

## UNIT-II

### **NATURAL RESOURCES**

- ✦ Anything that can be transformed to a form that becomes valuable and useful to human beings is termed as 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. The value of a natural resource depends on its availability and demand.

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

Classification of natural resources:

#### 1. **Renewable resources:**

- The resources that can be harvested continuously with proper planning and management.
- These can be replenished or reproduced easily.
- Ex: plants, animals, solar energy, wind energy etc. are known as renewable resources.
- These sources can be replenished by natural ecological cycles.
- These are continuously available and their quantity is not affected by human consumption.
- Many renewable resources can be depleted by human use, but may also be replenished.
- These are inexhaustible resources.
- These are generally referred to living resources such as fish, crops and forests.

#### 2. **Non renewable resources:**

- Non-renewable resources are natural resources that cannot be replenished by natural means. These resources, once used up, have very little chance of recovery or resynthesis.
- The total stock of these resources is limited and they are being consumed at a high rate, they have to be utilized wisely in order to retain them for the future generations.
- Ex: coal, minerals, and petroleum

#### 1. **FOREST RESOURCES**

Forest is an important renewable natural resource. Forests are our most valuable wealth of any nation. A forest is a biotic community with predominance of trees. Forests are one of the most precious gifts of nature. They restore oxygen in our atmosphere through photosynthesis and also providing solvents, medicines, fuels, and other products that are important for our health and comfort. Forests

also play a vital role in regulating climate, controlling water run-off and providing shelter and food for wildlife. India is rich in forest resources with great diversity of flora and fauna.

## **USES OF FOREST RESOURCES:**

### **DIRECT USES:**

1. **Timber:** Timber provided by forests can be utilized for the manufacture of plywood, doors, windows, sports goods, etc. Apart from being used for construction purposes, timber may also be used for furniture- making and paper production.
2. **Raw material:** forests provide raw materials for small scale as well as large scale industries.
3. **Edible products:** A forest provides a large number of products which are important for human beings. Ex: fruits, nuts, seeds, spices, medicines, and so on
4. **Natural habitat:** forest provides a natural habitat to tribal people who depend on the plants and trees present in their vicinity for obtaining food, medicines, and for other needs.
5. **Contribution of natural income:** forests contribute in raising income and thus strengthen a nation's economy by activities such as recreation, hunting, and fishing.
6. **Medicinal plants:** the leaves, bark, and wood of trees contain hundreds of compounds that are valuable to the field of medicines.
7. **Employment opportunities:** forests are helpful in generating employment opportunities.
8. **Tourism:** forests increase beauty of landscape, and presence of wild life are opening new avenues for tourism.

### **INDIRECT USES:**

1. **Forests help in minimizing natural hazards:** natural hazards such as floods, droughts, landslides, storms, etc. occur due to depletion of forest cover.
2. **They help in reducing soil erosion and siltation of downstream water bodies:** trees bind soil particles in their roots and hold them so that the soil particles are not washed away.
3. **They help in reducing desertification and land degradation:** forests add humus to the soil and aid in enriching fertility.
4. **They provide habitat to wild animals and help in maintaining biodiversity**
5. **They help in regulating hydrological cycle:** forests assist in cloud formations and contribute to rainfall by maintaining transpiration and evaporation processes.
6. **They help in regulating the gases in atmosphere:** absorption of co<sub>2</sub> by the forests contributes towards decreasing greenhouse effect in the atmosphere.

## **DEFORESTATION:**

- Socio-economic development of human society not only depends on the environment but also influences the environment.
- The continuous developmental process has lead to large scale **exploitation** of natural resources.
- The growing population and rapid industrialization and many related activities are responsible for forest area exploitation.
- DEFORESTATION refers to the removal or reduction of forest cover i.e. cutting of trees for many purposes

## **CAUSES OF DEFORESTION:**

### **Exploitation of forests has taken place to meet human demands in the following ways:**

- ✚ **Encroachment of forest land for agricultural use (growing food needs):** On account of increasing population, large areas of forests have been turned into agricultural land to meet the growing demands. Poor agricultural practices cause the soil to become infertile in the long run, leaving the land barren and useless.
- ✚ **Expansion of cities:** Owing to the growing population, there is an increasing demand for providing housing facilities. Large area of forests is being cleared in order to provide accommodation to more and more people.
- ✚ **Establishment of industrial areas:** Forests provide raw materials for several small and large scale industries. Hence with rapid industrialization there is an increasing threat to the forest. Industrial operations cut countless trees for the raw materials.
- ✚ **Construction of dams, canals, and highways:** Developmental activities such as construction of dams, bridges and highways have caused large scale cutting of trees. Construction of dams also causes submergence of forest land which lead to loss of several species of flora and fauna.
- ✚ **Mining:** Mining activities promote the deforestation process. Mining activities cause soil erosion and loss of bio diversity. Mining on a large extent leaves the areas unfit for any future use and destroys the scenic value of the land scape.
- ✚ **Demand for fire wood:** Tribal people, who depend on forest for fuel wood, are responsible for cutting trees.
- ✚ **Forest fires:** Millions of acres of forests were burnt as fires.
- ✚ **Fuel requirements:** increasing demands for fuel wood by the growing population in India alone has shot up to 300-500 million tons in 2001 as compared to just 65 million tons during independence, thereby increase the pressure on forests.

- ✚ **Overgrazing:** The poor in the tropics mainly for wood as a source of fuel leading to loss of tree cover and cleared lands are turned into grazing lands.

### **EFFECT OF DEFORESTATION:**

- ✚ **Loss of natural habitat of wild animals and plants:** Loss of flora and fauna has resulted in loss of biodiversity leading to ecological imbalance
- ✚ **Land degradation:** In the absence of forest cover, a large surface of land area is exposed to the sun, then the moisture content in the soil decreases drastically causing it to become dry and cracked. Soil erosion is also accelerated in the absence of forests because water and wind easily wash the soil away.
- ✚ **Increased intensity and frequency of floods:** Environment is endangered by floods due to clearing of forests. Deforestation in the foothills of the Himalayas has led to catastrophic flooding of the river Ganges.
- ✚ **Loss of forest products:** There is a decreased availability of forest products due to cutting of the trees.
- ✚ **Siltation of rivers and lakes:** In the absence of trees, the soil particles are eroded by rains during run-offs. This leads to the deposition of soil sediments in lakes and ponds.
- ✚ **Loss of revenue:** Deforestation leads to loss of forests products and hence causes a loss in revenue
- ✚ **Change in water cycle and reduced rainfall:** Forests contribute to a high amount of rainfall owing to high rate of transpiration and precipitation. In the water cycle, moisture is transpired and evaporated into the atmosphere, forming rain clouds before being precipitated as rain back onto the forests. When the forests are cut down, less moisture is evapotranspired into the atmosphere resulting in the formation of fewer rain clouds. Subsequently, there is a decline in rainfall, subjecting the area to drought.
- ✚ **Change in climate conditions:** The climate of a region depends upon the rainfall and temperature patterns. Forests are important sinks for atmospheric CO<sub>2</sub>.

### **CONTROL OF DEFORESTATION:**

1. Mining activities should be prohibited in areas declared as protected forests
2. Cutting of trees should be followed by massive plantation.
3. The environmental laws and legal provisions should be strictly enforced.
4. Forest extension should be carried out through social forestry, agro forestry, recreation forestry, extension forestry, etc.

5. Public awareness regarding medicinal and other economic and environmental significance of forests should be created. Local people should be educated about the evil effects of deforestation and they should be taught to participate actively in forest conservation programmes.

### **EFFECTS OF TIMBER EXTRACTION, MINING AND DAMS ON FORESTS AND TRIBAL PEOPLE:**

- ✦ The cause of destruction of forests is for timber trees for household furniture and other domestic purposes. Large scale deforestation has affected the lives of the tribes in these forests. Many tribes have either vanished or have had their normal functioning disturbed. They are forced to move to other places. The migration of tribes causes changes in their culture. Biodiversity of the area is also affected by timber extraction.
- ✦ Mining is the process by which underground material is dug out. The unplanned and unscientific mining is affecting forests and tribal people. The mining activities cause irreparable loss and disturb the stability of the ecosystem in the area. People leaving in the area get infected by various kinds of diseases. Mining also results in air pollution and degrades grass lands, plains, and hilly areas drastically
- ✦ Dams are very important for a country, the adverse effects of dams on forests and Tribal people are many. It leads to large scale deforestation. Floods, draughts, and landslides become more prevalent in such areas. Tribal life and culture is interwoven and integrated with forests. Once uprooted, tribal people become totally disoriented. Forests are the treasure of biodiversity and by destroying them we are going to lose many species. Such species could have economic, medicinal and other values.

## **2. MINERAL RESOURCES**

- Minerals are naturally occurring chemical compounds formed through inorganic processes under the earth crust.
- Their presence in the Earth's crust is the result of geological processes operating over a long period of time.
- Minerals are not found everywhere. Each region has varied deposits of minerals. The distribution of these mineral resources is uneven throughout the earth.
- Minerals are non-renewable resources i.e., once mined and put to use, they cannot be restored or replaced again.
- They are exhaustible resource and may be diminished by use.
- Their regular exploitation and overuse may completely exhaust the available deposits.

- Minerals have important contributions in the economic and industrial development of a country.
- India is rich in 35 minerals such as iron, aluminium, manganese, chromium, limestone, dolomite, mica, coal, magnesium, gold, silver, lead, tin, diamond, platinum and many more.

### **Types of minerals**

- **Metallic minerals:** These minerals are associated with their ores. The ores are mined and pure metals are obtained through chemical process. About 11 metallic minerals are produced in India.  
Ex: iron, lead, copper, zinc, manganese, etc.,
- **Non-Metallic minerals:** These minerals are moulded after mining and given different shapes and sizes. These minerals are used in their naturally occurring state.  
Ex: diamond, marble, granite, salt and mica, asbestos, dolomite and gypsum. Of all the minerals found in India, about 52 are non-metallic minerals.
- **Fuel minerals:** the minerals that are utilized as fuel are known as fuel minerals. Ex: coal, petroleum, and natural gas

<b><u>minerals</u></b>	<b><u>uses</u></b>
Aluminium	structural material, packaging
Chromium	steel alloys, chrome plate
Potassium	Fertilizers, glass, photography
Uranium	Nuclear bombs, electricity, tinting of glass
Tin	cans, containers, alloys
Copper	pipes, brass, bronze, electric wiring, alloys, cooking vessels, material in gold Jeweler, silver ware.
Gold	jewellery, alloys
Silver	jewellery, vessels, photography, alloys
Platinum	jewellery, equipment, industrial catalyst
Iron	primary component of steel
Lead	pipes, battery, electrodes
Manganese	alloy steels, disinfectants
Nickel	coins, alloys, metal plating
Zinc	brass, electrodes, and medicines.
Phosphorous	medicines, fertilizers, detergents
Sulphur	insecticides, rubber tyres, medicines

## **ENVIRONMENTAL EFFECTS OF EXTRACTION AND OVER-EXPLOITATION OF MINERAL RESOURCES**

Mining is extraction of economic minerals and building materials from the earth. These materials may be extracted by adopting opencast mining or underground mining. Mining activities requires diversion of forest land for various activities like 1) Opening of mine and extraction of material 2) Dumping of unwanted waste material 3) Road to be formed for transportation of men and materials 4) Big mines requires residential accommodation for employees and providing basic amenities.

