fertile fields and human settlements.
- Resettlement and rehabilitation of displaced people.
- Loss of free flowing rivers that are either drowned by reservoir impoundments or turned into linear, sterile irrigation canals.

- Dam projects can also lead to lowered nutritional status when highly productive fields are flooded.

C)Mineral Resources

Minerals are naturally occurring, inorganic, crystalline solid having a definite chemical composition and characteristic properties. Minerals are exhaustible, non renewable resources found in the earth crust. Some mineral elements are essential for the formation and functioning of the body of all organisms, plants as well as animals, including human being. But, the humans today use a wide variety of minerals, many in large quantities to sustain industry based civilization. Minerals can be metallic or non metallic

Types of Minerals:

Precious metallic minerals: Gold, Silver, Platinum etc. -2. Metallic minerals: Bauxite, Haematite, Laterite etc.

3. Non metallic Minerals: Graphite, Diamond, Quartz etc.

4. Mineral Fuels: Coal, Petroleum, Natural Gas etc.

5. Ferro-alloy metallic minerals: Manganese, Molybdenum, Tungsten, Cobalt, Nickel etc

6. Non ferrous metals: Copper, Zinc, lead etc.

7. Building material and stone: Limestone, marble, sandstone etc.

Some of the uses of mineral resources are:

1. Used in construction of buildings, bridges and housing settlement.
2. Development of industries and machinery.
3. Used for generation of energy mainly Coal, petroleum and natural gas.
4. Used for development of defence equipment.

5. Used in the field of communication like telephone, wires, cables, electronic devices etc.
6. Formation of alloys for various purposes.
7. Used for formation of ornaments like jewellery of gold, diamond, silver etc.
8. Used for synthesis of fertilizers, fungicides etc.

Distribution of Mineral Resources

The finite stock of minerals on earth is non renewable; and not only that, the geographical distribution of essential minerals is unequal. India's mineral resources are sufficiently rich and varied to provide an adequate base for the industrial development of the country. India is not only self sufficient in the production of these minerals but also export them. The position is also satisfactory in coal, felspar, limestone, fluoride, dolomite, gypsum, precious and semi precious stones and gold.

Exploitation of minerals

The mineral resources can be divided into several broad categories, depending on their use, such as elements for metal production and technology, building materials, minerals for the chemical industry and minerals for agriculture.

The ever increasing demands from the industry, transport, and agriculture and defense preparation are a cause of concern. Depletion of almost all known and easily accessible deposits is anticipated in elements such as mercury, tin, copper, gold, silver and platinum. The limited resource of phosphorus, which is essential component of chemical fertilizers, is another cause of concern.

Mining: The process of extracting out the minerals or their ores from the earth crust is called mining. Some minerals can be mined more easily as they are found at earth's surface, while others lie far beneath the surface and can be obtained by digging deep underground.

Mining process

Mining techniques: Mining techniques can be divided into two common excavation types: surface mining and sub-surface (underground) mining.

Surface mining: Surface mining is done by removing (stripping) surface vegetation, dirt, and, if necessary, layers of bedrock in order to reach buried ore deposits. Techniques of surface mining include: open-pit mining, which is the recovery of materials from an open pit in the ground, quarrying or gathering building materials from an open-pit mine, strip mining, which consists of stripping surface layers off to reveal ore/seams underneath; and mountaintop removal, commonly associated with coal mining, which involves taking the top of a mountain off to reach ore deposits at depth. Most (but not all) placer deposits, because of their shallowly buried nature, are mined by surface methods. Finally, landfill mining involves sites where landfills are excavated and processed.

Environment effects of extracting and using mineral resources

The environmental effects of extracting and using mineral resources depend on such factors as ore quality, mining, procedures, local hydrological, conditions, climate rock types, size of operation topography and several other related factors. The mining and processing of mineral resources usually have a considerable impact on land, water, air and biological resources; also have a social impact because of the increased demand for housing and services in mining areas. Some of the major environmental impacts of mining and processing operations are:

- Degradation of land
- Pollution of surface and ground water resources due to the release of harmful trace elements (cadmium, cobalt, copper, lead, and others) by leaching, even if drainage is controlled.
- Serious adverse impact on the growth of vegetation due to leaching out of trace elements and minerals.
- Air pollution due to emission of dust and gases.
- Deforestation including loss of fauna and flora.
- Adverse impact on historical monuments and religious places.
- Physical changes in land, soil, water and air associated with mining directly and indirectly affects the biological environment: kills caused by mining activity or contact with toxic soil or water are examples of direct impacts, whereas indirect impacts include changes in nutrient cycling total biomass

species diversity and ecosystem stability due to alteration in groundwater or surface water availability or quality.

