

MODULE -

3

ENVIRONMENT AND ECOSYSTEM

Environment: *Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness.*

Ecosystem: *Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession.*

3.1 ENVIRONMENT

3.1.1 DEFINITION

It deals with each problem that influences an organism. It is essentially a multidisciplinary technique that brings about an appreciation of our natural world and human impacts on its integrity. It is an applied science as it seeks practical answers to creating human civilization sustainable on this planet's finite resources.

3.1.2 SCOPE

Surroundings were originally a natural landscape like a forest, a river, a mountain, a desert, or a mixture of those components. Most of us live in landscapes which have been closely changed via human beings. Daily lives are linked with our environment and inevitably influences them. Reliance on nature is great to the point that we can't keep on living without ensuring the ecological assets- **Mother Nature**. Ill effects of rapid financial boom and development, brought about environmental degradation. Industrial improvement makes use of up massive amounts of natural resources.

3.1.3 NEED FOR PUBLIC AWARENESS

Earth's natural resources are dwindling and our surroundings is being progressively degraded by human activities, it's evident that measures have to be taken. Often feel that dealing with all that is something that the Government must do. Prevention of our surroundings degradation in which we have to all take part that need to become a part of all our lives. As an individual, we are able to play a significant role in environment management. It can be made conceivable through mass awareness. If every people feels powerfully regarding the environment, the press and media can boost our efforts. Politicians in a democracy respond completely to a powerful publically supported movement. One can join an NGO that supports the cause of conservation. Each of us is in charge of spreading this message to as many individuals as possible.

3.2 ECOSYSTEM

"Ecosystem" may be a region with a particular and recognizable landscape type like forest, grassland, desert, land or coastal space. The geographical, climatic and soil traits form its non-living (abiotic) factor. The living a part of the environment is called its biotic element. This community of living organisms in conjunction with the non-living parts of their surroundings interact as a system.

3.3 ENERGY FLOW

Every ecosystem has several interrelated mechanisms that affect human life. These are the **water cycle, the carbon cycle, the oxygen cycle, the nitrogen cycle and the energy cycle**. While every ecosystem is controlled by these cycles, in each ecosystem its abiotic and biotic features are distinct from each other.

3.3.1 WATER CYCLE

When it rains, the water runs alongside the floor and flows into rivers or falls directly into the ocean. A part of the rainwater that falls on land percolates into the ground. This is stored underground all through the rest of the year. Water is drawn up from the ground by plant life together with the vitamins from the soil. The water is transpired from the leaves as water vapour and returned to the

surroundings. The water is transpired from the leaves as vapour and returns back to the atmosphere. Because it is lighter than air, vapour rises and forms clouds. Wind blow the clouds for long distances and once the clouds rise higher, the vapour condenses and changes into droplets, that fall on the land as rain.

