STUDY MATERIAL FOR B.Com & B.Sc

ENVIRONMENTAL STUDIES

SEMESTER – III

ACADEMIC YEAR 2023-24

INDEX

ENVIRONMENTAL STUDIES
SYLLABUS

Unit 1: Multidisciplinary nature of environmental studies and Natural Resources

Concept of Renewable and non-renewable resources, Natural resources and associated problems: Forest resources: deforestation, Timber extraction, mining, dams and their effects. Water resources: over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Unit 2: Ecosystems:

Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem; Ecological succession, Food chains, food webs and ecological pyramids, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem and Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 3: Biodiversity and its conservation:

Definition, Level and Value of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. IUCN categories of threat: Terrestrial and marine hotspots of biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Conservation Schemes: Gir lion sanctuary project, Project tiger, Project elephant, Conservation of sea turtles in India. Ecotourism.

Unit 4: Environmental Pollution:

Types, Cause, effects and control measures of:- Air, Water, Soil and Noise pollution. Nuclear hazards and human health risk. Solid waste Management: control measures of urban and industrial wastes, Climate change global warming, Ozone layer depletion, acid rain, and impact on human communities and agriculture.

Unit 5: Social Issues and the Environment:

Sustainable development, Water conservation, Resettlement and Rehabilitation of people. Disaster management: floods, earthquake, cyclone and landslides. Consumerism and waste product, Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act; Environmental movement (Chipko, Silent valley, Bishnois of Rajasthan). Environmental Ethics, Environmental communication and Public awareness.

UNIT – I
NATURAL RESOURCES

INTRODUCTION:

Natural resources can be defined as 'variety of goods and services provided by nature which are necessary for our day-to-day lives'. Eg: Plants, animals and microbes (living or biotic part), Air, water, soil, minerals, climate and solar energy (non- living or abiotic part).They are essential for the fulfilment of physiological, social, economical and cultural needs at the individual and community levels.

TYPES OF NATURAL RESOURCES

They are of two types of resources namely Renewable and Non-Renewable Resources.

1. Renewable resources:

The resources that can be replenished through rapid natural cycles are known as renewable resource. These resources are able to increase their abundance through reproduction and utilization of simple substances. Ex: Plants, (crops and forests) and animals.

- Some examples of renewable resources though they do not have life cycle but can be recycled. Ex: Wood and wood-products, pulp products, natural rubber, fibers (e.g. Cotton, jute, animal wool, silk and synthetic fibers) and leather.
- In addition to these resources, water and soil are also classified as renewable resources.
- Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale.

2. Non renewable resources:

The resources that cannot be replenished through natural processes are known as non-renewable resources. These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.).Once a non-renewable resource is consumed, it is gone forever.

- Non-renewable resources can further be divided into two categories, viz.
  A) Recyclable and
  B) Non-recyclable

A) Recyclable: These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in the earth's crust (Ex: Ores of aluminium, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. Phosphate sock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

B) Non-recyclable: These are non-renewable resources, which cannot be recycled in any way.

Ex: Fossil fuels and uranium, which provide 90 per cent of our energy requirements.

NATURAL RESOURCES AND ASSOCIATED PROBLEMS:

- The main problem associated with natural resources is unequal consumption.
- A major part of natural resources are consumed in the 'developed' world. The 'developing nations' also over use many resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries.
- Advanced countries produce over 75% of global industrial waste and greenhouse gases.
- Energy from fossil fuels consumed in relatively much greater quantities in developed countries. Their per capita consumption of food too is much greater as well as their waste.

.

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.

FUNCTIONS OF FOREST:

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

USES OF FOREST

1. Commercial uses
2. Ecological use

1**. Commercial uses:**

I. Wood – used as a fuel
ii. Supply wood for various industries – Raw materials as pulp, paper, furniture timber etc.
iii. Minor forest products – gum, dyes, resins
iv. Many plants – Medicines

v. Supply variety of animal products – honey. Ivory, horns etc.

vi. Many forest lands are used for - Mining, grazing, for dams and recreation.

2. Ecological uses:

• Production of oxygen: Photosynthesis produces large amount of oxygen which is essential for life.

• Reducing global warming: Carbon dioxide is one of the main greenhouse gas. It is absorbed by plants for photosynthesis. Therefore, the problem of global warming caused byCO_2 is reduced.

• Wild life habitat: Forest is the home of millions of wild animals and plants.

• Pollution moderators: Forest can absorb many toxic gases and noises and help in preventing air and noise pollution.

Over exploitation of forest:

Due to over population, there is an increased demand for medicine, shelter, wood and fuel. Hence exploitation of forest materials is going on increasing.

Cause of over exploitation:

1. Increasing agricultural production.
2. Increasing agricultural activities.
3. Increase in demand of wood resources.

DEFORESTATION:

It is process of removal of forest resources due to natural or manmade activities (i.e.) destruction of forests.

Causes of deforestation:

1. Developmental projects:

Developmental projects causes deforestation through two ways.

• Through submergence of forest area.

• Destruction of forest area.

• Ex: big dams, hydroelectric projects, road construction etc.

2. Mining operations:

It reduces forest areas. Ex: Mica, coal, Manganese and lime stone.

3. Raw materials for industries:

Wood is an important raw material for various purposes. Ex: Making boxes, furniture and paper etc.

4. Fuel requirement:

Wood is the important fuel for rural and tribal population.

5. Shifting cultivation:

Replacement of natural forest ecosystem for mono specific tree plantation. Ex: Teak Forest fires: Forest fire destructs thousands of acres of forest.

Over grazing:

Over grazing by cattle reduces the cultivation land. Consequences of deforestation (or) impacts of deforestation:

1. Economic loss
2. Loss of biodiversity 3.
3. Destructs the habitats of various species
4. Increases the rate of global warming
5. Disruption of weather patterns and global climate
6. Degradation of soil and acceleration of the rate of soil erosion.
7. Induces and accelerates mass movement / landslides.
8. Increases flood frequency, magnitude / severity. Preventive measures (or) avoid of deforestation (or) methods of conservation of forests

Timber Extraction:

Wood used for engineering purposes like building houses, making furniture is called timber. The products derived from timber have been important to many civilizations, and thus it has acquired value within these civilizations. Timber extraction results in deforestation and in the fragmentation of the last remaining forests. It harms valuable species of trees, birds and wild animals.

Effects of Timber Extraction

1.Poor logging results in a degraded forest.
2. Floods may be intensified by cutting of trees or upstream watersheds.
3. Loss of biodiversity.
4. Climatic changes such as less rains.
5. Exploitation of tribal people by the contractors.
6. Soil erosion especially on slopes occurs extensively

DAMS:

Today there are more than 45,000 large dams around the world, which play an important role in communities and economies that harness these water resources for their economic development.

Effects of dams on forest:

1. Thousands of hectares of forest will be cleared.
2. Killing of wild animals and destruction of aquatic life.
3. Spreading of water borne diseases
4. Water logging increases the salinity of the soil. Ex: Narmadha Sagar project it has submerged 3.5 lakhs hectares of forest.

Effects of dam on tribal people

1. Construction of big dams lead to the displacement of tribal people.
2. Displacement and cultural change affect the tribal people both mentally and physically.
3. They do not accommodate the modern food habits and life style.
4. Tribal people are ill-treated by the modern society.
5. Many of the displaced people were not recognized and resettled or compensated.

MINING:

The process of extracting mineral resources and fossil fuels like coal from the earth is called as mining.

Types of mining

1. Surface mining: Mining of minerals from shallow deposits
2. Underground mining: Mining of minerals from deep deposits.

Effects of mining:

1. Pollute soil, water and air.
2. Destruction of natural habitat.
3. Continuous removal of minerals leads to the formation of trench where water is logged which contaminates the ground water.
4. Vibrations cause earth quakes.
5. Produces noise pollution
6. Reduces shape and size of the forest.
7. Increased risk of landslides.

WATER RESOURCES:

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

Uses:

- Is essential for all forms of life.
- Many uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually, all of these human uses, require fresh water.

EFFECTS OF OVER UTILIZATION OF WATER:

1. Decrease of ground water:

i. Increased usage decreases the ground water.
ii. Insufficient rain fall
iii. Building construction activities sealing the permeability of the soil.

2. Ground subsidence:

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

i. Problems: a. Structural damages to the buildings b. Fracture in pipes. c. Reversing the flow of canals.

3. **Lowering of water table:**

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

4. Over utilization of water causes earth quakes, landslides and famines.

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

6. Pollution of water: Near the agricultural land ground water decreases therefore water containing nitrogen enters into the ground and pollute the ground water.

a. Problem: Water which contains excess nitrate content is not suitable for drinking

FLOOD:

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

Causes of flood

1. Heavy rainfall, melting of snow and sudden release of water from dams. (Flash floods)
2. Reduction in the carrying capacity of the channel. 3. Deforestation, mining and over grazing increase the runoff from rains and the level of flood raises.

Effect of flood

1. Water spreads in the surrounding area and submerges them.
2. Cultivated land gets affected.
3. Extinction of civilization.

Flood management

1. Floods can be controlled by dams.
2. Channel management control flood.
3. Flood hazards reduced by forecasting or flood warning
4. Flood may also be reduced by reduction of run off by increasing infiltration through appropriate afforestation in the catchment area.

DROUGHT:

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

1. Inadequate rain fall
2. Late arrival of rain fall
3. Excessive withdrawal of ground water.

Causes of drought

1. When annual rain fall is below normal and less than evaporation, drought is created.
2. High population.
3. Intensive cropping pattern Ex: Maharashtra - There has been no recovery from drought for the last 30 years due to overexploitation of water by sugarcane crop.

Effects of drought

1. Drought causes hunger, malnutrition and scarcity of drinking water an also changes the quality of water
2. Drought causes widespread crop failure leading to acute shortage of food and adversely affects human and livestock population.
3. Worst situation of drought causes desertification.
4. Raw materials of ago based industries are critically affected during drought time, hence industrial and commercial growth decreases.
5. Drought increases the degradation of natural resources.

Drought management:

1. Indigenous knowledge is essential.
2. Rain water harvesting system.
3. Construction of reservoirs to improve ground water level.
4. Modern irrigation technology (drip irrigation) very useful to conserve water.
5. Afforestation activities also improve the potential of water in the drought area.
6. Crop mixing and dry forming are the suitable methods which minimize the risk of crop failures in dry area.

WATER CONFLICTS:

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

a. Sharing of Cauvery water between Karnataka and Tamil Nādu.
b. Sharing of Krishna water between Karnataka and Andhra Pradesh
c. Sarvani – Tamilnadu and Kerala International conflicts: Indus – India and Pakistan & Colorado River – Mexico and USA

DAMS-BENEFIT AND PROBLEMS:

Dams:

Dams made significant contributions to human development and the benefits derived from them have been considerable. Large dams are designed to control floods and to help the drought prone areas, with supply of water but large dams have proved to cause severe environmental damage. Hence an attempt has been made to construct small dams. Multiple small dams have less impact on the environment.

Benefits:

Dams ensure a year-round supply of water for domestic use and provide extra water for agriculture, industries and hydropower generation.

Problems:

- Dam construction and submersion leads to significant loss of farmland and forest and land submergence
- Siltation of reservoirs, water logging and salivation in surrounding lands reduces agricultural productivity
- Serious impacts on ecosystems - significant and irreversible loss of species and ecosystems, deforestation and loss of biodiversity, affects aquaculture
- Socio economic problems for example, displacement, rehabilitation and resettlement of tribal people. Fragmentation and physical transformation of rivers
- Displacement of people - People living in the catchment area, lose property and livelihood Impacts on lives, livelihoods
- Cultures and spiritual existence of indigenous and tribal people.

.

ENERGY RESOURCES:

Energy distribution in the world Developed countries like USA and Canada constitute only 5% of the world's population but consume25% of the world's available energy. Energy consumed by a person in a developed country for a single day is equal to energy consumed by a single person in a poor country for one year.

Types of energy resources:

1. Renewable energy resource (or) non-conventional energy resources
2. Non-renewable energy resources (or) conventional energy resources

1. Renewable energy sources:

Energy which can be regenerated. Types of renewable energy resources:

1. Solar energy:

Nuclear fusion reaction of sun produces enormous amount of energy. Several techniques are available for collecting, storing and using solar energy. a. Solar cell (or) Photovoltaic cell (or) PV cell: Solar cell consists of p- type semiconductor (Si doped with B) and n-type semiconductor (Si doped with P). P-type forms top layer and type forms bottom layer. Uses: It is used in calculators, electronic watches, street light, water pumps etc. b. Solar battery: Large number of solar cells connected in series is called solar battery. It is used in remote areas where continuous power supply is a problem. c. c. solar water heater: It consists of insulated box painted with black paint with glass lid. Inside the box black painted copper coil is present. Cold water is allowed to flow, it is heated up and flows out into a storage tank from which water is supplied through pipes.

2. Wind energy:

Moving air is called wind. The energy recovered from the force of the wind is called wind energy .Its speed is high. a. Wind mills: When a blowing wind strikes the blade of the wind mill, it rotates continuously. And rotational motion of the blade drives number of machines like water pump, flour mills and electric generators.

b. Wind farms: When a large number of mills are installed and joined together in a definite pattern – it forms wind farm. It produces large amount of electricity.

Advantages:

1. It does not cause air pollution
2. Very cheap

3. Ocean energy:

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

4. Geo thermal energy:

Temperature of the earth increases at a of 20 –750C per/km when we move down the earth. The energy utilized from the high temperature present inside the earth is called geo thermal energy

5. Bio mass energy: Bio mass:

Organic matter produced by plants or animals used as source of energy Bio gas: Mixture of methane, carbon dioxide and hydrogen sulphate. Methane is the major constituent.

2. Non renewable energy sources:

Energy which cannot be regenerated is called as non-renewable.

1. Coal:

It is a solid fossil fuel. Disadvantages: When coal is burnt large amount of CO2 is released which causes global warming. S, N produces toxic gases during burning.

2. Petroleum:

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

3. Natural gas:

These are found above oil in oil wells. It is a mixture of methane and other hydrocarbons. Calorific value is high. There are two types. Dry gas and wet gas.

4. Liquefied petroleum gas (LPG):

Petroleum gases obtained during FD and cracking can be easily converted into liquid under high pressure as LPG. It is colourless and odourless gas.

5. Nuclear energy:

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

LAND RESOURCES

Land is a very valuable resource. It provides food, fiber, wood, medicine and other biological materials needed for food. Soil is a mixture of inorganic materials and (rocks and minerals) and organic materials (dead materials and plants). Top soil is classified as a renewable resource as it is continuously regenerated by natural processes at a very slow rate. However, if the rate of erosion is faster than the rate of renewal, the soil becomes a non-renewable resource.

LAND DEGRADATION:

Land degradation is the major consequences of direct interference of human activities in the natural phenomenon.

Land degradation means:

1. Loss of natural fertility of soil because of loss of nutrients.
2. Less vegetation covers
3. Changes in the characteristic of soil.
4. Pollution of water resources from the contamination of soil through which water sweeps into ground or runoff to the water bodies.
5. Changes in climatic conditions because of unbalanced created in the environment.

Causes of Land Degradation:

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

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

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

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

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

Prevention and Control Measures for Land Degradation:

Following are some practices for controlling land degradation:

1. Strip farming:

It is & practice in which cultivated crops are sown in alternative strips to prevent water movement.

2. Crop Rotation:

It is one of the agricultural practices in which different crops are grown in same area following a rotation system which helps in replenishment of the soil.