- Mining accelerates destruction of forests and damages features of the Earth's surface
- It leads to soil erosion and reduces soil fertility
- It generates large amount of wastes, which lowers the quality of land
- Fumes from smelters damage forests and spread pollution over large areas.
- Mining causes pollution of air, water and land. During blasting operations, poisonous gases are released that causes air pollution and danger to the mine workers and also to the surrounding plants and animals.
- Mining waste is also dumped on land or in water leading to land and water pollution
- It lowers water table and causes ground subsidence and ground water pollution
- It results in removal of natural ecosystems and creation of trenches and open pits.
- Earthquakes and volcanic events are natural geological hazards, that are result of movements of earth's core and mantle
- Mining also leads to health hazards to miners including diseases such as asbestosis, silicosis, black lung disease etc.
- Combustion of coal and petroleum leads to the emission of radioactive pollutants, ash and trace metals

### **3. FOOD RESOURCES**

Natural or artificially produced materials which are used as food to derive metabolic energy are called food resources. Food is the ultimate source of metabolic energy required for growth, body repair, body heat balance, and for daily activities. Primitive societies obtained food through hunting and gathering. Today human beings obtain food from cultivated plants and domesticated animals

#### **TYPES OF FOOD RESOURCES**

There are 3 major sources of human food supply. **Agricultural crops, livestock, and fish.**

- ✚ **Agricultural crops:** All cereals---wheat, maize, rice, barley, etc.— Pulses, fruits and vegetables are important sources of food. Although there are 250000 species of plants, only 300 are grown as

food, and only 100 are produced on a large scale. Most of the world's food is provided by 20 crop species including wheat, rice, corn, potato, bananas, coconuts etc.

✚ **Livestock:** milk is obtained from cattle. The food items such as meat, eggs, honey, etc., are obtained from animals. A number of bird species such as chicken are also used as food material globally.

✚ **Fish:** major part of the world's population depends on fish as food source. Other aquatic organisms such as crabs, prawns, etc., are eaten by some section of the society. Artificial production of these may be done in fresh water based system (aquaculture) or marine water based system (mariculture)

## **WORLD FOOD PROBLEMS**

✚ **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 leads to less production of food grains

✚ **Under nutrition and malnutrition:** both under nourishment and malnourishment are global problems. People may not die because of these, but they become less productive.

### **Under nutrition and malnutrition**

- Undernourishment means to receive less calories than needed.
- Under nourished persons have less energy for doing any kind of work.
- They are susceptible to diseases, their body becomes weak and they frequently fall sick.
- They look old even at a young age.
- Slow body growth, mental retardness, illness, delayed adulthood, social inferiority complex etc.

◎ Malnourishment means lack of essential nutrients like protein, vitamins, lipids, minerals, etc. in the diet.

◎ It may lead to diseases, have less strength to function productively, and they face abnormal growth.

✚ **Hoarding and blank marketing:** malpractices such as hoarding and blank marketing create artificial scarcity of food and cause world food problems.

## **FACTORS CAUSING FOOD PROBLEMS**

✚ **Geographical conditions:** In many countries, geographical conditions do not favour agricultural yeild.



- ✚ **Lack of rain fall:** crop failure takes place due to failure of monsoons and other changes in weather and climate.
- ✚ **Population growth:** food resource is diminishing with the increase in population. Both population and food supply have increased, but food production has varied and on an average, there has been no gain in the amount of food available per person.
- ✚ **Natural hazards:** floods, drought, earthquakes, storms, etc. damage agriculture on a large scale.
- ✚ **Poor quality of soil:** infertile soil is not productive and hence causes deficiency in food production
- ✚ **Inadequate distribution system:** today, there is enough food produced in the world to feed all the people. Starvation and malnutrition occur because the available food is not equally distributed. Lacks of transportation, high cost of grains, insufficient distribution system, human greed, etc., are important factors affecting the distribution system.
- ✚ **Social disruption and terrorism:** social disruption and terrorism have adversely affected world food supply.

### **FERTILIZERS**

Fertilizers are used to increase the fertility of the soil by adding nutrients which help in plant growth. Fertilizers are of many different kinds and provide a variety of nutrients to the soil.

They are divided into two broad groups

- **Organic fertilizers:** These are natural fertilizers. These are made up of natural components, which are biodegradable. Ex: cow dung and compost.
- **Chemical fertilizers:** These are essentially chemicals produced in factories and their prolonged usage can lead to an effect on soil health.

#### **Adverse effects of chemical fertilizers**

- i. Excessive use of chemical fertilizers leads to loss of soil fertility and degrades soil quality.
- ii. Create nitrate pollution in ground water when they dissolve in water and seep into the soil
- iii. Excess fertilizer from agricultural fields finds its way into ponds, lakes and rivers through run-off from water from the fields. These run-off fertilizers speed up the growth of algae in the pond, lake and river waters. This phenomenon is known as **eutrophication**.
- iv. Nitrogen fertilizers lead to the accumulation of nitrates in the soil which are then transferred to living organisms.

## **PESTICIDES**

Pesticides are used with the intention to **kill certain species or to control populations of unwanted fungi, animals or plants that harm the crops.** Pesticides can be divided into several categories based on the kind of organisms that need to be controlled. 1. Insecticides 2. Herbicides 3. Fungicides.

### **Harmful effects of using pesticides**

1. Most of the pesticides are not very specific and kill many non-target organisms as well
2. Pesticides adversely affect other species such as frogs, snakes, and birds which are natural pest control mechanisms. They destroy earthworms which are highly beneficial to agriculture.
3. Pesticides from agricultural lands run down with rain water and enter local streams or lakes and adversely affect the people using this water.
4. Pesticides affect the health of farmers who use them.
5. Pesticides are retained in soil, concentrate in crops, and vegetables, cereals, and fruits, lead to biomagnifications and enter the human body.
6. Excessive use of pesticides causes the problems of air, water, and soil pollution.
7. The effectiveness of a pesticide is found to reduce when it is used over a long period time. There is an increase in the resistance to pesticides in insects, pathogens, etc.

### **Effect of pesticides on human**

- ☉ skin rashes, redness, itching
- ☉ Muscular weakness, pain in limbs(an arm, leg or wing)
- ☉ Insomnia, vomiting
- ☉ Uterine bleeding, miscarriages(the early and unplanned birth of a fetus), pregnancy complications
- ☉ Damage to nervous system, headache, muscle twitching(make a short jerking movement) and numbness(having no sensation of the part)
- ☉ Lung injury, shortness of breath
- ☉ All types of cancers

## **WATER LOGGING AND SALINITY**

- **Accumulation of water on land** for a long period is known as water logging.
- **Rain, over-irrigation, and inadequate drainage** cause excess water to accumulate in lowlands. Due to these, moisture percolates down and dissolves the underground salts in it which come to the surface after the water evaporates. It makes the **soil saline and alkaline.**
- Such lands either get converted to **pasture land** (land covered with grass) or are **dominated by seasonal weeds**(wild plant growing where it is not wanted and in competition with plants which have been deliberately grown)

### **Effects of water logging:**

1. It accelerates **denitrification** causing loss of nitrogen. This makes the soil nitrogen deficient.
2. It causes a **lack of oxygen** in the water-logged areas.
3. Due to low nitrogen and oxygen content, water logged areas support the growth of only a **few specific plants species.**
4. Water logged areas support the growth of micro organisms that cause rapid decomposition of accumulated organic matter. This leads to a **foul odour**
5. Long term water logging **reduces the aesthetic value**(appreciation of beauty and having a pleasant appearance of land) of the region

### **ORGANIC FARMING**

Organic farming is a form of agriculture which discourages the use of synthetic fertilizers and pesticides. In this, traditional techniques such as crop rotation, use of animal manure, etc., are used as to maintain soil productivity. Approximately 75 million acres of land worldwide is now cultivated using organic farming

### **OVERGRAZING**

- Overgrazing of a land is defined as the practice of grazing by a large number of animals (live stock) for an extended period of time on the vegetation without giving sufficient recovery periods to the land
- Systematic grazing adds the animal excreta to the soil which fertilizes it and promotes crop growth
- Overgrazing is caused by the continuously increasing population of livestock.

### **Effects of overgrazing on environment**

- ⊙ Leads to **elimination of sensitive, palatable plant species.**
- ⊙ Accelerates **soil erosion and damages soil fertility. Porosity of soil decreases, infiltration rate and moisture holding capacity of soil decreases.**
- ⊙ A large quantity of accumulated animal wastes is added to downstream water bodies causing problems of **water pollution and eutrophication**
- ⊙ Grazing animals that have been added from outside sometimes bring seeds of weeds and pathogenic organisms which may often become **harmful to other animals.**
- ⊙ Increasing the chances of **drought** (a very long period of abnormally low rainfall).

### **MODERN AGRICULTURE: (GREEN REVOLUTION)**

Green revolution refers to a series of research, development, and technology transfer initiatives, occurring between the 1940 s and the late 1970s, that increased agriculture production around the world, beginning most markedly in the late 1960s. the initiatives involved the development of high yielding varieties of cereal grains, expansion of irrigation infrastructure, modernization of management techniques,

distribution of hybridized seeds, synthetic fertilizers, and pesticides to farmers. The term green revolution was first used in 1968 by former USAID director William Gaud.

- ⊙ Modern systems of agriculture use large amounts of fossil fuel energy, excess water, chemical fertilizers, and pesticides to produce huge quantities of crop or livestock.
- ⊙ Use of high yielding variety of seeds
- ⊙ Use of chemical fertilizers
- ⊙ Protection of crops from pests by the use of pesticides.
- ⊙ Modern irrigational practices.

**Effects of modern agriculture on environment:**

1. Soil erosion and loss of fertility: low concentration of organic matter in soil accelerates soil erosion. Use of heavy, modern machines increases soil compactness, which affects soil fertility and other soil qualities
2. Sedimentation: increased soil erosion adds huge amount of sediments in lakes, ponds, and rivers. Excessive sedimentation degrades water quality, reduces the depth of the water body, affects fisheries, and accelerates the loss of biodiversity.
3. Fertilizers problems: excessive use of chemical fertilizers effect the soil health. The introduction of untreated or partially treated sewage into a water body could lead to an increase in the amount of organic matter in it. The organic matter provides nutrients for the growth of algae and other aquatic plants. This accumulation of excess nutrients is called eutrophication. Eutrophication also occurs when excess fertilizer nutrients mainly N and P accumulates in the water body. It usually results in an overgrowth of phytoplankton (small plant algae). Once these die, they begin to decompose. Their decomposition causes the depletion of dissolved oxygen, which is very important for the life of fish and other aquatic life. This lead to the death of fish and other aquatic organisms.
4. Pesticide problems: Excessive use of pesticides causes the problems of air, water, and soil pollution. Pesticides gain access to human body through grains (cultivated cereals or wheat), vegetables, fruits, fish etc. and cause a variety of adverse health effects.
4. Climate change: a number of agricultural activities add sizable amount of CO<sub>2</sub> into the atmosphere which increases global temperature. Along this deforestation due to agricultural expansion, burning of fossil fuel for operating agricultural machines, burning of weeds etc., are some of the agricultural activities responsible for climate change.