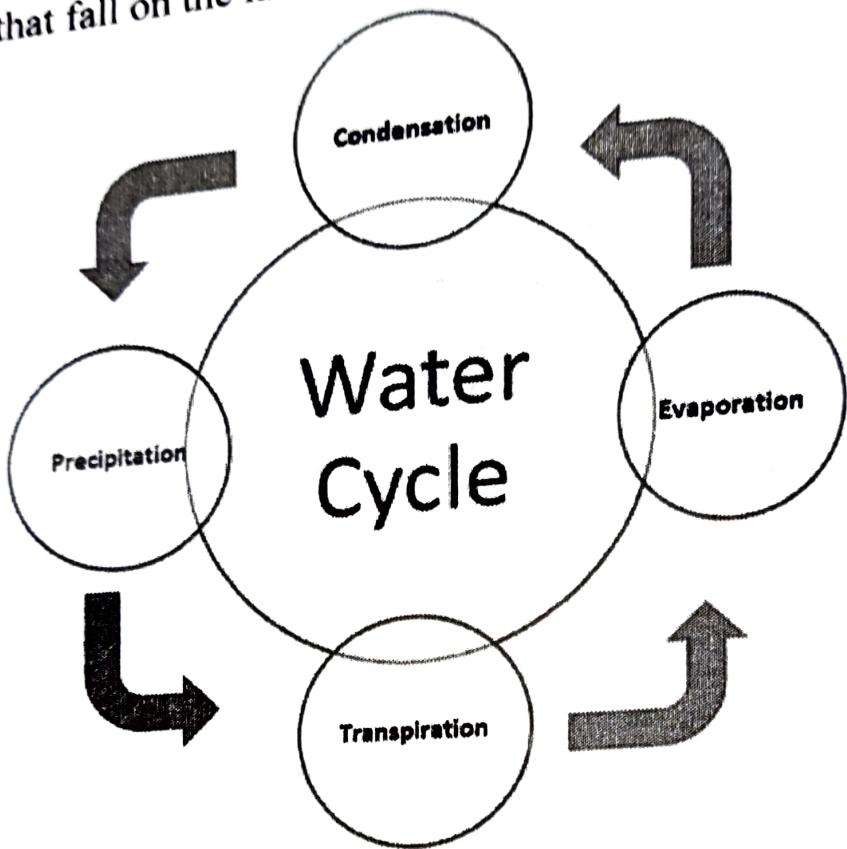


Fig 3.1 Water Cycle

3.3.2 CARBON CYCLE

The carbon, which occurs in organic compounds, is included in both the abiotic and biotic components of the ecosystem. Plants use photosynthesis for their growth and improvement. In this procedure, vegetation releases oxygen into the ecosystem on which animals depend for their respiration. Herbivorous animals feed on plant cloth, that is utilized by them for strength and for their improvement. Both plants and animals release carbon dioxide during respiration. They also return fixed carbon to the soil in the waste they excrete. When plants and animals die they return their carbon to the soil. These processes complete the carbon cycle.