- Rehabilitation of affected population including tribals.

Conservation of minerals

Efforts are thus urgently required to check the wasteful and injudicious use of minerals. Some of the suggested measure in this direction is;

- Recycling
- Developing more efficient technologies
- Designing smaller equipments
- Exploiting untapped deposits such as deep mining and finding new uses for glass, ceramics, plastics, and synthetic fibers and using those substitutes for exhaustible minerals.

D)Food resources

Food is the chief essential materials which the body need for its well being. It is the basic need of all organisms. These essential materials are called ' nutrients'. Plants and animals are the main sources of human food. Good food is indispensable for health at all stages of life and for satisfactory growth during infancy, childhood, adolescence and adulthood. FAO (Food and Agriculture Organization) of United Nations have estimated that an average person needs about 2500 calories per day. A diet which can provide the basic nutrients to our body is called Balance Diet.

Source of food

People obtain food from cultivated plants and domesticated animals.

Crops: Crop plants produce grains about 76% of the world,s food. Most of the world food is provided by only twenty crops species, These are in approximate order of importance wheat, rice, corn, potatoes, barley, sweet potatoes, cassavas, soya beens, oats, sorghum, millet, sugarcane, sugar beets, rye, peanuts, field beans, chick-peas, pigeon –peas, bananas, and coconuts, put of these, wheat rice, and corn are the three crops on which humanity depends

for the majority of its nutrients and calories. Fruits and vegetables also make a large contribution to human diets, altogether, they amount to nearly a large quantity as corn. They are especially important because they are rich in vitamins, minerals, dietary fiber and complex, carbohydrates.

2. Livestock: Domesticated animals are an important food Source the major domesticated animals used as food by human beings are 'ruminants' (e.g. cattle, sheep, goats, camel, reindeer etc. Milk, prized by people everywhere is providing by milching animals.

3. Aquaculture: Aquaculture, also known as aqua farming, is the farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants. Fisheries produce 7% of world 'food.

World Food Problems:

World population is growing every year and so the demand of food is also increasing constantly. During last 50 years world grain production has increased almost three times. The food and agriculture organization (FAO) estimates that about 840 million people remain chronically hungry, nearly 800 million of them in the developing world .This means that every year our food problem is killing as many people as were killed by the atomic bomb dropped on Hiroshima during world war II. About 40% million people die every year due to undernourishment ad malnutrition. Malnutrition children are mentally retarded, show stunted growth and social and developmental disorders. In the richer countries the most common dietary problem is too many calories . For instance , the average daily caloric intake in North America and Europe is above 3,500 calories nearly contributes to overweight, high blood pressure, heart attack, and other cardiovascular diseases that have become the leading causes of death in most developed countries.

In India alone, more than 300 million people are good insecure and poverty stricken; this means that they do not possess adequate purchasing power to by food which could fulfill the minimum calorie requirement of a human body per day.

Vitamin/ Mineral	Deficiency disease/disorder	Symptoms
Vitamin A	Loss of vision	Poor vision, loss of vision in darkness (night), sometimes complete loss of vision
Vitamin B1	Beriberi	Weak muscles and very little energy to work
Vitamin C	Scurvy	Bleeding gums, wounds take longer time to heal
Vitamin D	Rickets	Bones become soft and bent
Calcium	Bone and tooth decay	Weak bones, tooth decay
Iodine	Goiter	Glands in the neck appear swollen, mental disability in children
Iron	Anaemia	Weakness

The Impacts of overgrazing

Overgrazing occurs when plants are exposed to livestock grazing for extended periods of time, or without sufficient recovery periods. It reduces the usefulness of the land and is one cause of desertification and erosion. Sustainable grassland production is based on grass management, animal management, and livestock marketing. Following are the main impacts of overgrazing.

(i) Desertification - Desertification is the degradation of land in arid, semi arid and dry sub-humid areas resulting from various climatic variations, but primarily from human activities. Current desertification is taking place much faster and usually arises from the demands of increased populations that settle on the land in order to grow crops and graze animals.

(ii) Soil Erosion:

Due to overgrazing by cattle, the cover of vegetation almost gets removed from the land. The soil becomes exposed and gets eroded by the action of strong wind, rainfall etc. the grass roots are very good binders of soil. When the grasses are removed, the soil becomes loose and susceptible to the action of wind and water.

(iii) Loss of Useful Species:

Overgrazing adversely affects the composition of plant population and their regeneration capacity. The original grassland consists of good quality grasses and herbs with high nutritive value. When the livestock graze upon them heavily, even the root stocks which carry the reserve food or regeneration get destroyed. Now some other species appear in their place. These secondary species are hardier and are less nutritive in nature. Some livestock keep on overgrazing these species also.

