## UNIT II

## Ecosystem and its components

### Overview

Why are there so many living organisms on Earth, and so many different species? How do the characteristics of the nonliving environment, such as soil quality and water salinity, help determine which organisms thrive in particular areas? These questions are central to the study of ecosystems— communities of living organisms in particular places and the chemical and physical factors that influence them. Learn how scientists study ecosystems to predict how they may change over time and respond to human impacts [1].

### Introduction

Ecology is the scientific study of relationships in the natural world. It includes relationships between organisms and their physical environments (physiological ecology); between organisms of the same species (population ecology); between organisms of different species (community ecology); and between organisms and the fluxes of matter and energy through biological systems (ecosystem ecology).

Ecologists study these interactions in order to understand the abundance and diversity of life within Earth's ecosystems—in other words, why there are so many plants and animals, and why there are so many different types of plants and animals. To answer these questions they may use field measurements, such as counting and observing the behavior of species in their habitats; laboratory experiments that analyze processes such as predation rates in controlled settings; or field experiments, such as testing how plants grow in their natural setting but with different levels of light, water, and other inputs. Applied ecology uses information about these relationships to address issues such as developing effective vaccination strategies, managing fisheries without over-harvesting, designing land and marine conservation reserves for threatened species and modeling how natural ecosystems may respond to global climate change [1].

Change is a constant process in ecosystems, driven by natural forces that include climate shifts, species movement, and ecological succession. By learning how ecosystems function, we can improve our ability to predict how they will respond to changes in the environment. But since living organisms in ecosystems are connected in complex relationships, it is not always easy to anticipate how a step such as introducing a new species will affect the rest of an ecosystem. Human actions are also becoming major drivers of ecosystem change [1].

**Ecological hierarchy**

Ecological hierarchy theory describes the arrangement of biological organisms in relation to one another. At the simplest level of the hierarchy are individual organisms. At the individual level, interactions with other organisms are not considered. Moving up the hierarchy, ecologists have found more complex ways to describe the relationships between organisms. These culminate in the biosphere, which describes the totality of all living things on planet Earth [2].

**The hierarchy of Ecology from smallest to largest** progress in the following order (Fig. 1) [3].

**Organism:** (Individual)

⇓

**Population:** (Group of a Species)

⇓

**Community:** (Many different Populations in an area)

⇓

**Ecosystem:** (The living and non-living things in an area)

⇓

**Biome:** (Collection of Ecosystems, categorized by amount of rainfall and temperature)

⇓

**Biosphere:** (Every part of the Earth that supports living things)

## Individuals

The first level of the ecological hierarchy is the individual organism. This level of the hierarchy examines how one organism interacts with its environment. Aspects of evolution are used extensively in studying this level. For example, the individual-organism level allows a scientist to study why a giraffe has a very long neck. He can infer that evolution has given the giraffe the long neck so it can reach a food source high on a tree. Organismal ecology is concerned with the biological, morphological and physiological development of individual organisms in response to their natural environment.

## Populations and Communities

The second level involves populations. A population contains a group of individuals -- belonging to one species and living in a specific geographic area -- which interact with one another. Population ecology studies the interactions among the individual members of a population.

The third level of the ecological hierarchy describes communities of life. The community level focuses on the relationship between different species in a community. Predator and prey relationships play a large role in community-level analyses. Parasitism and competition between species are another important part of this ecological level.