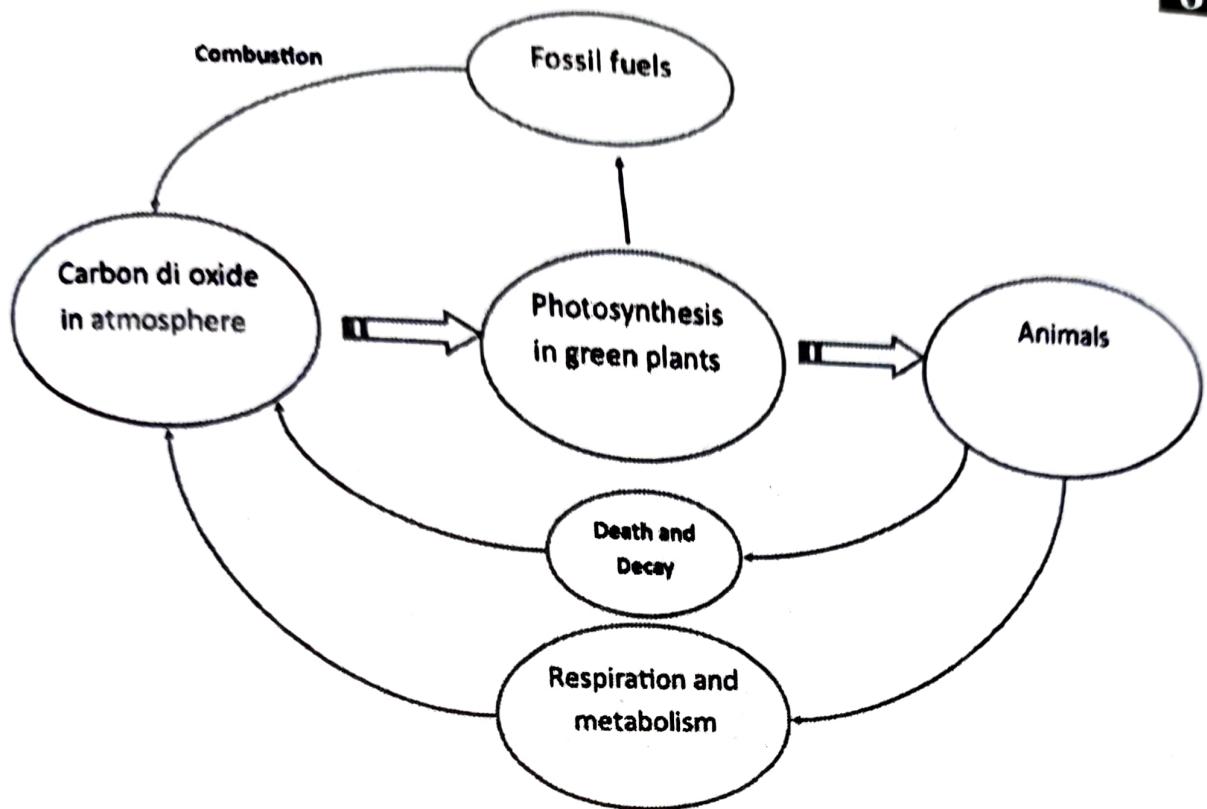


Fig 3.2 Carbon Cycle

3.3.3 NITROGEN CYCLE

Carnivorous animals feed on herbivorous animals that eat plants. When animals defecate, this waste material is broken down through worms and bugs typically beetles and ants. These little 'soil creatures' break the waste material into littler bits on which minute microorganisms and organisms can act. This material is hence separated further into supplements that plants can retain and use for their development. In this manner supplements are reused once again from creatures to plants. Thus the nitrogen cycle on which life is dependent is completed.

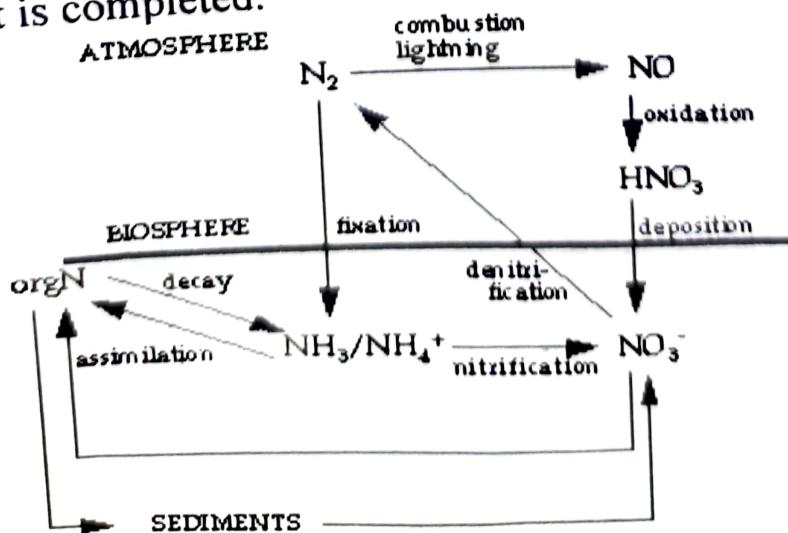


Fig 3.3 Nitrogen Cycle

3.3.4 OXYGEN CYCLE

The oxygen cycle is the biogeochemical cycle that portrays the development of oxygen inside and between its three principle stores: the (air), the biosphere (living things), and the lithosphere (earth's hull). The fundamental driving element of the oxygen cycle is photosynthesis, which is responsible for the modern Earth's atmosphere and life.

Plants are the main creators of oxygen within the atmosphere through photosynthesis. Here the tree makes use of daylight and carbon dioxide to supply electricity and releases oxygen. The animals breathe in the oxygen and then breathe out carbon dioxide. The plant can then use this carbon dioxide and the cycle is completed.

