Unit II

Natural resources: Forest resources: Ecological Importance of forest, Deforestation- Causes and remedies, Water resources: Global water resources distribution. Mineral resources: Environmental effects of extracting and processing Mineral resources. Food resources: Effects of modern agriculture, Fertilizer-pesticide problems, Water logging and Salinity. Land resources: Land as a resource, Man induced landslides, Soil erosion and desertification.

Natural Resources:

Any component of the environment which has inherent value of its own is called as resource. Any component which can be transferred in a way such that it becomes more valuable and useful is termed as resource.

2.1 FOREST RESOURCES

A forest can be defined as a biotic community predominant of trees, shrubs or any other woody vegetation usually in a closed canopy. It is derived from latin word '*foris*' means'*outside*'.

India's Forest Cover is 6,76,000 sq.km (20.55% of geographic area). Scientists estimate that India should ideally have 33% of its land under forests. Today we only have about 12% thus we need not only to protect our existing forests but also to increase our forest cover.

2.1.1 Forest Functions:

1) Protective and ameliorative functions
    a. Watershed protection
    b. Erosion control
    c. Land bank
    d. Atmospheric regulation
2) Productive functions
    a. Fodder for cattle
    b. Fuel wood and charcoal
    c. Poles for building homes
    d. Food: (consumptive use)
    e. Sericulture & Apiculture
    f. Medicinal plants for traditional medicines
3) Recreational and educational functions
4) Development functions
    a. Employment functions
    b. Revenue

2.2.1 Ecological uses

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

- **Production of Oxygen:** The main greenhouse gas carbon dioxide is absorbed by the forests as a raw material for photo synthesis. Thus forest canopy acts as a sink for carbon dioxide thereby reducing the problem of global warming caused by greenhouse gas CO_2.

- **Wild life habitat**: Forests are the homes of millions of wild animals and plants. About 7 million species are found in the tropical forests alone.
- **Regulation of hydrological Cycle**: Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff. They control climate through transpiration of water and seed clouding.
- **Soil Conservation:** Forests bind the soil particles tightly in their roots and prevent soil erosion. They also act as wind breakers.
- **Pollution moderators**: Forests can absorb many toxic gases and can help in keeping the air pure and in preventing noise pollution.

2.2.2 Commercial uses

- Man depends heavily on a larger number of plant and animal products from forests for his daily needs.
- The chief product that forests supply is wood, which is used as fuel, raw material for various industries as pulp, paper, newsprint, board, timber for furniture items, other uses as in packing articles, matches, sports goods etc.
- Indian forests also supply minor products like gums, resins, dyes, tannins, fibres, etc.
- Many of the plants are utilized in preparing medicines and drugs; Total worth of which is estimated to be more than $300 billion per year.
- Many forests lands are used for mining, agriculture, grazing, and recreation and for development of dams.

2.2.3 Over Exploitation of Forests

- Man depends heavily on forests for food, medicine, shelter, wood and fuel.
- With growing civilization, the demands for raw material like timber, pulp, minerals, fuel wood etc. shot up resulting in large scale logging, mining, road- building and clearing of forests.
- Our forests contribute substantially to the national economy.
- The international timber trade alone is worth over US $ 40 billion per year.
- The distressing effects of deforestation in India include soil, water and wind erosion, estimated to cost over 16,400 cores every year.

2.2.4 Ecological Significance of Forests

- Balances CO_2 and O_2 levels in atmosphere.
- Regulates earth temperature and hydrological cycle
- Encourage seepage and reduces runoff losses, prevents drought
- Reduces soil erosion (roots binding), prevents siltation and landslides thereby floods
- Litter helps in maintaining soil fertility
- Safe habitat for birds, wild animals and organisms against wind, solar radiation and rain

2.3 DEFORESTATION

Deforestation refers to the loss of forest cover; land that is permanently converted from forest to agricultural land, golf courses, cattle pasture, home, lakes or desert. The FAO (Food and Agriculture

Organization of the UN) defines tropical deforestation as "change of forest with depletion of tree crown cover more than 90%" depletion of forest tree crown covers less than 90% is considered forest degradation