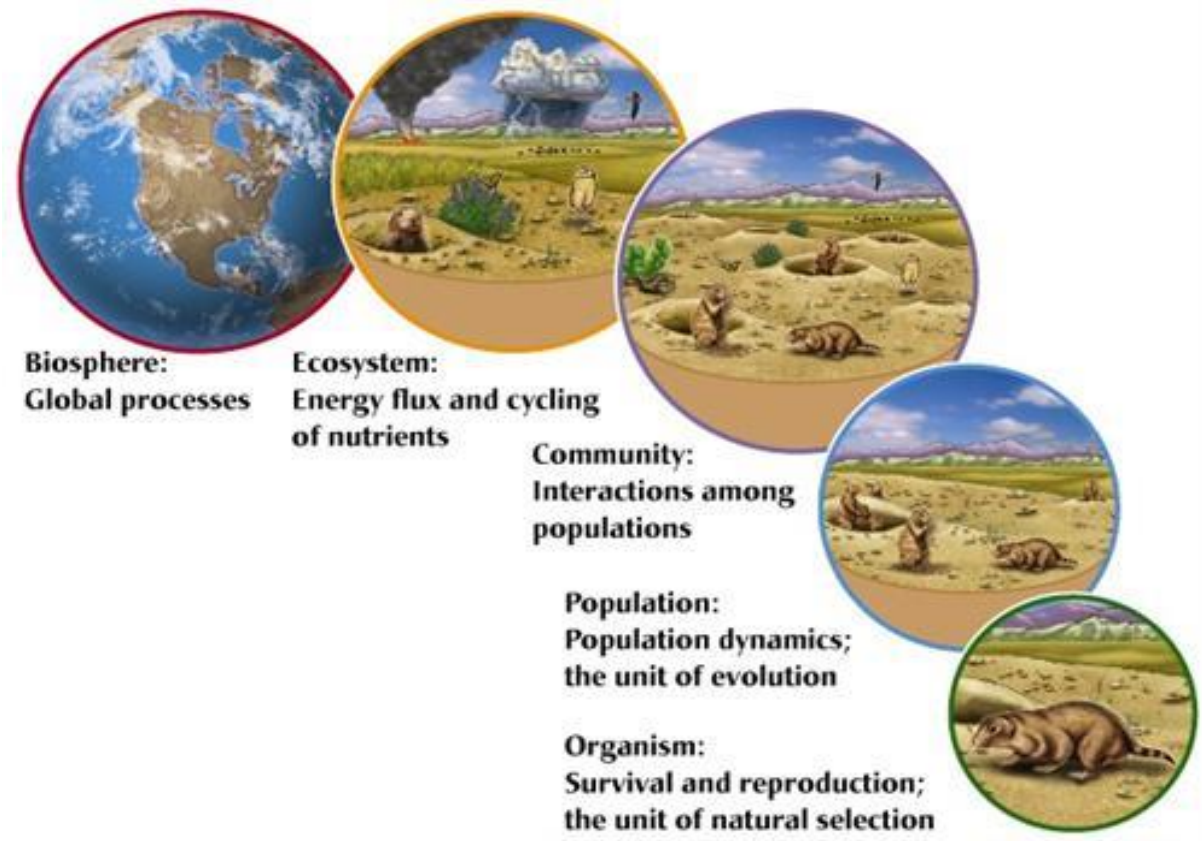
## Ecosystems

The next level up is an ecosystem. A community is part of an ecosystem, but does not comprise an entire ecosystem. Nonliving components in the environment are included in an ecosystem. The living organisms in an ecosystem interact with one another and with the nonliving factors in the environment. Examples of an ecosystem include a single lake, a confined forest, a prairie or a mountain summit.

## Biosphere

At the widest level of analysis, the biosphere represents the totality of all things on Earth, including their interactions. The biosphere includes all ecosystems on Earth

and how they interact together. By default, the biosphere includes climate, geology, the oceans and human pollution. This level of analysis can seem abstract, but it frequently has practical applications. Global climate change, for example, examines how the destruction of one ecosystem -- like the Amazon rainforest -- can lead to a loss of global climate regulation, and affect life on a part of Earth distant from the Amazon [2].



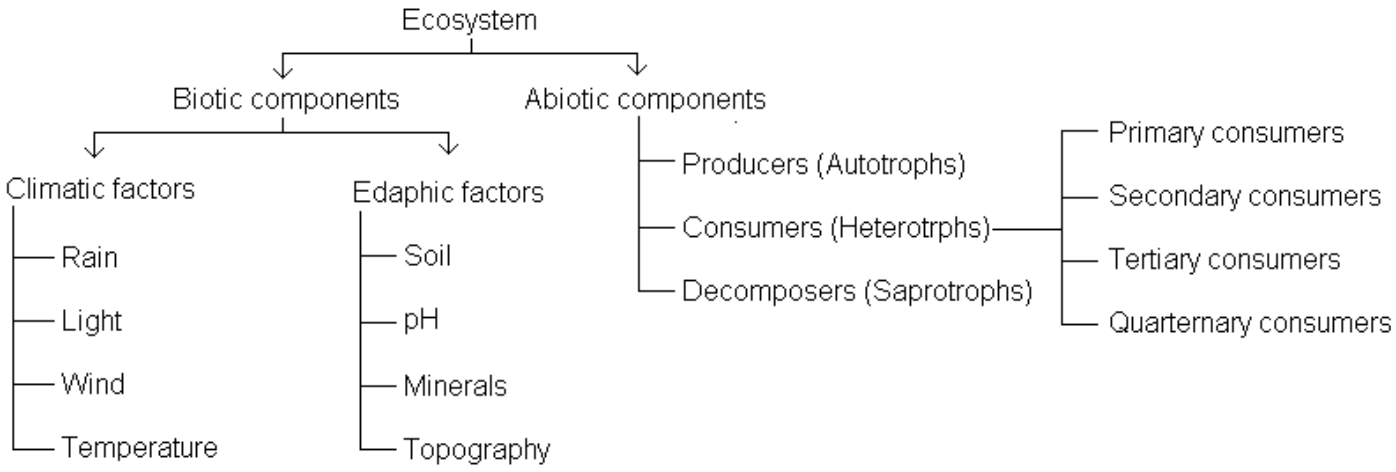

**Ecosystem**

An ecosystem is a community of organisms involved in a dynamic network of biological, chemical and physical interactions between themselves and with the nonliving components. Such interactions are crucial for sustaining the system and allowing it to respond to changing conditions.

