1. Details of Module and its structure

Module Detail	
Subject Name	Geography
Course Name	Geography 01 (Class XI, Semester - 1)
Module Name/Title	Life on the Earth – Part 1
Module Id	kegy_11501
Pre-requisites	Basic knowledge about the Ecosystem, Components of ecosystem
Objectives	After studying this lesson, you will be able to: • Differentiate between biotic and abiotic components of ecosystem. • Define and classify ecosystem as well as biomes. • Examine structure and functions of ecosystem. • Explain food chain and food web. • Discuss factors affecting biomes. • Explain various cycles operating in the ecosystem. • Describe the need to maintain ecological balance and identify factors affecting it.
Keywords	Ecosystem, Components of Ecosystem, Food Chain and Food Web, Biome and Their Characteristics, Biogeochemical Cycles, Ecological Balance

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In simple term, environment is the surroundings of our reference. When we say the environment of any certain areas/ region, it includes three important realms of that reference/ area/ region. They are lithosphere, atmosphere and hydrosphere. You know it very well that living organisms of the earth forms the fourth realm constituting a thin layer of all the three mentioned previously. It is known as biosphere (Figure 1). The biosphere includes all the aspects required for sustaining life in this narrow belt of life. Primarily, they are land, water and air. Here, every form of life is found. It consists of all lives in the form of plants and animals including all micro-organisms. All life forms are interacting with their surrounding environment. Most of the organisms exist on the lithosphere and the hydrosphere as well as in the atmosphere. But there are some organisms who move freely from one realm of life to the other. For example frogs, crocodiles, turtle etc. can be found on land and in water as well. However, life on the earth is found almost everywhere. Living organisms are found from the poles to the equator, from the bottom of the sea to several km in the air, from freezing waters to dry valleys, from under the sea to below the ground. There is wide variation in the life form over the globe and it is quite distinct.

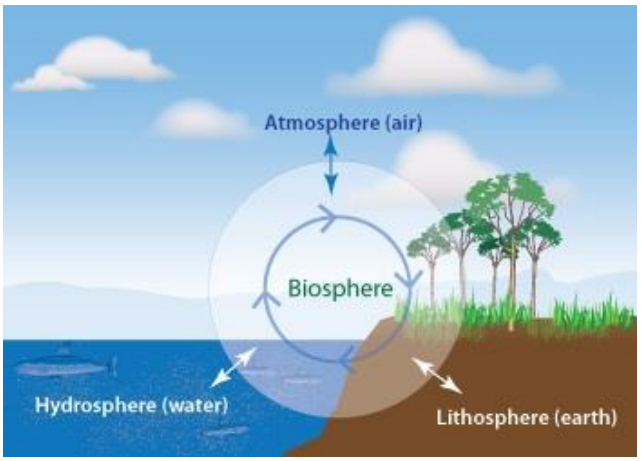


Figure 1: Constituent of biosphere

Source: https://briangrimmerblog.files.wordpress.com/2014/07/image.jpg

The biosphere and its components – biotic and abiotic – are very significant elements of the environment. These elements interact with other components of the natural landscape such as land, water and soil. They are also influenced by the atmospheric elements such as temperature, rainfall, moisture and sunlight. The interactions of biosphere with land, air and water are important to the growth, development and evolution of the organisms.

Ecology

You must be reading newspapers and magazines on regular basis. They cover a wide variety

of topics of general concern. Just try to recapitulate about what you read today or yesterday or a few days before. Many of them must be concerning to the living organisms and their status in present day context. You might have also read about ecological and environmental problems in newspapers and magazines. Have you ever thought, what ecology is?

Let us discuss it in a very simple way. The term ecology is derived from the Greek word 'oekologie'. In ancient Greek the word, 'oikos' means 'house', 'logie' means the 'science of'. In other words, it is the study of the earth as a house of living world, which means the house of plants, human beings, animals and micro-organisms. They all live together as interdependent components. A German zoologist, Ernst Haeckel, used the term 'oekologie' for the first time in 1869. It signifies the modern term ecology in English language today. The study of interactions between life forms (biotic) and the physical environment (abiotic) is the science of ecology. Hence, ecology can be defined as a scientific study of the interactions of organisms with their physical environment as well as interactions among themselves. You know it very well that the environment is made up of two components: abiotic and biotic. The Figure 2 is clearly showing the interactions and relationships with various components of the surroundings.