3. Ridge and Furrow Formation:

Soil erosion is one of the factors responsible for lad degradation. It can be prevented by formation of ridge and furrow during irrigation which lessens run off.

4. Construction of Dams:

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

5. Contour Farming:

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

LANDSLIDES:

Landslides are the downward movement of a slope composed of earth materials such as rock, soil or artificial fills. Landslides are also called rock-slide, debris-slide, slump, earth-flow or soil-creep. During construction of roads and mining activities huge portions of mountainous fragile areas are cut down and thrown into adjacent areas and streams. These land masses weaken the already fragile mountain slopes leading to man-induced landslides.

Effects of landslides:

Landslides increase the turbidity of nearby streams, thereby reducing their productivity
Destruction of communicative links
Loss of habitat and biodiversity
Loss of infrastructure and economic loss

Causes of landslides

➢ Removal of vegetation - deforestation in slopes creates soil erosion leading to landslides underground mining activities cause subsidence of the ground.

➢ Movement of heavy vehicles in areas with unstable slopes causes landslides. Addition of weight by construction on slopes causes landslides.

➢ Over exploitation of groundwater also leads to landslides.

SOIL-EROSION:

➢ Soil erosion is the process of removal of superficial layer of soil. Soil erosion removes soil components.

➢ Harmful effects of soil erosion.

➢ Soil fertility is lost.

➢ Loss of soil ability to hold water and sediment.

➢ Sediment runoff can pollute water courses and kill aquatic life types of soil erosion

➢ Normal erosion: this is caused by the gradual removal of topsoil by natural processes.

➢ The rate of erosion is slow.

➢ Accelerated erosion: this is caused by manmade activities. In this case, the rate of erosion is much faster than the rate of formation of soil.

Causes of soil erosion

Water: water affects soil erosion in the form of rain, run-off, rapid flow or wave action

Wind: wind is an important climate agent that carries away the fine particles of soil there by contributing to soil erosion.

Biotic agents:

Over grazing, mining and deforestation are the major biotic agents causing soil erosion. These processes disturb the top soil thereby exposing the soil to various physical forces inducing erosion. Landslides cause soil erosion. Construction of dams, buildings and roads removes the protective vegetal cover leading to soil erosion.

DESERTIFICATION:

"Desertification is a type of land degradation in which a relatively dry land region becomes increasingly arid, typically losing its bodies of water as well as vegetation and wildlife. It is caused by a variety of factors, such as climate change and human activities. Desertification is a significant global ecological and environmental problem."

Causes of desertification

Overgrazing:

Animal grazing is a huge problem for many areas that are starting to become desert biomes. If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back

Deforestation:

When people are looking to move into an area, or they need trees in order to make houses and do other tasks, then they are contributing to the problems related to desertification. Without the plants (especially the trees) around, the the biome cannot thrive.

Farming practices:

Some farmers do not know how to use the land effectively. They may essentially strip the land of everything that it has before moving on to another plot of land. By stripping the soil of its nutrients, desertification becomes more and more of a reality for the area that is being used for farming.

Urbanization and other types of land development:

As mentioned above, development can cause people to go through and kill the plant life. It can also cause issues with the soil due to chemicals and other things that may harm the ground. As areas become more urbanized, there are less places for plants to grow, thus causing desertification.

Climate change:

Climate change plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent. Unless climate change is slowed down, huge areas of land will become desert; some of those areas may even become uninhabitable as time goes on.

Stripping the land of resources:

If an area of land has natural resources like natural gas, oil, or minerals, people will come in and mine it or take it out. This usually strips the soil of nutrients, which in turn kills the plant life, which in turn starts the process toward becoming a desert biome as time goes on.

Natural disasters:

There are some cases where the land gets damaged because of natural disasters, including drought. In those cases, there isn't a lot that people can do except work to try and help rehabilitate the land after it has already been damaged by nature.

Effects of desertification

Farming becomes next to impossible.

If an area becomes a desert, then it's almost impossible to grow substantial crops there without special technologies. This can cost a lot of money to try and do, so many farmers will have to sell their land and leave the desert areas.

Hunger:

Without farms in these areas, the food that those farms produce will become much scarcer, and the people who live in those local areas will be a lot more likely to try and deal with hunger problems. Animals will also go hungry, which will cause even more of a food shortage.

Flooding:

Without the plant life in an area, flooding is a lot more eminent. Not all deserts are dry; those that are wet could experience a lot of flooding because there is nothing to stop the water from gathering and going all over the place. Flooding can also negatively affect the water supply, which we will discuss next.

Poor water quality:

If an area becomes a desert, the water quality is going to become lot worse than it would have been otherwise. This is because the plant life plays a significant role in keeping the water clean and clear; without its presence, it becomes a lot more difficult for you to be able to do that.

Overpopulation:

When areas start to become deserts, animals and people will go to other areas where they can actually thrive. This causes crowding and overpopulation, which will, in the long run, end up continuing the cycle of desertification.

Poverty:

All of the issues that we've talked about above (related to the problem of desertification) can lead to poverty if it is not kept in check. Without food and water, it becomes harder for people to thrive, and they take a lot of time to try and get the things that they need.

UNIT 2
ECOSYSTEM

INTRODUCTION:

Ecosystems In 1935, the British ecologist A.G.Tansley coined the term "eco system".

• The term "eco system" is made up of two Greek words. "Eco" means ecological sphere (or) place of living while "system" means "group of organisms joined in regular and interdependent manner. A group of organisms interacting among themselves and with environment is known as ecosystem. A system of interaction of organisms with their surroundings (i.e., environment) is called as "ecosystem". Examples: Pond, lake, ocean, forest and desert…. etc are some of the examples of the ecosystems.

CONCEPT AND TYPES OF ECOSYSTEM:

The ecosystem can be generally classified into two types:

1. Natural Ecosystem
2. Artificial Eco system

1. Natural ecosystem:

A natural ecosystem is developed and governed by nature. These are capable of operating and maintaining themselves without any major interference by man.

The following are the two types of natural ecosystem based on their habitat.

a. Terrestrial Ecosystem.

b. Aquatic Ecosystem.

a**) Terrestrial Ecosystem:**

This ecosystem is related to land. Examples: Grassland ecosystem. Forest ecosystem, and Desert ecosystem etc.

b) Aquatic Ecosystem:

This ecosystem is related to water, it is further sub divided into two types based on salt content. i. Fresh Water Ecosystem:

a. Running Water Ecosystems Examples: Rivers, streams (small narrow rivers)

b. Standing Water Ecosystems Examples: Pond, lake & well, etc ii. Marine Ecosystem: Examples: seas and sea shores

2. Man made (or) artificial ecosystem:

An artificial ecosystem is created and maintained by man for his different needs. Examples: Reservoirs, Artificial lakes and gardens, etc

STRUCTURE AND FUNCTION OF ECOSYSTEM:

STRUCTURE OF AN ECOSYSTEM:

The term structure refers to various components. So, the structure of an ecosystem explains the relationship between the abiotic (non-living) and the biotic (living) components. Each and every ecosystem has two major components are:

1. Biotic (living) components.
2. Abiotic (Non-living) components.

Biotic Components:

The living component of an ecosystem is called "Biotic component". Examples: Plants (Producers), Animals (Consumers) and Micro Organisms (Decomposers) The biotic components of an ecosystem are classified into three types based on how they get their food.

A. Producers (Autotrophs): Plants
B. Consumers (Heterotrophs): Animal
C. Decomposers (Saprotrophs): Micro organisms

A. Producers (or) Autotrophs (Auto=self, troph=feeder)

The sun which is the primary source of energy, gives energy to the plants to produce food through photosynthesis. Plants use the light, carbon dioxide, water and the green pigment chlorophyll in their leaves to produce sugars and oxygen. These plants that produce food through photosynthesis are called producers. They are autotrophic organisms because they manufacture their own food. Producers are called energy transducers.

B. Consumers (or) Heterotrophs (Hetero = other, troph = feeder:

Consumers are organisms, which cannot prepare their own food and depend directly (or) indirectly on the producers. Examples: Plant Eating Species: Insects, rabbit, goat, deer, cow, etc. Animals Eating Species: Fish, lions, tigers, etc. Depending upon the food habits the consumers are divided into four types.

i. Herbivores (or) Primary Consumers (Plant Eaters)
ii. Carnivores (or) Secondary Consumers (Meat Eaters)
iii. Omnivores (or) Tertiary Consumers (With plant & meat eaters)
iv. Detritivores (dead organism eaters)

Herbivores:

Animals that eat only plants are called Herbivores. They directly depend on the plants for their food. So, they are called Plant eaters. Examples: Insects, goat, deer, cow, horse, etc.

Carnivores:

Animals that eat other animals are called carnivores. They directly depend on the herbivores for their food. Examples: Frog, cat, snake & foxes, etc.

Omnivores:

Animals that eat both plants and animals are called omnivores. They depend on both herbivores and carnivores for their food. Examples: humans, tigers, lions, rats and fox etc.

Detritivores:

Animals that eat dead organisms and waste of living are called detritivores. Examples: beetles, termites, ants, crabs, earthworms, etc.

C. Decomposers (or) Saprotrophs: (Sapros = Rotten, trophos = feeder)

Decomposers attack the dead bodies of producers and consumers and decompose them into simple compounds. During the decomposition inorganic nutrients are released. The organisms which break down complex compounds into simple products are called decomposers (or) reducers. Examples: micro-organisms such as bacteria and fungi, etc.

Abiotic Components:

The non-living component of an ecosystem is called the “abiotic component”.

These non-living components enter the body of a living organisms, take part in metabolic activities and then return to the environment. The abiotic component of the ecosystems divided into three portions.

1. Climate factors: Solar radiation, temperature, wind, water current, rainfall, etc.
2. Physical factors: light, fire, soil, air, etc.
3. Chemical factors: Organic and Inorganic substances.

FUNCTION OF AN ECOSYSTEM:

The function of an ecosystem is related to the cycling of materials (matter) and flow of energy.

Types of functions: Functions of an ecosystem are of three types:

1. Primary Function: The producers (plants) can make their food themselves through photosynthesis. This process is called primary function of eco system. Examples: All green plants and trees.

2. Secondary Function: The consumers (animals and humans) cannot make their own food. They are always depending upon the producers for their energy. This is called secondary function of eco system.

3. Tertiary Function: Decomposers attack the dead bodies of consumers and producers and decompose them into simpler compounds. During the decomposition inorganic nutrients are released. Examples: Microorganisms like bacteria and fungi, etc

The functioning of an ecosystem may be understood by studying the following terms:

A. Food chains
B. Food webs
C. Food pyramids (or) Energy pyramids
D. Energy and material flow.
E. Ecological succession

ECOLOGICAL SUCCESSION

• “Ecological succession is a series of changes that occur in an ecological community over time.”

• It is the steady and gradual change in a species of a given area with respect to the changing environment.

1**. Primary Succession**

• Primary succession is the succession when plants and animals settle for the first time in an area where there was previously no life. Usually occurs where there was previously no soil

• When the planet was first formed there was no soil on earth. The earth was only made up of rocks. These rocks were broken down by microorganisms and eroded to form soil. The soil then becomes the foundation of plant life. These plants help in the survival of different animals and progress from primary succession to the climax community.

• If this primary ecosystem is destroyed, secondary succession takes place.

2. Secondary Succession

Secondary succession occurs when the primary ecosystem gets destroyed. For e.g., a climax community gets destroyed by fire. It gets recolonized after the destruction. This is known as secondary ecological succession. Small plants emerge first, followed by larger plants. The tall trees block the sunlight and change the structure of the organisms below the canopy. Finally, the climax community arrives

FOOD CHAIN:

• Anything which we eat to live is called food.
• Food contains energy.
• Food can be transferred from one organism to the other.
• The process of transfer of food (energy) from one organism to a series of organisms is called as "food chain".

Types of food chain:

Three basic types of food chains are found in a typical eco system. They are:

1. Grazing food chains. 2. Detritus food chains. 3. Parasitic food chains.

1. Grazing food chains: Grazing food chain starts with green plants (producers) and goes to decomposer food chain (or) detritus food chain through herbivores and carnivores. It has two types: a. Terrestrial food chain and b. Aquatic food chain

a. Terrestrial food chain: Food chain on land is called terrestrial food chain. Example: Grassland food chain, Forest land food chain, Desert land food chain

Grass land food chain

Grasses ⇨ Grasshoppers ⇨Frog Snake ⇨Eagles

Forest food chain

Green plants ⇨Deer ⇨Tiger (or) lion

Aquatic food chain:

This food chain is slightly different from terrestrial food chain. It is seen in aquatic(water) eco system. Food chain in water is called "Aquatic food chain". Example: Marine food chain Example: Ocean Fresh water food chain Example: Pond, lake, streams, etc.

Food chain in a pond

Phytoplankton ⇨Zoo Plankton ⇨Small fish ⇨Large fish

Man Marine Food chain:

Sea Weeds ⇨ Small fish ⇨Large fish Sharks and other animals

1. Detritus' food chain:

Detritus food chain starts with dead organic matter (plants and animals) and goes to decomposer through consumers. Detritus food chains, independent of solar energy, but they depend on influx of dead organic matter. Example: Dead Plants Soil mitts Algae Crabs Small fish large fish

2. Parasitic food chain:

Parasitic food chain operates in many ecosystems. In this food in this food chain either consumer (or) producer is parasitized and the food passes to smaller organisms. A parasitic food

chain involves host parasite hyper parasites' links. Example: Trees Fruit eating birds Lice & Bugs Bacteria Fungi

FOOD WEB

• Web means "network". So, food web is a network of food chains.

• In a food web many food chains are inter connected, where different types of organisms are connected at different tropic levels.

• So, food web is the natural interconnection of food chains and a graphical representation of what-eats-what in an ecological community.

• Another name for food web is consumer-resource system. This food web shows many linear food chains. These linear food chains are inter connected with other food chains operating in the eco system to form a food web. The grazing food chains are as follows:

Grains → Mouse → Cat
Grains → Mouse → Hawk
Grains → Mouse → Snake → Hawk
Grains → Insect → Sparrow → Hawk
Grains → Insect → Sparrow → Snack → Hawk
Grains → Insect → Lizard → Snack → Hawk

ECOLOGICAL PYRAMIDS

• The concept of ecological pyramids was first developed by British ecologist Charles Elton in1927.

• An ecological pyramid is a graphical representation of the relationship between the different living organisms at different trophic levels.

• An ecological pyramid is shown in the following figure.

• On the basis of the number of organisms, the biomass of organisms and energy flow in organist population.

Three types of ecological pyramids are: 1. Pyramid of numbers. 2. Pyramid of biomass 3. Pyramid of energy.

1. Pyramid of numbers

• It shows the number of individual organisms present in each tropic level.

• It is expressed in numbers per unit area.

• Depending upon the type of ecosystem, we have three types of pyramids of numbers.

a. Upright pyramid of numbers.
b. Partly upright pyramid of numbers.
c. Inverted pyramid of numbers.

a. Upright pyramid of numbers.

The number of individual organisms gradually decreases from lower tropic level to higher tropic level is called "upright pyramid of numbers".

Example: A grassland ecosystem and a pond ecosystem show an upright pyramid of numbers. The producers in the grass lands are grasses, which are small in size and large in numbers. So,

producers occupy lower tropic level (1s t tropic level). The primary consumers (herbivores) are rats, which occupy the II tropic level. Since the numbers of rats are lower when compared to the grasses, the size of which is lower. The secondary consumers (carnivores) are snakes, which occupy the III tropic level. Since the numbers of snakes are lower when compared to the rats, the size of which is lower. The tertiary consumers (omnivores) are eagles, which occupy the IV tropic level. The number and size of the last tropic level is lowest.

b. Partly upright pyramid of numbers.