An ecosystem is also defined as a functional and structural unit of Ecology. This implies that each ecosystem has a definite structure and components, and that each component part of the system has a definite role to play in the functioning of the ecosystem [4].

**Components of ecosystem**

Unlike ecological communities which comprise of living elements only, ecosystems have two 'parts': The **living (biotic) components** like plants and animals; and the **nonliving (abiotic) components** like water, air, nutrients and solar energy. These two parts of the ecosystem do not stand in isolation; rather they continuously interact with one another. In fact they are so closely linked to each other that experts, by looking at the type and condition of the abiotic environment of an ecosystem can identify the kind of life that one is likely to find in an ecosystem, and vice versa. Before we understand what these interactions are like, let us analyze the two components in detail [4].




**Abiotic component or Nonliving components of ecosystem**

Nonliving components Nonliving (or abiotic) components of an ecosystem include all the physical and chemical factors that influence living organisms, like air, water, soil, rocks etc. Thus, it is an assemblage of organic and inorganic substances present in an ecosystem. The various climatic factors that affect the ecosystem functioning are also a part of this. The non-living components are essential for the living world. Without sunlight, water, air and minerals, life cannot exist.

**Biotic component or Living components of ecosystem**

Living organisms (biotic components) in an ecosystem can be classified as either producers or consumers, depending on how they get their food.

**Producers (autotrophs, i.e. self feeders)** can make the organic nutrients they need, using simple inorganic compounds in their environment: for instance, the green plants on land and the small algae in aquatic ecosystems produce their food by the process of photosynthesis.

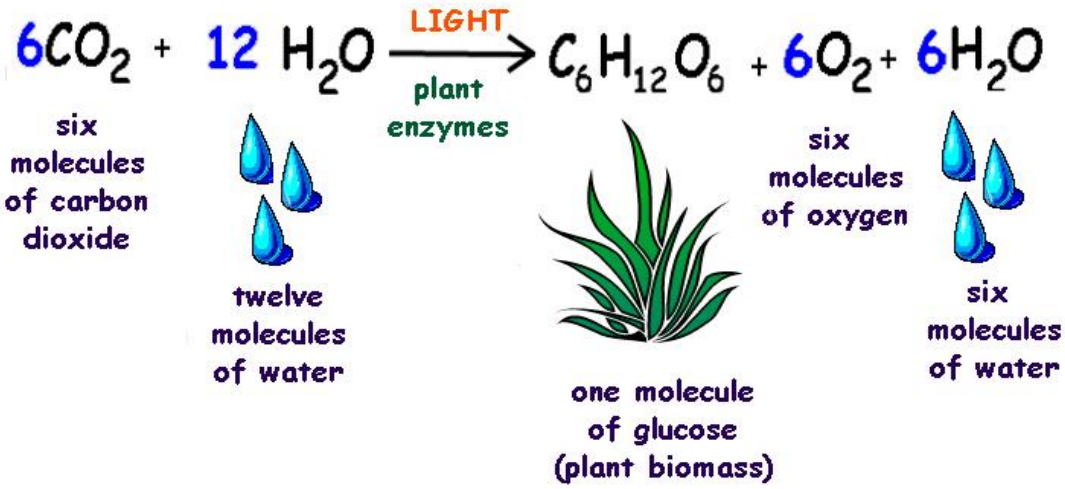
**Consumers (heterotrophs, i.e. other feeders)** are those organisms, which directly or indirectly depend on food provided by producers. Consumers, depending on their food habits, can be further classified into four types.