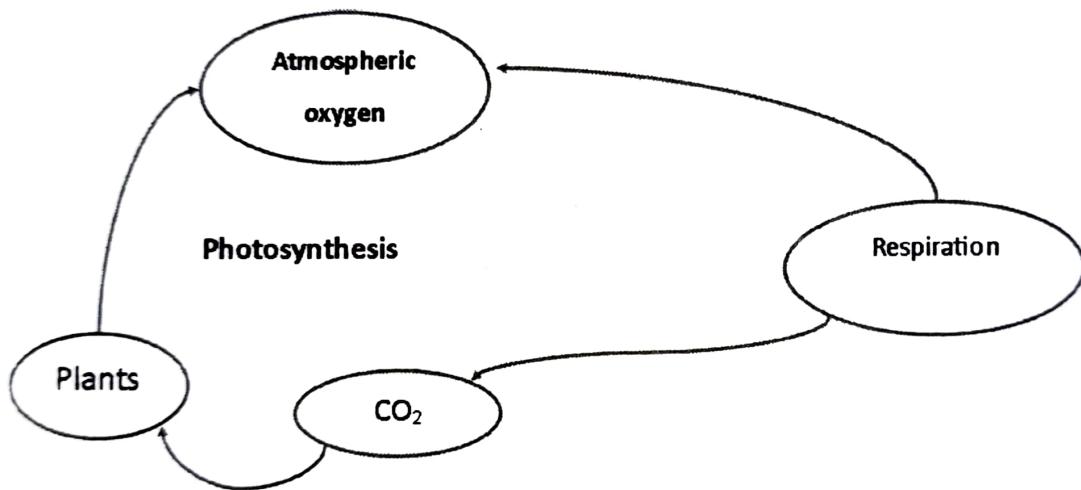


Fig 3.4 Oxygen Cycle

3.3.5 ENERGY CYCLE

The energy cycle is based totally on the flow of energy through the surroundings. Energy from sunlight is transformed via plants into developing new plant fabric which includes leaves, plants, fruit, branches, trunks and roots of vegetation, referred to as producers in the ecosystem. The herbivorous animals feed on these plants. The carnivores in turn depend on herbivorous animals on which they feed. Thus the unique plant and animal species are linked to one another through food chains.

The energy in the ecosystem can be depicted within the form of a food pyramid or energy pyramid. The food pyramid has a large base

of vegetation known as 'producers'. The pyramid has a narrower middle section that depicts the number and biomass of herbivorous animals, which might be called 'first order producers'. The apex depicts the small biomass of carnivorous animals called 'second order consumers'.

When plant life and animals die, this material is back to the soil after being damaged down into simpler substances by means of decomposers inclusive of bugs, worms, bacteria and fungi so that plant life can take in the vitamins via their roots. Animals excrete waste products after digesting food, which goes back to the soil. This links the energy cycle to the Nitrogen cycle.