A forest eco system is an example of partially upright pyramid. In a forest eco system, big trees are the producers, which are less number. So, these producers occupy the lower tropic level which is narrow base. The primary consumers (herbivores) are birds, insects, which occupy the II tropic level. Since the number of birds, insects and other species are higher when compared to the trees, the size of which is broader. The secondary consumers (Carnivores) are fox, snakes, lizards, which occupy the third tropic level. Since the number of foxes, snakes are lower when compared to the birds, insects the size of which is lower. The tertiary consumers (omnivores) are lion, tiger, which occupy the IV tropic level. Since the number of lions, tiger is lower when compared to the fox and snakes the size of which is very (or) narrow lower.

c. Inverted pyramid of numbers

The number of individual organisms gradually increases from lower tropic level to higher tropic level, is known as “inverted pyramid of numbers”. Example: Parasitic food chain shows as inverted pyramid of number as

2. Pyramid of Biomass:

It represents the total amount of biomass (mass (or) weight of biological material (or) organism) present in each tropic level. · It is expressed in gram per unit area. Depending upon the type of ecosystem, we have two types of pyramids of biomass.

i. Upright pyramid of biomass.

ii. Inverted pyramid of biomass

i. Upright Pyramid of Biomass:

• A forest ecosystem showed an upright pyramid of biomass.

• In this ecosystem, the biomass decreases from the producer level to consumer levels (as shown in figure)

ii. Inverted pyramid of biomass:

The pyramid of biomass gradually increases from producer level to consumer level are called as Inverted pyramid of biomass. Example: The pond ecosystem shows an inverted pyramid of biomass.

3. Pyramid of Energy:

It represents the amount of flow of energy in each tropic level. It is expressed in calories per unit area per year.

➢ In an eco-system, the energy flows from producer level to the consumer level.

➢ At each successive tropic level, there is a huge loss of energy (about 90%) in the form of heat, respiration, etc. Thus, at each next higher level only 10% of the energy passes on. Hence, there is a sharp decrease in energy at each and every producer to omnivores (or) top carnivores.

FOREST ECOSYSTEM:

Forest is a natural ecosystem consisting of dense growth of trees and wild animals. About 40% of our land is occupied by forests. Wherever moisture is sufficient and temperature is not too low, that area is occupied by forests. The forests in India occupy an area little more than 1/10 of the total land. Depending upon temperature, available water and soil conditions, forests are broadly divided into five types

a. Tropical forests
b. Subtropical forests
c. Temperate forests
d. Alpine forests
e. Scrub jungle

Abiotic components:

In forest ecosystem organic and inorganic substances, light, temperature, soil, rainfall etc. form the abiotic components for their growth.

Producers:

Forest trees, shrubs and herbaceous plants are producers. They synthesize their own food by photosynthesis.

Consumers:

Ants, flies, elephant, beetles, deer etc., eat plant products. So they are primary consumers. Snakes, birds, lizards, fox etc., consume on herbivores. So they are called secondary consumers. The tertiary consumers include lion, tiger, leopard etc.

Decomposers:

Microbes such as fungi, bacteria and actinomycetes form decomposers. During decomposition of organic materials, they are transformed into inorganic minerals, which are further utilized by the producers for their growth. The types of producers and consumers living in forests differ depending on nature and types of forests.

GRASSLAND ECOSYSTEM:

The plane lands occupied by grasses characterize the grasslands. Grasses form the climax community in this ecosystem.

Producers:

Trees are generally absent, if present, they grow along stream banks. Tall, medium and short grasses are abundant. These are producers, which capture the solar energy and produce food for the other animals of the ecosystem.

Consumers:

As grass forms the major habitat, grazing animals are abundant. The soil is rich in humus. Bison, wild horses, ass, zebra, ground squirrel are the herbivores. Prairie dogs, snake, buffalo etc., are the carnivores.

Decomposers:

The microbes such as fungi, bacteria and actinomycetes in the soil play an important role in decomposing the dead plants and animals and thus circulating the nutrients back into the ecosystem. It is evident that the type of producer and consumer differs depending on the type of grassland.

DESERT ECOSYSTEM:

The desert ecosystem is a large wasteland where the availability of water is very low.

Abiotic components:

The abiotic factors influencing the desert ecosystem are water, air, light, temperature, humidity etc. Generally the desert ecosystem is always dry due to very low availability of water.

Producers:

Plants, which can adapt to the climatic conditions of the desert, can only live in the desert. Hence xerophytic plants form climax community in this ecosystem. Cacti are abundant. These succulent plants adapt themselves to the ecosystem and prepare food for the rest of the trophic levels of the ecosystem.

Characteristics of vegetation in desert ecosystem;

a. Trees and bushes are scarcely distributed.
b. Trees grow up to 30 m height.
c. The plants are spinous in nature.
d. The plants spread their root system near the top soil.
e. The stem and leaves are succulent.
f. The vegetation is of open canopy type

AQUATIC ECOSYSTEM:

• In contrast to terrestrial ecosystems, which are established on land, an aquatic environment is one that forms around a body of water.

• Aquatic ecosystems feature populations of creatures that are mutually and environmentally reliant.

• Marine and freshwater ecosystems are the two primary types of aquatic ecosystems.

• Freshwater environments can be lentic (including pools, ponds, and lakes), lotic (including streams and rivers), or wetland (areas where the soil is saturated or inundated for at least part of the time).

Pond ecosystem:

• Pond Ecosystem refers to fresh water ecosystem on which different organisms depend for their survival and to fulfil their nutritional needs as well.

• The ponds are the water bodies which are usually of 12-15 feet deep in which the sun rays can reach which results into growing of plants down there.

• Pond ecosystem falls under the Lentic ecosystem for the reason that the water remains stagnant in ponds for a relatively longer period time.

Structure:

There are two main components:

(A) Abiotic component:

Abiotic component of pond consists of water, dissolved minerals, oxygen and carbon dioxide. Solar radiations are the main source of energy.

(B) Biotic component:

It includes the following:

Producers-Phytoplankton. These are small, usually single-celled, photosynthetic organisms, also known as algae. Primary Consumers-Zooplankton these are other small organisms that live in pond, these are members of the animal kingdom that are suspended in the water column. Examples - water fleas, tadpoles. They consume phytoplankton

Secondary Consumers-Larger invertebrates Snails, worms, leeches insects consume these smaller animals. Tertiary Consumers-Vertebrates Vertebrates are animals with backbones. In a pond these might include fish, frogs, salamanders, and turtles.

Characteristics:

1. Still waters: pond ecosystems are lentic ecosystems – i.e., they involve stagnant or standing water.
2. Surrounded by banks: pond ecosystems are surrounded by either artificial or natural banks.
3. Wet: these ecosystems are wet and humid ones.
4. Different levels: distinct communities of creatures will live at different levels of a pond. Crustaceans and deep-water fish may live at the lower level, for example, whilst birds and blooming plants may live towards the surface. 5. Variable in size: some pond ecosystems can be very small (such as a rock pool) while others can be almost as large as a lake.

Types of pond ecosystem

Ponds can come in many different forms, and they all have their own differentiating characteristics.

1. Salt ponds. Salt ponds contain brackish (i.e., salty) water and can occur close to the sea side where waterlogged ground creates natural pools. Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools
2. Garden ponds. These artificially created ponds can contain ornamental plant and animal species that come from all over the world.
3. Freshwater pools. Freshwater pools can form anywhere inland, either from rainfall or from the presence of water saturating the soil. They can also be created by rivers flowing in to a depression in the ground.
4. Vernal pools. Vernal pools are seasonal ponds. They form in depressions in the ground, but only during certain types of the year when the rainfall is heaviest. As a result, they will attract certain types of animals and birds that are in need of a drink whenever they appear and at other times of the year will be relatively deserted – one example for instance is a seasonal oasis in the desert.

5. Underground ponds. Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, and lichens and so on.

LAKE ECOSYSTEM:

These are big fresh water ecosystem.

Zones

- Top layer – shallow, warm, prone to anthropogenic activities – Littoral zone
- Second layer – enough sunlight, high primary productivity – Limnetic zone
- Third layer – very poor or no sunlight – Profundal zone
- Eg. Dal Lake in Srinagar, Naini lakein Nainital

Structure

Abiotic factors Abiotic factors in a lake environment include: sunlight, temperature, water flow, rocks and oxygen content. Biotic factors:-

1. Planktons – phytoplankton eg. Algae – zooplankton eg. Rotifers
2. Nektons – that swim in water eg. Fishes
3. Neustons – that float on the surface of water Benthos – that attached to sediments eg. Snails

Types of lakes:

1. Oligotrophic lakes – with less nutrient content
2. Eutrophic lakes – with very high nutrient content due to fertilizer contamination
3. Desert salt lakes – that contains high saline water due to over evaporation
4. Volcanic lakes – formed by water emitted from magma due to volcanic eruptions
5. Dystrophic lakes – that contains highly acidic water (low pH)
6. Endemic lakes – lakes that contain many endemic species, etc.

STREAM ECOSYSTEM

- A stream is a general term as a small channel of freshwater that contains flowing water.
- Oxygen and nutrient content are uniform.
- They carry sediments, nutrients and other materials into rivers and lakes and on to the ocean.
- They do not suffer from oxygen deficiency as pond and lake organisms.
- This is because large surface area of running water provides more oxygen supply.

Structure

Abiotic Factors:

- Temperature
- Sunlight levels
- PH level of the water
- Vitamins and minerals in the water
- Water clarity

Biotic Factors:

Biotic factors are all of the living things and factors within an ecosystem. According to the U.S. Geological Survey, there are three key and dominant biotic factors that make up a stream ecosystem: fish, invertebrate species and algae.

- Biotic Factor: Algae
- Algae is perhaps the most important biotic factor.
- Invertebrate species that are important to freshwater ecosystems like streams generally include earthworm leeches, water beetles, mayflies, dragonflies, mussels and more
- Fish Species
- Fish species are another critical biotic factor that make up stream communities. These fish will eat both the algae and the invertebrate species in the water.
- Other animal species common in streams include crayfish, spiders, frogs, water snakes and bird species (ducks, kingfishers, etc

Types

1. Perennial streams flow all year long.
2. Seasonal streams are only seen at certain times of year, usually in wet season or as a result of snow or ice melting.
3. Continuous streams flow without stopping until they reach an endpoint or another body of water.
4. Interrupted steams, may have breaks or different reaches depending on seasonality, barriers another factors.

RIVER ECOSYSTEM

Large streams flowing from mountain highlands are rivers. Three phases:

1. Mountain highlands – rushing down water fall of water – large quantity of dissolved oxygen – plants attached to rocks and fishes that require more oxygen are found.
2. Second phase – gentle slopes of hills – warmer – supports the growth of plants and fishes that require less oxygen are seen.
3. Third phase: river shapes the land – lots of silts, nutrients are brought – deposited in plains and delta – very rich in biodiversity

OCEAN ECOSYSTEM

- Gigantic reservoirs of water covering.
- The oceans cover about 70 percent of the earth's surface and have an average depth of 2.4 miles. The planet has five oceans: Arctic, Atlantic, Pacific, Indian, and Antarctic.
- Huge variety of sea products, drugs etc.
- provide Fe, Mg, oils, natural gas, sand etc

Zones: Divided in to 3 zones.

- Euphotic zone – abundant sunlight
- Bathyal zone – dim sunlight
- Abyssal zone – dark zone – world's largest ecological unit

Organisms in ocean: Ocean Plant Life

• Marine plants live in the euphotic zone of the ocean, because they need sunlight to create food through photosynthesis. These plants include seaweeds, marine algae and sea grasses.

• Kelp provides food and shelter to ocean animals and is even used by humans in things like ice-cream and toothpaste.

• Phytoplankton is another important plant found in the ocean. This is the food for many ocean creatures, from the largest whales to the smallest fish.

Ocean Animals

• The ocean contains a large variety of animal life, including fish, mollusks, dolphins, seals, walruses, whales, crustaceans, bacteria, sea anemones and many others. Most marine animals live in the top two ocean zones, where they have access to plants and other ocean animals to eat.

ESTUARY ECOSYSTEM

• An estuary is a body of water that forms when freshwater from the land meets and mixes with saltwater from the ocean.

• Estuaries come in a variety of sizes and are also known as bays, lagoons, harbors, inlets, sounds, wetlands, and swamps.

• Estuaries are special environments to which plants and animals have evolved.

• Estuaries serve as a transition zone between river and maritime environments.

• Reefs, barrier islands, headlands, and deltas protect estuaries from ocean forces.

• Estuaries transport and trap nutrients and sediment by combining the actions of freshwater flow, wind, waves, and tidal action.

• Example: Tapi estuaries in Gujarat and Narmada in Maharashtra.

Types

There are four different kinds of estuaries, each created a different way.

1. Coastal plain estuaries: - are created when sea levels rise and fill in an existing river valley. The Chesapeake Bay, on the East Coast of the United States, is a coastal plain estuary.

2. Tectonic estuaries:-the mixture of seawater and fresh water creates a tectonic estuary. San Francisco Bay, on the West Coast of the United States, is an excellent example of a tectonic estuary.

3. Bar-built estuaries: - When a lagoon or bay is protected from the ocean by a sandbar or barrier island, it is called a bar-built estuary. The Outer Banks, a series of narrow barrier islands in North Carolina and Virginia, create sandy, bar-built estuaries.

4. Fjord estuaries: - are a type of estuary created by glaciers. Glacier Bay in Alaska and the Georgia Basin region of Puget Sound in Washington State are good examples of fjords

UNIT - III

BIODIVERSITY AND ITS CONSERVATION

Biodiversity is the abbreviated word for —biological diversity (bio-life or living organisms, diversity- variety). Thus, biodiversity is the total variety of life on our planet, the total number of races, varieties and species. The sum of total of various types of microbes, plants and animals (producers, consumers and decomposers) in a system. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain.

LEVELS OF BIODIVERSITY

The concept of biodiversity may be analyzed in 3 different levels. They are

1. Ecosystem diversity 2. Species diversity 3. Genetic diversity

Ecosystem diversity

- A set of biotic components (plants, animals and microorganisms) and abiotic components (soil, air, water, etc) interacting with each other is known as an ecosystem.
- Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs.
- It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

Species diversity:

- A discrete group of organisms of the same kind is known as species.
- Species diversity is the diversity between different species.
- Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganism.
- No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

Genetic diversity:

- A species with different genetic characteristics is known as a sub-species or "genera".
- Genetic diversity is a measure of the variety of versions of same gene within individual species.
- Within individual species, there are varieties that are slightly different from one other. These differences are due to differences in the combination of genes.
- Genes are the basic units of hereditary information transmitted from one generation to the other.

Ex: (i) Rice varieties - All rice varieties belong to the species "oryzasativa". However, there are thousands of rice varieties that show variation at the genetic level in the form of different size, shape, colour and nutrient content.

(ii) Teak wood varieties: The various teak wood varieties available are - Indian teak, Burma teak, Malaysian teak etc.

VALUE OF BIODIVERSITY

Consumptive use value:

• The consumptive use value is the value placed on nature's products that are consumed directly, without passing through a market. Some of them are firewood, food, and game meat.

• High consumptive use values on resources may lead to the following problems:

▪ Over-exploitation of wildlife in developing countries

▪ Loss of traditional controls on hunting and Loss of wildlife populations at productive levels.