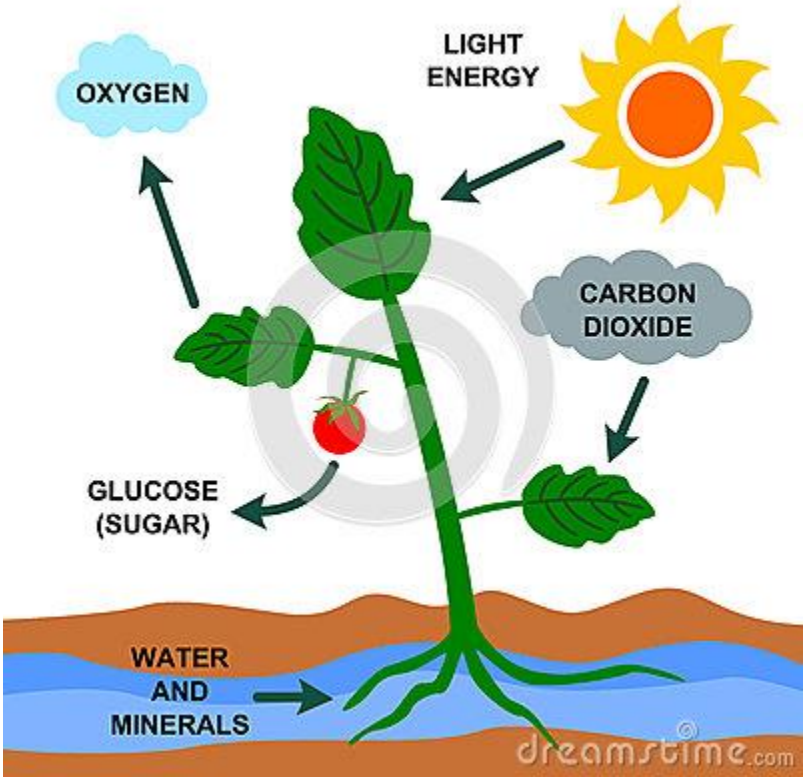
1. **Herbivores** (primary consumers) e.g. deer, rabbits, cattle, etc., are plant eaters and they feed directly on producers. In a food chain, they are referred to as the primary consumers.
2. **Carnivores** (secondary consumers) are meat eaters and they feed on herbivores. They are thus known as secondary consumers. They are animal eaters, e.g. lions, tigers.
3. **Omnivores** (tertiary consumers) eat both plants and animals, e.g. pigs, rats, cockroaches and humans.
4. **Decomposers** (quarternary consumers) digest the complex organic molecules in dead organic matter (detritus) into simpler inorganic compounds. They absorb the soluble nutrients as their food. Some examples are bacteria, fungi, and mites. What is important to note is that each ecosystem will have certain representative organisms playing each of the above mentioned roles [4].

**Photosynthesis**

All living things need energy to survive. Animals have to hunt or gather food to get the energy they need, but plants can make their own food using light energy from the sun. This process is called **photosynthesis**, and it takes place in the chloroplasts, tiny green structures found in the green parts of plants [5].

**Photosynthetic reaction [6]**




It is a complicated process, but basically, carbon dioxide and water are converted to glucose (a simple sugar) and oxygen.

Introduction, types, characteristic features, structure and function of the (a) Terrestrial ecosystem ( forest ecosystem, grassland ecosystem, desert ecosystem) and (b) Aquatic

ecosystems - (ponds ecosystems, streams ecosystems, lakes ecosystems, rivers ecosystems, oceans ecosystems, estuaries ecosystems)

**Introduction to Major ecosystem**

Earth is the giant ecosystem (biosphere) where abiotic and biotic components are constantly acting and reacting upon each other brining structural and functional changes in it. These worst ecosystem is, how ever, difficult to handle and thus for convenience nature is generally studied by making its artificial subdivisions in to units of smaller ecosystems

An ecosystem represent the highest level of ecological integration which is energy based. This functional unit is capable of energy transformation, accumulation and circulation. Two major ecosystems are basically categorized in biosphere such as…

i) Natural ecosystem

ii) Artificial ecosystem

**Natural ecosystem**

An ecosystem which raises based on natural activities only by means of abiotic, biotic and energy components, where no mans activities is involved. Based upon the habitation and water presentation, these are further divided as:

1. *Terrestrial ecosystem* – A terrestrial ecosystem is an ecosystem found only on landforms. Four primary terrestrial ecosystems exist: tundra, taiga, desert, temperate, and grassland. Major ecosystems under terrestrial as follows:

    i) Forest ecosystem

    ii) Grassland ecosystem

    iii) Desert ecosystem

2. *Aquatic ecosystem* – An aquatic ecosystem is an ecosystem in water. Communities of organisms that are dependent on each other and on their

environment live in aquatic ecosystems. The two main types of aquatic ecosystems are

i) Marine ecosystems – ocean, estuarine

ii) Freshwater ecosystems – pond, lake, river

**Artificial (man- engineered) ecosystem**

An ecosystem which raises based on mans activities with the help of abiotic, biotic and energy components, for e.g. Croplands, all agricultural fields etc.

**TERRESTRIAL ECOSYSTEM**

**Forest ecosystem**

A forest ecosystem is a natural woodland unit consisting of all plants, animals and micro-organisms (Biotic components) in that area functioning together with all of the non-living physical (abiotic) factors of the environment. It occupies nearly 40% of the world's land area. In India it occupies only19% of the total area.

**Types of forest ecosystem**

Depending on climate conditions, forest can be classified into the following types

- Tropical rain forest
- Tropical deciduous forest
- Tropical scurb forest
- Temperate rain forest
- Temperate deciduous forest

**Features of different types of forest**

**Tropical rain forest**

They found in equator region, very high temperature with good wild life both in fauna and flora.

**Tropical deciduous forest**

They found below the equator region, warm climate and rainy during monsoon and rich amount of deciduous trees and animals.