5. Effect on Biogeochemical cycles: use of fertilizers, deforestation, rapid soil erosion, etc, adversely affects the biogeochemical cycles
6. Loss of genetic diversity: traditional agricultural systems encourage diversity in crop breeds. Modern agriculture encourages monocultures of crops and single varieties to maximize grain production.
7. Intensification of inequity: the poor farmers cannot afford to purchase new seeds and more fertilizers and pesticides from the market. Traditionally access to all these was free or they were available at prices affordable by most farmers. As a result of modern agriculture, existing inequities grow.
8. Irrigation related problems: modern agriculture has increased the need for irrigation water at two levels. First, it has prompted a shift away from crops which require less water. Ex. Oil seeds to crops like wheat and rice, which require water inputs throughout the year. Modern crop varieties need much more water. Irrigation without proper consideration for the drainage of excess water can be dangerous. Water logging is another problem-Salinization. Salinization diminishes the productivity of the soil and runs it forever.
10. Change in land use patterns: modern agriculture has led to an increase in the area under wheat and rich cultivation, while there is a decrease in the area under pulses. Wheat and rice are considered as soil depleting crops, while pulses are considered as soil nourishing crops. Repeated cultivation of wheat and rice crops means draining the soil of nutrients.

## **5. WATER RESOURCES**

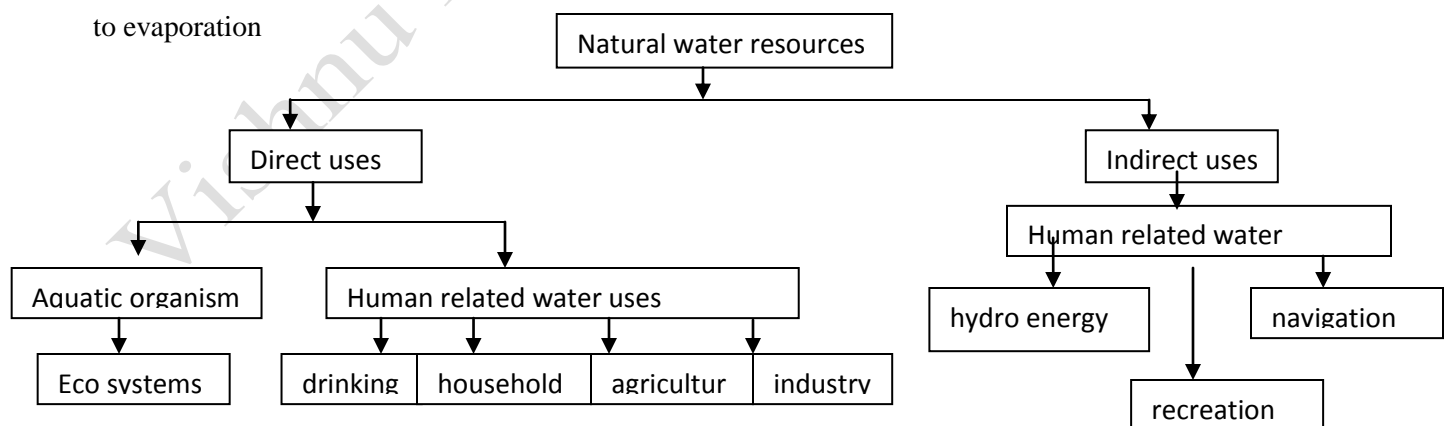
- ✚ Water is an essential component of all living things, and all animals and plants need water.
- ✚ Water plays a key role in determining the weather, it helps to shape the land surface and regulate the climate. Hydrological cycle is the process by which water from the land and oceans vaporize into the atmosphere by the solar energy, the vapor, in turn, condenses as the result of cooling and return to land in the form of precipitation.
- ✚ Life began in water it is the basic component of every living cell.
- ✚ Water moves through different biotic and abiotic components of the earth in a water cycle known as hydrological cycle 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 ways are used for inland transport

- ✚ Water may be used for obtaining common salt
- ✚ Water provides habitat to aquatic flora and fauna
- ✚ There are two kinds of water 1. Salt water and 2. Fresh water. Salt water contains great amounts of salt, whereas fresh water has a dissolved salt concentration of less than 1%. Only fresh water can be use as drinking water.
- ✚ Water is also classified as hard water and soft water. When water contains calcium and magnesium salts in it is called hard water, which is not suited for drinking, bathing, cooking, washing etc., the water does not contain a high concentration of calcium and magnesium salts is called soft water and may be used for a variety of human activities.

**Sources of water:** 97.5% of water on the earth is salt water in oceans. Only 2.5% is fresh water. Sources of fresh water are

1. Surface water: water in lake, river or freshwater wetland is known as surface water (0.9%)
2. Ground water: fresh water located in the pore space of soil and rocks is called ground water (30.1%)
3. Ice caps and glaciers: fresh water from ice caps and glaciers is relatively inaccessible (68.7%)

**GROUND WATER:** most of fresh water on land is not in rivers and lakes. It is hidden underground in spaces between soil and rock particles as ground water. As rainwater seeps into the ground, some of it clings to particles of soil or to roots of plants. This moisture provides the plants with the water they need to grow. The rest moves deeper into the ground. Most usable groundwater occurs upto a depth of 750m. Groundwater supplies water to wells, springs, and even to rivers and streams. Ground water has a number of advantages when compared to surface water. Ground water reservoirs do not suffer seepage losses as surface reservoirs, e.g., streams and lakes. The chances of pollution are also less, and less water is lost due to evaporation



## **EFFECTS OF OVER-EXPLOITATION OF GROUND WATER:**

Over utilization of ground water leads to a number of problems.

1. Reduced surface water flow
2. Lowering of water table
3. Water logging
4. Ground subsidence
5. Degradation of water quality
6. Increased salt content
7. Increased power costs.

## **Effects of over- utilization and pollution of surface and ground water**

- With the growth of human population there is a increasing need for large amount of water to fulfill a variety of basic needs. Most of the people are using more water than they really need.
- Many agriculturists use more water than necessary to grow crops.
- There are many ways in which farmers can use less water without reducing yields such as the use of drip irrigation systems.
- Agriculture also pollutes surface water and ground water stores by the excessive use of chemical fertilizers and pesticides

## **Conflicts over water**

Future global conflicts could arise over control of the shared river basins on which millions of people depend for drinking water, irrigation and energy. There were many conflicts over the world on river water.

As much as 90 % of the waste water in the world is discharged without treatment in the developing countries.

### **DAMS**

- The water of many rivers, which flow throughout the year, goes waste. Such rivers remain flooded during heavy rains causing a great damage to the land, crops, animals, and human life. In order to avoid such damage and utilize water throughout the year for human consumption, agricultural practices, and power generation, dams have been constructed on most of the rivers.
- The water of the river is blocked by constructing a strong wall of iron and concrete. The size and height of the dam depends upon the catchment area. The dams are provided with many opening gates through which collected water can be released downstream in case it crosses the danger level in order to avoid fatal accidents and to prevent calamities.

### **ADVANTAGES OF DAMS:**

- ✚ **Irrigation:** Dams are necessary for huge irrigation projects. Dams and reservoirs play an important role in meeting irrigation requirements. 30-40% of the 268 million hectares of irrigated land is watered from dams.
- ✚ **Production of electricity:** Dams are utilized for the production of electricity. 20% of dams generate electricity.
- ✚ **Promote navigation:** dams allow ships to travel on previously unnavigable rivers. Dams make navigation through seasonal rivers easy by maintaining a minimum depth of water.
- ✚ **Recreation:** dams present a beautiful view of a lake and is a great source of recreation. Activities such as boating, swimming, fishing etc. are additional benefits of these multipurpose projects.
- ✚ **Control of floods:** Dams play an effective role in controlling floods by regulating river water flow down the dam. The dams are designed, constructed, and operated as per a specific plan for steering floods through the basin without any damage to life and property.
- ✚ **Act as a source for domestic uses:** Due to large variations in hydrological cycle and unpredictable rainfall, it is essential to construct dams and reservoirs so that the water can be utilized during periods of water scarcity.
- ✚ **Water supply:** 12% of large dams supply towns and cities with water. Dams ensure a year round water supply.

**DISADVANTAGES OF DAMS:** There are number of disadvantages associated with dams. Not only are they expensive to construct but also cause several environmental problems in the long run. Hence dam construction meets with stiff opposition.

1. Deforestation and loss of biodiversity
2. Sinking of agricultural and forest land
3. Displacement of tribal people from their home land
4. Growth of aquatic weeds: a large number of aquatic weeds grown at dam sites and it poses problem when the water is to be used for domestic purposes.
5. Siltation of reservoirs due to degraded catchment conditions: a rapid stream always carries some soil particles in suspension because of much up and down movement of water. However water in the reservoir is calm and slow moving. As a result, most of the sediment that enters the reservoir from the run off that



feeds it, settles at the bottom. This leads to reduced recharge of groundwater aquifers and variations in nutrient contents and dissolved oxygen, rendering the water inhospitable to aquatic life.

#### 6. Change in the microclimate

7. Increase in water borne and soil borne diseases: dam reservoirs become breeding grounds for mosquitoes, snails, and flies (vectors of deadly diseases such as malaria, schistosomiasis, and river blindness) owing to their slow movement.

#### 8. Increase in flash floods

9. Increase in the frequency of earthquakes and land slips: the rise in water level can destabilize the geodynamic situation leading to substantial landslips. High pressure of water in dams leads to enhanced seismic activities.

10. Increase in water logging and salinity: the reservoir of the dam provides more surface area for evaporation. The loss of water due to evaporation is very high. As salt does not evaporate, the remaining water becomes more saline. Use of saline water from dams for irrigation, increased the rate of Salinization of the soil.

### **WATER CALAMITIES**

A number of calamities are related to fluctuations in water supply of a region. These may be caused both by abundance and deficiency of water. Floods and Droughts are the most common problems occurring due to variations in water supply of an area.

#### **DROUGHT:**

- ✚ Drought may be defined as the deficiency of rainfall (relative to the statistical multiyear average for a region) over an extended period of months or years.
- ✚ A drought is the condition, in which a region suffers a severe deficiency in its water supply.
- ✚ Generally this condition leads to adverse effects on the ecosystem and agriculture.
- ✚ Drought can cause significant damage and harm the local economy.