Deforestation

2.3.1 Causes for Deforestation

- Agriculture: Conversion of forests to agricultural land to feed growing numbers of people
- Commercial logging: Destroys
- The cash crop economy: Raising cash crops for increased economy.
- Mining
- Increase in population: The needs also increase and utilize forests resources.
- Urbanization & industrialization
- Mineral exploration
- Construction of dam reservoirs
- Infrastructure development
- Forest fires
- Human encroachment & exploitation
- Pollution due to acid rain

2.3.2 Environmental effects /Consequences of deforestation

- Food problems
- Ecological imbalance
- Increasing CO2
- Floods leading to soil erosion
- Destruction of resources
- Heavy siltation of dams
- Changes in the microclimate
- Loss of biodiversity
- Desiccations of previously moist forest soil
- Environmental pollution
- Global warming

2.3.3 Forest Conservation:

Conservation derived from two Latin words, *con* – together, *servare* – to keep or guard measures, *i.e.* an act of preservation or to keep together.

❖ **Concepts in conservation of Forest:**

- Restraining cutting of trees and submerging the forests
- Reforestation
- Afforestation
- Control forest diseases and forest fire
- Recycling forest products
- Replacing forest products

2.4 WATER RESOURCES:

Water is an indispensable resource. Around 97% of world surface is covered with water. Most of the animals and plants have 60-65% of water in their body. Unique features of water:

- High specific heat
- High latent heat of vaporisation
- Good solvent for oxygen, nutrients and pollutants
- Anomalous expansion on freezing
- High surface tension

Global distribution of water is very much random depending on the geographical conditions. The availability of water decreases in the following order.

- Tropical rain forest
- Temperate regions
- Deserts

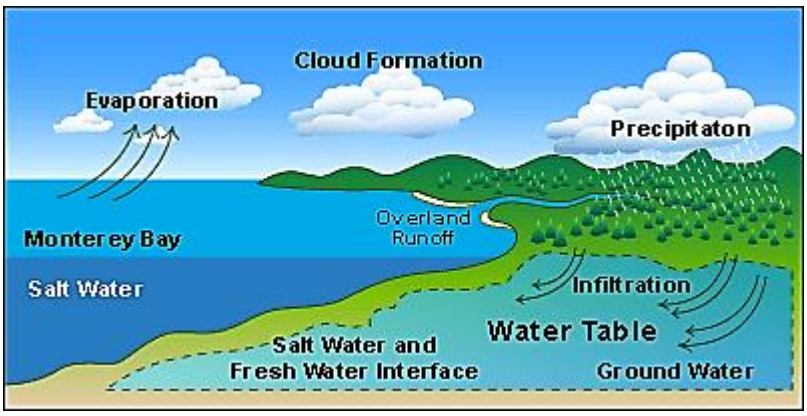
Water is used for domestic, irrigation and also industrial purposes. Out of the total available water 75% is used for agriculture, 20% for industrial usage. In our country ~93% of water is used for agricultural purposes.

Ground water: 9.86% of fresh water is ground water and it is 35-50% greater than surface water.

Aquifer: The layer of soil which is permeable has the ability to store water is called an aquifer. It is generally made up of gravel, sand etc.

Unconfined aquifer: it is covered by permeable layer. The recharge of this layer is by rainfall or snowmelt.

Confined aquifer: sandwiched between impermeable layers. The recharge is through unconfined aquifer layers.



Water Cycle

2.4.1 Over Utilization of Ground Water

Over utilization of water leads to rapid depletion of water resources, ground subsidence, lowering of water table and water logging.

Reasons: Economic development, rapid industrial growth and population explosion. The use of ground water and surface water rates which are higher than that of recharge ultimately leads to,

- Water scarcity
- Water logging
- Salination
- Alkalization
- Water pollution or contamination
- Creates declining of water levels
- Crops failure and reduction in agricultural production
- Over pumping of ground water create drought, famine and food shortage
- Over pumping of ground water sea water intrusion in coastal aquifers
- Land subsidence may due to over pumping of ground water

Clean water is universal right. It is the responsibility of everyone to ensure the purity of water. Water is a valuable commodity and it has to be conserved.