**Tropical scurb forest**

Very dry climate for longer time, and have small deciduous trees and animals.

**Temperate rain forest**

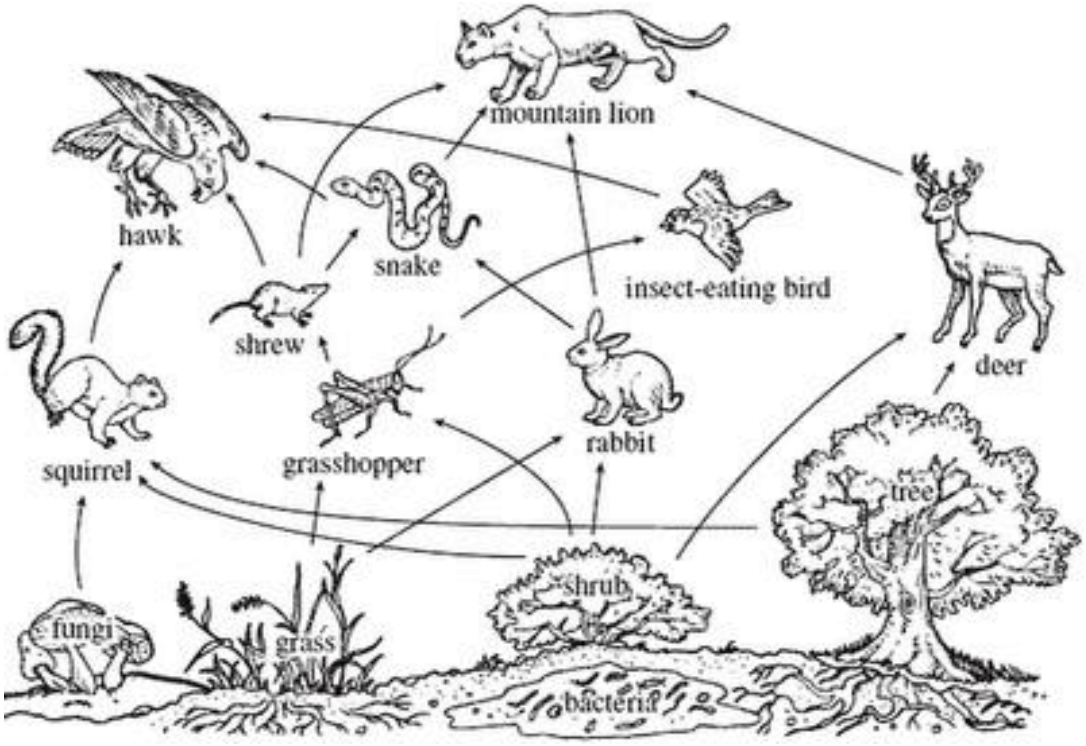
They found in temperate area with adequate rainfall and rich in coniferous trees and animals.

**Temperate deciduous forest**

Generally it found in moderate temperature and it will be rich in all kind of trees and animals.

**Characteristics of forest ecosystems**

- Will be having warm temperature and adequate rainfall.
- It maintains the climate and rainfall.
- It supports much wild life and protects biodiversity.
- Rich in nutrients and energy cycle, conservation of nutrients will be fast due less penetration of photosynthetic activity.




**Structure and function of forest ecosystem.**

Two important components are involved in major functions of each ecosystem such as:

I. **Abiotic component –** Physiological components

II. **Biotic component – Biological** Produce, Consumer, Decomposer

**Abiotic component**

These are inorganic as well as organic substances present in the soil and atmosphere. In addition to minerals present in forest. We find the dead organic debris – the litter accumulation chirfly in temperature climate. Moreover, the light conditions are different due to complex stratification in the plant communities. Thermal stratification also prevails- at canopy, sub- canopy, middle zone, ground flora zone, litter zone and rhizosphere zone.

**Biotic components**

i) **Producers –** 1st participator who modifies the function in the ecosystem. Trees and plant are playing a major role in producing the food by photosynthesis using sunlight **e.g.** tectona grandis, Adina cordifolia, Quercus, Acer, Pinus thuja, picea etc.,

ii) **Consumers –** 2nd participator who modifies the function in the ecosystem, who is directly, depend on the producers for the food.