#### **Types of drought:**

1. meteorological drought: meteorological drought occurs when the actual rainfall in an area is significantly less than the climatological mean of that area. There is prolonged period with less than average rain fall

2. hydrological drought: this occurs when there is running down of surface water leading to very low stream flow and drying of lakes, rivers, and reservoirs.
3. Agricultural drought: this occurs when there is inadequate soil moisture resulting in acute crop stress and fall in agricultural productivity.

### **Consequences of Drought:**

1. Impact on agriculture: Drought are responsible for diminished crop growth and production yields due to lack of water for irrigation
2. Impact on environment: drought causes desertification, erosion, dust storms and dust bowls which further causes erode of land scape. Also affect the aquatic wildlife habitat
3. Impact on health: Drought is responsible for malnutrition, dehydration and related diseases.
4. Social impacts: subsistence farmers are forced to migrate during drought because they do not have alternative food sources. Mass migration results in internal displacement and international refugees.
5. Economic impacts: drought lead to reduced electricity production due to reduced water flow through hydroelectric dams.

### **Strategies for mitigation of drought impacts**

Society vulnerability to drought is minimized through the following actions

1. An artificial technique of cloud seeding helps in inducing rain fall
2. Desalination of sea water for irrigation
3. Planned crop rotation can help to minimize soil erosion.
4. Rain water harvesting
5. Redirecting rivers for irrigation in drought areas.
6. Treatment and purification of sewage wastewater for reuse.
7. Continuous observation of rainfall

### **FLOODS:**

- ✚ Flood can be defined as a temporary rise of the water level, as in a river, or lake or along a sea coast, resulting in its spilling over and out of its artificial or natural confines onto land.
- ✚ Flood is a temporary covering of land by water.
- ✚ Flood refers to the presence of an unusually large amount of water at any place or more water than what can be handled by the drainage of the area.

- ✚ Occurrence of floods depends on climate, nature of the collecting basin, streams, soil, vegetative cover, amount of snow melt, and overall rain fall.

### **Types of floods:**

1. Flash floods: these floods may be caused suddenly due to heavy rainfall, which may be associated with towering cumulus clouds, severe thunderstorms, cyclones, dam failure and river obstructions.
2. River floods: these floods may be caused by precipitation over large catchment areas or by melting of snow or sometimes both
3. Coastal floods: these floods are associated with cyclonic activities such as hurricanes, tropical cyclones, etc.,

### **Effects of floods:**

1. Physical damage: canals, bridges, sewage systems, road ways, vehicles, buildings, housing, etc.
2. Casualties: human and animals die due to drowning. And also spread diseases.
3. Contamination of water
4. Spread of water borne diseases
5. Loss of harvest( loss of food crops and affects the food supplies)
6. Economic effects like food shortage leading to price increases, Temporary decline of tourism, money also needed for rebuilding of any type of structure.

### **Benefits of floods:**

1. Water availability
2. Ecosystem services
3. Increase in soil fertility
4. Improved fisheries
5. Higherviability of hydro energy project

## **6. LAND RESOURCES**

- The solid portion of the Earth's surface is called as Land. It is a significant natural resource which plays an important role in the development of human society. The science dealing with land is known as pedology.
- The human civilization has taken shape on land.
- Land is used for agriculture.
- Land contains huge amount of mineral deposits.
- It also contains water in the form of underground water.
- Most of the animals have their habitat on land.

- Land provides all the resources required to fulfil the basic needs of human civilization such as food, cloth, and shelter.

### **Land degradation**

The fertility of land supports the growth and productivity of natural vegetation and agricultural crops. A number of natural and anthropogenic factors lower the quality of land. This phenomenon is commonly referred as land degradation.

#### **Cause of land degradation:**

1. Heavy rains
2. High speed winds
3. Natural disasters like earthquakes and floods
4. Expansion of desert (activities such as overgrazing, soil erosion)
5. Mining
6. Urbanization (for building houses, industries, roads etc.,)
7. Deforestation
8. Overgrazing
9. Construction of dams and canals
10. Excessive use of fertilizers
11. Dumping of industrial and municipal waste

### **SOIL EROSION**

Soil erosion is the wearing away of soil or geological material from one point on the Earth's surface to be deposited elsewhere. It is defined as the detachment and transportation of the fertile layer of soil by water or air.

#### **Causes of soil erosion:**

1. Large scale deforestation
2. Floods in rivers
3. Overgrazing
4. Dry violent winds
5. Improper agricultural technique

#### **Effects of soil erosion:**

1. Decrease in productivity of land
2. Desertification of land
3. Deposition of soil in water bodies
4. Reduction of agricultural land at the banks of rivers

### **Methods to control soil erosion:**

1. Afforestation on barren land
2. Control of overgrazing
3. Construction of small check dams
4. Promoting equitable use of water resources.
5. Preventing excavation of rocks
6. Vegetative bunds
7. Strip cropping
8. Stubble mulching

### **DESERTIFICATION**

Desert is an area of land that receives very less or no rainfall. It is very thinly populated with little or no vegetation. The fertility in desert is minimum and they are devoid of wildlife.

Conversion of fertile, non- desertic land into infertile desertic land is called desertification

### **Causes of Desertification**

1. Very low rainfall
2. Excessive evaporation
3. High salinity of soils
4. Continuous cutting of trees
5. Overgrazing
6. Over irrigation
7. Excessive ploughing
8. Excessive use of fertilizers.

### **Effect of desertification:**

1. Rapid soil erosion
2. Poor soil quality
3. Unfavourable climate
4. Low water table

### **Control of desertification**

1. Promoting large scale plantation of trees
2. Changing agricultural practices and promoting dry land farming
3. Control overgrazing
4. Promoting equitable use of water resources
5. Development of water catchment areas.

### **WASTELAND RECLAMATION**

Wasteland reclamation is the process of turning barren, sterile wasteland into something that is fertile and suitable for habitation and cultivation.

The formation of wasteland is nothing but the result of increasing overuse and abuse of our land resource.

- Wasteland can be classified as
- Barren and uncultivable land
- Fallow land
- Fallow and cultivable wasteland.
- Saline and alkaline land and water eroded wasteland.

All types of wastelands should be reclaimed for productive use for;

- Meeting the constant demand for agricultural land for our ever growing population.
- Afforestation to maintain ecological balance.
- Protection of natural resources.

By reducing the salt content of soil through leaching and flushing and using gypsum, urea, potash and compost before planting, crops can convert fallow and cultivable wasteland into a usable one.

Agro forestry is used in fallow lands for multiple use trees, agricultural crops or livestock management. This is done by planting trees and cultivating crops in between or under trees to form an integrated system of biological production within a specified area.

Five districts in the country (under the state ministry) – sundargarh (Orissa), Purulia (west Bengal), Almora (Uttarpradesh), Bellary (Karnataka) and Durgapur (Rajasthan) - have been chosen for the implementation of the plan for reforestation and reclamation of degraded lands by the Ministry of Environment and Forests.

### **Landslides**

- ✦ A sudden, uncontrolled descent of a mass of earth and rock down a slope (mountain slope) under the force of gravity is called a landslide. The mountainous regions of northern and north-eastern parts of India are vulnerable to landslides.

#### **Causes:**

- Deforestation
- Industrialization,
- Railway tracks
- And making place for human habitation accelerate the process.
- Construction of dams,
- Hill roads

Thus, for the implementation of developmental projects proper precautionary measures should be taken.

Landslides not only destroy human life but also destroy plantation and wildlife. They also block roads causing immense casualties to human life and economic loss to the country

In remote areas, landslides disrupt emergency services such as water, power and communication.

## 6. ENERGY RESOURCES

- ⊕ All living creatures on the Earth, whether a plant, and animal or a microbe, need energy to perform their vital functions. The Earth is a vast storehouse of energy. The fossil fuels beneath its surface, wind and water on its surface, the plants growing on it, the sunlight falling upon it are all sources of energy.
- ⊕ Energy is the capacity of doing work. It can neither be created nor destroyed but can be converted from one form to another.
- ⊕ The advancement of science and technology has increased the energy consumption of the human civilization. The rate of energy consumption by a country has now become a measure of the pace of its development. The higher the rate of energy consumption, the faster is the pace of development.
- ⊕ Energy can be obtained from various sources. The sun is an inexpensive and unlimited, therefore ideal source of energy.
- ⊕ Besides energy from the sun (solar energy) can also be obtained from different resources such as fossil fuels, biomass, biogas, nuclear power, hydroelectricity, wind energy, tidal energy and geothermal energy.
- ⊕ Depending on the source, energy can be broadly classified into renewable and non-renewable energy.
- ⊕ **Renewable or non-exhaustible sources of energy** are those that are present in nature and are continuously produced, irrespective of human activity. Solar, wind, tidal, geothermal and biogas energy are examples of renewable resources of energy.
- ⊕ **Nonrenewable resources** are also present in nature as deposits. Once they are used, these deposits get exhausted (depleted) and cannot be replaced. Fossil fuels like coal, petroleum, natural gas and timber, different ores and electricity are all non-renewable sources of energy. Due to constant use, not only is the stock is reducing but their increased use is also creating a number of social-economic and environmental problems like forest cover depletion, global warming and pollution.
- ⊕ The economic growth and development of a nation constantly needs more energy to be generated and consumed. The demand and consumption of energy is therefore an index of a nation's development. For example according to the world resources institute, in 1998 the per capita

energy consumption in USA was 24 times the per capita energy consumption in India thus establishing the superiority of economic development of the USA.

- ✦ Our energy demands are bound to grow as long as the earth exists and we have to sustain energy sources innovatively and find alternative sources of energy.

### **Non- renewable sources**

- ▶ Non renewable sources of energy include fossil fuels and ores such as uranium and so on. These sources of energy get exhausted with use and cannot be replaced.
- ▶ About 90% of present day energy consumption is based on non-renewable sources. Since they deplete fast, the demand for renewable sources of energy has become more important in recent times

### **Fossil fuels**

- ▶ The Industrial Revolution in Europe in the 19th century fired man's search for alternative sources of fuel to meet energy needs of the mushrooming industries. With the realization that fossil fuels could meet this requirement, the energy needs of the world were fulfilled for the time being.
- ▶ Fossil fuels are called so because they have been derived from fossils, which were formed millions of years ago during the time of the dinosaurs. They are fossilized organic remains that over millions of years have been converted to oil, gas, and coal. Because their formation takes so long, these sources are also called non-renewable.
- ▶ These fuels are made up of decomposed plant and animal matter. When plants, dinosaurs, and other ancient creatures died, they decomposed and were buried, layer upon layer under the ground. Their decomposed remains gradually changed over the years. It took millions of years to form these layers into a hard, black rock-like substance called coal, a thick liquid called oil or petroleum, and natural gas—the three major forms of fossil fuels.
- ▶ Fossil fuels are usually found below ground. Coal is either mined or dug out while oil and natural gas are pumped out. Coal is widely distributed and is easier to locate than oil and gas.
- ▶ Fossil fuels take millions of years to make, but burn and disappear in seconds. Once they are used, they cannot be reused. People have irretrievably damaged the planet by extracting and burning these fuels. It is best not to waste fossil fuels as they are not renewable. We have to learn to conserve these sources of energy.
- ▶ Every year, millions of tonnes of coal is consumed as energy. This has led to global warming (greenhouse effect) and the depletion of resources. At present, the worldwide burning of coal, oil, and natural gas releases billions of tonnes of carbon dioxide (measured as carbon) into the



atmosphere every year. Burning any fossil fuel means pollution of some sort. Even if the fuel is low in sulphur, the atmosphere contains nitrogen, which combines with oxygen at the high burning temperatures found in boilers, jet, or car engines. This yields nitrogen oxides, which like sulphur dioxide, dissolves in rain to form nitric acid. Both gases are poisonous to humans.