Figure 2: Ecology and its relationships

Source: https://kyotoreview.org/wp-content/uploads/word-cloud-ecology.jpg

Ecosystem:

A system consisting of biotic and abiotic components of a given area is known as ecosystem. Both components of the ecosystem are interrelated and interact with each other. Different types of ecosystems are created due to changing physical conditions. Varying ranges of environmental conditions lead to the existence of various types of plants and animal species. This variation is leading to the adaption through evolution. This sort of occurrence is known as ecological adaptation. Let us study about the components of ecosystem.

Components of Ecosystem

The ecosystem has two components – abiotic and biotic.

1. Abiotic Components: The abiotic components are natural and do not have life. They are:

Water: It is found in the form of stored water in depression areas, rainfall/snowfall or as moisture in soil, as well as water vapour in the atmosphere, or snow/ice at higher latitudes and higher altitudes.

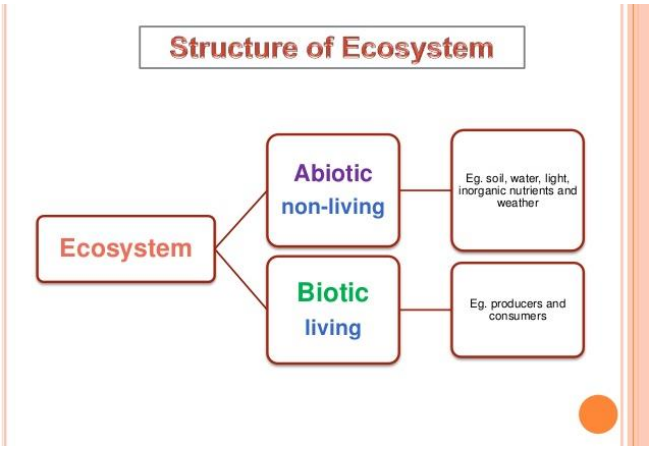
Air: It contains several types of gases like nitrogen, oxygen and carbon dioxide and numerous others with lesser amount.

Solar radiation: Sun is the main source of emanating energy reaching on earth. It provides the heat and light.

Rocks: They can be porous or non-porous, they provide different types of minerals and nutrients.

Soil: It is characterized by differences in depth, acidity (pH), fertility and nutrients.

2. Biotic Components: The biotic components consist of plants and animals including insects and bacteria – every form of life. There is always interaction among themselves and with their natural environment. Man is one of the active member of the environment, but the



technological man has does not have cordial relations with the physical environment. Figure 3 is showing both the components – abiotic and biotic.

Figure 3: Structure of ecosystem

Source: https://image.slidesharecdn.com/ecosystem-140307081405-phpapp02/95/ecosystemstructure-and-function-5-638.jpg?cb=1394181205

The interactions of a particular group of organisms with abiotic factors within a particular habitat is known as ecological system. Within this ecological system, a very well defined energy flows and material cycles on land, water and air can be seen clearly.

The biotic sphere is composed of various layers comprising both flora and fauna. They can be categorised into individual organism at the unit level. Collectively various individuals called population. Population of different species residing in a certain area is known as community. Community of living organisms of a larger area is termed as ecosystem. Still further bigger area with distinct lives is termed as biosphere. The Figure 4 is showing the same vividly.