**a)** Primary consumers – All kind of herbivores, where it directly depends on the green trees and plant for their food **e.g.** ants, flies, beetles, bugs, spiders, deer, insect, squirrel etc.,

**b)** Secondary consumer – Primary carnivorous are the secondary consumers who is directly depend on the herbivores for their food **e.g.** birds, lizards, fox, snakes etc.,

**c)** Tertiary consumer – secondary carnivorous are the tertiary consumers who is directly depend on the Primary carnivorous for their food **e.g.** lion, tiger etc.,

iii) **Decomposer –** 3rd participator where the dead or decayed organic material will be converted as a nutrient and they actively participate in bio-geochemical cycle. **e.g.**

Fungi (spices of *Aspergillus, Coprinus, Polyporus, Ganoderma, Fusarium etc.,*)

Bacteria (spices of *Bacillus, Clostridium, Pseudomonas, Angiococcus etc*.,)

**GRASSLAND ECOSYSTEMS**

Grasslands are areas where the vegetation is dominated by grasses (Poaceae), however it may be associated with plants from other families also. Grasslands occur naturally on all continents ecoregions of the earth except Antarctica. The structure and

function of the world's grasslands makes them one of the most vulnerable to global climate changes of any terrestrial ecosystem. Grasslands—as highly dynamic ecosystems—provide goods and services to support flora, fauna, and human populations world-wide. Grasslands have been goldmines of plants used for food. Many of our food grains—wheat, corn, rice, rye, millet, and sorghum—have originated in grasslands. Many types of grassland remain the primary source of genetic resources for improving our crops and for increasing the number of pharmaceuticals. Grass-lands produce forage for domestic livestock, which in turn support human livelihoods with meat, milk, wool, and leather products. Grasslands provide habitat for breeding, migrating, and wintering birds; ideal conditions for many soil fauna; and range-lands for wild herbivores. These ecosystems cycle water and nutrients, and build and maintain stabilization mechanisms for soil. Grassland vegetation, above and below ground, as well as the soil, serve as large storehouses for carbon, helping to limit global warming. Grasslands also supply energy from fuel, wood and wind generated from wind farms. These largely open-air landscapes support recreational activities such as hunting, wildlife-watching, and tourism more generally, and offer aesthetic and spiritual gratification.

Definitions for grasslands vary. Some studies classify grasslands by vegetation while others characterize them by climate, soils, and human use of the ecosystem. Bailey (1989) presents a map of ecosystem units or eco-regions of the continents—including dry savanna or steppe, grassy savanna, prairie, and shrub savanna—using climate and vegetation as indicators of the extent of each unit. He qualifies this method by stating that: The delineation of eco-regions should properly be based upon the distinctiveness and distribution of various ecological associations. Savannas often have been described as forming a continuum between tropical forests and grasslands.

Several major studies have presented estimates of the extent of the world's land area in grasslands. These estimates vary, in part, because of differences in land cover characterizations of grasslands. The estimates range from approximately 41 to 56 million $km^2$, or 31 to 43 percent of the earth's surface (Whittaker and Likens 1975; Atjay et al. 1979; Olson et al. 1983)

## Types of grasslands

There are two broad types of grasslands in the world: Tropical and Subtropical Grassland (Savannah) and Temperate Grassland.

### Tropical Savannah

Tropical Savannahs are close to the equator and remain warm year round with marked dry and wet seasons that discourage the creation of forests. Tropical Savannah occurs in Africa, India, Australia, South America and Indonesia– typically have well-drained soils with only a thin layer of humus, often located in the transitional region between rainforest and desert. Rainfall of 50 to 130 centimeters a year is concentrated in six to eight months with drought the rest of the year. Soils are usually very thin, supporting only grasses and forbs (flowering plants), with only scattered trees and shrubs. Differences in climate and soils create many variations in the plant communities and animal species throughout the Savannah. In many areas, the grasslands have been burned to maintain a healthy grass crop for grazing animals. In some areas the Savannah has been expanded by cutting the forest and burning the area each year to prevent the return of trees. Flooded grasslands are also located at subtropical and tropical latitudes, which are flooded seasonally or year-round. They are also known as swamp. Desert grassland is composed of sparse grassland eco-regions located in the deserts and xeric shrub lands biome

### Temperate grasslands

Temperate grasslands have less rainfall (25 to 90 centimeters) than tropical grasslands and a much greater range of temperatures from winter to summer than Savannah. They undergo hot summers and cold winters with moderate rainfall. These interior grasslands are distinguished by deep-rooting, perennial tall grasses, flowers and herbs with very few shrubs and trees. Due to their rich, fertile soils and favorable climate, many of these ecosystems have been converted to agricultural production or ranching. There are two broad types of grasslands in temperate latitudes: Prairie and Steppe

### Prairie grasslands

Prairie grasslands are found across the globe. They have a variety of names in other parts of the world: pampas in South America, veldt in South Africa and puszta in Hungary. These areas have deep, rich soils and are dominated by tall grasses; trees

and shrubs are restricted to river valleys, wetlands and other areas with more moisture. Over the years the native grass species on the extensive areas of level ground have been ploughed and fields seeded. Many of these grasslands have been lost to cereal crops.

**Steppe grasslands**

Steppe grasslands receive only 25 to 50 centimeters of rainfall each year and the grasses are much shorter than those on prairie grasslands. They are also not as widespread, occurring only in Central and Eastern Europe, Northern Eurasia and Western North America.