(iv) Reduced pasture for animals - Overgrazing causes animals to run short of pasture.

(v) Reduction in the diversity of plant species: overgrazing adversely affects the composition of plant population and their generation capacity. Several juicy fodder giving species like cenchrus, heteropogon etc are replaced by unpalatable and sometimes thorny plants like Lantana, xanthium etc.

Impacts of traditional agriculture. About half of the global population practice traditional agriculture. It involves small fields simple implements, naturally available water, organic fertilizers and mix crops, and results in low production. The main impacts are:

i) **Shifting cultivation:** Shifting cultivation means slash and burn cultivation. It is practised in many tribal areas results in deforestation.

ii) **Depletion of nutrients:** slash and burn cultivation destroys the organic matter and makes the soil nutrient poor within a short period.

iii) **Soil erosion:** loss of forest cover exposes the soil to wind, rain and storms, thereby resulting in soil erosion.

Impacts of Modern Agriculture

Modern agricultural practices have substantially changed the farming, crop production and harvesting, on the other hand it leads to several ill effects on environment. As agricultural modernization progressed, the ecology-farming linkage was often broken as ecological

principles were ignored and/or overridden. In fact, several agricultural scientists have arrived at a general consensus that modern agriculture confronts an environmental crisis. The main impacts are as follows:

Some Local and Regional Changes of Modern Agricultural Practices:

1. It leads to soil erosion.
2. It results into increase in sedimentation towards downstream side of river.
3. Alteration in the fertility of soil.
4. Increase in deforestation for more cultivated land.
5. Leads to soil pollution.
6. It leads to desertification i.e. lands converting into deserts.
7. It results into change in the ecology of estuaries due to increase in sedimentation at the junctions of rivers.

Pesticide-Fertilizer problems

Disadvantages of Use of Artificial Chemical Fertilizers:

1. Irrational use of chemical fertilizers to boost up crop yield, have contaminated ground water with nitrate. The presence of nitrate in excessive amount is dangerous for human health. Nitrate reacts with haemoglobin and impairs the oxygen transport by the blood. This condition is called **methaemoglobinemia or blue baby syndrome**.
- 2 Excessive use of NPK are often washed off with runoff water to water bodies and lakes causing the overnourishment of lakes called **Eutrophication**. It often leads to algal blooms, which makes water unfit for use.

3. Increase in water borne diseases due to contamination of surface and ground water resources.

4 Loss of natural fertility of the soil.

5. Loss of organic matter from the soil.

6. Threat to the quality of drinking water due to disposal of fertilizers into landfills sites and lands.

Disadvantages of Use of Pesticides:

Pesticides are the chemicals used to mix with the soil to kill pests. Following are its disadvantages:

1. Species which are not targeted are also killed or injured.

2. After sometime the pest develop resistance against the pesticides.

3. Soil fertility is reduced.

4. On short duration exposure it causes illness and slow poisoning to human beings.

5. On long duration exposure it causes cancer, genetic defects, immunological and other chronic diseases.

6. Tendency to be concentrated by food web.

7. Misuse or unsafe methods of application.

8. Creation of new pests due to the killing of beneficial predators that previously kept a number of pests under control.

9. The qualities that make synthetic organic pesticides to effective stability, solubility and high toxicity- make them environmental nightmare due to their persistence and mobility in the environment.

10. The pesticides remain in toxic form in successive tropic level of food chain and get magnified and cause adverse effect on human health. The process is called **Biomagnification**

Water Logging: The problem of water logging arises either due to surface flooding or due to high water table. The productivity of water logged soils is very poor due to less oxygen availability for respiration of plants sown over such soils/areas. In India; areas which are frequently waterlogged include estuarine deltas of Ganges, areas of Kerala and Andaman & Nicobar Islands.

Salinity: Salinity refers to increased concentration of soluble salts in the soil. It results due to intensive agricultural practices. Due to poor drainage of irrigation and flood waters, the dissolved salts in these waters accumulate on the soil surface. In arid areas with low rainfall, poor drainage of irrigation and flood waters, the dissolved salts in these waters accumulate on the soil surface. Excess of these salts (mainly carbonates, chlorides and sulphates of sodium and traces of calcium and magnesium) form a crust on the soil surface and are injurious to the survival of plants.

Case studies

Salinity and water logging in Punjab, Haryana and Rajasthan;

- The first alarming report of salt affected waste land formation due to irrigation practices came from Haryana in 1858.
- The floods of 1947, 1950, 1952, in Punjab resulted in aggravated water logging with serious drainage problems.
- Rajasthan too has suffered badly in this regard following the biggest irrigation project: "Indira Gandhi canal Project."