Mining and exploration for fossil fuels can cause disturbance to the surrounding ecosystem. The burning of fossil fuels emits oxides of sulphur and nitrogen into the atmosphere.

⊕ **Coal:**

- ▶ Fossil fuel includes coal, petroleum and natural gas.
- ▶ About 90% of the world's energy requirements are met by burning fossil fuel. Burning these not only produce energy but also many harmful gases such as carbon dioxide, carbon monoxide, sulphur dioxide and oxides of nitrogen. About 60% of air pollution occurs due to the burning of petrol and diesel in automobiles.
- ▶ The presence of carbon dioxide within a certain limit is not harmful since it is used by plants during photosynthesis but excess deposit of carbon dioxide in the earth's atmosphere causes global warming due to the green house effect.
- ▶ Carbon monoxide, if combined with haemoglobin of blood can cause death in humans within seconds.
- ▶ Oxides of sulphur cause irritation of the respiratory system and prevent the growth of plants.
- ▶ Sulphur dioxide combines with atmospheric moisture to cause acid rain.
- ▶ Oxides of nitrogen affect the respiratory system, pulmonary function and cause irritation in the eyes and nose.
- ▶ Photochemical smog is a result of the increase in oxides of nitrogen in the atmosphere. Therefore in order to check air pollution the rampant burning of fossil fuels has to be banned.
- ▶ **Coal:** due to its high abundance and easy availability, coal is the most widely used fossil fuel. It is a solid fossil fuel formed by partial decomposition of plants deposited in layers at varying depths. Depending upon the depth, pressure and quality of plant materials, the quality of coal varies. Depending on the carbon content coal has different grades;
- ▶ **Lignite coal:** it is the lowest grade of coal and is known as brown coal. It contains about 70% carbon.
- ▶ **Bituminous coal:** when lignite coal is buried deep, the pressure drives out more volatile matters and increases in carbon content. It contains about 75 – 85% carbon.
- ▶ **Anthracite coal:** this is the best quality of coal with 95% carbon content. So, on burning it gives off very little smoke. The high cost and less availability has restricted the use of this good quality of coal.

- ▶ Coal is used mainly for cooking and heating purposes. It is used as a fuel for steam power plants and for running engines and industries. It is also used for the generation of electricity in thermal power plants. Many chemical products are also made from it. (Coke, tar, ammonia and sulphur compounds, petroleum, etc)
- ⊕ **Natural gas:** it is formed by the decomposition of organic matter buried in the interiors of the earth and is recovered by the process of compression and cooling. Natural gas is a mixture of helium and a mixture of hydrocarbons like methane, propane and butane.
- ⊕ **Petroleum:** it is mineral oil found between the rocks under the earth's surface. It is mostly covered with compressed natural gas. Gasoline is used as a fuel in automobiles and airplanes while diesel is also used as a fuel in automobiles.
- ⊕ Energy resources can be classified into the two categories.
  1. **Renewable energy sources:** Renewable sources are those which are being continually replenished. Renewable sources of energy, or flow sources, rely on natural energy flows and sources in the environment and thus have the potential of being continually replenished. Ex: solar energy, wind energy, geothermal energy, tidal energy, biomass energy etc.
  2. **Non renewable energy sources:** non renewable energy sources are available in limited amount and develop over a longer period. Because of unlimited use they are likely to be exhausted one day. Ex: coal, mineral, oil, natural gas, nuclear power etc

**Advantages and disadvantages of Renewable and non renewable energy sources**

Energy Type	Advantages	Disadvantages
<b>Renewable</b>	<ul style="list-style-type: none"> <li>• Wide availability</li> <li>• Lower running cost</li> <li>• Decentralized power production</li> <li>• Low pollution</li> <li>• Available for the foreseeable future</li> </ul>	<ul style="list-style-type: none"> <li>• Unreliable supply</li> <li>• Usually produced in small quantities</li> <li>• Often very difficult to store</li> <li>• Currently per unit cost of energy is more compared to other types</li> </ul>
<b>Nonrenewable</b>	<ul style="list-style-type: none"> <li>• Available in highly concentrated form</li> <li>• Easy to store</li> <li>• Reliable supply</li> <li>• Lower cost per unit of energy produced as the technology is matured</li> </ul>	<ul style="list-style-type: none"> <li>• Highly polluting</li> <li>• Available only in few places</li> <li>• High running cost</li> <li>• Limited supply and will one day exhausted</li> </ul>
<b>Sustainable (Nuclear power)</b>	<ul style="list-style-type: none"> <li>• Highly reliable</li> <li>• Produces large amounts of energy with very little CO<sub>2</sub> emissions</li> <li>• Uses small amount of raw material per unit energy production</li> </ul>	<ul style="list-style-type: none"> <li>• Risk of radioactivity</li> <li>• High waste disposal costs</li> <li>• High capital investment and maintenance cost</li> </ul>

## **SOLAR ENERGY**

- ▶ Solar power (also known as solar energy) is the technology of obtaining usable energy from the light of the sun.
- ▶ Solar energy has been used in many traditional technologies for centuries, and has come into widespread use where other power supplies are absent, such as in remote locations and in space.
- ▶ Solar energy can be used in a number of applications including
  - Heat (hot water, building heat, cooking)
  - Electricity generation (photovoltaic cells, heat engines)
  - Desalination of seawater
  - Plant's lifecycle
- ▶ Indirectly, the sun is responsible for all our energy. Plants use the sun's light to make food, animals eat plants for food, decaying plants hundreds of millions of years ago produced the coal, oil and natural gas that we use today. So, fossil fuels is actually sunlight stored millions and millions of years ago.

### **⊕ Benefits:**

- ▶ Solar power is an extremely clean way to generate electricity.
- ▶ There are no air emissions associated with the operation of solar modules or direct application technologies.
- ▶ Residential-scale passive construction, photovoltaic, solar water heating, and other direct applications reduce power generation from traditional sources and the associated environmental impacts.

## **SOLAR THERMAL ENERGY**

- ▶ Solar Thermal is one of the best ways to lower your carbon footprint and help protect the environment.
- ▶ Typically over 20% of a home's Green house gas emissions come from heating water.
- ▶ For many commercial businesses, such as fitness centers, water heating can account for over 50% of green-house emissions.
- ▶ A solar water heater is one of the most influential and economical ways to reduce your greenhouse gas emissions.
- ▶ For example, a two collector solar thermal system will offset the same amount of greenhouse gasses as a 2.5 KW solar electric system at a fraction of the cost.
- ▶ Solar energy is the most readily available and free source of energy since prehistoric times.
- ▶ It is estimated that solar energy equivalent to over 15,000 times the world's annual commercial energy consumption reaches the earth every year

### ⊕ **Applications of solar energy:**

1. Solar water heaters 2. Solar lights 3. Solar Cookers 4. Solar vehicles 5. Solar home appliances 6. Solar power plant 7. Solar furnace

### ⊕ **Advantages**

- ▶ Solar energy is **free** - no fuel, **no waste or pollution**.
- ▶ In sunny countries, easy to use in remote places
- ▶ Good for low-power uses such as solar powered garden lights and battery chargers

### ⊕ **Disadvantages**

- ▶ Doesn't work at night.
- ▶ Very expensive to build solar power stations.
- ▶ Can be unreliable unless you're in a very sunny place

## **WIND ENERGY**

- It is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, wind mills for mechanical power, wind pumps for pumping water or drainage, or sails to propel ships.
- India now has the 5<sup>th</sup> largest wind power installed capacity, of 3595 MW, in the world estimated gross Wind potentials in India is 45,000 MW.

### ⊕ **Advantages**

1. Wind is free.
2. Produces no waste or greenhouse gases.
3. The land beneath can usually still be used for farming.
4. Wind farms can be tourist attractions.
5. A good method of supplying energy to remote areas

### ⊕ **Disadvantages**

1. The wind is not always predictable - some days have no wind.
2. Suitable areas for wind farms are often near the coast, where land is expensive.
3. Some people feel that covering the landscape with these towers is ugly
4. Can kill birds.
5. Can affect television reception if you live nearby.
6. Can be noisy.

## **HYDRO ENERGY**

**Hydropower, hydraulic power or water power** is power that is derived from the force or energy of moving water, which may be harnessed for useful purposes. The potential energy of falling water, captured and converted to mechanical energy by waterwheels, powered the start of the industrial revolution

## GEOTHERMAL ENERGY

- ▶ The word geothermal comes from the Greek words geo (earth) and therme (heat). So, geothermal energy is heat from within the Earth. We can recover this heat as steam or hot water and use it to heat buildings or generate electricity.
- ▶ Geothermal energy is a renewable energy source because the heat is continuously produced inside the Earth.

### ⊕ Advantages

- ▶ Geothermal energy does not produce any pollution, and does not contribute to the greenhouse effect.
- ▶ The power stations do not take up much room, so there is not much impact on the environment.
- ▶ No fuel is needed.
- ▶ Once you've built a geothermal power station, the energy is almost free.
- ▶ It may need a little energy to run a pump, but this can be taken from the energy being generated.

### ⊕ Disadvantages

- ▶ The big problem is that there are not many places where you can build a geothermal power station. You need hot rocks of a suitable type, at a depth where we can drill down to them.
- ▶ The type of rock above is also important, it must be of a type that we can easily drill through.
- ▶ Sometimes a geothermal site may "run out of steam", perhaps for decades.
- ▶ Hazardous gases and minerals may come up from underground, and can be difficult to safely dispose of.

## TIDAL ENERGY

- ▶ The tide moves a huge amount of water twice each day, and harnessing it could provide a great deal of energy - around 20% of Britain's needs.
- ▶ Although the energy supply is reliable and plentiful, converting it into useful electrical power is not easy.
- ▶ There are eight main sites around Britain where tidal power stations could usefully be built, including the Severn, Dee, Solway and Humber estuaries. Only around 20 sites in the world have been identified as possible tidal power stations.
- ▶ A few years ago, "tidal power" meant "tidal barrage", but these days there are other options as well.