Montane grasslands are located above the tree line. The biome includes high altitude (montane, subalpine, and alpine) grasslands and shrub lands around the world. Similar to montane grasslands, polar arctic tundra can have grasses, but high soil moisture means that little tundra is grass-dominated today. However, during the Pleistocene ice ages, a polar grassland known as steppe-tundra occupied large areas of the Northern hemisphere.

**The various components of a grassland ecosystem are as follows—**

**1. Abiotic substances:**

These include the nutrients present in the soil and the aerial environment. The elements required by plants are hydrogen, oxygen, nitrogen, phosphorous and sulphur. These are supplied by the soil and air in the form of $CO_2$, water, nitrates, phosphates and sulphates. In addition to these some trace elements are also present in the soil.

**2. Primary producers:**

Autotrophic producers are green plants that are capable of structural institutions and their internal processes to bind the primary global bodies, transporting it, save and re-used for the stability of the ecosystem. These are mainly grasses of the family, Poaceae, a large variety of herbs, some shrubs and scattered trees.

**3. Consumers:**

Herbivores such as grazing mammals (e.g., cows, sheep, deer, rabbit, buffaloes, etc), insects (e.g., Dysdercus, Coccinella, Leptocorisa, etc), some termites and millipedes are the primary consumers.

The animals like fox, jackals, snakes, frogs, lizard, birds etc., are the carnivores feeding on the herbivores. These are the secondary consumers of the grassland ecosystem. Hawks occupy the tertiary tropic level as these feed on the secondary consumers.

**4. Decomposers:**

These include bacteria of death and decay, moulds and fungi (e.g., Mucor, Penicillium, Aspergillus, Rhizopus, etc) [1-3]. These bring the minerals back to the soil to be available to the producers again.

## DESERT ECOSYSTEM

### Introduction

Desert ecosystem is a sensitive ecosystem that is mainly composed of sand. The atmosphere is dry and lacks humidity. To qualify as a desert, a place should receive less than 10 inches of water a year. It is a highly specialized ecosystem that hosts certain species that are unique and can survive only in this habitat. Clouds are very scarce in deserts, because of which deserts are dry and have hot days and cold nights. Clouds are supposed to bring rain and block the sun, absence of which makes the desert dry. Clouds also prevent the heat from escaping the atmosphere at night, absence of which makes the desert cold at nights.

### Types

Mainly deserts are of very fine red sand type that inhabits its own flora and fauna. Some of the deserts consist of sand mixed with pebbles and rocks. In general, a dry place which receives precipitation below potential evapotranspiration (but not extremely) is

called a semi-arid place (steppe climate). 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 process converts such semi-arid places to deserts. Deserts start out as a rock, years of wind and water had caused weathering of these rocks has led to the formation of dunes.

**Characteristic features**

- Receives very less rainfall with which many plants and animals will not sustain.
- Composed of dry sand, and some pebbles and rocks.
- Has very little water bodies (oasis is found in few places)
- Temperature during daytime is very high leading to a hot climate.
- Temperature during night is very less leading to a cold climate.
- Vegetation is very poor as only certain plants will be able to survive.
- Very few animals are found in the desert.

Structure and function:

The different structural components of the desert can be classified as abiotic and biotic components.

**Abiotic components**

The abiotic components of the desert include the nutrients in the soil. The soil lacks organic matter and also there is scarcity of water.

**Biotic components**

There are three biotic components in a desert ecosystem, they are, producers, consumers and decomposers.

Producers – Succulent plants are the ones that are found predominantly in the deserts. Succulent plants store water and during daytime transpiration are very less. These plants have a thick waxy layer that protects them from the hot sun. Many plants have beautiful flowers but also possess poisonous thorns.

Consumers – Many insects and reptiles are found in the deserts. Of the many insects that are found in the desert the ants are the most abundant species. Certain ants are capable of deflecting sunlight and are called as silver ants. The insects generally come out at night when the temperature is less. Snakes and certain poisonous lizards are found in the desert which is part of the rare species.

Also the desert inhabits certain rodents, birds and some mammalian vertebrates. Rats are the most common rodents, accompanied by hamsters and burrowers. The most important animal in the desert is the camel which is called as the car of the desert. Travelling in the desert happens mainly on camels. Two types of camels, one hump and two humps camel are found in the deserts.

Decomposers – A few thermophilic bacteria and fungi are the common decomposers that are found in the desert. They are less in number because the amount of dead organic matter is very less.

**Biodiversity**

Biodiversity is short for “biological diversity.” Biodiversity is “the variety of all living things, and the systems which connect them.” This includes all the planet’s different plants, animals and micro organisms, plus the genetic information they contain and the ecosystems of which they are a part. It is the result of millions of years of evolution.