E)Energy Resources:

Energy is derived from the word Energos means work. Energy may be defined as, "any property, which can be converted into work." Or Energy is defined as, "the capacity to do work." Though energy is present in a number of forms (mechanical, thermal, chemical, biological energy and energy in the matter which differs basically from one another; but together constitutes the physical reality of our universe. In fact, all living beings are operated by means of energy, which is derived from the environment. The Sources from which energy can be obtained to provide heat, light, and power are called energy resources. The first form of energy was fire.

Broadly energy is used for the following purposes:

- Cooking, heating lighting and other such facilities.
- Transporting people and goods.
- Manufacturing consumer goods and capital equipment.
- Production and conversion of primary fuels into other forms of energy as desired by the consumers (e.g. conversion of chemical to electrical energy by dry cell battery) and many more.

Energy distribution world scenario: The level of energy consumption seems to be the benchmark for measuring the strength and wealth of a nation. The more developed a country, the greater amount of energy it demands. As population continues to grow and more developing nations, such as the BRICs (Brazil, Russia, India, and China), have entered industrialization, the global demand for energy has increased exponentially. The uneven distribution and dis-proportioned demand and consumption have compounded the energy problems.

Fuel wood, animal waste and agricultural residues are the traditional sources of energy that continue to meet the bulk of the energy requirements in rural India. India is the world's fourth largest energy consumer. India urgently needs to work out how to deal with the huge challenges its energy sector is facing and address growing demands at the same time, a global energy organization has warned.

The govt of India has formulated an energy policy with the objectives of ensuring adequate energy supply at a minimum cost, achieving self sufficiency in energy supplies and protecting environment from adverse impact of utilizing energy resources in a nonjudicial manner.

1. Accelerated exploitation of domestic conventional energy resources, viz oil, coal hydro and nuclear power,
2. Intensification of exploration to achieve indigenous production of oil and gas.
3. Management of demand of oil and other forms of energy
4. Energy conservation and management
5. Optimization of utilization of existing capacity in the country.
6. Development and exploitation of renewable sources of energy to meet energy requirements of rural communities.
7. Intensification of resources and development activities in new and renewable energy resources and

Energy Resources : The energy resources can be classified in two ways.

1.Non renewable Energy resources : Non renewable energy sources are those natural resources which are exhaustible and cannot be replaced once they are used. These are available in limited amount and develop over a long period. These include fossil fuels (such as coal, oil and natural gas) and nuclear power.

a. Fossil fuels: Fossil fuel is a general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude *oil, coal, natural gas*, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years. fossil fuels are of three types

Solid (e.g. Coal, peat)

Liquid(e.g. petroleum)

Gaseous (e.g. natural gas)

Coal is the most abundant fossil fuel in the world.it contains carbon, water, sulphur and nitrogen.Coal meets 70 percent of total energy needs of the world.In India it is about 58 per cent.Coal is used for cooking,heating,in industries and thermal power plants.

b. Nuclear energy: The energy released during fission or fusion reaction of radioactive materials, especially when used to generate electricity is called nuclear energy.

Nuclear fission. The nucleus of certain isotopes (uranium) with large mass numbers are split in to lighter nuclei on bombardment by neutrons .It releases a large amount of energy.

Nuclear fusion. **nuclear fusion** is a **nuclear** reaction in which two or more atomic nuclei come very close and then collide at a very high speed and join to form a new type of atomic nucleus

The Indian Scenario : The first nuclear power station in India was constructed at Tarapur, in Thana district near Mumbai, which is generating electricity since October 1969. At present the capacity of nuclear power plants in the country is 1940 MWe (Megga Watt electrical) accounting for about or the total power generating capacity in the country. The operating atomic powr stations are at Tarapore (2 reactors of BWR type), Rawathbatta (2 PHWR) , kalapakkam (2 PHWR), Narora (2 PhWR) and kakrapora (2 PHWR) One fast breeder test reactor at Kalapakkam was commissioned in 1985. In addition there are eight research reactors (6 at Trombay, and 2 at Kalpakkam). The department of atomic energy set up in 1954 is the executive agency for all activities related to nuclear energy . The atomic Energy commission set up in 1948 is responsible for planning and formulating atomic energy policy.

2. Renewable energy resources – Renewable energy resources are those natural resources which are inexhaustible (i.e which can be replaced as we use them) and can be used to

produce energy again and again. These include solar, wind, water, geothermal, ocean, and biomass energy. Nuclear energy however can be considered as inexhaustible sources of energy if atomic mineral are used in fast breeder reactor technology.

Important alternate renewable energy resources are:

I) Hydel Energy

Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. *Hydro power* is one of the best, cheapest, and cleanest source of *energy*, next only to thermal power. This can be assessed by the fact that nearly 30% of the total power of the world is met by hydro electric power.