▪ Consumptive use value benefits the communities closest to the resource if harvested sustainably and managed efficiently.

Productive use value:

• Productive use value refers to products that are commercially harvested (sold in a market).

• Its value is estimated at the production end rather than retail end by adding an inflated cost to the finished product.

• Productive use value is often the only value of biological resource reflected in national income accounts and may have a major impact on the national economy.

• Timber, fish, honey, construction materials, mushrooms, fruits, medicinal plants and game meat sold in a market have productive use value.

Social value:

The loss of biodiversity directly influences the social life of the country possibly through influencing ecosystem functions (energy flow and biogeochemical cycle). This be easily understood by observing detrimental effects of global warming and acid rain which cause an unfavourable alteration in logical processes.

Aesthetic Values:

Beautiful plants and animals inspire us to protect biodiversity. The most important aesthetic value of biodiversity is eco-tourism.

Ex: 1. People from distant places spend time and money to visit areas where they can enjoy aesthetic value of biodiversity. This is called eco-tourism.

2. The pleasant music of wild birds, beautifully coloured butterflies, color of peacocks and colour of flowers are very important for their aesthetic value.

Optional value:

• This refers to the potential of biodiversity that is currently known and needs to be explored.

• This refers to the idea that there may be several existing species that may prove to be important in future and their usefulness needs to be studied with reference to a specific problem currently plaguing the society.

• Ex: 1. The growing biotechnology field is searching for the cure for diseases like cancer and AIDS.

• Medicinal plants and herbs play a very important role in the economic growth of our country. peacocks and colour of flowers are very important for their aesthetic value.

THREATS TO BIODIVERSITY

Any disturbance in a natural ecosystem tends to reduce its biodiversity. Waste generated due to increase in human population and industrialization spoils the environment and leads to decreased diversity in biological species.

Causes for loss of biodiversity are:

1. Habitat loss
2. Poaching of wildlife and
3. Man-wildlife conflicts

1. HABITAT LOSS:

The loss of populations of interbreeding organisms is caused by habitat loss. Factors influencing habitat loss are:

a. Deforestation: Loss of habitat is mainly caused by deforestation activities. Forests and grasslands are cleared for conversion into agriculture lands or settlement areas or

b. developmental projects. Forests and grasslands are natural home to thousands of species which disintegrate due to the loss of their natural habitat.

Destruction of wetlands: Wetlands, estuaries and mangroves are destroyed due to farming, filling and pollution that cause loss of biodiversity

c. Habitat fragmentation: When the habitat is divided into small and scattered patches the phenomenon is called habitat fragmentation. This leads to the disappearance of most wildlife

d. Raw material: To produce hybrid seeds, wild plants are used as raw materials leading to extinction of many wild plant species.

e. Production of drugs: Pharmaceutical companies collect wild plants for the production of drugs leading to extinction of several medicinal plant species.

f. Illegal trade: Illegal trade of wildlife reduces biodiversity leading to habitat loss

g. Developmental activities: Construction of dams in forest areas coupled with the discharge of industrial effluents kills birds and other aquatic life.

2. POACHING OF WILDLIFE:

Poaching refers to killing animals or commercial hunting. It contributes to loss of biodiversity. Poaching can be of two types listed below:

a. Subsistence poaching: This refers to killing animals for survival.

b. commercial poaching: This refers to hunting animals in order to sell their products. Factors influencing poaching:

Human population: Increased human population in India has led to pressure on forest resources, leading to degradation of wildlife habitats.

Commercial activities:

Although a ban has been imposed internationally on the trade of products of endangered species, there is a continued smuggling of wildlife products. Since trading of such products is highly profitable, poachers continue to hunt endangered and smuggle their fur, skin and tusks to other countries. Wildlife products include furs, horns, tusks, live specimens and herbal products.

3. MAN-WILDLIFE CONFLICTS:

Man-wildlife conflicts arise, when wildlife starts causing immense damage and danger to man. Under such conditions it is very difficult for the forest department officials to convince the affected villagers to gain the villagers support for wildlife conservation.

Ex: 1. In Sambalpur, Orissa, several people were killed by elephants. In retaliation, the villagers killed and injured several elephants.

Villagers sometimes hide explosives in their fields to ward-off animals which explode when the elephants enter the fields.

Several people were killed when leopards attacked them in Sanjay Gandhi National Park, Mumbai.

Factors influencing man-animal conflicts

1. Shrinking forest cover compels wildlife to move outside the forest
2. Human encroachment into forest area induces a man-wildlife conflict
3. Injured animals have a tendency to attack man
4. Wild animals venture out of the forest area in search of food
5. Villagers set-up electric wiring around their fields. This injures animals (Elephants) who suffer pain and get violent

IUCN CATEGORIES OF THREAT: TERRESTRIAL AND MARINE:

- Biodiversity is declining at a faster rate than at any other time in human history, driven by unsustainable economic activity.
- Businesses, governments, and civil society around the world lack the ability to measure their potential positive impacts on biodiversity in comparable and consistent ways.
- To deliver on the Global Biodiversity Framework, which guides conservation action over the next decade and beyond, we need to be able to quantify contributions to conserving biodiversity around the world.
- The Species Threat Abatement and Restoration (STAR) metric estimates the potential contributions of specific actions in specific places towards international biodiversity targets.
- The STAR metric can help all actors – companies, the finance industry, governments and civil society – better plan projects that would bring benefits for threatened species, assess biodiversity risk, and align contributions to achieve global targets.

Terrestrial Ecosystems

Here are a few examples of how environmental pollution is destroying terrestrial ecosystems.

- Melting ice sheets and rising sea levels are destroying habitats in Polar Regions.
- Droughts and more frequent severe weather are causing habitat fragmentation in warmer regions.

- Dangerous particulates from industry and vehicles can clog respiratory systems and cause cancer in animals too.
- Contaminated drinking water can poison wildlife and spread disease in ecosystems.
- Acid rain will damage habitats and acidify soils.
- Contaminated soils from industrial and agricultural runoff do not support as many producer populations and can affect the food chains of entire ecosystems.
- Noise and light pollution will confuse and stress animals and may force them to migrate to unsuitable habitats.

HOT SPOTS OF BIODIVERSITY IN INDIA:

1. Eastern Himalayas – Indo Burma region:
   - Geographically comprises of Nepal, Bhutan and neighbouring state of Northern India
   - 35,000 plant species of which 30% are endemic
   - 63% mammals
   - 60% of the Indian Birds
2. Western Ghats – Sri Lanka:
   - Geographically comprises of Maharashtra, Karnataka, Tamil Nadu and Kerala.
   - 1500 endemic, dicotyledonous plant species
   - 62% amphibians and 50% lizards

CONSERVATION OF BIODIVERSITY:

The following measures should be taken to conserve biodiversity.

1. Illegal hunting and trade of animals and animal products should be stopped immediately
2. People-at-large should boycott purchasing coats, purse or bags made of animal skin
3. Bio-diversity laws should be strengthened.

TYPES OF CONSERVATION:

1. In-situ conservation and
2. Ex-situ conservation

IN-SITU CONSERVATION:

In-situ conservation involves protection of flora and fauna within its natural habitat. The natural habitats or ecosystems under in-situ conservation are called "protected areas".

a. Biosphere reserves
b. National parks
c. Wildlife sanctuaries
d. Gene sanctuaries

Biosphere reserves: They cover large areas (>5000 sq.km.) They are normally used to protect species for a long time.

National parks: It is an area dedicated for the conservation of wildlife along with its environment. It covers an area ranging from 100 to 500 sq.km. One or more national parks may exist within a biosphere reserve. A national park is used for enjoyment through tourism, without affecting the environment.

Wild life sanctuaries is an area that is reserved for the conservation of animals only.

i. It protects animals only

ii. It allows operations such as harvesting of timber, collection of forest products, private ownership rights and forestry operations, provided it does not affect animals adversely. Gene sanctuaries it is an area where plants are conserved.

Advantages of in-situ conservation

It is cheap and convenient.

Species get adjusted to natural disasters like drought, floods, forest fires etc.

Disadvantages of in-situ conservation:

A large surface area of earth is required to preserve biodiversity Maintenance is not proper due to shortage of staff and pollution.

EX-SITU CONSERVATION:

Ex-situ conservation involves protection of flora and fauna outside their natural habitats. This type of conservation is mainly done for conservation of crop varieties and wild relatives of crops.

Important centres of ex-situ conservation:

1. Botanical gardens
2. Seed banks
3. Microbial culture collections
4. Tissue and cell cultures
5. Museums and 6. Zoological gardens

Advantages of Ex-situ conservation

1. Survival of endangered species is increasing due to special care and attention
2. In captive breeding the animals are assured of food, water, shelter and security thereby have a longer life span

Disadvantages of Ex-situ conservation

1. It is an expensive method
2. Freedom of wildlife is lost

CONSERVATION SCHEMES:

1. Gir lion sanctuary project:

Gir National Park is the only place in the world outside Africa where a lion can be seen in its natural habitat. The lions of Gir are a majestic animal, averaging 2.75 metres in length, and with a bigger tail tassle, bushier elbow tufs and prominent belly folds than his African cousin which has larger mane. Gir is a home to 40 species of mammals and 425 species of birds.

We all know, Gir is the only natural habitat of world popular Asiatic Lions. Where our tailor made Gir Wild Life Tour Package gives you an unparalleled opportunity to watch those rare Asiatic Lions coupled with thousands of other elusive wild animals and hard-to-find birds like uncommon Asiatic wild ass, hyenas, Gir foxes, pygmy woodpecker, brown fish owl and black buck etc, it will make sure that you receive the highest standards of luxury, comfort and travel. Additionally, all this is available at very competitive rates.

The entire forest area of the Gir National Park is dry and deciduous which provides best habitat for Asiatic Lions. As per the new statics of 2015, the entire Saurashtra Region is inhabited by 523 Lions and more than 300 Leopards. Apart from these two animals the park is a home to two different species of Deer. The Sambar is counted largest Indian Deer. The Gir forest is also known for the Chowsingha – the world's only four horned antelope. The Jackal, striped Hyena and India Fox are some of the smaller carnivores found in Gir Forest.

2. PROJECT TIGER

It is a wildlife conservation movement initiated in India to protect the endangered tiger. The project was initiated in 1973 by the Ministry of Environment, Forest and Climate Change of the Government of India. As of March 2024, there are 55 protected areas that have been designated as tiger reserves under the project. As of 2023, there were 3,682 wild tigers in India, which is almost 75% of the world's wild tiger population.

One of the most successful wildlife conservation ventures 'Project Tiger' which was initiated way back in 1972, has not only contributed to the conservation of tigers but also of the entire ecosystem. This project is sponsored by Ministry of Environment Forest and Climate Change. About 47 tiger reserves situated in more than 17 regions including Corbett National Park and Ranthambore National Park are part of this project which conducts assessments of number of tigers, their habitat, hunting habits under the supervision of the Tiger Task Force. Project Tiger has seen significant success in recovery of the habitat and increase in the population of the tigers in the reserve areas, from a scanty 268 in 9 reserves in 1972 to above 1000 in 28 reserves in 2006 to 2000+ tigers in 2016.

Tiger Population:

In 2006, it was estimated that there were 1,411 tigers living in the wild, the lowest ever recorded. The 2010 National Tiger Assessment estimated the total population of wild tigers in India at 1,706. As per Ministry of Environment and Forests, the wild tiger population in India stood at 2,226 in 2014 with an increase of 30.5% since the 2010 estimate.

Tiger Reserves:

Tiger reserves were set up as a part of Project Tiger initiated in 1973 and are administered by the National Tiger Conservation Authority of Government of India. Tiger reserves consist of a core area which includes part(s) of protected areas such as a national park or a wildlife sanctuary and a

buffer zone which is a mix of forested and non-forested land. Project tiger is aimed at performing the necessary activities to ensure viability of tiger population in the core area and to promote a balance between the existence of people and animals in the buffer zones.

PROJECT ELEPHANT

It is a wildlife conservation movement initiated in India to protect the endangered Indian elephant. The project was initiated in 1992 by the Ministry of Environment, Forest and Climate Change of the Government of India to provide financial and technical support to the states for wildlife management of free-ranging elephant populations. The project aims to ensure the long-term survival and viability of elephant populations in their natural habitats by protecting the animals, their habitats and migration corridors. The project also facilitates research of ecology and management of elephants, creating awareness of conservation among local people, and providing veterinary care for captive elephants.

CONSERVATION OF SEA TURTLES IN INDIA:

With an objective to conserve the Olive Ridley Turtles, the UNDP Sea Turtle Project was initiated by Wildlife Institute of India, Dehradun as the Implementing Agency in November 1999. The project is for 10 coastal state in India especially Odisha where it has contributed towards the preparation of a map of breeding sites of Sea Turtles; identification of breeding places and habitats along the coast line, and migratory routes taken by Sea Turtles. The project also helped in the development of guidelines to safeguard the turtle mortality rate and for tourism in sea turtle areas. Amongst the major achievements of the project is the demonstration of use of Satellite Telemetry to locate the migratory route of sea turtles in the sea.

Apart from these projects, GOI also has been handling projects like Vulture Conservation and India Rhino Vision (IRV) 2020.

Steps Taken By Indian Government to Protect Biodiversity

Along with above specified conservation projects of the wild animals, GOI has also initiated few schemes that are worked upon to protect the biodiversity and minimize the mortality of critically endangered, endangered and threatened animals. Here are few important steps that Government of India has taken for the wildlife protection:

1. In the Wildlife Protection Act of 1972, GOI created Protected Areas like National Parks, Sanctuaries, Conservation Reserves and Community Reserves for the wildlife and imposed punishments on those indulged in illegal act of hunting.
2. Wetland (Conservation and Management) Rules 2010 have been drafted to protect of wetlands in India. The Central Government has also initiated the scheme, National Plan for Conservation of Aquatic Eco-System that lends assistance to the states for the sound management of all wetlands.

3. In order to curb the illegal trade of wildlife and that of endangered species, Wildlife Crime Control Bureau has been established.
4. Special organizations like Wildlife Institute of India, Bombay Natural History society and Salim Ali Centre for Ornithology and Natural History are formed to conduct research on conservation of wildlife.
5. To check the dwindling population of Gyps vulture in India, Government of India has banned the veterinary use of diclofenac drug.
6. For restocking of the endangered species, the Central Government first initiated Integrated Development of Wildlife Habitat Scheme and later modified it by including a new component, Recovery of Endangered Species which included animals like Hangul/stag deer in Jammu & Kashmir, Vultures in Punjab, Haryana and Gujarat, Snow Leopard in Jammu & Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh, Swiftlet in Andaman & Nicobar Islands, Nilgiri Tahr in Tamil Nadu, Sangai Deer in Manipur. Financial and technical assistance is also extended to the state government to provide better means of protection and conservation for the specified species.
7. The State Governments have been asked to strengthen the field formations and increase patrolling in and around the Protected Areas.
8. GOI intensified anti-poaching activities and initiated special patrolling strategy for monsoon season. Also, deployment of anti-poaching squad.
9. In order to strengthen tiger conservation, National Tiger Conservation Authority is constituted by Government of India.
10. A Special Tiger Protection Force (STPF) has also been constituted and is deployed in Karnataka, Maharashtra and Odisha.
11. E-Surveillance has been started in Kaziranga National Park in Assam and borders of Ratapani Wildlife Sanctuary in Madhya Pradesh.

ECOTOURISM:

Definition:

Ecotourism is now defined as “responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education” (ties, 2015). Education is meant to be inclusive of both staff and guests.