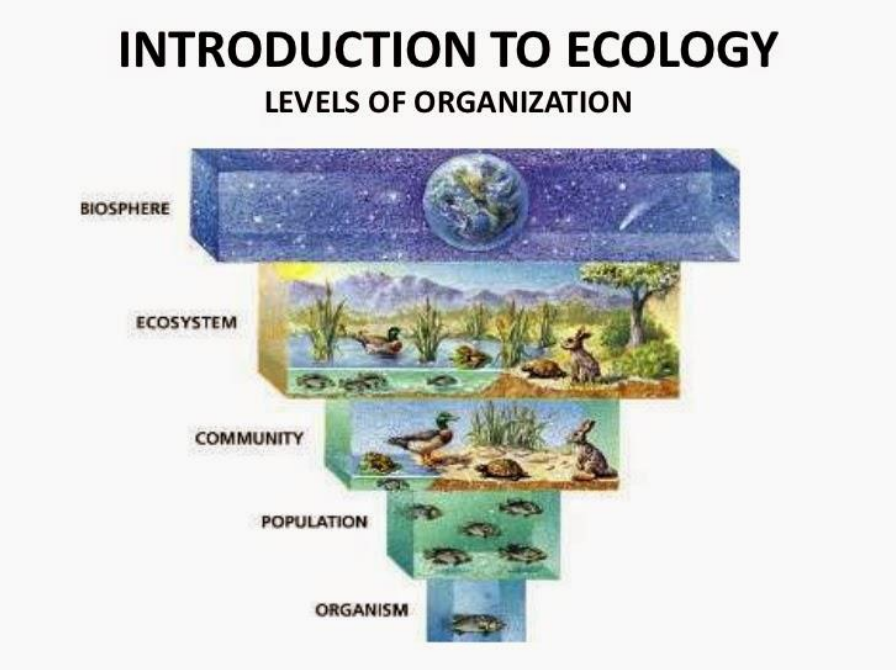


Figure 4: Ordering of living organisms

Source:http://1.bp.blogspot.com/dN4X_MHzufs/VIUSbs4mhDI/AAAAAAAAANQ/ocNrTTWU9Qc/s1600/ecological-equilibrium-seminor-2-728.jpg

Types of Ecosystems

Ecosystems are of two major types – terrestrial and aquatic.

1. Terrestrial Ecosystem: Terrestrial ecosystem is developed over the land surface of the

earth. Depending upon the scale of study, it can further be classified into several groups. A biome is amalgamation of plant and animal community covering a large geographical area. The boundaries of different biomes on land are determined mainly by climatic variations. Therefore, a biome can be defined as the total assemblage of plant and animal species interacting within specific conditions in a certain region of the globe. These include rainfall, temperature, humidity and soil conditions. Some of the major biomes of the world with distinct characteristics are:

a) Forest Biomes

b) Grassland Biomes

c) Desert Biomes

d) Tundra Biomes

2. Aquatic Ecosystem: Aquatic ecosystems is found in the water bodies as the term aquatic is self-explanatory. It can be classified as:

a) Marine Ecosystem: Marine ecosystem includes the oceans, estuaries and coral reefs found in the oceanic water. Waters of the marine ecosystems are more saline in nature. Generally, Open Ocean and the coastal areas are included in this category.

b) Freshwater Ecosystem: It includes lakes, rivers, ponds, streams, marshes and bogs. In this ecosystem, waters have less salinity and a different types of biotic life is observed.

Structure and Functions of Ecosystems:

The structure of an ecosystem involves a description of the available plants and animal species. From a structural point of view, all ecosystems consist of two factors – abiotic and biotic:

1. **Abiotic Factors:** Just on the above page, you have read about the abiotic factors of the environment. But to reiterate the same, it includes rainfall, temperature, sunlight, atmospheric humidity, rocks, soil conditions, inorganic substances such as carbon dioxide, water, nitrogen, calcium, phosphorus, potassium, etc. The flow in the function of an ecosystem may very clearly be seen from Figure 5.