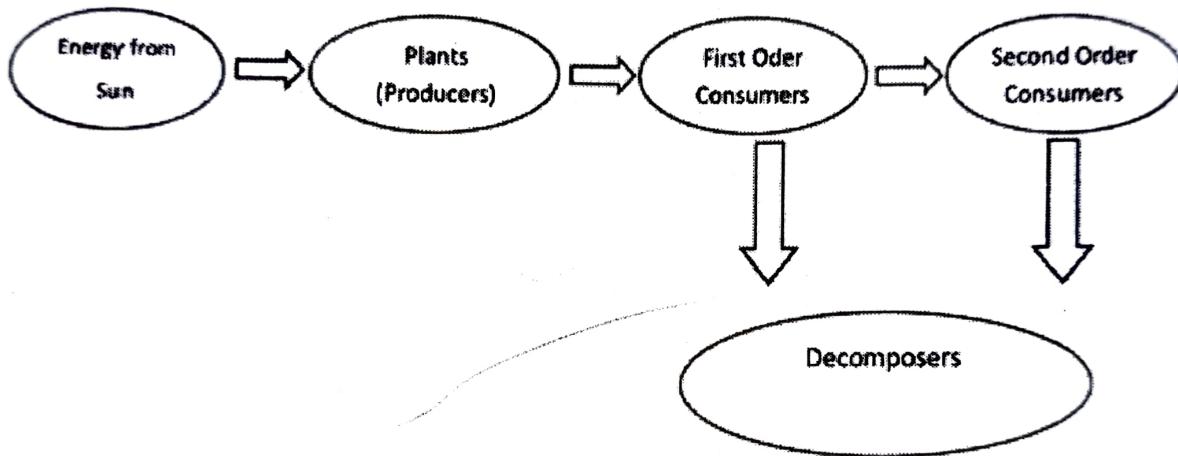


Fig 3.5 Energy Cycle

3.4 ECOLOGICAL SUCCESSION

Ecological succession is a process through which ecosystems tend to transform over a period of time. Succession can be related to seasonal environmental changes, which create adjustments in the community of plant life and animals residing in the surroundings. There is a tendency for succession to produce a more or less stable state at the end of the successional stages. The successive levels are associated with the manner wherein strength flows via the organic system

Ex: *Pond ecosystem* - fluctuation from a dry terrestrial habitat to the early colonisation stage by small aquatic species after the monsoon, which gradually passes through to a mature aquatic ecosystem, and then reverts back to its dry stage in summer where its aquatic life remains dormant.

3.5 FOOD CHAINS, FOOD WEBS AND ECOLOGICAL PYRAMIDS

The transfer of energy from the source in plants through a series of organisms by eating and being eaten constitutes **food chains**. These food chains are not isolated sequences, but are interconnected with each other. This interlocking pattern is known as the **food web**. Each step of the food web is called a trophic level. These trophic levels together form the **ecological pyramid**.