Principles of Ecotourism:

Ecotourism is about uniting conservation, communities, and sustainable travel. This means that those who implement, participate in and market ecotourism activities should adopt the following ecotourism principles:

- Minimize physical, social, behavioural, and psychological impacts.
- Build environmental and cultural awareness and respect.
- Provide positive experiences for both visitors and hosts.
- Provide direct financial benefits for conservation.
- Generate financial benefits for both local people and private industry.
- Deliver memorable interpretative experiences to visitors that help raise sensitivity to host countries' political, environmental, and social climates.
- Design, construct and operate low-impact facilities.
- Recognize the rights and spiritual beliefs of the Indigenous People in your community and work in partnership with them to create empowerment.

UNIT - IV
ENVIRONMENTAL POLLUTION

INTRODUCTION:

Pollution may be defined as an undesirable change in the physical, chemical or biological characteristics of air, water and land that may be harmful to human life and other animals, living conditions, industrial processes and cultural assets. Pollution can be natural or manmade.

Pollutants:

The agents that pollute are called pollutants.

Classification of Pollutants:

Pollutants are of two types:

1. Non-degradable pollutants:

These are the pollutants, which degrade at a very slow pace by the natural biological processes. These are inorganic compounds such as salts (chlorides), metallic oxides waste producing materials and materials like, aluminium cans, mercuric salts and even DDT.

2. Biodegradable pollutants:

These include domestic sewage that easily decomposes under natural processes and can be rapidly decomposed by natural/ artificial methods. These cause serious problems when accumulated in large amounts as the pace of deposition exceeds the pace of decomposition of disposal.

TYPES OF POLLUTION

1. Air pollution

Air pollution refers to any physical, chemical or biological change in the air. It is the contamination of air by harmful gases, dust and smoke which affects plants, animals and humans drastically. Types of Air Pollutants There are two types of air pollutants:

1. Primary Pollutants:

The pollutants that directly cause air pollution are known as primary pollutants. Sulphur dioxide emitted from factories is a primary pollutant.

2. Secondary Pollutants:

The pollutants formed by the intermingling and reaction of primary pollutants are known as secondary pollutants. Smog, formed by the intermingling of smoke and fog, is a secondary pollutant.

CAUSES OF AIR POLLUTION:

Following are the important causes of air pollution:

1. Burning of Fossil Fuels:

The combustion of fossil fuels emits a large amount of Sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.

2. Automobiles:

The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

3. Agricultural Activities:

Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilizers emit harmful chemicals in the atmosphere and contaminate it.

4. Factories and Industries:

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons and chemicals. These are released into the air, degrading its quality

5. Mining Activities:

In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

6. Domestic Sources

The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

Effects of Air Pollution

The hazardous effects of air pollution on the environment include:

1. Diseases:

Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma. Many people die every year due to the direct or indirect effects of air pollution.

2. Global Warming:

Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth. This increase in earth's temperature is known as global warming. This has resulted in the melting of glaciers and an increase in sea levels. Many areas are submerged underwater.

3. Acid Rain:

The burning of fossil fuels releases harmful gases such as nitrogen oxides and Sulphur oxides in the air. The water droplets combine with these pollutants, become acidic and fall as acid rain which damages human, animal and plant life.

4. Ozone Layer Depletion:

The release of chlorofluorocarbons, halons, and hydro chlorofluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.

5. Effect on Animals:

The air pollutants suspend on the water bodies and affect the aquatic life. Pollution also compels the animals to leave their habitat and shift to a new place. This renders them stray and has also led to the extinction of a large number of animal species.

Air pollution control:

Following are the measures one should adopt, to control air pollution:

• Avoid Using Vehicles People should avoid using vehicles for shorter distances. Rather, they should prefer public modes of transport to travel from one place to another. This not only prevents pollution, but also conserves energy.

• Energy Conservation a large number of fossil fuels are burnt to generate electricity. Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you can save the environment at the individual level. Use of energy-efficient devices such CFLs also controls pollution to a greater level.

• Use of Clean Energy Resources The use of solar, wind and geothermal energies reduce air pollution at a larger level. Various countries, including India, have implemented the use of these resources as a step towards a cleaner environment.

Other air pollution control measures include:

1. By minimizing and reducing the use of fire and fire products.
2. Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled or treated at the source itself to reduce its effects
3. Fuel substitution is another way of controlling air pollution.
4. The last and the best way of reducing the ill effects of air pollution is tree plantation.

2. WATER POLLUTION:

Water pollution is the contamination of water bodies (like oceans, seas, lakes, rivers, aquifers, and groundwater) usually caused due to human activities. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism.

Drinking water, also called Potable Water, is the water that is considered safe enough for human and animal consumption. This is water that is generally used for drinking, cooking, washing, crop irrigation, etc. These days chemicals, bacteria, and other pollutants are even affecting our drinking water.

Sources of Water Pollution:

Some of the most commonly occurring water pollutants are

• Domestic Waste
• Industrial effluents
• Insecticides and pesticides
• Detergents and Fertilizers some of the water pollution that is caused is by Direct Sources, such as factories, waste management facilities. Refineries etc. that directly release waste and

harmful by-products into the nearest water source without treating them. Indirect sources include pollutants that enter the water bodies via groundwater or soil or via the atmosphere as acid rain.

Effects of Water Pollution:

1. Diseases:

In humans, drinking or consuming polluted water in any way has many disastrous effects on our health. It causes typhoid, cholera, hepatitis and various other diseases.

2. Destruction of Ecosystems:

Ecosystems are extremely dynamic and respond to even small changes in the environment. Water pollution can cause an entire ecosystem to collapse if left unchecked.

3. Eutrophication:

Chemicals in a water body, encourage the growth of algae. These algae form a layer on top of the pond or lake. Bacteria feed on this algae and this decreases the amount of oxygen in the water body, severely affecting the aquatic life there.

4. Effects the food chain:

Disruption in food chains happens when toxins and pollutants in the water are consumed by aquatic animals (fish, shellfish etc) which are then consumed by humans.

Prevention:

The best way to prevent large-scale water pollution is to try and reduce its harmful effects.

There are various small changes we can make to protect ourselves from a scary future where water is scarce.

1. Save Water:

Conserving water is our first aim. Water wastage is a major problem globally and we are only now waking up to the issue. Simply small changes you can make domestically will make a huge difference.

2. Better treatment of sewage:

So, treating waste products before disposing of it in a water body helps reduce water pollution on a large scale. Agriculture or other industries can reuse this wastewater by reducing its toxic contents.

3. Use environmentally friendly products:

By using soluble products that do not go on to become pollutants, we can reduce the amount of water pollution caused by a household.

3. SOIL POLLUTION:

Soil pollution is defined as, “contamination of soil by human and natural activities which may cause harmful effect on living organisms”.

Causes of Soil Pollution

1. Industrial wastes:-

Disposal of Industrial wastes is the major problem for soil pollution. This has probably been the biggest contributor in the last century, especially from mining and manufacturing, as the by-products are often contaminated, and not disposed of properly.

2. Urban wastes

Urban wastes comprise of both commercial and domestic wastes consisting of garbage and rubbish materials like plastics, glasses, metallic cans, fibres, paper, rubbers etc. Urban wastes, can be dangerous. This happens because they are not easily degraded.

3**. Agricultural practices**

Modern agricultural practices pollute the soil to a large extent. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides and weedicides are added to increase the crop yield. They are full of chemicals that are not produced in nature and cannot be broken down by it. As a result, they seep into the ground after they mix with water and slowly reduce the fertility of the soil.

4. Radioactive pollutants

Radioactive substances resulting from explosions of nuclear testing laboratories and industries giving rise to nuclear dust radioactive wastes, penetrate the soil and accumulate giving rise to land/soil pollution.

5. Accidental Oil Spills

Oil leaks can happen during the storage and transport of chemicals. This can be seen at most of the fuel stations. The chemicals present in the fuel deteriorates the quality of soil and make them unsuitable for cultivation.

6. Acid Rain

When there are pollutants in the air, and it starts to rain, they mix and fall back to the ground, causing acid rain. This pollution can then dissolve important nutrients, changing the structure of the soil.

7. Biological agents

Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents.

Effects of Soil Pollution on Human Beings

Crops and plants that are grown on polluted soil absorb much of the pollution and then pass these on to us. This could explain the sudden surge in small and terminal illnesses. Long term exposure to such soil can affect the genetic make-up of the body, causing chronic health problems that cannot be cured easily. In fact, it can cause food poisoning over a long period of time.

Effects on Plants and Animals

Since soil pollution is often accompanied by a decrease in the availability of nutrients, plant life ceases to thrive in such soils. Soils contaminated with inorganic aluminium can prove toxic to plants. Also, this type of pollution often increases the salinity of the soil, making it inhospitable for the growth of plant life.

Effects on the Ecosystem:

Since the volatile contaminants in the soil can be carried away into the atmosphere by winds or can seep into underground water reserves, soil pollution can be a direct contributor to air and water pollution. It can also contribute towards acid rain (by releasing huge quantities of ammonia into the atmosphere). Crop yield is greatly affected by this form of pollution. In China, over 12 million tons of grain (worth approximately 2.6 billion USD) is found to be unfit for human consumption due to contamination with heavy metals (as per studies conducted by the China Dialogue).

Control measures of soil pollution:

1. Soil erosion can be controlled by a variety of forestry and farm practices. Ex: Planting trees on barren slopes. Contour cultivation and strip cropping may be practiced instead of shifting cultivation.
2. Proper dumping of unwanted materials: Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.
3. Production of natural fertilizers: Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers. Ex: Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil.
4. Proper hygienic condition: People should be trained regarding sanitary habits. Ex: Lavatories should be equipped with quick and effective disposal methods.
5. Public awareness: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.
6. Recycling and Reuse of wastes: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.
7. Ban on Toxic chemicals: Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals.

4. NOISE POLLUTION:

Noise pollution means an unwanted or undesirable sound that leads to physical and mental problems. Noise pollution is dependent on the loudness and frequency of the sound. In fact, when the sound exceeds its limit, it becomes fatal for human and other organisms.

Types of Noise Pollution:

Following are the three types of pollution:
Transport Noise
Neighbourhood Noise
Industrial Noise

1. Transport Noise:

It mainly consists of traffic noise which has increased in recent years with the increase in the number of vehicles. The increase in noise pollution leads to deafening of older people, headache, hypertension, etc.

2**. Neighbourhood Noise**

The noise from gadgets, household utensils etc. Some of the main sources are musical instruments, transistors, loudspeakers etc.

3. .Industrial Noise

It is the high-intensity sound which is caused by heavy industrial machines. According to many researches, industrial noise pollution damages the hearing ability to around 20%.

Causes and Sources of Noise Pollution:

Following are the causes and sources of noise pollution:

Industrialization:

Industrialization has led to an increase in noise pollution as the use of heavy machinery such as generators, mills, huge exhaust fans are used, resulting in the production of unwanted noise.

Vehicles:

Increased number of vehicles on the roads are the second reason for noise pollution.

Events:

Weddings, public gatherings involve loudspeakers to play music resulting in the production of unwanted noise in the neighbourhood.

Construction sites:

Mining, construction of buildings, etc add to the noise pollution. Effects of Noise Pollution on Human Health Noise pollution can be hazardous to human health in the following ways: Hypertension: It is a direct result of noise pollution which is caused due to elevated blood levels for a longer duration.

Hearing loss:

Constant exposure of human ears to loud noise that are beyond the range of sound that human ears can withstand damages the eardrums resulting in loss of hearing.

Sleeping disorders:

Lack of sleep might result in fatigue and low energy level throughout day affecting everyday activities. Noise pollution hampers the sleep cycles leading to irritation and uncomfortable state of mind.

Cardiovascular issues:

Heart-related problems such as blood pressure level, stress, and cardiovascular diseases might come up in a normal person.

There are four fundamental ways in which noise can be controlled: Reduce noise at the source, block the path of noise, increase the path length and protect the recipient. In general, the best control method is to reduce noise levels at the source. Source reduction can be done by

effectively muffling vehicles and machinery to reduce the noise. One of the best methods of noise source reduction is regular and thorough maintenance of operating machinery.

Noise levels at construction sites can be controlled using proper construction planning and scheduling techniques. The path of traffic noise can also be blocked by construction of vertical barriers alongside the high way. Planting of trees around houses can also act as effective noise barriers. Increasing the path length between the source and the recipient offers a passive means of control. Use of earplugs and earmuffs can protect individuals effectively from excessive noise levels.

Preventive measures

1. Prescribing noise limits for vehicular traffic
2. Ban on honking (usage of horns) in certain areas
3. Creation of silence zones near schools and hospitals
4. Redesigning buildings to make them noise proof
5. Reduction of traffic density in residential areas
6. Giving preference to mass public transport system.

5. NUCLEAR HAZARDS

Nuclear pollution is the physical pollution of air, water and soil by radioactive materials. Nuclear energy can be both beneficial and harmful depending on the way in which it is used. Approximately 17 % of the electrical energy generated in the world comes from nuclear power plants. However, on the other hand it is impossible to forget the destruction that nuclear bombs caused the cities of Hiroshima and Nagasaki. The radioactive wastes from nuclear energy have caused serious environmental damage.

Causes

Nuclear accidents from nuclear energy generation plants:

In the postmodern world, various forms of energy are being discovered. Among them is nuclear energy, which is touted to be the most potent source of energy due to its high latent power. Reports indicate that the high latent power is due to its high level of radiation.

The use of nuclear weapons:

The use of nuclear missiles and atomic bombs, a form of nuclear energy, in the Second World War not only explains cause but also the damaging nature of radioactive pollution or contamination.

Use of radio isotopes:

Radio isotopes are used to make detectors and in other industrial activities. Isotopes such as uranium have high concentrations of radiation in them. On the other hand, common Isotopes such as carbon containing radioactive material are easily found in water ways through sewage lines.

Cosmic rays:

These come from outer space to our planet with intense radiation as their nature, therefore, causing radioactive pollution. Gamma rays, for example, are said to have the highest level of radiation and yet, depending on their intensity. Effects

Effects of nuclear hazards:

All organisms are affected from radiation pollution, and the effects are extremely dangerous. The effects may be somatic (individual exposed is affected) or genetic (future generations) damage. The effects are cancer, shortening of life span and genetic effects or mutations. Some of the possible effects are listed as under:

- Break DNA in cells
- Man do not die, but suffer from fatigue, nausea, vomiting and loss of hair
- Bone marrow is affected & blood cells are reduced.
- Kill organism by damaging the tissue of heart and brain.
- Kill organism by damaging the tissue of heart and brain
- Develops different types of cancer
- Through food chain also, radioactivity effects are experienced by man But the most significant effect of radioactivity is that it causes long range effects, affecting the future of man and hence the future of our civilizations.

Control Measures:

I. Laboratory generated nuclear wastes should be disposed off safely and scientifically.

II. Leakage of radioactive elements from nuclear reactors, careless use of radioactive elements as fuel and careless handling of radioactive isotopes must be prevented.

III. Safety measure against accidental release of radioactive elements must be ensured in nuclear plants.

IV. Unless absolutely necessary, one should not frequently go for diagnosis by x-rays.

V. Regular monitoring of the presence of radioactive substance in high-risk area should be ensured

VI. Among the many options for waste disposal, the scientists prefer to bury the waste in hundreds of meters deep in the earth's crust is considered to be the best safety long term option.