So why is biodiversity so important? Everything in the natural world is connected. This means that everything we do as humans affects biodiversity, and biodiversity affects us. In the world of which we are a part, the more variety the better. This provides protection against things going wrong. Diverse ecosystems, and therefore diverse species and genes, make for a healthier, more resilient planet.

Biodiversity enhances an ecosystem’s ability to do these essential ecological processes:

- oxygen production
- form and build healthy soils
- filter water on its way to the sea

• pollinate crops and plants generally
• store and recycle nutrients
• resist feral invasion

A lessening of biodiversity in an ecosystem weakens the ability of that system to survive and perform the ecosystem services that we as humans benefit so much from. Basically, there are three types of biodiversity: species, ecosystem and genetic diversity.

Species Diversity
Suggested student activity: Unit of Work on “Birds” Yr ¾ upwards.
This includes every organism great and small – from amoebas to elephants – that currently exist, or have ever existed on our planet. This includes plants, fungi, insects, fish, reptiles & amphibians, birds and mammals, plus molluscs, worms, spiders, algae and other micro organisms. So far scientists have identified more than 1.4 million living species, with millions more yet to be discovered!
Note: species’ diversity also refers to the differences within species as well as the variety (total number) of species. For instance, …

**Ecosystem Diversity**
An ecosystem is a community of organisms (living things) which depend upon each other for their existence. For example, you might expect to find kangaroos, or emus, or echidnas, in grassy woodland, but not in Antarctica, because these animals need the plants or bugs in the woodland, and conversely the plants need them: plants are tip-pruned by kangaroos, emus disperse and help germinate seed in their scats, and echidnas till the soil which also aids in germination of some seeds.
Examples of some local SA ecosystems are: woodland of the Mt Lofty Ranges, grasslands of the mid-North, mallee scrub, Port Adelaide mangroves, the Port Noarlunga reef, Murray River system, ponds, caves. On a more global scale, some examples are: oceans, the polar and Antarctic ice sheets, rainforests and deserts.

**Genetic Diversity**

Genes are simply traits that we inherit from our parents and can pass on to our children, for example, traits such as hair colour, eye colour, curly or straight hair and whether you can curl your tongue and so on.

Genes are the basic units of life on Earth. They are responsible for both the similarities and the differences between organisms, eg the changes in colour and markings of birds within a particular species. “Genetic diversity is the variety of genes within a species.

Each species is made up of individuals that have their own particular genetic composition. This means a species may have different populations, each having different genetic compositions. To conserve genetic diversity, different populations of a species must be conserved.”

Because our environment is constantly changing, we need a diverse range of genes to be able to adapt. Preserving variety within populations of species is essential for preserving the ability of that species to cope with environmental change. An organism’s ability to adapt to environmental change will determine how well it survives in the long run. The greater the diversity of genes in a population, the greater the chances that some individuals will possess the genes needed to survive under conditions of environmental stress (such as climate change, drought, fire, famine, introduction of a new predator etc).

## QUESITIONS FOR PRACTICE

### Part A

1. What are the components of Ecosystems? What role do they play in ecosystem processes?
2. Are food chains in nature never-ending? Why? Justify your answer.
3. What do you understand by “nutrient cycling”? What is the significance of decomposers in nature?
4. Define any two types of interactions that take place in the living world? Also mention the significance of those interactions.
5. Write short notes on: (i) Grassland ecosystem (b) Desert ecosystem
6. Describe food chain and food web with suitable examples.
7. In nature, grazing and detritus food chains are operated simultaneously. Explain.
8. How are food and energy needs satisfied in a pond ecosystem?
9. Terrestrial ecosystems are different at different places, why?
10. Why is the concept of a food web ecologically more real than that of a simple food chain?
11. Define biodiversity. Explain genetic, species, and ecosystem biodiversity.
12. Give an account of consumptive use of biodiversity.
13. Explain the value of biodiversity on social, ethical, and aesthetic basis.
14. In what way do our changing lifestyles and consumption patterns lead to biodiversity loss?
15. State the difference between national park and sanctuaries? What do you understand by buffer zone and core zone?
16. Write short notes on: (a) Hotspots of biodiversity (b) Endangered and endemic species.

### Part B

1. What is ecological succession? Describe the stages of succession.
2. What is meant by ecological pyramid? Explain the different types of pyramids giving suitable examples.

3. Define ecosystem? Explain the structure and function of an ecosystem.
4. Explain the threats to biodiversity. How can they be prevented?
5. Write an essay on biodiversity of India.
6. Define biodiversity. Describe its various types and explain the need for its conservation.
7. Explain the importance of biodiversity and the strategy for its conservation.
8. What is meant by “biodiversity”? Explain the three levels of biodiversity and point out the major threats of biodiversity depletion.
9. Anthropogenic activities, to a large extent, are responsible for the loss of biodiversity. Explain.

**Reference:**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