### ⊕ Advantages

- Once you've built it, tidal power is free.
- It produces no greenhouse gases or other waste.
- It needs no fuel.
- It produces electricity reliably.
- Not expensive to maintain.

- Tides are totally predictable.
- Offshore turbines and vertical-axis turbines are not ruinously expensive to build and do not have a large environmental impact

#### ⊕ **Disadvantages**

- A barrage across an estuary is very expensive to build, and affects a very wide area - the environment is changed for many miles upstream and downstream. Many birds rely on the tide uncovering the mud flats so that they can feed. Fish can't migrate, unless "fish ladders" are installed.
- Only provides power for around 10 hours each day, when the tide is actually moving in or out.
- There are few suitable sites for tidal barrages

### **WAVE ENERGY**

- ⊕ Ocean waves are caused by the wind as it blows across the sea. Waves are a powerful source of energy. The problem is that it's not easy to harness this energy and convert it into electricity in large amounts. Thus, wave power stations are rare.

#### ⊕ **Advantages**

- The energy is free - no fuel needed, no waste produced.
- Not expensive to operate and maintain.
- Can produce a great deal of energy.

#### ⊕ **Disadvantages**

- Depends on the waves - sometimes you'll get loads of energy, sometimes almost nothing.
- Needs a suitable site, where waves are consistently strong.
- Some designs are noisy. But then again, so are waves, so any noise is unlikely to be a problem.
- Must be able to withstand very rough weather.

### **NUCLEAR ENERGY**

- ▶ When an atomic nucleus splits, a tremendous amount of energy is released. This energy is known as nuclear energy. The atom bomb, which was dropped on Hiroshima and Nagasaki in August 1945, is example of the tremendous power of atomic energy. The splitting of the nucleus is caused either by nuclear fission and nuclear fusion.
- ▶ A nuclear reactor is device which converts nuclear energy into electricity. In nuclear reactor large amount of energy which is released in the form of heat due to the controlled reaction rate is used to produce steam which can urn turbines and produce electricity.

#### **Advantages**

- One gram of U235 can deliver as much energy as two tons of coal.

- Reactors can run for years without refueling and do not produce CO<sub>2</sub> or other greenhouse gases.

#### **Disadvantages**

- We have no permanent disposal system for the nuclear waste.
- There have been several “meltdowns” in the industry and they have taken the lives of many people.

#### **BIOMASS ENERGY**

- Biomass is available all round the year. It is cheap, widely available, easy to transport, store, and has no environmental hazards.
- It can be obtained from plantation of land having no competitive-use.
- Biomass-based power generation systems, linked to plantations on wasteland, simultaneously address the vital issues of wastelands development, environmental restoration, rural employment generation, and generation of power-with-no-distribution-losses.
- It can be combined with production of other useful products, making it an attractive by product.

#### **ROLE OF AN INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES**

- ⊕ The global ecosystem has a limited capacity for replenishing natural resources. The increasing overuse and misuse of natural resources will destabilize the natural balance. Non renewable natural resources if not checked will get exhausted soon. Even renewable resources, namely those from oceans, forests, grasslands, wetlands and so on are also going to get exhausted or degraded in the future. Population growth and increasing consumerism of the affluent members of society put pressure on natural resources. The following are some illustrations.

1. Switch off lights, fans, air conditioners and other electrical gadgets when they are not required.
2. Close the tap; mend the leakages to avoid wastages and to save water.
3. Do not use plastic products; instead use recyclable paper products.
4. Use energy efficient lights and electrical gadgets to save electric energy.
5. Use a pressure cooker. Keep the vessels covered with a lid. Keep cooled foodstuff out of the refrigerator to bring it to room temperature before cooking.

- ⊕ Let us play a positive role in conserving natural resources instead of waiting for the society and the government to do everything.

**•Energy Conservation**

Switch off electric lights and appliances whenever not needed  
Ride a bicycle as often as possible

**•Forest Conservation**

Plant a large number of trees  
Make equitable use of forest and forest products

**•Water Conservation**

Repair leakages  
Save water in agriculture and domestic activities  
Adopt rainwater harvesting techniques

**•Land Conservation**

Do not dump agricultural, industrial, and domestic waste on land

**•Sustainable Food**

Adopt vegetarian food habits  
Use unpackaged food items such as vegetables and dry beans instead of canned or packaged food

**EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFE STYLES**

- ⊕ Instead of overexploiting natural resources we may be able to lead a better lifestyle through the equitable use of natural resources such as sharing of community halls, ponds, grounds, forest products, staying in flats instead of houses and using public transport or car pools instead of using one vehicle each. Such a life style will help sustain nature's wealth.
- ⊕ A dense forest, green grassland, the clean water of a lake, the ocean sheltering all types of aquatic plants, animals and resources all these can be sustained in our lifestyle if we avoid wastefulness and overutilization of the fast depleting natural resources and by equitable use and sharing.



## UNIT – III

### BIODIVERSITY AND ITS CONSERVATION

#### 1. Define Biodiversity?

**Biodiversity**      **Bio = Life**      **Diversity = Variety**

Biodiversity plays an important role in our existence.

- If we observe a patch of forest, we may notice a large variety of plant life, ranging from grasses to huge trees, a wide variety of animal life, from tiny insects to large mammals, and numerous micro organisms in the soil which cannot be seen by the naked eye.
- Everything present around us, whether visible or invisible, which is living and has its own existence, is an integral part of the vast biodiversity of the biosphere.
- The variety or variability of organisms and ecosystems is referred as biodiversity
- “The variability of all species of plants, animals & microorganisms together within the ecosystem in which they thrive”.
- Biodiversity is the variety of life on Earth and the essential interdependence of all living things
- The tremendous variety of life on Earth is made possible by complex interactions among all living things including microscopic species like algae and mites.
- The "totality of genes, species, and ecosystems of a region".
- ▶ Scientists have identified more than 2 million species. Tens of millions -- remain unknown
- ▶ The biodiversity found on Earth today consists of many millions of distinct biological species, which is the product of nearly 3.5 billion years of evolution.
- ▶ About 1.7 million species have been identified till date, while many more species are believed to exist.
- ▶ According to UNEP (United Nations Environment Program) estimate, approximately 9.0 – 52 million of species exist on Earth
- ▶ India's position is 10th in the world & 4th in Asia in terms of Plant diversity.

## 2. What are the levels or types of Biodiversity?

A. Biodiversity is usually considered at three different levels:

### Generic diversity

- ✦ Genetic diversity refers to the variation of genes of the same or within the species.
- ✦ Genetic diversity is the change of genes within the groups of plants and animals.
- ✦ This covers genetic variation between distinct populations of the same species.
- ✦ It also covers genetic variation within a population.
- ✦ Genetic diversity can be measured using a variety of DNA-based and other techniques.
- ✦ This type of diversity that gives rise to the different varieties of crops, fruits, etc.
- ✦ genetic variability or diversity within a species, i.e. between the individuals of a species
- ✦ Example ; 5,000 recorded varieties of mango

88,000 recorded varieties of *Oryza sativa*

### Species diversity

Species diversity is measured in relation to a given area. It can be assessed in terms of the number of species or the range of different types of species an area contains. So far, 1.7 million species have been described worldwide.

- Estimates of the total number of species on Earth range from 5 to 100 million.
- Species are distinct units of diversity, each playing a specific role in an ecosystem. The diversity which arises due to variations among species present in specific areas is called species diversity.
- Horses and donkeys are distinct species, as are lions and tigers.
- Species diversity - diversity between different species

Example ; *Felis tigris* , *Felis domestica*

### Ecosystem diversity

- Ecosystem diversity is refers to the diversity of habitats including the different life forms within them. The term also refers to the variety of ecosystems found within a biogeographically or political boundary.
- Ecosystem diversity encompasses the broad differences between ecosystem types, and the diversity of habitats and ecological processes occurring within each ecosystem type.
- Different physical settings favor very different communities of species.
- Ecosystem diversity contains the large differences among ecosystem types, the diversity of natural environment (habitats) of plants and animals and ecological processes that takes place within each ecosystem type.
- Different physical conditions help the growth of different types of animals and plants.

### 3. Explain the values of Biodiversity

#### A. Value of biodiversity:

- ✦ **Consumptive Use** – food, clothing, shelter, medicines, proteins, enzymes, papers, sports goods, musical instruments, beverages, pets, zoo specimens, tourism and trade concern
- ✦ **Productive Use** – domesticated agricultural crops, medicines, climatic control etc.
- ✦ **Social Value** - quality of life, outdoor recreation etc.
- ✦ **Ethical Value** – duty to preserve and protecting biodiversity based on high moral principles. (Cloning, Bio Piracy, Smuggling etc.)
- ✦ **Aesthetic Value** – hiking, canoeing, bird watching, nature photography, national parks, eco tourism, ultimately natural beauty
- ✦ **Optional value** – discovery of new species, wealth from waste, recharging of ground water etc.

**1. intrinsic value:** whenever something has a value for its own sake, we say, it has intrinsic value. it does not have to be useful to humans to possess that value.

**2. Productive values and Consumptive Use**– biodiversity has a productive value. There are many products which are used by humans.

- Ex: cinchona plant is used to make medicine, wood is used as fuel, production of charcoal is done through plants and trees, and a number of dyes and dye based products are also obtained from plants.
- Fruits, vegetables (food), beverages, rubbers, fibers, clothing, shelter, medicines, proteins, enzymes, papers, sports goods, musical instruments, beverages, pets, zoo specimens, tourism and trade concern, and a number of products obtained from or derived from the living environment have consumptive and productive values.

**3. Recreational and aesthetic values:** biodiversity adds to the aesthetic value of the planet. Each species and ecosystem adds to the richness and beauty of life on earth. Ecotourism, bird watching, wildlife, pet keeping, gardening, a sound of singing bird, the smell of wet earth after the first showers of rain, watching a sun set over an ocean. People enjoy all these recreational activities. Contact with nature is ecologically and emotionally restorative.

**4. Ecological services:** it is impossible for a species to exist independently of others. Many species depend on each other in intricate ways for survival. Destroying one species can lead to further extinctions or changes. Specific life forms present in a particular habitat help to create conditions for other life forms to live.

Solar energy absorption, nutrient cycling, air and water purification, soil formation, food production, waste disposal and a number of other ecological services depend on biodiversity. They are all very

essential for humans, animals, plants, etc.

**5. Ethical value:** each species is unique and has the right to exist, while humans do not have the right to eliminate any. The scientific and ethical principles guide developmental activities. Ethical use has deep roots within human culture, religion, and society. In order to obtain a sustainable world, it is important to develop and incorporate the concept of ethical use into our culture. **Ethical Value – duty** to preserve and protecting biodiversity based on high moral principles.