SOLID WASTE MANAGEMENT:

Rapid population growth and urbanization in developing countries has led to people generating enormous quantities of solid waste and consequent environmental degradation. The waste is normally disposed in open dumps creating nuisance and environmental degradation. Solid wastes cause a major risk to public health and the environment. Management of solid wastes is important in order to minimize the adverse effects posed by their indiscriminate disposal.

Types of solid wastes:

Depending on the nature of origin, solid wastes are classified into

1. Urban or municipal wastes
2. Industrial wastes

1. Sources of urban wastes:

Domestic wastes containing a variety of materials thrown out from homes. Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.

Commercial wastes:

Coming out from shops, markets, hotels, offices, institutions, etc. Ex: Wastepaper, packaging material, cans, bottle, and polythene bags, etc.

Construction wastes:

Includes wastes of construction materials. Ex: Wood, Concrete, Debris, etc. Biomedical wastes: It includes mostly waste organic materials Ex: Anatomical wastes, Infectious wastes, etc.

Classification of urban wastes

Bio-degradable wastes

- Those wastes that can be degraded by micro-organisms are called bio- degradable wastes Ex: Food, vegetables, tea leaves, dry leaves, etc.

Non-biodegradable wastes:

Urban solid waste materials that cannot be degraded by microorganisms are called non-biodegradable wastes. Ex: Polythene bags, scrap materials, glass bottles, etc.

2. Sources of industrial wastes:

The main source of industrial wastes is chemical industries, metal and mineral processing industries. Ex: Nuclear plants: It generated radioactive wastes. Thermal power plants: It produces fly ash in large quantities.

Chemical Industries:

It produces large quantities of hazardous and toxic materials. Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

Effect of improper solid waste management:

1. Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.

2. Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil

3. Toxic substances may percolate into the ground and contaminate the groundwater. 4. Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.

CONTROL MEASURES OF URBAN AND INDUSTRIAL WASTE:

Two important steps involved in solid waste management are

1. Reduce, Reuse and Recycle of Raw Materials.
2. Discarding wastes

Reduce, Reuse and Recycle of Raw Materials.

1. Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced.

2. Reuse - Refillable containers that are discarded after use can be reused. Rubber rings can be made from discarded cycle tubes and this reduces waste generation during manufacture of rubber bands.

3. Recycle- Recycling is the reprocessing of discarded materials into new useful products Ex: Old aluminium cans and glass bottles are melted and recast into new cans and bottles, preparation of cellulose insulation from paper, Preparation of automobile body and construction material from steel cans This method (Reduce, Reuse & Recycle), i.e, 3R's help save money, energy, raw materials and reduces pollution.

DISCARDING WASTES:

The following methods are adopted for discarding wastes:

1. Landfill:

Solid wastes are placed in a sanitary landfill in which alternate layers of 80 cm thick refuse is covered with selected earth-fill of 20 cm thickness. After 2-3 years solid waste volume shrinks by 25-30% and land is used for parks, roads and small buildings. This is the most common and cheapest method of waste disposal and is mostly employed in Indian cities.

2. Incineration:

It is a hygienic way of disposing solid waste. It is suitable if waste contains more hazardous material and organic content. It is a thermal process and very effective for detoxification of all combustible pathogens. It is expensive when compared to composting or land-filling. In this method municipal solid wastes are burnt in a furnace called incinerator. Combustible substances such as rubbish, garbage, dead organisms and non-combustible matter such as glass, porcelain and metals are separated before feeding to incinerators.

3. Composting:

It is another popular method practiced in many cities in our country. In this method, bulk organic waste is converted into fertilizer by biological action.

CLIMATE CHANGE AND GLOBAL WARMING:

Rise in the global temperatures will result in melting of the ice masses in the Arctic and Antarctica regions, resulting in rising of sea level and low lying coastal areas will be submerged. The summers will be longer and hotter whereas the winters will be shorter and warmer. Due to increased concentration of carbon dioxide the growth and yield of plants will increase resulting in rapid depletion of nutrients from the soil.

Climatic change:

The average temperature in many regions has been increasing in recent years. In some regions of Asia and Africa severe droughts have been observed in recent decades. The great warm

storms have been more frequent, persistent and intense in some parts of Asia and Africa. As these are signs that the earth is sick, climate is changing and making it more difficult for survival of mankind. The earth is losing its ability to balance itself due to the imbalances created by human activities in the environment. Human societies will be seriously affected by extremes of climate such as floods and droughts. This is a major concern for human health. Hygienic health of people depends on safe drinking water, sufficient food, secure shelter and good social conditions. All these factors are affected by climate change. Fresh water supplies may be seriously affected, reducing the availability of clean water for drinking and washing, during drought as well as floods. The risk of the spread of infectious diseases to human will increase. The climate change also leads to spreading of diseases such as malaria and filariasis in new areas. Food production will be seriously reduced due to climate change. The local reduction in food production would lead to starvation and malnutrition with long term. The recent studies have shown that in the near future, the global mean surface temperature will rise by 1.4 to 5.8o C. Temperature will be greatest in the land surface areas. The frequency of weather extremes is likely to increase leading to floods or drought. There will be less cold season and more summer with heat waves. Global mean sea level is projected to rise. Due to global rise of sea level, the human habitats adjacent to the coastal regions and the islands will be submerged under the sea in the near future.

Global warming:

The energy of the sun is emitted as heat radiations. About 75 percent of solar energy reaching the earth is absorbed and retained by the earth's surface. The rest of the heat radiates back to the atmosphere. The temperature of the earth's surface is determined by the energy balance between the heat energy reaching the earth's surface and the heat energy that is radiated back into space. Fossil fuel based industrialisation and over exploitation of resources like coal, oil and gases by the people have raised the concentration of green house gases like carbon dioxide, methane, chlorofluoro carbons and water vapour. These green house gases in the lower levels of atmosphere trap the solar radiation and not allow the solar rays to escape into outer space. Thus, the green house gases add heat on the earth's surface. This results an increase in temperature on the earth's surface and is commonly known as global warming

ACID RAIN:

Combustion of fossil fuels like coal, oil, natural gas etc., produces chemicals such as sulphur dioxide and nitrogen oxides. In the atmosphere these chemicals react with sunlight and water present in the air to produce sulphuric acid and nitric acid. These chemicals are carried by air currents and move upwards into the atmosphere. During rainfall these chemicals finally return to the earth's surface in the form of acid rain. Acid rain dissolves and washes away nutrients in the soil. Actually nutrients like calcium, potassium, iron and magnesium have been leached away from the soil by acids. These nutrients are essential for the plant growth.

Acid rain causes reduced rate of photosynthesis and growth. The activity of symbiotic nitrogen fixing bacteria present in the root nodules of leguminous plant is inhibited by acid rain. This also destroys the fertility of the soil. Acid rain that falls on the surface of the earth reaches rivers, lakes, ponds etc., and causes water in them to become acidic. This affects plants and animal life in aquatic habitat. Acid rain corrodes buildings, monuments, statues, bridges etc. Acid

rain is known to be corrosive to basic materials such as lime stone and marble. The fish caught in acid waters may be harmful to human consumption. Acid rain and dry acid deposition in the air causes respiratory problems in human. Control of acid rain: The best way to stop the formation of acid rain is to reduce the emission of sulphur dioxide and nitrogen oxides into the atmosphere. This can be achieved by using less quantity of fossil fuels in power plants, vehicles and industry.

OZONE LAYER DEPLETION:

Ozone layer depletion is the thinning of the ozone layer present in the upper atmosphere. This happens when the chlorine and bromine atoms in the atmosphere come in contact with ozone and destroy the ozone molecules. One chlorine can destroy 100,000 molecules of ozone. It is destroyed more quickly than it is created.

Some compounds release chlorine and bromine on exposure to high ultraviolet light, which then contributes to ozone layer depletion. Such compounds are known as Ozone Depleting Substances (ODS).

The ozone-depleting substances that contain chlorine include chlorofluorocarbon, carbon tetrachloride, hydro chlorofluoro carbons, and methyl chloroform. Whereas, the ozone-depleting substances that contain bromine are halons, methyl bromide, and hydro bromofluorocarbons.

Causes of Ozone Layer Depletion

Ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

Chlorofluorocarbons

Chlorofluorocarbons or CFCs are the main cause of ozone layer depletion. These are released by solvents, spray aerosols, refrigerators, air-conditioners, etc.

The molecules of chlorofluorocarbons in the stratosphere are broken down by ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

Unregulated Rocket Launches

Researchers say that the unregulated launching of rockets results in much more depletion of the ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

Nitrogenous Compounds

The nitrogenous compounds such as NO2, NO, N2O are highly responsible for the depletion of the ozone layer.

Natural Causes

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

The volcanic eruptions are also responsible for the depletion of the ozone layer.

Effects of Ozone Layer Depletion

The depletion of the ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

Effects on human health

Humans will be directly exposed to the harmful ultraviolet radiation of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and weak immune system.

Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

Effects on the Environment

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

Effects on Marine Life

Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the food chain are also affected.

Solutions to Ozone Layer Depletion

The depletion of the ozone layer is a serious issue and various programmes have been launched by the government of various countries to prevent it. However, steps should be taken at the individual level as well to prevent the depletion of the ozone layer.

Following are some points that would help in preventing this problem at a global level:

Avoid Using ODS

Reduce the use of ozone depleting substances. E.g. avoid the use of CFCs in refrigerators and air conditioners, replacing the halon based fire extinguishers, etc.

Minimise the Use of Vehicles

The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimised as much as possible.

Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

Use of Nitrous Oxide should be prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimised at the individual level as well

IMPACT ON HUMAN COMMUNITIES AND AGRICULTURE

The environmental impact of agriculture is the effect that different farming practices have on the ecosystems around them, and how those effects can be traced back to those practices. The environmental impact of agriculture varies widely based on practices employed by farmers and by the scale of practice. Farming communities that try to reduce environmental impacts through modifying their practices will adopt sustainable agriculture practices. The negative impact of agriculture is an old issue that remains a concern even as experts design innovative means to reduce destruction and enhance eco-efficiency. Animal agriculture practices tend to be more environmentally destructive than agricultural practices focused on fruits, vegetables and other biomass. The emissions of ammonia from cattle waste continue to raise concerns over environmental pollution.

The environmental impact of agriculture involves impacts on a variety of different factors: the soil, water, the air, animal and soil variety, people, plants, and the food itself. Agriculture contributes to a number larger of environmental issues that cause environmental degradation including: climate change, deforestation, biodiversity loss, dead zones, genetic engineering, irrigation problems, pollutants, soil degradation, and waste.] Because of agriculture's importance to global social and environmental systems, the international community has committed to increasing sustainability of food production as part of Sustainable Development Goal 2: “End hunger, achieve food security and improved nutrition and promote agriculture”. The United Nations Environment Programme's 2021 "Making Peace with Nature" report highlighted agriculture as both a driver and an industry under threat from environmental degradation.

UNIT - V

SOCIAL ISSUES AND THE ENVIRONMENT

Sustainable development:

"Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs."

The concept of sustainable development can be interpreted in many different ways, but at its core is an approach to development that looks to balance different, and often competing, needs against an awareness of the environmental, social and economic limitations we face as a society.

All too often, development is driven by one particular need, without fully considering the wider or future impacts. We are already seeing the damage this kind of approach can cause, from large-scale financial crises caused by irresponsible banking, to changes in global climate resulting from our dependence on fossil fuel-based energy sources. The longer we pursue unsustainable development, the more frequent and severe its consequences are likely to become, which is why we need to take action now.

Environment:

Living within our environmental limits is one of the central principles of sustainable development. One implication of not doing so is climate change.

But the focus of sustainable development is far broader than just the environment. It's also about ensuring a strong, healthy and just society. This means meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity.

If sustainable development focuses on the future, does that mean we lose out now?

Not necessarily. Sustainable development is about finding better ways of doing things, both for the future and the present. We might need to change the way we work and live now, but this doesn't mean our quality of life will be reduced.

A sustainable development approach can bring many benefits in the short to medium term, for example:

Savings - As a result of SDC scrutiny, government has saved over £60m by improving efficiency across its estate.

Health & Transport - Instead of driving, switching to walking or cycling for short journeys will save you money, improve your health and is often just as quick and convenient.

Water Conservation Basics:

Water is essential to our daily lives. Whenever water is used, there is a potential for conservation both inside and outside of your home or business. Fresh water is a limited resource, making water conservation an important factor for the environment. With population growth, expansion of industry, increasing levels of development activity, and the potential for climate change impacts there is increasing pressure placed on the province's water resources. Whether you are on a municipal or a private domestic water supply, water conservation is a wise practice.

Here are some reasons why you might want to use less water:

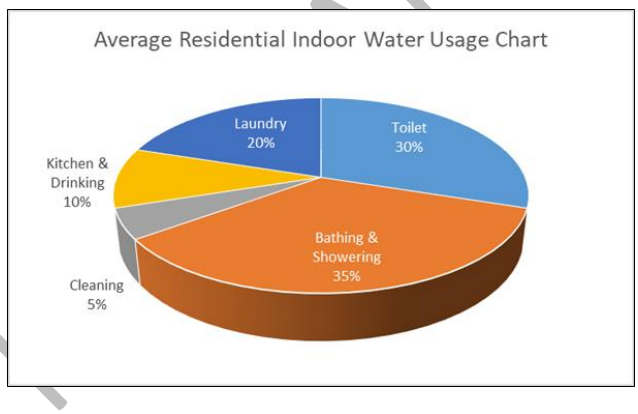
- Save money on your power bills by using less energy to heat and pump water
- Delay or prevent expansion of costly water and wastewater treatment plants in your community which can save money on taxes
- Reduce water shortage frequency and impacts
- Environmental benefits

Water Usage

On average, Canadians use approximately 223 litres of water per person per day – making Canada one of the largest per capita water consumers in the world.

Newfoundland and Labrador is the highest per capita residential water consumer in Canada, using approximately 628 litres of water per person per day.

Water is an important part of our daily lives and we use it for a wide variety of purposes. The majority of indoor water use occurs in the household bathroom at 65%.



Use Less Water

The majority of indoor household water use comes from toilets, washing machines, baths, showers, faucets and leaks. Outdoor water usage for things like watering the grass, washing the driveway, and for recreational uses can also use significant amounts of water. What you can do to

save water is fairly simple. There are numerous ways to decrease your water use and help conservation efforts:

1. CHECK FOR LEAKS

Frequently checking for leaks helps to ensure you aren't using large amounts of water. Toilets are the most common source of water leakage.

2. INSTALL WATER SAVING DEVICES

Adding water-saving devices to your home or business can help to conserve water. Consider adding:

- Water faucet aerators
- Low-flow showerheads
- Toilet dams

3. OTHER SIMPLE CONSERVATION TIPS

Conservation in the bathroom:

The bathroom accounts for the majority of indoor water use. Learn how to check for leaky toilets and other tips to save water.

- Install water efficient toilets and fixtures.
- When washing, brushing your teeth or shaving, never let the tap run continuously.
- Turn off the taps tightly (but gently) so they do not drip.
- Take shorter showers.
- Fix leaky faucets and toilets. Even the smallest drip from a worn washer can waste 75 or more litres a day. Larger leaks can waste hundreds.
- To check for a toilet leak, place a few drops of food coloring or dye test tablets (available at home improvement stores) in the toilet tank. Do not flush; wait 10-15 minutes. If the bowl water changes colour, you have a leak.

Conservation in the kitchen

- Take foods out of the freezer early to allow plenty time to thaw rather than running water over it.
- Keep water in the fridge so you don't have to run the tap to get cold water.
- Completely fill the dishwasher before you turn it on. It can use 35-45 litres per cycle.
- If you wash dishes by hand, don't leave the water running for rinsing.