Utility – Some of the inherent advantages of hydel power .

The first benefit of the hydropower is that no air or water pollutants are produced. The water used does not contaminate the air or water by producing harmful wastes. No poisonous bi-products are produced. If we compare it to the a nuclear source which produce electricity from a radioactive substance in a nuclear reactor, then we notice that no pollutants are produced from a hydropower source as compared to the nuclear wastes and radioactive rays which are damaging the life on earth. These wastes from nuclear reactors then reach water due to power system and this is how water pollution takes place, not only affecting humans but also aquatic life.

Saving natural resources:The hydropower does not use any fuel or fossil fuels. The natural balance in an ecosystem is not disturbed. The fossils are non-renewable so their saving is very important to make sure that they do not deplete.

Employment.Hydel projects are labor-intensive in nature. They can be used for tackling problem of unemployment.

Other benefits. Hydel projects are used for irrigation, source of water supply for industrial and domestic uses, flood control navigation and recreational sites.

ii) Solar Energy: The sun is the ultimate source of energy, directly or indirectly for all other forms of energy. The energy from the sun in the form of radiations is called solar energy. Solar energy technology comprises of two distinct categories, viz., thermal conversion and photo conversion. Thermal conversion takes place through direct heating ocean waves and current and wind. Photo conversion includes photosynthesis, photochemistry, photoelectron-chemistry, photo galvanism and photovoltaics. There are a number of solar technologies by which it can be harnessed.

Solar Water Heating: **Solar water heating** (SWH) is the conversion of sunlight into renewable energy for **water heating** using a **solar** thermal collector. A solar water heater unit comprises a flat plate collector and an insulated storage tank. A typical collector consists of a blackened metal plate absorber containing metal tube/pipes for water to remove the heat and its usually provided with a glass cover (one or more layer of glass) and a layer of insulation beneath the plate. The collector tubing /piping is connected to a hot water storage tank. The collector absorbs solar radiations and transfer the heat to the circulating water (either by gravity or by a pump). Usually the storage tank is located above the top of the collector. This system of water heating is commonly used in hostels, hospitals, hotels, guesthouses, etc as well as domestic and industrial units.

Solar cells: A **solar cell**, or **photovoltaic cell**, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. These are also known as photovoltaic cells. These cells are made up of semiconductor materials like silicon and gallium. When solar energy falls on them, a potential difference is produced which causes the flow of electrons resulting in the generation of electricity. A group of solar cells joined together in a definite pattern form a solar panel which can produce a large amount of solar energy and can produce electricity sufficient to run street light, irrigation water pump etc.

1. **Solar Drying** : Solar drying of agriculture and animal products is the most ancient traditional and widespread method of utilizing direct solar energy.
2. **Solar Greenhouses:** A greenhouse is closed structure covered with transparent material (glass or plastic) which acts as a solar collector and utilizes solar radiant energy for the growth of plants. The incoming short wave solar radiations can pass through the greenhouse glazing; but the long wave thermal radiations emitted by the objects within the

greenhouse cannot escape through the glazed surface. As a result, the radiations get trapped within the greenhouse and result in an increase in temperature.

3. **Solar Furnaces:** A **solar furnace** is a structure that uses concentrated solar power to produce high temperatures, usually for industry. Solar furnaces provide a means of generating extremely high temperatures (up to around 3500°C) under very clean conditions.. In a solar furnace, high temperature is obtained by concentrating the solar radiations on to a specimen using a number of heliostats (turntable mirrors) arranged on a sloping surface.
4. **Solar cooker:** A **solar cooker** is a device which uses the energy of direct sunlight to heat, cook or pasteurize food or drink. Solar cooker make use of solar heat by reflecting the solar radiations using a mirror directly on a glass sheet which cover the black insulated box within which raw food is kept. The food cooked in solar cookers is more nutritious due to slow heating. The one disadvantage is that it cannot be used during night and cloudy weather.

The Indian Scenario : India is the first Asian country to have a solar pond project in Bhuj, Kutch district of Gujarat. The Bhuj solar pond has been designed to supply about 220 lakh kWh of thermal energy per annum, about 1,25,000 kWh of electricity per annum and about 80000 liter of potable water per day.

iii) Wind Energy: **Wind power** is extracted from air flow using wind turbines or sails to produce mechanical or electrical power. Wind energy is a renewable source of non polluting energy and is emerging as one of the most potential source of alternate energy which will be helpful to a great extent in bridging the gap between the energy demand and supply. The moving air (wind) has huge amounts of kinetic energy, and this can be transferred into electrical energy using wind turbines. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. The electricity is sent through transmission and distribution lines to a substation, then on to homes, business and schools.