**6. Medicinal value (Health and healing values):** a large number of communities depend on traditional medicines for primary health care, most of which are derived from plants and animals. A large percentage of the world population is now utilizing medicines derived from plants

**7. Non consumption values:** soil formation, protection of soil from erosion, carbon fixing through photosynthesis, etc., are a number of values that have a very important role in providing suitable conditions for living organisms.

**8. Survival:** human beings would perish in the absence of biological diversity. Biodiversity meets the basic survival needs of a vast number of people. Most of the men are hunters whose survival depends on the availability of animals. This activity provides them with a source of income and enables them to meet their house hold expenses.

**9. Agricultural value (food security):** biodiversity is a critical for agriculture. All our food requirements are met by the biological world. Cereals, pulses, and other food crops, vegetables, fruits, milk, meat, honey, etc, are the outcomes of biodiversity. Many plant species ginger (adrak), minta(pudina), turmeric(haldi) etc., used as spices all over the world. Tea, coffee are used to prepare non alcoholic beverages, white grapes, madhuca, etc., are used to prepare alcoholic beverages. 60% of global food demands, thousand of plant species existing in nature could be utilized by humans as food.

**10. Instrumental value:** a species or individual organism has instrumental value if its existence or use benefits some other entity; many people draw income directly from forests, grasslands and fisheries

**Consumptive value:**

- Food/Drink
- Fuel
- Medicine
- Better crop varieties
- Industrial Material

**Non-Consumptive Value:**

- Recreation
- Education and Research
- Traditional value

**Ecological services:**

- Balance of nature
- Biological productivity
- Regulation of climate

- Degradation of waste
- Cleaning of air and water
- Cycling of nutrients
- Control of potential pest and disease causing species
- Detoxification of soil and sediments
- Stabilization of land against erosion
- Carbon sequestration and global climate change
- Maintenance of Soil fertility

#### 4. Explain the concept of Hotspot?

##### A. Hotspots of biodiversity

- Hotspots are biologically rich areas with high diversity and a large percentage of endemic species. For example 20 % of the world's plants are found on 0.5 % of the earth's surface.
- Hotspot is a biogeography region with a significant reservoir of biodiversity that is threatened with destruction
- The hotspots are the areas with higher concentration of endemic species and which usually experience rapid rate of habitat modifications and loss.
- The hotspots are the areas with higher concentration of groups of animals and plants that live in specific area (endemic species).
- Hot spots undergo changes in their natural environment (habitats) at faster rate and it leads to loss of hot spot diversity.
- An area is designated as a hot spot when it contains at least 0.5% of plant species as endemic.
- There are 25 such hot spots of biodiversity on a global level, out of which two are present in India.
  1. Indo- Burma (earlier The Eastern Himalayas)
  2. The western Ghats.
- These hot spots covering less than 2% of the world's land area are found to have about 50% of the terrestrial biodiversity.

#### Biogeographical Zones of India

India has ten biogeographic regions

- |                        |                          |
|------------------------|--------------------------|
| 1. The Trans-Himalayan | 4. The Semi-arid zone(s) |
| 2. The Himalayan       | 5. The Western Ghats     |
| 3. The Indian desert,  | 6. The Deccan Peninsula  |

- 7. The Gangetic Plain
- 8. The Northeast India

- 9. The Islands and
- 10. The Coasts

## 5. Explain how India is called as a mega diversity nation?

### India is a mega diversity nation:

- India has great biodiversity containing a large number of animal's and plant's natural environment (habitats) from
  1. Cold and high Himalayan ranges to the sea coast
  2. The wet north eastern green forests to the dry north western dry desert
  3. Different type of forests
  4. Different type of wet lands
  5. Different type of islands
  6. Different type of oceans.
- India contains about 8 % of worlds biodiversity on 2 % of earth's surface making it one of the 17 mega diversity countries in the world.
- India being a very big country shows a great diversity in climate, position of rivers, roads, buildings, etc. (topography) and earth's soil mixtures (geology) and hence the country is very rich in terms of biological diversity.
- India is home for 33 % of animals and plants (life forms) that live in the world.

### The important points that help to India's great biodiversity are

- **Physical geography (Physiography) of India:**
  - India is called as tropical country because
    - India is protected from the Himalayans in the north.
    - It has tropical monsoon thought the land.
- Changes in positions of different places and different type s of local climate.
- **Wetlands:**
  - India has different types of natural wet lands.
  - Wetlands are covered under water for full or few months of a year.
- **Forests:**
  - India has different types of forests like
    1. The evergreen tropical rain forests in the Andaman and Nicobar Islands
    2. The Western Ghats
    3. The northeastern states

4. Low bushes growing on high Himalaya Mountains
5. Semi-evergreen rain forests
6. Monsoon forests which shredding their leaves annually
7. Thorn forests
8. Pine forests in the medium mountain regions

- **Marine Environment:**

- Great fishing regions in oceans.
- Islands containing bright colored stones (Coral reefs)
- A number of islands opposite Sri Lanka.
- India can be divided into 10 biogeographical zones and 26 biotic zones, which contains all the important ecosystems of the world.
- There are 33 Botanical Gardens, 90 national parks, 275 zoos, 500 sanctuaries and 17 biosphere reserves in India.
- There are 47,000 groups of plants and 81,000 groups of animals identified in the country.
- 60% of this animals and plants live in the Western Ghats and it is one of the hotspots of diversity in India.
- Of the 81,000 groups of animals recorded 372 are mammals, 1228 are birds, 428 reptiles, 204 amphibians, 2546 fishes, 57,245 insects, 5,042 molluscs and several other groups of invertebrates.
- India is signed on the international agreements like Convention of International Trade on Endangered Species (CITES) and Convention of Migratory Species (CMS).
- India contains 5 world heritage sites.
- India contains 6 Ramsar wetlands (according to Ramsar convention on wet lands, Ramsar, Iran, 1991).
- India has two eco-zones called the Palaearctic eco-zone and the Indo-Malayan eco-zone out of 8 eco-zones of the world.

## 6. What are the threats to the biodiversity?

**Habitat loss** (natural environment loss), **degradation** (decomposition), **fragmentation** (separating into parts):

- Habitat loss & decomposition are main reasons for loss of wild life.
- According to international union for conservation of nature (IUCN), 89% of birds, 83% of mammals & 91% of plants are under danger due to the loss of their natural environment (habitats).

- The main causes of habitat loss are Mining, Dams, Agriculture, construction of buildings in forest areas (human settlements), industry etc.

#### **Poaching of Wildlife:**

- Killing of wild animals for illegal business of wild products like fine hair (furs), horns, tusks etc, is called poaching.
- Poaching is main reason for decrease in number of animals and plants.
- Wildlife is sold in many countries for live samples, medicines, furs, skin, horns, tusks etc worth of millions of dollars.

#### **Introduction of Exotic (non-local) species:**

- It is the spread of non-local (foreign) plants and animals in the local natural environment (habitat)
- This non-local animals and plants are called exotics.
- These non-local plants or animals may change or decompose the local natural environment.
- Hence these are called as biological pollutants.

#### **Climate change:**

- The change in the world's climate put animals, plants and their ecosystems under danger.
- The spread of animals and plants depends on climate conditions.
- When climate changes plants and animals may not be able to adjust.

#### **Man – wildlife conflicts (fights):**

- The fight between man and wildlife started with the gradual development of man, but it has been increasing day by day.
- When wild animals are not having enough food and enough places for their movements, they came out of the forest and attack humans and agricultural crops and then got killed by the human.

#### **Other threats (or danger) to biodiversity:**

- Pollution
- Over grazing
- Change villages into towns and cities (Urbanization)
- Setting up industries (Industrialization)
- Insufficient water (Drought)
- Change productive land into dry land (Desertification)
- Loss of land productivity (fertility)
- Tourism
- Unequal development of different regions.

- Over usage of (exploitation) of resources
- Over usage of (exploitation) of bio resources
- Soil decomposition and wear away of soil slowly (soil erosion)
- Construction of roads, dams and reservoirs
- Changing agricultural land (Shifting cultivation)
- Carrying wild life secretly (Smuggling)
- Thefts of wild life (bio piracy)
- Cutting of forests (deforestation)



## 7. What are the endangered and endemic species?

### A. Endangered and endemic species (groups of animals and plants under danger)

- The groups of animals and plants under high degree of danger are called endangered species
- Owing to anthropogenic disturbances, the population of many plant and animal species is declining at an alarming rate and many species are almost on the verge of extinction. Such plant and animal species are called endangered species.
- A species is critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.
- These are facing high degree of danger and they become few in numbers due to the following reasons.
  - ⊕ Climate changes
  - ⊕ Hunting habits of human beings
  - ⊕ Killing wild animals illegally (poaching)
  - ⊕ Over usage (exploitation) of animals and plants
- The [International Union for Conservation of Nature](#) (IUCN) has estimated the percentage of endangered species.
- Red Data Book (RDB) was developed during 1960s and the animals and plants were placed in different classes based on the degree of danger.
- World Conservation monitoring Centre (WCMC) & IUCN Species Survival commission update the IUCN Red list every two years since 1986.
- Some of the Endangered animal and plant species are:

S.No.	Animal / Plant	Examples
1.	<b>Reptiles</b>	Python, Gharial (a fish eating crocodile), Tortoise, Green Turtle
2.	<b>Birds</b>	Great Indian bustard (a bird like ostrich), Pelican, Great Indian Horn bill, peacock, Siberian white crane, Spotted owl.
3.	<b>Carnivorous mammals</b>	Indian wolf, Red panda, Sloth bear, Tiger, Leopard, Indian lion, Striped hyena, Red fox, Golden cat, Desert cat, Dugong (an Asian sea mammal).
4.	<b>Other mammals</b>	Black rhinoceros, Black buck
5.	<b>Plants</b>	Many types of Orchids, Rhododendrons, Sarpagandha, Sandal wood tree, Sago palm tree, pitcher plant (a type of gum producing tree).

- The state which threatened with extinction are included in vulnerable, endangered or critically endangered categories.
- Species with small world population that are not at present endangered. But are at risk, are called rare.

- 25,000 endangered species are at present
- If human interference continues, such species may become extinct in future.