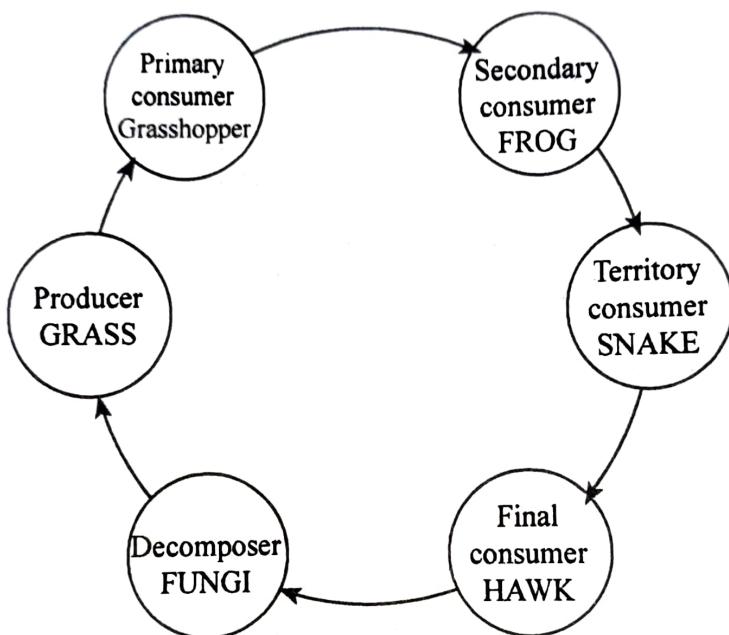


Fig 3.6 Food Chain

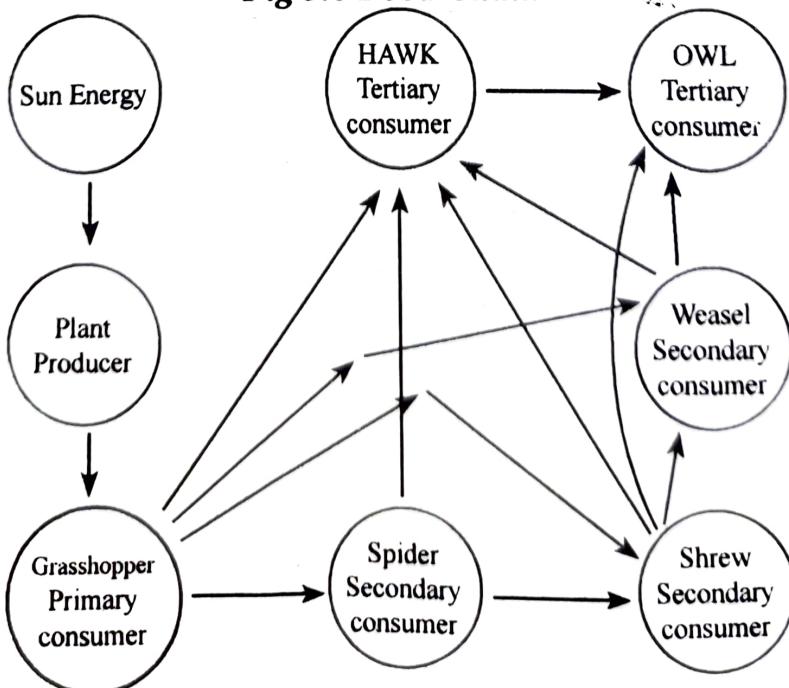


Fig 3.7 Food Web

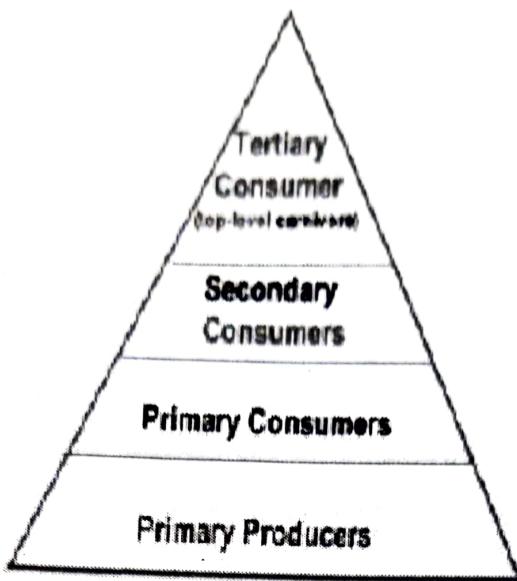


Fig 3.7 Energy Pyramid

3.6 ECOSYSTEMS

3.6.1 FOREST ECOSYSTEM

Forests are formed by a community of plants which is predominantly structurally defined by its trees, shrubs, climbers and ground cover.

The forest ecosystem has two parts:

- **The non-living or abiotic aspects of the forest:** The type of forest depends upon the abiotic conditions at the site. Vegetation is specific to the amount of rainfall and the local temperature which varies according to latitude and altitude.
- **The living or the biotic aspects of the forest:** The plants and animals form communities that are specific to each forest type. The biotic component includes both the large (macrophytes) and the microscopic plants and animals.

Types of forest ecosystem

Forests in India can be broadly divided into Coniferous forests and Broad leaved forests.

Coniferous forests: Grow in the Himalayan mountain region, where the temperatures are low. These forests have tall stately trees with needle like leaves and downward sloping branches so that the snow can slip off the branches.

Broadleaved forests: They have several types, such as evergreen forests, deciduous forests, thorn forests, and mangrove forests. Broadleaved forests have large leaves of various shapes.

Evergreen forests grow in the high rainfall areas of the Western Ghats, North Eastern India and the Andaman and Nicobar Islands. These forests grow in areas where the monsoon lasts for several months. There is no dry leafless phase as in a deciduous forest. An evergreen forest thus looks green throughout the year. The trees overlap with each other to form a continuous canopy. Thus very little light penetrates down to the forest floor.

Deciduous forests are found in regions with a moderate amount of seasonal rainfall that lasts for only a few months. The deciduous trees shed their leaves during the winter and hot summer months. The forest frequently has a thick undergrowth as light can penetrate easily onto the forest floor.