The Indian Scenario

India is rated high in the world for wind resource availability. The total wind energy potential in India is estimated at 25000 MW. Of this about 6000 MW is located in Tamil Nadu and 5000 MW in Gujarat. Coastal areas of Tamil Nadu, Gujarat, Andhra Pradesh and Maharashtra, plains of Rajasthan, Uttar Pradesh and Madhya Pradesh, and hill tops are favorable to wind power generation.

iv) Bio Energy: It is renewable energy made available from materials derived from biological sources. Biomass is any organic material which has stored sunlight in the form of chemical **energy**. As a fuel it may include wood, wood waste, straw, manure, sugarcane, and many other byproducts from a variety of agricultural processes. At least half of the world's population uses biomass as their main source of energy for domestic purposes. In rural areas of India fuel wood is still a major source of energy.

Biogas - Biogas is a gaseous mixture generally composed of about 60% methane (a high value fuel) 40% carbon dioxide (an inert gas) and traces of other gases such as nitrogen and hydrogen sulphide. It is a clean anaerobic fuel which can be stored and transported easily. It has a calorific value of more than 5000 kcal/m³ depending on its carbon dioxide content. Biogas is a sustainable source of energy by virtue of its production from vastly available natural organic wastes, simplicity of construction, operation and maintenance of the production units and multiple benefits accrued at the national and user level.

V) Geothermal Energy:

Geothermal energy is thermal *energy* generated and stored in the Earth. Resources of **geothermal energy** range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma. In the molten core of the earth temperatures are as high as 4000 °C. The heat (thermal energy) from the molten core of the earth offers an inexhaustible source of energy. The most potent sources are volcanoes and hot springs. Geothermal energy taken from natural steam, hot water or dry rocks may be used for electric

The Indian Scenario:

India has vast potential for geothermal energy with more than 340 hot water springs with average temperature of 80-100 ° C at their places of occurrence. A 5 KW geothermal pilot power plant has been commissioned at Manikaran in Himachal Pradesh. A potential of 4-5 MW geothermal power has been estimated in the Puga Valley of Ladakh in Jammu and Kashmir. But larger scale geothermal power plants have not been developed till date.

vi) Ocean Energy: Ocean are large water bodies covering 70.8% of the Earth. The ocean can produce two types of energy: thermal energy from the sun's heat, and mechanical energy from the tides and waves.

a. Ocean Thermal Energy Conversion (OTEC)

b. Tidal Energy and wave energy

Tidal Energy : All the flowing water carry with them kinetic energy. When such a flowing water encounters a turbine, a part of the momentum of the flowing water is transferred on to the turbine, and thus causing it to rotate. The rotation of the turbine can then be used to generate electricity.

Wave Energy: Wave motion consists of both vertical and horizontal movements of water. **Wave power** is the transport of energy by ocean surface waves, and the capture of that energy to do useful work – for example, electricity generation, water desalination, or the pumping of water (into reservoirs). A machine able to exploit wave power is generally known as a **wave energy converter (WEC)**.

F) Land Resources

Land is a major constituent of the lithosphere. Land is most valuable asset blessed by nature upon which we depend for food, fibre and fuel, the basic amenities of life. It forms about one fifth of the earth surface, which is largely covered with forests, grasslands and crop lands, most humans or natural activities need space for their location and development, which is provided by land. In India 42% of the land area is plain, about 30% is mountains and plateaus cover is about 28% of the total land area.

Soil as a Natural Resource:

Top layer of earth is called soil. Soil is a renewable resource for survival of life. The study of soil is called pedology. Soil is a renewable natural resource. It plays a very vital role in determination of the quality and composition of the biosphere. In fact the biosphere develops over the soil. It is not only a home for microbes, but also gives nutrition for plants. Some of the important functions of soil are as under –

1. Food and other biomass production
2. Environmental Interaction: storage, filtering, and transformation
3. Biological habitat and gene pool
4. Source of raw materials
5. Physical and cultural heritage
6. Platform for man-made structures: buildings, highways

Land degradation and its causes :

The change in the characteristic and quality of soil which adversely affect its fertility is called as land Degradation. Land All modern and growth oriented activities are having their direct or indirect impact on land. Though land resources are very much related to natural disasters like volcanic eruptions, earthquakes, etc, but it is due to human activities that soil gets polluted .

Causes of Land Degradation:

(a) Deforestation:Deforestation is taking place at a faster rate due to increasing demands of timber, fuel and forest products which results into degradation of land resources.

(b) Overgrazing: Overgrazing refers to excessive eating of grasses and other green plants by cattle. It results into reduced growth of vegetation, reduced diversity of plant species, excessive growth of unwanted plant species, soil erosion, and degradation of land due to cattle movement.