**Flying squirrel**

▪ **Crocodile**

▪ **Wild ass**

**Gir lion**

▪ **Flamingo**

are some **endangered animal species** of India

#### **List of endangered animal species of India**

- |                       |                      |                  |
|-----------------------|----------------------|------------------|
| ▪ Agra monitor lizard | ▪ Great Indian rhino | ▪ Asian elephant |
| ▪ Desert cat          | ▪ Desert fox         |                  |
| ▪ Kashmir stag        | ▪ Gangetic dolphin   |                  |

#### **Endangered species in India**

- |                                       |                                  |
|---------------------------------------|----------------------------------|
| ▪ Commiphora wightii (guggal )        | ▪ Cycas beddomei (cycas)         |
| ▪ Rauvolfia serpentina ( sarpagandha) | ▪ Lasiurus indicus (seven grass) |
| ▪ Santalum album (sandal)             | ▪ Juniperus communis (juniper)   |
| ▪ Adansonia digitata (kalpvriksha)    | ▪ Ephedra gerardiana ( ephedra)  |
| ▪ Tecomella undulata (rohida)         |                                  |

#### **Endemic species**

- Species may differ in the area of their distribution; some species are cosmopolitan, while some are restricted to limited areas.
- A group of animals and plants commonly found in a specific area are called endemic species.
- Endemic species are limited to a specific geographical area or ecosystem.
- **The plant or animal species confined to a particular region and having originated there, or species which occur continuously in that area are known as endemic species.**
- The restriction of species to a small region is known as endemism.
- Endemic species remain limited in their distribution because of certain geographical barriers such as presence of sea, valley, mountain etc.

#### **Endemic species in India**

- |                    |                     |
|--------------------|---------------------|
| ▪ Elettaria repens | ▪ Butea monspersa   |
| ▪ Ficus religiosa  | ▪ Ficus bengalensis |

#### **Endemic flora (plant life):**

- India contains 62% endemic flora (plant life of a region) in Himalayans, Khasi Hills & Western Ghats.

- Out of about 47,000 groups of plants in our country, 7000 are endemic
- Some endemic flora of our country is *Cycas beddomiei*, *Sapria himalayana*, *Uvaria lurida*, *Napenthes khasians* etc.
- 3,000- 4,000 higher plants may be under high degree of danger in India
- **Endemic fauna** (animal life):
  - 81,000 groups of animals in our country are endemic.
  - 62% amphibians and 50% lizards are endemic to Western Ghats.
  - These contains 53 groups of mammals, 69 birds, 23 reptiles and 3 amphibians
  - Golden monkey, Niligiri Langur, Indian Wolf, Red Fox, Himalayan Brown Bear, Great Indian One Horned Rhinoceros, White Winged Wood Duck, Black Necked Crane, Indian Pea Fowl, Gharial, Indian egg eating Snake, Indian Salamander etc. are some examples of endemic animal species of India.
  - According to the [International Union for Conservation of Nature](#) (IUCN), India contains 172 groups of animals under danger.

Endemism may occur in biologically isolated areas such as the highlands of Ethiopia, or large bodies of water such as lake Baikal

At the start of 17 th century, there were millions of petrels and cedars(junipers) in Bermuda. At end of the century, both are driven to near extinction owing to large scale ship building as well as introduction of new species in the habitat.

**Endemic Species: Species restricted to a particular geographical area or ecosystem.**

- Thus Indian subcontinent has about 62% endemic flora, restricted mainly to Himalayas, khasi Hills & Western Ghats.
- *Cycas beddomiei*, *Sapria himalayana*, *Uvaria lurida*, *Napenthes khasians* etc. are some endemic flora of our country.
- A large number out of a total of 81,000 species of animals in our country is endemic. About 62% amphibians and 50% lizards are endemic to western Ghats.
- Golden monkey, Niligiri Langur, Indian Wolf, Red Fox, Himalayan Brown Bear, Great Indian One Horned Rhinoceros, White Winged Wood Duck, Black Necked Crane, Indian Pea Fowl, Gharial, Indian egg eating Snake, Indian Salamandar etc. are some examples of endemic animal species of India.
- According to The International Union of Conservation of Nature and Natural Resources (IUCN), the species that considered in imminent danger of extinction and whose survival is unlikely, if factors causing their decline continue to operate.

- Out of about 47,000 species of plants in our country, 7000 are endemic
- India contains 172 species of animals considered globally threatened by IUCN, or 2.9% of the world's total number of threatened species.
- These include 53 species of mammals, 69 birds, 23 reptiles and 3 amphibians
- As many as 3,000- 4,000 higher plants may be under high degree of threat in India

## 8. What are Threatened Species?

A. Species those are prone to extinction in human dominated landscapes or due to poaching and over usage.

Red Data Book (RDB) was developed during 1960s and the species were placed under various threatened categories according to the severity of the threats faced by them and the estimated eminence of their extinction.

World Conservation monitoring Centre (WCMC) in collaboration with IUCN Species Survival commission network of the specialist groups compiles the IUCN Red list every two years since 1986.

## 9. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

A. Conservation is defined as *“the controlled human use of biosphere so that it is useful to both present generations and future generations”*.

### *Need for Conservation of Biodiversity*

1. Biological diversity affects us all.
2. Biological diversity has direct consumptive value in food, agriculture, medicine, industry.
3. It also has aesthetic and recreational value.
4. Biodiversity maintains ecological balance and continues evolutionary process.
5. The indirect ecosystem services provided through biodiversity are photosynthesis, pollination, transpiration, chemical cycling, nutrient cycling, soil maintenance, climate regulation, air, water system management, and waste treatment and pest control.

- ✓ The convention on Biological Diversity held in June, 1992 stressed the need of the conservation of Biodiversity for sustainable development and perpetuation of human beings on earth.
- ✓ Conservation is defined as *“ the management of human use of the biosphere so that it may yield the greatest sustainable benefit to the present generation while maintaining its potential to meet the needs and aspirations of the future generations”*.

The two basic approaches to wildlife conservation in protected habitats are:

**1) In- situ conservation and**

**2) Ex- situ conservation.**

**In- situ conservation**

- Conservation of species within their natural habitat or in its natural ecosystem or even in man made ecosystems. The protection of animals and plants in its original place is called in-situ conservation.
- Eg: National Parks, Sanctuaries, Biosphere Reserves
- The in-situ conservation is done with the help of protected areas.
- **Protected Areas:**
- It is an area of land devoted to the protection and control of biological diversity.
- These are perfectly controlled by laws.
- These protected areas are
  - ✦ **Biosphere reserves**
  - ✦ **National parks**
  - ✦ **Wild Life Sanctuaries**
- At present we have 17 major biosphere reserves, 90 National parks, 500 wildlife sanctuaries in our country having 4% of the geographic area. Some important ones of these present in India are:

**Biosphere reserves (BR):**

1. Sheshachalam BR, A.P.
2. Sunderabans BR, West Bengal
3. Agasthyamalai BR, Kerala
4. Gulf of mannar BR, Tamilnadu
5. Nanda Devi BR, Uttarakhand

**National parks (NP):**

1. Sunderaban NP, West Bengal
2. Gir NP, Gujarat
3. Bandipur NP, Karnataka
4. Desert NP, Rajasthan
5. Corbett NP, Uttarakhand

**Sanctuaries (S):**

1. Annamalai S, Tamilnadu
2. Mudumalai S, Tamilnadu
3. Nagarjuna sagar S, A.P.
4. Periar S, Kerala
5. Chilka lake bird S, Orissa.

- There are different categories of **protected areas** which are managed with different objectives. These include; **Biosphere reserves, National parks, Wild Life Sanctuaries** etc.

**Ex- situ conservation**

- ✦ “The conservation of Species (particularly of endangered species) outside their natural Habitats”.
- ✦ It is the protection of plants and animals outside their natural environment (habitat).
- ✦ This is used to protect animals and plants under high degree of danger.
- ✦ E.g: Zoos, Botanical Gardens, Aquaria, Nurseries, DNA bank, Seed bank, Gene bank etc.

- There are more than 1500 Botanical gardens in the world containing more than 80,000 species.
- There are more than 800 zoos around the world with about 3,000 species of mammals, birds, reptiles and amphibians.
- In India, we have many gene banks. The important ones are:
- ***National Bureau of Plant genetic Resources (NBPGR), New Delhi:***
- Agricultural and horticultural (cultivation of flowers, fruits, vegetables etc.) crops and their wild varieties are preserved by **cryo-preservation of seeds** (at **-196° C in Liquid Nitrogen**), pollen etc.
- ***National Facility for Plant Tissue Culture Repository (NFPTCR) at NBPGR Campus, New Delhi:*** It has been set up for the development of a facility of conservation of varieties of crop plants/ trees by tissue culture.
- Tissue culture is a method of growing bits of animals and plant tissues in sterile (microorganisms free) medium.
- Some of these are

#### **Zoological parks (ZP):**

1. Nehru ZP, Hyderabad
2. Venkateswara ZP, Tirupati
3. Indira Gandhi ZP, Vizag
4. **Arignar Anna ZP, Chennai**
5. **Madras crocodile bank trust, mamlapuram, Chennai**

#### **Botanical Gardens (BG):**

1. [Lalbagh BG](#), [Bangalore](#), [Karnataka](#)
2. Jhansi BG, [Jhansi](#), [Uttar Pradesh](#)
3. [Empress Garden](#), [Pune](#)
4. [Government BG](#), [Tamil Nadu](#)
5. Saharanpur BG, [Saharanpur](#), [Uttar Pradesh](#)

## **10. Assessment of Biodiversity and its impact on Environment.**

**A. Rapid Assessment Survey:** A detailed survey has to be carried out in one season of the study area and a list of floral and faunal species by using the following methodology.

Survey has to be carried out for core and buffer zones, habitat wise, forest block wise and species-wise with special emphasis on endemic, endangered and threatened species.

Secondary data is also to be collected from the forest department and local villagers. Preparation of species-level exhaustive check list of flora and fauna.

Preparation of conservation based action plan for onsite implementations and for proper management of the species and habitat.

#### **A. Floral study:**

Quadrat method will be followed for carrying out the study of trees, shrubs, herbs and

grasses. A detailed list of floral species will be prepared for identifying the endangered, rare and endemic plants if any. The specimens will be identified with the aid of standard books.

## **B. Faunal study:**

### **a. Insects:**

i. For carryout the study of ground insects, quadrates (10m X 10m) are to be laid in various habitats.

ii. The dragonflies, butterflies, other aquatic and terrestrial insects will be identified by line transect method (500m X 10m).

☐ The Specimens were identified by using various field guides and other available literature

### **b. Herpeto fauna (Amphibians and Reptiles):**

☐ Capture– re capture method will be used

☐ Reptile species were identified using “Fauna of British India”

☐ Amphibians were identified based on the keys and descriptions of available literature

### **c. Aves: (Birds)**

☐ Bird surveys will be carried out using Point count method

☐ In this method all the birds found near water bodies in every 50m will be listed out.

☐ Identification of birds was done using “A pictorial guide to the birds of the Indian Sub-Continent” by Dr. Salim Ali.

### **d. Mammals:**

☐ Mammalian surveys will be conducted through line transect method (each transect is 1km each for 5 transects in Core and 10 transects buffer regions covering all the habitats).

☐ Major mammals will be identified by direct and indirect evidences (Vocal, Scat & Pugmarks).

☐ Identification will be done using “A pictorial guide to the Mammals of the India” by Prater (1997).

### **e. Aquatic species:**

☐ Aquatic animals like fishes, amphibians, water snakes, aquatic insects will be sampled from the water bodies (both lentic and lotic).

☐ A list of all species with their status will be note

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