Surface water: When evaporation and transpiration rates are lower than the rainfall, surface water body like lake, river, pond, streams etc. are formed.

Flood: over flow of water, whenever the water in flow is greater than the carrying capacity of the channels flood occurs.

2.4.2 Causes:

- Heavy rainfall, snow melt, sudden release of water from dams.
- Prolonged down pour leading to overflowing of rivers and lakes
- Reduction in carrying capacity due to obstructions or sediments etc.
- Deforestation, overgrazing, mining increases water run off
- Removal of dense forests from hilly regions

2.4.3 Effects:

- Submerges the flooded area
- Loss of soil fertility due to soil erosion
- Extinction of civilization at costal area

2.4.4 Flood management:

- Dams and reservoirs can be constructed
- Embankments and proper channel management
- Flood way should not be encroached
- Forecasting or flood warning
- Decrease of run off by infiltration through afforestation or rain water harvesting etc.

2.5 MINERAL RESOURCES

Minerals are naturally occurring substances with definite chemical and physical properties. Mineral is an element or inorganic compound that occurs naturally.

2.5.1 Uses of minerals

- Development of industrial plants and machinery
- Generation of energy e.g. coal, lignite, uranium
- Construction, housing, settlements
- Defense equipments- weapons, shields
- Transportation
- Communication-telephone wires, cables, electronic devices
- Medical system- particularly in Ayurvedic System
- Formation of alloys for various purposes
- Agriculture- as fertilizers, seed dressings and fungicides
- Jewellery- e.g. Gold, silver, platinum, diamond

2.5.2 Environmental impacts of mineral extraction

Environmental impacts of over extraction of mineral resources: Depending on the conditions of terrain and depth of ore deposits 2 types of mining operations are carried out.

1. Open cast mining
2. Underground mining.

In both types each steps in mining processing produce several environmental effects such as,

- Deforestation takes place due to removal of vegetal covers.
- Great volume of debris has been generated which disrupt the surface and ground water circulation. It also reduces the water carrying capacity of streams very close to mining area.
- The stacking of over burden and building of soil banks creates problems of landslides.
- Underground fire in coalmines is a hazard that is difficult to control.
- Mining and ore processing normally causes air pollution and water pollution.
- The acid water generated in coalmines can pose a serious problem of water pollution, which adversely affects the flora and fauna.
- Deeper excavation of ground causes lowering of water table, which leads to drying of wells or sea water intrusion.
- In stone quarries, blasting of rocks not only annoying the people nearby, but also cause hazard from fly rocks and dusts and damage to buildings due to vibrations.
- The disposal of waste material produced after concentrations of ore create increase concentration of heavy metals and toxic elements in the environment.

2.5.3 Impacts of mining:

Mining is done to extract minerals from deep deposits in soil. Environmental damages caused by mining activities are as follows:

- **Devegetation and defacing of lands:** Mining requires removal of vegetation along with underlying soil mantle and overlying rock masses. This results in destruction of landscape in the area.

- **Subsidence of land:** Subsidence of mining areas results in tilting of buildings, cracks in houses, buckling of roads, bending of rail tracks and leaking of gas from cracked pipe lines leading to serious disasters.
- **Groundwater contamination:** Mining pollutes the groundwater. Sulphur, usually present as an impurity in many ores is known to get converted into sulphuric acid through microbial action, thereby making the water acidic.
- **Surface water pollution:** The acid mine drainage often contaminates the nearby streams and lakes. The acidic water, radioactive substances like uranium, heavy metals also contaminate the water bodies and kill aquatic animals.
- **Air pollution:** In order to separate and purify the metal from other impurities in the ore, smelting is done which emits enormous quantities of air pollutants. Oxides of sulphur, arsenic, cadmium and lead etc. shoot up in the atmosphere near the smelters and the public suffers from several health problems.
- **Occupational Health Hazards:** Miners working in different type of mines suffer from asbestosis, silicosis, black lung disease.