(c) Agricultural practices:The modern agricultural practices, excessive use of fertilizers and pesticides has adversely degraded the natural quality and fertility of the cultivation land.

(d) Industrialization: Development of industries for the economic growth of the country leads to excessive deforestation and utilization of land in such a way that it has lost its natural up gradation quality.

(e) Urbanization: Increasing growth of population and demand for more residential areas and commercial sectors is also one of the reasons for land degradation.

(f) Salination : Salination refers to increase in the concentration of soluble salts in the soil. Poor drainage of irrigation and flood waters results in accumulation of dissolved salts on the soil surface. In arid and semi arid areas with poor drainage and high temperatures, water evaporates quickly leaving behind a white crust of salts on the soil surface. The high concentration of salts in soil severely affect the water absorption process of the plants, resulting into poor productivity.

(g) Soil Erosion : Soil erosion refers to the loss or removal of the superficial layer of the soil by the action of wind, water or human activities.

(h) Water logging: Water logging may be due to surface flooding or due to high water table. Excessive use of canal irrigation may disturb the water balance and create water logging as a result of seepage or rise in the water table of the area. The productivity of water logged soil is severely reduced due to lesser availability of oxygen for the respiration of plants.

(i) Shifting cultivation: Shifting (Jhum) cultivation a very peculiar practice of slash and burn agriculture, prevalent among many tribal communities inhabiting the tropical and sub tropical regions of Africa. Asia and Island of Pacific ocean has also laid large forest tracts bare. This practice has led to complete destruction of forests in many hilly areas of India, especially the North-East and Orissa, and caused soil erosion and other associated problems of land degradation

(j) Landslides: Human activities such as construction of road and railway, canal, dam and reservoir and mining in hilly areas have affected the stability of hillslopes and damaged the protective vegetation cover both above and below roads and other such developmental works. This has upset the balance of nature, making such areas vulnerable to landslides.

(k) **Soil Pollution** : Soil pollutants (such as pesticides chemicals, radioactive and industrial wastes, plastics, bottles and tin cans, clothes carcasses, etc.) have an adverse effect on the physical, chemical and biological properties of soil and hence reduce its productivity.

(l) **Monoculture**: growing cash crops or more profitable crops year after year reduced the quality of soil

(m) **Mining**: mining cause great loss to land as these leave ditches/pit holes result in degradation of land.

SOIL EROSION

Removal of top fertile layer of the soil by water, wind,, oceanic waves and glaciers is called soil erosion. Soil erosion can be a slow process that continues relatively unnoticed or can occur at an alarming rate, causing serious loss of topsoil.

Types of soil erosion

- **Normal erosion**: Gradual removal of top soil by the natural process. The rate of erosion is slower.
- **Accelerated erosion**: Caused by man-made activities.the rate of erosion is much faster than the rate of formation of soil.

Causes of soil erosion

- **Rainfall Intensity and Runoff**: The impact of raindrops will break up the soil and water build-up will create runoff, taking sediment with it.
- **Soil Erodibility**: Based on the characteristics of each unique soil, it is more or less susceptible to erosion. Recurring erosion is more typical for soil in areas that have experienced erosion in the past.
- **Slope Gradient and Length**: The steeper the slope, the greater amount of soil can be lost. As the soil erodes downward, it increases the slope degree, which in turn, creates further erosion.
- **Vegetation**: Vegetative cover of plants or crop residues protects the soil from raindrop impact and splash. The less vegetation cover, the more erosion can occur.
- **Construction**: construction of dams , buildings, roads removes the protective vegetation cover and leads to soil erosion.

CONSERVATION OF SOIL

Following are some practices for controlling **Soil erosion**:

1. Strip farming:It is a practice in which cultivated crops are sown in alternative strips to prevent water movement.

2. Crop Rotation:It is one of the agricultural practice in which different crops are grown in same area following a rotation system which helps in replenishment of the soil.

3. Ridge and Furrow Formation:Soil erosion is one of the factors responsible for land degradation. It can be prevented by formation of ridge and furrow during irrigation which lessens run off.

4. Construction of Dams:This usually checks or reduces the velocity of run off so that soil support vegetation.

5. Contour Farming:This type of farming is usually practiced across the hill side and is useful in collecting and diverting the run off to avoid erosion.

6. Organic Farming: Organic farming involves practices which provide increased organic input to the soil. Application of bio-fertilizers is an important practice of organic farming.

7. Mulching: In this method, Soil is covered with crop residue and other form of plant litter known as mulch.It retain soil moisture, decreases runoff and increases organic matter in the soil.