- Don't let the faucet run while you clean vegetables. Just rinse them in a stoppered sink or a pan of clean water.
- Keep cooking fats, oils and grease out of the drain. They can stick to and block the inside of pipes, which can lead to sewer back-ups and basement flooding.

Conservation in the laundry room

- Purchase a high efficiency washing machine.
- Try to only do laundry when the machine is full.
- If you need to wash smaller loads, be sure to adjust your washer's water level settings accordingly.

Conservation outdoors

- Deep-soak your lawn, long enough for the moisture to soak down to the roots where it will do the most good. A light sprinkling can evaporate quickly and tends to encourage shallow root systems.
- Water in the morning to eliminate evaporation.
- Adjust sprinklers to water lawns and not driveways or the sidewalk.
- Avoid watering on windy days.
- Put a layer of mulch around trees and plants. Mulch will slow evaporation of moisture and discourage weed growth too.
- Use a broom, not a hose, to clean driveways and sidewalks.
- When washing your car, rather than use a running hose consider using a bucket, a sponge, and a hose with a trigger nozzle.
- Check garden hoses and connections frequently and keep them drip-free. Leaks outside the house may not seem as bad since they are not as visible, but they can be just as wasteful as leaks inside.

Conservation during winter

Typically, water use increases in the summer as we try to meet water demand of lawns, vegetable gardens and flowers. Unlike most provinces, Newfoundland and Labrador uses more water in the winter months compared to the summer. This is mainly due to the risk of freezing water pipes during cold temperatures. Here are some ways you can conserve water during the winter:

- Drip faucets instead of running water to prevent your pipes from freezing.
- Collect water in a bucket for flushing the toilet. Showers take longer to heat up in the winter so take advantage of the first few minutes of cold water.

- Wrap all exposed pipes and insulate hot water pipes to help protect them against bursting.
- If your pipes do burst, know where your shut off valve is to prevent excessive damage and decrease water usage.
- Call in a plumber after the first thaw to check your pipes for damage and leaks.
- Do not use your hose to melt snowbanks. This is an unnecessary waste of water.

Regardless of the season, it is important to be conscious of the amount of water you're using. Be sure to follow the bathroom, kitchen and laundry room water conservation tips year round to prevent excessive use of water during all seasons.

4. WATER EFFICIENCY FOR BUSINESS

By reducing water consumption you can:

- Lower operating costs.
- Enhance your public image by demonstrating your commitment to the environment.
- Increase your competitiveness by saving money and attracting new loyal costumers

RESETTLEMENT AND REHABILITATION OF PEOPLE

Resettlement and Rehabilitation is one of the most serious problems caused by the developmental activities. Though the developmental projects raise the quality and standard of living of the people of country, there is over exploitation of natural resources and degradation of the environment. Besides this, the native people are directly affected

Resettlement:

Resettlement is simple relocation or displacement of human population. This process does not focus on their future welfare.

Rehabilitation

Rehabilitation involves making the system to work again by allowing the systems to function naturally. It includes replacing the lost economic assets, safeguard employment, provide safe land for building, restore social services, repair damaged infrastructures, etc.,

Rehabilitation policy:

A sound national policy on rehabilitation and resettlement of affected people in essential.

1. The extent of damage and suffering that the proposed project would cause should be studied and ascertained before starting the project

2. The rehabilitation and resettlement work should be a part of the project and all those affected should be rehabilitated before the commencement of the project.

3. The people should be rehabilitated on "minimum dislocation basis", by choosing adjacent areas.

4. The extent of rehabilitation should meet the ends of social justice and balanced development.

5. The advantages of rehabilitation should be on par with those of the beneficiaries of the proposed project.

Objectives of Resettlement and Rehabilitation Plan:

The main objectives of the Resettlement and Rehabilitation Plan are to:

To minimize displacement and to promote as far as possible, non-displacing and least is placing

- Alternatives. Involuntary resettlement should be avoided where feasible. To provide better standard of life and to assist in each PAFs in regaining their economic status and sustain
- It for life long. To compensate the families affected adversely by construction of the project.
- To improve the quality of life of the PAFs and the surrounding project affected area by developing
- Infrastructure facilities and also to provide trainings and skill development activities for their better living. To ensure that special care is taken for protecting the rights of the weaker sections especially the
- Scheduled Tribes and also care is to be taken not to disturb much the cultural and ethnicity of the area. To provide adequate compensation to PAFs whose land is acquired?
- To create good rapport with the local people for long-term relationship and mutual benefits.

Legal Framework:

The principles adopted for addressing resettlement issues in the subproject have been guided by the Rehabilitation and Resettlement plan which is consistent with the existing legislations and policies of the Government of India applicable to state of Himachal Pradesh. The Final Rehabilitation and Resettlement plan is based on (i) The RFCTLARR Act, 2013

DISASTER MANAGEMENT:

FLOOD:

India is one among the most flood prone countries in the world. Structural and non-structural measures are taken to control floods.

a**) Structural measures:**

In structural measures we keep the water-away from the people. Some of the structural measures helped to control floods are given below.

i) Watershed management: Cleaning, deeping of natural water reservoirs drainage channels must be taken up once in a year. It will help to store flood water and prevent flood damage in rural and urban areas.

ii) Reservoirs: In every village, the village panchayats should dug up village ponds. The government officials should remove the encroachments on ponds and tanks before the onset of monsoons.

iii) Natural water retention basins: The natural water retention basins such as ponds, lakes and dams should be inspected by the government officials periodically. If necessary, the flood protection embankments, ring bunds and other bunds should be strengthened to prevent floods.

iv) Safe disposal of surplus water: Usually the water level is gradually increased in the ponds, lakes and dams during monsoon seasons. If the water level is full, the surplus water should be removed out by opening the shutters. This may help to prevent breaking up of water basins due to high pressure.

b) Non-structural measures:

In non-structural measures, we keep the people away from the water. The aim of the non-structural measures is reducing flood damage by involving people. Some of the non structural measures used to control floods are given below.

i) Flood plain zoning: Flood plain is the land adjoining the river. The flood plain zone is occupied by water during high floods. Whenever flood occurs the people living at the flood plain zone should be evacuated.

ii) Flood forecasting and warning: The flood occurring areas are forecasted and warning should be issued through media.

iii) Flood proofing: Raising the level of' the building with the help of earth fill and the ring bunds may be constructed around village or group of properties. Flood Management

a) Pre flood measures:

The following pre-flood measures should be taken to prevent calamities to be occurred by floods.

i)Identification of low lying areas which are vulnerable to flooding either by river or rainfall. Availability of open spaces for setting up evacuation camps. It will provide shelter to people from submerged localities.

ii) Availability of safe drinking water and food reserves.

iii) The district headquarter relief committee should be headed by district collector assisted by various heads of departments and voluntary agencies. Their telephone number should be published.

b) During the flood

i) Rescue and evacuation operations should be done immediately in the flood affected area.

ii) The following personals should be used for rescuing the people from the floods affected area. (Home guards, police men, ex-servicemen, fire service, defence personnel, divers etc.

iii) All deaths occurred due to floods must be promptly identified and handed over to the relatives.

iv) The people in the floods hit area and evacuation centre should be provided with food, safe drinking water, medicines etc.

v) A team of doctors and Paramedical staff ready at flood hit area.

c) Post flood measures

i) The medical team should make regular visits to all the flood affected areas ever after the flood water have subsided. This is essential to prevent spreading of epidemics among the people.

ii) A comprehensive survey should be made to assess the damage caused by floods. On the bases of information provided by survey teams, the government should give necessary compensation to the flood affected people. iii) Repair of water supply system, roads, canals, railway lines, electrical lines should be started as soon as possible.

CYCLONE:

India with its long coastal line is vulnerable to cyclones. It develops in the Bay of Bengal and Arabian Sea. Cyclones are intense low pressure systems that develop in the oceanic area. These systems are classified on the basis of velocity of surface winds. They are given below. There are two cyclone seasons in India. The first is the pre-monsoon season (April and May) and the second is post monsoon season (October to December). The cyclones of the post-monsoon season are more severe than pre-monsoon season. The frequency of cyclone is more in east coast than the west coast. Impact of cyclone

i) Uprooting of trees which disturb transportation and relief supply to the people of cyclone affected area.

ii) Sudden fall of electric poles, sign posts and transmission line towers.

iii) Damage to windows, roof projections and sunshades of the buildings.

iv) Fall of weakly built walls and light weight roof coverings. Cyclone warning system in India the Indian Meteorological Department is the nodal agency for observing, detecting and forecasting cyclones which develop in the Indian seas. The cyclones are monitored through synoptic charts and INSAT (Indian National Satellite). When the cyclones approach the coastal areas they are observed through cyclone detection radars. They are installed in coastal stations of east and west coasts.

Cyclone warning is provided in two stages. In the first Stage, a cyclone alert issued 48 hours before the commencement of the adverse weather along the coast. In the second stage, a cyclone warning issued 24 hours before the cyclones anticipated heavy rainfall. The cyclone warning messages are continuously broadcasted through television and radio till the cyclone crosses the coast.

Cyclone management:

All the district of the maritime states is vulnerable to the cyclone impacts to a different degree. Therefore, the concerned district Collectors should be familiar and get prepared with the measures to be taken in the event of cyclone disaster.

a) Pre cyclone measures

i) Prior to the cyclone season (April and May, October to December) pre-cyclone measures should be carried out in the cyclone vulnerable areas. The measures taken before the cyclone are such as the strengthening of communication facilities, checking and repair of cyclone shelters,

repair of roads, make arrangements for the storage of food, first aids kits, availability of safe drinking water etc.

ii) After receiving first warning from the concerned cyclone warning centre, the district administration should have constant touch with the concerned cyclone warning centre.

iii) Publicity of cyclone warnings which increases the alertness of the public, particularly the fishermen community.

iv) Keep adequate number of vehicles ready at the nearest point. It helps to evacuate the people from low lying areas in a shorter time as and when required.

v) The materials such as hooks for cleaning debris, rubber tyres and tubes for using as floats in water tents, kerosene lanterns, large cooking vessels, ropes, wires, torches, polythene bags etc., should be in adequate quantities.

b) Post cyclone measures

i) After the cyclone, rescue the people who are affected.

ii) As early as possible, restore the supply of power, remove the fallen trees on the roads.

iii) Food and water should be supplied to the affected people

iv)Appropriate vaccination must be undertaken to prevent any outbreak of epidemics among the cyclone affected peoples.

v) Essential commodities such as rice, wheat, pulses, salt, match box, kerosene, diesel etc., should be supplied to cyclone, affected areas at concessional rates or free of cost.

vii) Land survey of the affected area should be undertaken to assess the damage caused.

ix) Loan should be sanctioned on the basis of survey to repair the damaged houses.

c) Suggestions for the future:

i) The roads adjoining to the coastal areas should be improved. This is to facilitate quick evacuation of people and supply relief to the affected.

ii) Construct a high level coastal road with its top about one metre above the sea level. It should have adequate drainage openings.

iii) The government officials working in the cyclone prone areas should be provided adequate training related to the cyclone preparedness and relief work.

iv) The fishermen may be advised to avoid fishing during cyclone.

EARTHQUAKE:

Earthquakes are unpredictable and strike suddenly without warning. The magnitude of earthquake is measured in Richter scale. Earthquakes of magnitude 8. 0 and above are considered as very destructive. Earthquake management the following measures are taken for earthquake management

a**) Pre-earthquake activities**

i) Severe earthquake results in the falling of objects and debris from buildings. Hence, the shelves (wooden) should be fixed to the walls. The heavy objects from shelves above head level should be removed.

ii) Bed should be placed away from windows and heavy object. Donot hang mirrors or picture frames over beds. iii) Appliances used in houses and industries should be tightened.

iv) Keep adequate safe drinking water, food, first aid kit, medicine, tools, torch with batteries, blankets etc., in a secure place at your residence.

b) During the earthquake

i) Do not afraid, stay calm and wait for information from official sources.

ii) Most injuries occur while people enter or leave buildings. So do not move when the tremors occur.

iii) If you are inside the buildings, stay under unbreakable table or desk. Stay away from glass windows and outside doors. If unable to move, cover your head and body with pillows, blankets etc., to protect yourself from falling objects.

iv) Do not use elevators as power may have failed. Do not run in the staircases.

v) If an earthquake occurs when you are outside, get away from buildings, walls, trees and utility wires. Stay in an open area until tremors stop.

vi) If you are driving, stop and stay inside. Do not remain next to large buildings. Do not remain on bridges and flyovers.

vii) Check for injuries, apply first aid. Inform police. viii) Evacuate the building if a gas leak is suspected. Do not light matches.

c) Post-earthquake activities:

i) Temporary shelters should be provided to earthquake affected people.

ii) Arrangements have to be made for the medical care for the injured.

iii) Restoration of transport and communications in the earthquake affected area.

iv) Temporary support to the cracked buildings with the help of iron bars.

v) Distribution of relief supplies such as blankets, medicines etc., to the earthquake affected people.

vi) Search and rescue operations should be made in the earthquake affected area.

vii) Quick assessment of damage caused by earthquake and provide compensation to the affected people.

LAND SLIDE:

A falling of a rock or soil from steep slope is cal1d landslide. It is a serious geological hazard common in hilly regions of India. Landslides cause extensive damage to roads, bridges, agricultural lands, forests, orchards etc, resulting in the loss of property as well as life. Economical degradation of hill areas has been increased due to landslides. Landslide preventive measures

i) Construction of check dams in the landslide vulnerable areas. It may prevent the fast flowing of rainwater and land erosion.

ii) Road side drains are formed to facilitate surf ace drainage of water. It helps to prevent road erosion.

iii) Sub surface trench drains are constructed to facilitate sub surface drainage of water.

iv) Concrete retaining walls are constructed in the landslide prone areas to prevent land erosion.

v) Display boards are installed for the public in the landslide prone areas to avoid accidents.

vi) Plant suitable trees in barren-lands and sloppy areas.

Risks due to landslide incidence

i) Landslides lead to spread and deposition of debris which blocks the flow of water in streams.

ii) ii) Breaches occur in the buildings, roads and bridges.

iii) Communication lines and supply lines are disturbed.

iv) Landslides bring huge quantities of soil which blocks the roads and prevent the supply of essential commodities through vehicle.

v) The consequences of landslides include loss of homes, loss of agricultural land, loss of employment, loss of revenues, increased medical needs etc.

CONSUMERISM AND WASTE PRODUCTS:

Modern societies are based on using large amounts of use and throw goods. This causes the production of extremely large quantities of waste products. Over utilisation of consumer products by each family of the city leads to more production of wastes. For instance, two hundred million cans, bottles, plastic containers, paper plates and paper cups are thrown away each year in the developed countries. Disposable items greatly increase the waste materials in the land. The increasing demands of consumption of goods in urban centers cause enormous amounts of waste production. Hence, the useful materials from the wastes are recovered before they are disposed into environment. Therefore, reuse of goods and waste utilization should become a part of the production-consumption cycle. The industrial sector disposes large quantities of solid wastes. Burning or dumping wastes into streams or oceans or lands damages the environment. It is estimated that the per capita production of domestic waste is many times higher in a developed country than developing country. Large quantities of solid, liquid and gaseous waste is produced by urban people in the form of plastic, paper, tin cans, bottles, leather, mineral refuse and pathological waste from hospitals. These wastes are considered to have great economic value which enhances pollution in the environment. Dead animals, agricultural wastes, fertilizer, pesticide, animal excreta etc., are some of the waste products produced by rural people.