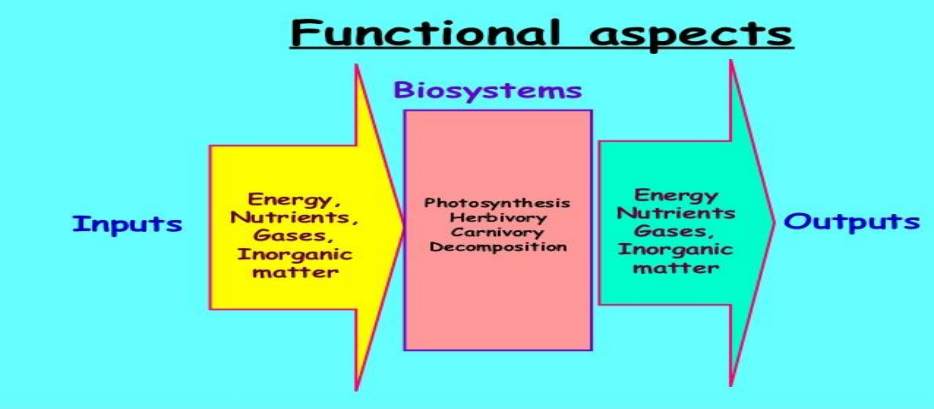


Figure 5: Functions in ecosystem

Source: https://image.slidesharecdn.com/ecosystemconcepts2victorb-091218001745-phpapp01-140322065434-phpapp02/95/ecosystem-concepts-20-638.jpg?cb=1395472332

2. **Biotic factors:** These include

i) **The producers**: The producers include all the microscopic organisms or plants which prepare the food for themselves. This process is completed by the process of photosynthesis in the presence of sun.

ii) **The consumers:** The consumers have been divided broadly into three groups, but the level may keep on increasing depending upon the order of consumption. That is very popularly called the Trophic Level of food order (Figure 6). Some important among them is mentioned here:

a) **Primary Consumers:** The primary consumers are those who survive by eating producers (plant and plant products). They include herbivorous animals like deer, goats, mice and all plant-eating animals. They are termed as herbivorous.

b) **Secondary Consumers:** The secondary consumers survive by eating animals. They include animals like snakes, tigers and lions. They are termed as carnivores.

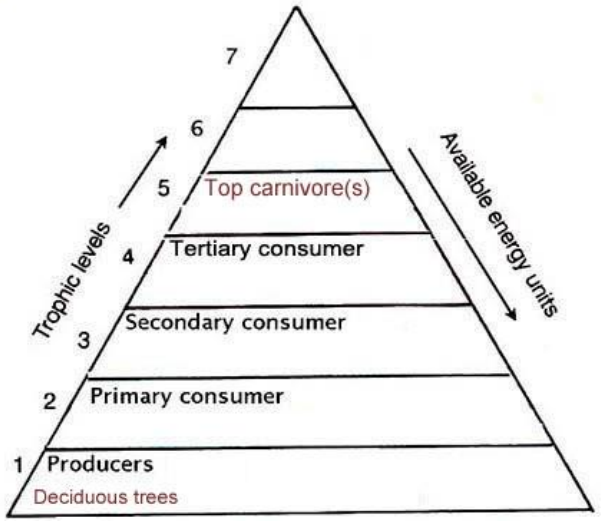


Figure 6: Trophic levels

Source: http://webprojects.oit.ncsu.edu/project/bio181de/Lab/ecosystems/trophicpyramid.jpg

c. **Tertiary Consumers**: The tertiary consumers survive by eating both plants as well as animals. They include like hawks, mongooses and human beings. They are recognized as omnivore.

d. **Quaternary consumers:** The quaternary consumers are known as the higher level of consumers in the line of food chain. They are surviving on higher order of organisms. The same may even be studied from the flow chart given below showing two food chains of land and water.

e. **The Decomposers:** Decomposers are those that feed on dead organisms (for example, scavengers like vultures and crows), and further breaking down of the dead matter by other decomposing agents like bacteria and various microorganisms.

The producers are consumed by the primary consumers whereas the primary consumers are, in turn, being eaten by the secondary consumers. Further, the secondary consumers are consumed by the tertiary consumers. The decomposers feed on the dead at each and every level. They change them into various substances such as nutrients, organic and inorganic salts essential for soil fertility. Organisms of an ecosystem are linked together through a food chain as it is very clear from the above diagrammatic presentation. For example, a plant eating beetle feeding on a paddy stalk is eaten by a frog, which is, in turn, eaten by a snake, which is then consumed by a hawk. This sequence of eating and being eaten and the resultant transfer of energy from one level to another is known as the food-chain.