Remedial measures:

- Adopting eco-friendly mining technology
- Utilization of low grade ores by using microbial – leaching technique. In this method, the ores are inoculated with the desired strains of bacteria like Thiobacillus ferroxidans, which remove the impurities and leave the pure mineral.
- Re-vegetating mined areas with appropriate plants
- Gradual restoration of flora
- Prevention of toxic drainage discharge

2.5.4 Case studies

2.5.4.1 Mining and quarrying in Udaipur

- Soap stones, building stone, and dolomite mines spread over 15,000 hectares in Udaipur have caused many adverse impacts on environment.
- About 150 tons of explosives are used per month in blasting.
- The Maton mines have badly polluted the Ahar river.
- The hills around the mines are suffering from acute soil erosion.
- The waste water flows towards a big tank of “Bag Dara".
- Due to scarcity of water people are compelled to use this effluent for irrigation purpose.
- The animals like tiger, lion, deer, and birds have disappeared from the mining area.

2.5.4.2 Mining in Sariska and Tiger Reserve in Aravallis

- The Aravalli range is spread over about 692 Km in the North-west India covering Gujrat, Rajasthan, Haryana, and Delhi.
- The hill is rich in mineral resources.
- Mining operations within and around the Sariska Tiger reserve has left many areas permanently infertile and barren.
- The precious wild life is under serious threat.

2.6 FOOD RESOURCES

Problems Faced by Food Resources

- Overgrazing
  - Land degradation
  - Soil erosion
  - Loss of useful species
- Modern agriculture
  - High yield variety crops
  - Micronutrients imbalance
  - Nitrate pollution
  - Eutrophication
  - Pesticide related problems
  - Water logging
  - Salinity

2.6.1 World Food Problems

- Problems mainly under nutrition and malnutrition
- Natural calamities:-famine, drought, earthquake, flood, gale, storm
- Disease and medical facilities
- Pest damage:-insects, bacteria, viruses, parasites consume 60% of world‟s food production
- Hunger
- Population explosion in rural areas
- Environmental pollution
- Lack of water for irrigation
- Less rainfall due to deforestation
- Livestock overgrazing
- Overfishing

2.6.2 Changes caused by Overgrazing and Agriculture

Overgrazing: Process of eating away the vegetation along with its roots without giving a chance to regenerate

- Land degradation-leads to organically poor, dry, compacted soil cannot be used for further cultivation
- Soil erosion-cover of vegetation gets removed from soil
- Loss of useful species-good quality grasses and herbs with high nutritive value, when grazed lose even the root stocks which carry the reserve food for regeneration get destroyed which gives raise to secondary species like parthenium, Lantane, Xanthium etc

Modern agriculture: The practice through which specific plant species are cared and managed so as to obtain maximum yield of consumable parts of plants –agriculture makes use of hybrid seeds and selected and single crop variety, high tech equipment and lots of energy subsides in the form of fertilizers, pesticides and irrigation water e.g. green revolution

- Damage to soil

- Water contamination
- Water scarcity
- Global climate change
- Water logging-results when soil is over irrigated
- Soil salinity-increase plant productivity, interferes with water uptake by plants
- Fossil fuels and pesticides produce air pollution

2.6.2.1 Impacts related to high yielding varieties:

- Monoculture ie the same genotype is grown over vast areas. Disease spread easily
- Micronutrient imbalance e.g Zinc deficiency-affect soil productivity
- Nitrate pollution-nitrogenous fertilizers applied deep soil contaminates ground water. cause blue baby syndrome methaemoglobinemia- affects infants
- Eutrophication: Over nourishment of lakes due to agriculture field wash out-leads to algal bloom-dead organic matters increases due to decomposition-leads to oxygen demand

2.6.2.2 Problems associated with pesticide use:

- Evolution of genetic resistance
- Imbalance in ecosystem
- Creation of new pest
- Persistence, Bioaccumulation and Biomagnification
- Mobility through soil, water, air, washed away into rivers, streams, when it rains can harm fishes
- Creating super pest
- Death of non starget organisms
- Salinity
- Water logging

2.6.2.3 Water logging / salinisation:

Saturation of soil with irrigation water or excessive precipitation. So that water table rises close to surface.