The principles such as reduce, reuse and recycle should be employed. The consumers should use the products as much they required (water, food, paper etc.,). Donate old clothes to the poor people, instead of throwing away. Wet garbage includes kitchen wastes which can be used for composting.

Avoid use of non-biodegradable materials such as Styrofoam and certain types of plastics. Do not throw garbage in public places. Garbage can cause diseases and health problems.

Use and Throw plastics:

There are biodegradable and non-biodegradable types of plastics. The biodegradable type of plastics can be recycled and reused. But the non-biodegradable type of plastics accumulates in the environment. The modern man uses plastic carrier bags, use and throw plastic cups, plates, mineral water bottles etc., in their routine life. After use they throw away these plastic materials into the land surface. Often, these plastic materials are consumed along with their foodstuff by domestic animals like sheep, cow, dog etc. As a result, the plastics cannot be digested and result

into death of animals. In addition, the use and throw plastics when dumped in the surface of the land cannot allow percolation of water into soil. In due course, plants cannot get adequate amount of water and become dry. Moreover, underground water also decreases in the land.

ENVIRONMENT PROTECTION ACT, 1986

Objectives:

a) Protection and improvement of environment (air, water, land).

b) Prevention of hazards to all living creatures and property (humans, plants, animals).

c) Maintenance of harmonious relationship between human beings and their environment.

d) Planning and execution of nation-wide programme to prevent, control and abate environmental pollution.

e) Laying down the standards for the emission or discharge of environmental pollutants from various sources.

f) Restricting areas in which industries, operations or processes shall not be carried out.

g) Carrying out investigations and research in environmental pollution problems.

h) Inspection of any premises, industries, manufacturing process, equipment or machinery and giving directions to prevent, control and abate environmental pollution.

i) Establishment of environmental laboratories and institutes

j) The central government and its officers have the power to take samples of air, water, soil or substances from the factory or place, for analysis.

k) The central government has the power to appoint or recognise government analysts for the purpose of analysis of samples of air, water, soil or any other substance.

l) The report signed by a government analyst may be used as evidence of the facts stated therein in any proceeding under the legislation.

m) The central government has the power to close, prohibit or regulate any industry.

AIR (PREVENTION AND CONTROL OF POLLUTION) ACT, 1981

Objectives:

a) Prevention, control and abatement of air pollution.

b) Maintaining the quality of air.

c) Establishment of state or central pollution control boards for the prevention and control of air pollution.

Powers of the board:

a) Power to declare any areas or areas as air pollution control areas by notification in the official gazette.

b) Prohibit use of any fuel or appliance or burning of any material causing or likely to cause air pollution in an air pollution control area.

c) Power to establish standards for emission of air pollutants from automobiles laid down by the state board.

d) No person shall establish or operate any industrial plant in an air pollution control area, without the previous consent of the state board.

e) No person shall discharge any air pollutant in excess of standards laid down by the state board in an air pollution control area.

f) Any person empowered by a state board shall have right to enter any place or industry for examining and testing any control equipment, industrial plant, record, register, documents etc.

g) Any officer empowered by the state board has the power to take samples of air or emission from any chimney and send the same for analysis to the laboratory recognised by the state board.

Penalties for violations of the provision under the act:

Any person failing to comply with any of the provisions of the act shall be punishable with imprisonment for a term which may extend to three months or with fine which may extend to ten thousand rupees or both. In the case of continuing violation, an additional fine which may extend to five thousand rupees for every day.

WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974.

Objectives:

a) Prevention and control of water pollution

b) Maintaining or restoring healthy and hygienic water.

c) Establishment of Central board and State board for the prevention and control of water pollution.

Provisions of the act: (Central Water Pollution Control Board)

a) To lay down standards for streams and wells and to promote their cleanliness.

b) To advise and provide technical assistance to the central government on matters concerning the prevention and control of water pollution.

c) To prepare manuals or guides for treatment and disposal of sewage and industrial effluents and to establish or recognise laboratories for analysis of water samples.

Provisions of the act: (State Water Pollution Control Board)

a) Planning a comprehensive programme for prevention, control and abatement of pollution of streams and wells.

b) Advising the state government regarding water pollution control or location of industries.

c) Conducting and encouraging research relating to different aspects of water pollution.

d) To collaborate with the central water board for training personnel for handling water pollution programmes. e) Inspecting industrial effluents and waste water treatment plants.

f) Evolving economical and reliable methods of disposal, treatment and reuse of waste water in agriculture.

g) Laying down the standards of treatment of sewage and industrial effluents to be discharged into any stream. h) Establishing or recognising laboratories for analysis of water samples.

Powers of the board:

a) The water pollution control board officers have the power to take samples of water of any stream or well or effluents discharged from the industry for analysis.

b) Without the proper consent of the water pollution control board, no person shall establish any industry which is likely to discharge any sewage or effluents into stream or well or on land.

WILD LIFE PROTECTION ACT, 1972

Objectives:

a) To maintain essential ecological processes and life supporting systems.

b) To preserve the biodiversity

c) To ensure protection and conservation of wild life.

Provisions:

a) The central government may appoint a Director of wildlife preservation, Assistant Director of wildlife preservation and other required officers and employees.

b) The state government may appoint a Chief Wildlife warden, Wildlife wardens and other required officers and employees.

c) The state government or union territory may constitute a Wildlife Advisory Board. It advises the state government about selection of areas to be declared as sanctuaries and national parks formulation of the policy for protection and conservation of wildlife and specified plants.

d) Prohibition of Hunting endangered species of animals.

e) The Chief Wildlife Warden may grant permission to any person on payment of the prescribed fee, allowing him to hunt any wild animal for the purpose of education, scientific research, collection of specimens and collection of snake venom for the manufacture of life saving drugs.

f) Prohibiting picking and uprooting of specified plants.

g) The central government shall constitute a body to be known as Central Zoo Authority for taking care of the animals kept in a zoo, assessment of the functioning of the zoos and identification of endangered species of wild animals for the purpose of captive breeding.

Powers of Chief Wildlife Warden and authorised officers:

a) Power of cancellation of gun license of any person who has committed offence against this act.

b) The director or forest officer or any police officer not below the rank of a Sub Inspector has the power to stop any vehicle in order to conduct search.

c) If any person possess any captive animal, wild animal, animal article, meat etc., in his custody is considered as offence committed against this act. Arrest such a person with warrant and detain him.

Penalties for violation of the provisions:

a) A person violating any provision of this act shall be punished with imprisonment or a fine or both.

b) The license held by the offender shall be cancelled and he shall not be eligible for a license for a period of 5 years from the date of conviction.

FOREST CONSERVATION ACT, 1980

Objectives:

a) Protection and conservation of forests.

b) To ensure judicious use of forest products.

Provisions:

a) This act was enacted with a view to check indiscriminate diversion of forest land to non forest purposes.

b) Under this act prior approval of central government is required before any reserved forest is declared as deserved or forest land is diverted to non forest purposes.

c) If diversion is permitted, compensatory afforestation is raised over equivalent area of non forest lands.

d) According to this act six regional offices have been set up for monitoring forest conservation matters by department of environment, forests and wildlife.

Powers of the central government:

a. The land that has been notified or registered and mentioned in government records as forest land, may not be used for non forest purpose. If the state government wants to convert the forest land into non forest purpose, it should get prior permission from the central government.
b. The state forest department should not have power to provide lease any forest land to any person or agency or organisation without prior approval of central government.

c) This act also prohibits the cutting of naturally grown trees in the forest land for the purpose of reforestation.

ENVIRONMENTAL MOVEMENTS: CHIPKO, SILENT VALLEY, BISHNOIS OF RAJASTHAN

An environmental movement can be defined as a social or political movement, for the conservation of environment or for the improvement of the state of the environment. They can also be called as green movement or conservation movement. The environmental movements are outcome of people trying to gain control over their natural resources, unjust developmental policies of government, socio-economic inequity and environmental degradation. So, these movements mainly center on ecology, health and human rights.

CHIPKO MOVEMENT:

Year: 1973

Place: Chamoli district and later at Tehri-Garhwal district of Uttarakhand.

Leaders: Sundarlal Bahuguna, Gaura Devi, Sudesha Devi, Bachni Devi, Chandi Prasad Bhatt, Govind Singh Rawat, Dhoom Singh Negi, Shamsher Singh Bisht and Ghanasyam Raturi.

Aim: The main objective was to protect the trees on the Himalayan slopes from the axes of contractors of the forest.

The Chipko is one of the world known environmental movements in India. It brought world attention on the environmental problems of the Alaknanda catchment area in the mid-Western Himalayas. The trigger for the modern Chipko movement was outcome of the growth in development that took place with the perspective of border security, after 1963 China border conflict. It proved to be disastrous for forest and total environment of the area. Widespread floods inundated the area in 1970.

SILENT VALLEY:

Year: 1978

Place: Silent Valley, an evergreen tropical forest in the Palakkad district of Kerala, India.

Leaders: The Kerala Sastra Sahitya Parishad (KSSP), many NGOs and the poet-activist Sughatha kumari.

Aim: To protect the moist evergreen forest in Palakkad district from being destroyed by a hydroelectric project.

Silent valley was named by English man during colonial rule, who found that there was no noise of cicadas after dark. It is one of rich bio diverse areas of India. It has a triangular shape. On two sides are the Kozhikode and Palghat cities in Kerala and on the other side is located the Coimbatore city in neighbouring Tamil Nadu.

BISHNOIS OF RAJASTHAN:

Year: 1700s

Place: Khejarli, Marwar region, Rajasthan state.

Leaders: Amrita Devi along with Bishnoi villagers in Khejarli and surrounding villages.

Aim: Save sacred trees from being cut down by the king's soldiers for a new palace.

The Bishnois living in western Rajasthan on the fringe of the Thar Desert, for centuries, have been conserving the flora and fauna. For them nature-loving people, protection of the environment, wildlife, and plants is a part and parcel of their sacred traditions. In the fifteenth century, Jambhoji, a resident of a village near Jodhpur, had a vision that the cause of the drought that had hit the area and hardship that followed was caused by people's interference with nature. Thereafter, he became a 'sanyasi' and came to be known as Swami Jambeshwar Maharaj. This was the beginning of the Bishnoi sect. He laid down 29 tenets for his followers which included Jeev Daya Palani – Be compassionate to all living beings and Runkh Lila Nahi Ghave – Do not cut green trees. Nature protection was given foremost importance in these tenets.

ENVIRONMENTAL ETHICS:

Issues And Possible Solutions Environmental destruction is largely caused by the consumption of the rich.

- The worst sufferers of environmental destruction are the poor.
- Even where nature is being 'recreated', as in afforestation, it is being transformed from the needs of the poor and towards those of the rich.
- Even among the poor, the worst sufferers are the marginalized cultures and occupations.

- There cannot be proper economic and social development without a holistic understanding of society and nature.
- If we care for the poor, we cannot allow the Gross Nature Product to be destroyed any further.
- Conserving and recreating nature has become our highest priority.
- Gross Nature Product will be enhanced only if we can arrest and reverse the growing alienation between the people and the common property resources.
- In this we will have to learn a lot from our traditional cultures. It is totally inadequate to talk only of sustainable rural development, as the World
- Conservation Strategy does. We cannot save the rural environment or rural people dependent on it, unless we can bring about sustainable urban development

ENVIRONMENTAL COMMUNICATION AND PUBLIC AWARENESS:

Environmental communication is a practical discipline that enables understanding of complex environmental issues and strengthens the role of individuals and organizations in environmental governance. Environmental communication serves to raise awareness, change behaviour, influence public opinion, advocate for policies, address conflicts and pass legislation.

The citizens` involvement in environmental management and protection depend, largely, on their level of awareness about environmental issues. By increasing availability of and access to environmental information, citizens can become an important non-state actor against the environmental degradation and climate change

ISSUES INVOLVED IN THE ENFORCEMENT OF ENVIRONMENTAL LEGISLATION-PUBLIC AWARENESS

It is necessary to create awareness about the norms and projected environmental restrictions under which organization may have environmental regulations and legislations rests with a number of different agencies. Central government is responsible for enforcement of various environmental legislation for less polluting small scale industries. There is an urgent need to use a range of measures to complement regulations. It should be a must for all potential polluters to apply permission to operate, discharge or emit any pollutants. In addition there should be a greater monitoring. The technique of environmental assessment is applied to ensure that the significance of potential environmental impacts of proposed projects are critically examined during the planning process. Another way of increasing awareness on environmental protection is the introduction of voluntary scheme under which companies which would meet certain standard of environmental property of their products.

The various expectations in different types of pollution are as follows:

1. Water Pollution:

Under the water resource act of the country it should be criminal offence to cause or knowingly permit the entry in to controlled water of any poisonous, noxious or polluting matter or any other solid matter, trade or sewage effluent without the consent. Accidental spillage or discharge of such materials should be treated as an offence.

2. Air Pollution:

The legal responsibility about air pollution may be found in terms of the environmental protection act, covering two complementary systems of air pollution

(1) the most potentially polluting activities. The major sources of air pollution are

(a) Emission from industrial sources

(b) Emission from motors vehicles,

(c) Emission from other sources.

Thus, to prevent air pollution, rules and regulations are required to be framed. 129

3. Wastes Disposal:

They may be regulatory bodies for waste disposal, waste collection. These should also be directives relating to waste on the disposal of waste oil, the disposal of polychlorinated biphenyl, and polychlorinated phenyls. After the united Nation's Conference on Human Environment in 1972 the Environmental legislation got a fresh impieties Indian first systematic approach in dealing with the environmental issues started from water Act of 1974. This Act was amended in 1988 and a new section 33 A was introduced which empowers state boards to issue directives to any person to close any industry and to stop or regulate supply of water and electricity. Because of the continuing environmental degradation and the Bhopal gas tragedy in 1974 the central government enacted fresh legislation for adopting more strict environmental policies. Environmental Protection Act 1986 is one of the most significant legislation to protect the environment. Under Article 48A, the addition was made to the directive principles of state policy as the state shall endeavours to protect and improve the environment and safeguard the forests and wildlife of the country. Article 51A (g| imposes high responsibility on every citizen to protect the environment and improve natural resources, including forests, lakes, rivers and wildlife.

Every citizen has a choice of few records to mitigate pollution. These are

(1) A common law and action

(2) A writ petition for completing the agency to enforce the law and

(3) A citizen suit. An upcoming industry must submit No Objection Certificate in respect of pollution before it starts the implementation process. In case of a large project, it should submit Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) to the Govt. of India for final clearance of the project. Recently Supreme Court of India emphasized on the need to strengthen some institutional machinery to enforce antipollution law across the state. Supreme Court has further suggested that Government should set up special courts exclusively to deal with cases relating to violation of environmental laws. Supreme Court has also suggested that chemical industries should be treated separately. In 1996, Supreme Court has ordered Union Government and local authorities to keep clean the historical places on a regular basis.

AWARENESS:

It is evident that the growing number of poor people, in developing countries due to the rapid population growth complex with economic constraints contributes to the degradation of environment and the renewable to the degradation of environment and the renewable sources like water, forests, and extinction of various species on which the man depends. For these, greater awareness is needed. Due care is necessary to harness the natural resources, so that the quality of the environment does not deteriorate. It is unfortunate to note that degradation of environment continues inspire of environmental legislations and standardization. One of the reasons for this is improper implementation of the various environmental laws and standards. The most important reason may lack of awareness and understanding the implicate environmental degradation.