Types of food-chain

Generally, two types of food-chains are recognized – grazing and detritus food-chain:

i. **Grazing food-chain:** In a grazing food-chain, the first level starts with plants as producers and ends with carnivores as consumers at the top level, with the herbivores being at the intermediate level. There is a loss of energy at each level which may be through respiration, excretion or decomposition. An example of food-chain referring to terrestrial and aquatic system can be studied through the Figure 7.

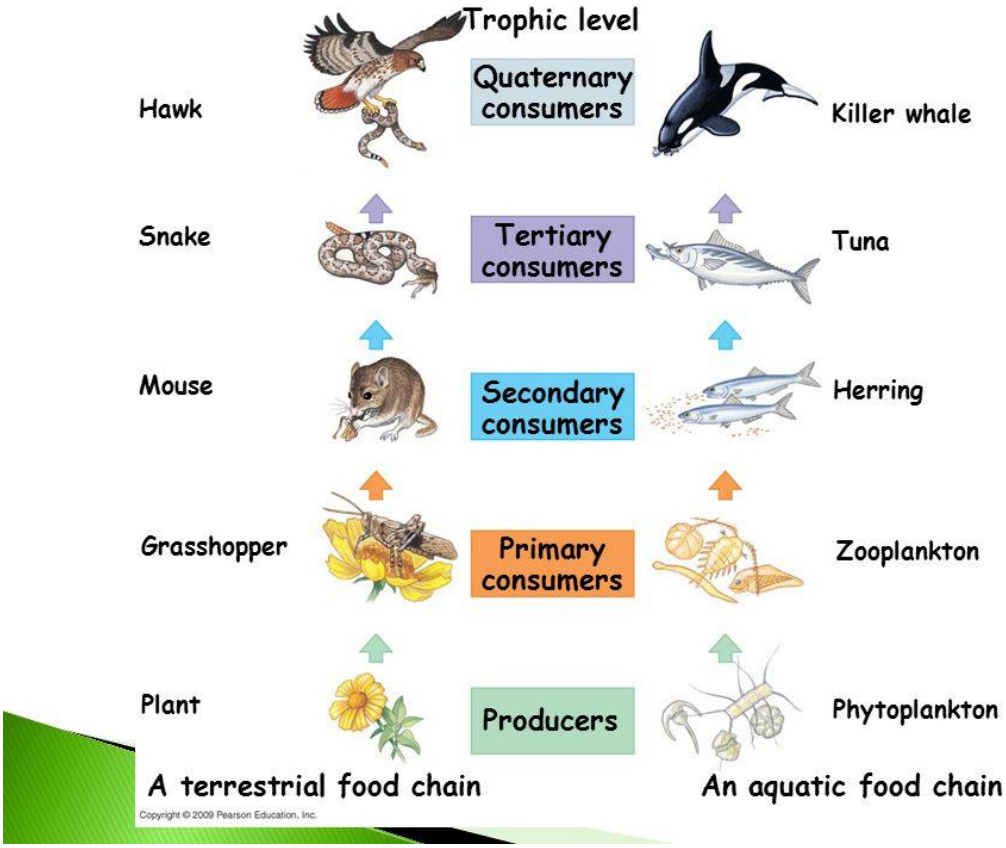


Figure 6: Food-chain

Source: http://images.slideplayer.com/15/4627434/slides/slide_51.jpg

ii. **Detritus food-chain:** A detritus food-chain is based on autotrophs energy capture initiated. Producers are being eaten by various animals in the food-chain. When the producers or any animals die at any level, their dead bodies are decomposed and disintegrated, breaking down of organic waste and finally returns to the nutrient cycle. This cycle is completed through various detritus and microorganisms.

Transfer of energy occurring during the process of a food chain from one level to another is

known as flow of energy. The energy pyramid diagram is a presentation of the transfer of energy from one trophic level to another in an ecosystem. Energy received at the earth's surface from the sun is utilised by producers. It is done through photosynthesis. Roughly 10 percent of the enery is transferred from the lower to the higher level because organisms are using the energy for their survival. Whatever the energy is consumed by one level of organisms, even whole of the energy stored at that level at is not completely utilized at the higher level consumer. It is this reason that the energy is lost at successive higer order of food chain. It can very well be observed from the following diagrammatic presentation of energy pyramid. A diagrammatic presentation in Figure 8 illustrates the same.