8. Afforestation: Trees or wind breakers are planted in deserts to check velocity of wind.

9. Terrace Farming: A slope is divided into a number of small flat fields called terraces.it slow down the velocity of the runoff and allows the water to move to the slides of the fields, where it flows away without eroding the soil.

Desertification: The transformation of a fertile land into desert by natural or man's activities is called desertification. This is driven by a number of factors, alone or in combination, such

as drought, climatic shifts, tillage for agriculture, overgrazing and deforestation for fuel or construction materials. Around 80 percent of the productive land in the arid or semi-arid regions converted into desert.

Causes of desertification:

- **Deforestation:** The process of destruction of forested land initiates a desert producing cycle that feeds itself. Since there is no vegetation to hold back the surface runoff, water drains off quickly before it soaked in soil. This increases soil erosion, soil fertility and loss of water.
- **Overgrazing:** Overgrazing removes the vegetation cover of top soil which results in soil erosion
- **Mining:** Mining is also responsible for desertification.

LAND SLIDES

Landslides are the downward and outward movement of a slope composed of earth materials such as rock. Soil, artificial fills. Other name of landslides are rockslide, slump and soil creep.

Causes of landslides:

- Removal of vegetation: in the sloppy area creates soil erosion, which leads to landslides
- Heavy rainfall: heavy rain fall results in flooding which causes landslides
- Transport: Due to the movement of buses and trains in the unstable sloppy region cause landslides.
- Ground water level: Over exploitation of ground water also leads to landslides.
- Underground mining: causes subsidence of the ground.

Harmful effects of landslides:

- Landslides increases turbidity of nearby streams, thereby reducing their productivity.
- Loss of property and biodiversity
- Destruction of communication links

- Loss of infrastructure and economy

❖ **Role of individual in conservation of natural resources**

Conservation of natural resources means management of human use of resources so that it may give maximum benefit to the present generation, while maintain its potential to meet the requirement of the future generation. So it is the duty of every individual to conserve the natural resources.

Conservation of food resources:

1. Cook required amount of food.
2. Don't waste the food; give it to someone before spoiling.
3. Don't store large amount of food grains and protect them from damaging insects.

Conservation of forest:

1. Use non timber product.
2. Plant more trees.
3. Grassing must be controlled
4. Minimize the use of paper and fuel.
5. Avoid the construction of dam, road in the forest areas.

Conservation of soil:

1. Grow different type plants i.e trees, herbs and shrubs.
2. In the irrigation process, using strong flow of water should be avoided.
3. Soil erosion can be prevented by sprinkling irrigation.
- 4 .Use green manures in the garden.
5. Use mixed cropping.

Conservation of energy:

1. Switch off light, fan and other appliances when not in use.
2. Use solar heater for cooking.
3. Dry the cloth in the sun light instead of driers.
4. Use always pressure cookers
5. Grow trees near the house to get cool breeze instead of using AC and air cooler.
6. Ride bicycle or just walk instead of using scooter for a short distance.

Conservation of water:

1. Use minimum water for all domestic purposes.
2. Check the water leaks in pipes and repair them properly.
3. Reuse the soapy water, after washing clothes for washing courtyard, carpets etc.
4. Use drip irrigation.
5. Rain water harvesting system should be installed in all the houses.
6. Sewage treatment plant may be installed in all industries and institution.
7. Continuous running of water taps should be avoided.
8. Watering of plants should be done in the evening

❖ EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFESTYLES

Reduction of the unsustainable and unequal use of resources, and control of our population growth are essential for the survival of our nation and indeed of human kind everywhere. Our environment provides us with a variety of goods and services necessary for our day-to-day lives, but the soil, water, climate and solar energy which form the 'abiotic' support that we derive from nature, are in themselves not distributed evenly throughout the world or within countries.

A new economic order at the global and at national levels must be based on the ability to distribute benefits of natural resources by sharing them more equally among the countries as well as among communities within countries such as our own. It is at the local level where people subsist by the sale of locally collected resources, that the disparity is greatest. 'Development' has not reached them and they are often unjustly accused of 'exploiting' natural resources. They must be adequately compensated for the removal of the sources to distant regions and thus develop a greater stake in protecting natural resources. There are several principles that each of us can adopt to bring about sustainable lifestyles. This primarily comes from caring for our Mother Earth in all respects. A love and respect for Nature is the greatest sentiment that helps bring about a feeling for looking at how we use natural resources in a new and sensitive way. Think of the beauty of a wilderness, a natural forest in all its magnificence, the expanse of a green grassland, the clean water of a lake that supports so much life, the crystal clear water of a hill stream, or the magnificent power of the oceans, and we cannot help but support the conservation of nature's wealth. If we respect this we cannot commit acts that will deplete our life supporting systems.