Water logging results when soils are over irrigated without drainage. Occurs in clayey soil, soil root zone becomes saturated with so much water blocking oxygen supply for growth and soil becomes unsuitable.

Carbon dioxide and ethylene accumulate around roots affect the plants.

2.7 LAND RESOURCE

Land is critically important national resource which supports all living organisms including plants and animals. The soil profile of land determines its ability to serve socioeconomic needs.

It has been estimated that more than 5000 million tonnees of top soil is eroded annually along with 5 million tons of nutrients. About 1/3 of this is lost in sea while the rest in reservoirs and rivers leading to flood.

About 38% of the area in India suffers from moderate to high degree of water based erosion. The per capita availability of land in the country has declined from 1.37 hectare in 1901 to 0.33 hectare in 2000, all these lands cannot be utilized for agricultural purpose.
Some land would be required for other activities (to maintain urban area). Effective steps have to be taken for preventing diversion of land suitable for sustainable farming to non-farm uses. Simultaneously, degraded lands and waste lands have to be improved by ecological restoration. The Department of Land Resources was setup in April 1999 by ministry of Rural Development to act as nodal agency for land resource management.

2.7.1 Land Degradation:

Land degradation is defined as the reduction in soil capacity to produce in terms of quality, quantity goods and services. The definition is also based on

1. Sustainability or ability to produce continuously and indefinitely.
2. Quality of land resource that makes it sustainable or resistant to degradation
3. Carrying capacity or the number of people and animals the land can normally support without significant stress.

Landscapes generally undergo degradation but are usually compensated by nature"s inherent recovering ability. Whenever degradation occur exceeding nature's restorative capacity, the result will be a disaster.

2.7.2 Man induced landslides:

The hill slopes are prone to land slides, landslips, rockslides etc. These hazardous features have reduced the overall progress of the region as they obstruct the roads, communication media and water flow. There are two types of slides,

1. Slides due to natural factors
2. Slides induced by man and his activities

Some of the human activities that cause land sliding are

- Massive deforestation
- Erratic agricultural practices
- Road building
- Unscientific quarrying etc.
- Engineering. Constructions

2.7.3 Soil erosion:

1. Terracing: Terracing reduces soil erosion on steep slopes by concerting the land into a series of broad, level terraces. This retains water for crops at each level and reduces soil erosion by water run off.
2. Contour Farming: This method is adopted for gently sloped land. This involves planting crops in rows across the contour of gently sloped land.
3. Alley Cropping or Agro forestry: In this method crops are planted together in strips or alleys between trees and shrubs that can provide fruits and fuel wood. The trees and shrubs provide shade which reduce water loss by evaporation and preserve soil moisture.

4. Wind Breaks or Shelter Belts: Wind breaks and shelter belts or trees are established to reduce wind erosion and also for retaining soil moisture.

2.7.4 Desertification in hilly regions of the Himalayas:

- Desertification in Himalayas, involving clearance of natural forests and plantation of monocultures like Pinus roxburghi, Eucalyptus camadulensis etc., have upset the ecosystem by changing various soil and biological properties.
- The area is invaded by exotic weeds. These areas are not able to recover and arev losing their fertility.

2.8 ROLE OF INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES

- Natural resources-forest, water, soil, food, mineral and energy
- Overuse of these resources cause problems

2.8.1 Conserve water:

- Don’t keep water taps running
- Install water saving toilets
- Check for water leaks
- Reuse soapy water
- Use drip and sprinkling irrigation
- Conserve energy
- Turn off lights, fan when not in use
- Use solar cooker for cooking
- Try riding bicycle

2.8.2 Protect soil:

- Don’t uproot plants
- Grow grass which binds soil and prevent erosion
- Make compost
- Use green manure
- Don‟t over irrigate
- Use mixed cropping