Thorn forests are found in the semi-arid regions of India. The trees, which are sparsely distributed, are surrounded by open grassy areas. Thorny plants are able to conserve water.

Mangrove forests grow along the coast especially in the river deltas. These plants are able to grow in a mix of saline and fresh water. They grow luxuriantly in muddy areas covered with silt that the rivers have brought down. The mangrove trees have breathing roots that emerge from the mud banks.

Conservation of forest ecosystem: The forests can be conserved only when its resources are used carefully. This can be done by using alternate sources of energy instead of fuelwood. There is a need to grow more trees than are cut down from forests every year for timber. Afforestation needs to be done continuously from forests with all their diverse species must be protected as National Parks and Wildlife Sanctuaries where all the plants and animals can be preserved.

3.6.2 GRASSLAND ECOSYSTEM

A wide range of landscapes in which the vegetation is mainly formed by grasses and small annual plants form a variety of grassland ecosystems with their specific plants and animals. Grasslands cover areas where rainfall is usually low and/or the soil depth and quality is poor. The low rainfall prevents the growth of a large number of trees and shrubs, but is sufficient to support the growth of grass cover during the monsoon. Each grassland ecosystem has a wide variety of species of grasses and herbs.

TYPES OF GRASSLANDS

The Himalayan pasture belt: It extends upto the snowline. The grasslands at a lower level form patches along with coniferous or broadleaved forests. These Himalayan pastures have a large variety of grasses and herbs. There are also a large number of medicinal plants.

The Terai: This consists of patches of tall grasslands interspersed with a Sal forest ecosystem. The patches of tall elephant grass, are located in the low-lying waterlogged areas. The Sal forest patches cover the elevated regions and the Himalayan foothills. The Terai also includes marshes in low-lying depressions. This ecosystem extends as a belt south of the Himalayan foothills.

The Semi-arid plains: This is located in Western India, Central India and the Deccan are covered by grassland tracts with patches of thorn forest and are covered with seasonal grasses and herbs on which its fauna is dependent.

The Shola grasslands: It consist of patches on hillslopes along with the Shola forests on the Western Ghats, Nilgiri and Annamalai ranges. This forms a patchwork of grassland on the slopes and forest habitats along the streams and low lying areas.

Conservation of grassland ecosystem: Grasslands should **not be overgrazed** and areas of the grasslands should be closed for grazing. A part of the grassland in an area must be closed every year so that a **rotational grazing pattern is established**. Fires must

be prevented and rapidly controlled. To protect the most natural undisturbed grassland ecosystems, **Sanctuaries and National Parks must be created.**

3.6.3 DESERT ECOSYSTEM

Deserts and semi-arid areas are located in Western India and the Deccan Plateau. The climate in these vast tracts is extremely dry. This has sand dunes. There are also areas covered with sparse grasses and a few shrubs, which grow if it rains. the rainfall is scanty and sporadic. In an area it may rain only once every few years. Desert and semi-arid regions have a number of highly specialized insects and reptiles.

3.6.4 AQUATIC ECOSYSTEM

The aquatic ecosystems constitute the marine environments of the seas and the fresh water systems in lakes, rivers, ponds and wetlands. These ecosystems provide human beings with a wealth of natural resources. The aquatic ecosystems are classified into freshwater, brackish and marine ecosystems, which are based on the salinity levels.

The fresh water ecosystems: They have running water are streams and rivers. Ponds, tanks and lakes are ecosystems where water does not flow and have expanses of shallow water with aquatic vegetation, which forms an ideal habitat for fish, crustacean and water birds.

Marine ecosystems are highly saline, while brackish areas have less saline water such as in river deltas.

Brackish water ecosystems in river deltas are covered by mangrove forests and are among the world's most productive ecosystems in terms of biomass production. The largest mangrove swamps are in the Sundarbans in the delta of the Ganges.