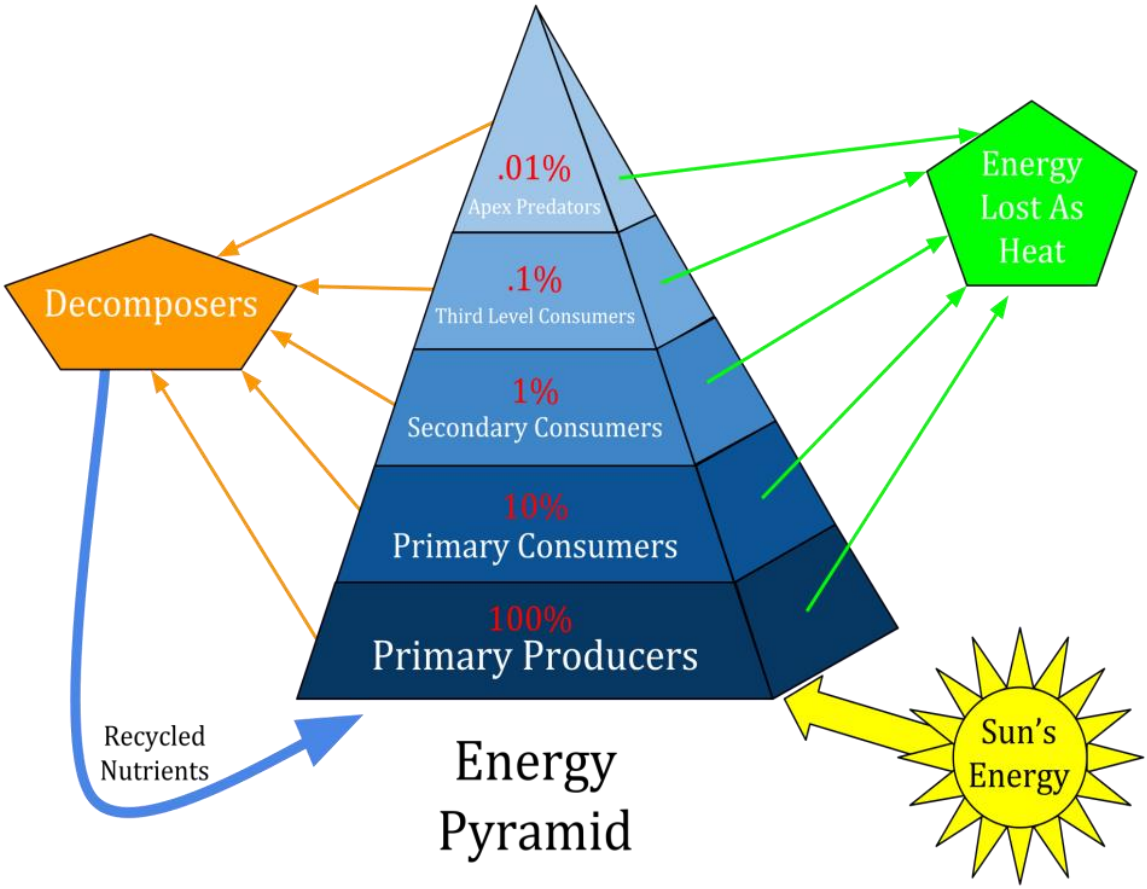


Figure 8: Reducing energy wirh increasing trophic level

Transfer of Energy Source: https://en.wikipedia.org/wiki/Ecological_pyramid

Number of Organisms at Different Trophic Levels

The number of organisms at different trophic levels in an ecosystem is decreasing at every successive increasing order. The producers are largest in terms of numbers. The number of primary consumers is less as numerous plants/grasses/shrubs/trees/crop plants are needed for the survival of a single herbivore. In the same way, increasing higher order of organisms are

still lower in number. This is the reason that the pyramid of the numbers of organisms are drastically smaller with increasing order of trophic level.

Pyramid of Numbers at Different Trophic Levels

In general, the pyramid of number of species from lower level to upper level keeps on declining. Large number of species are required to support relatively lesser number of species at the higher level, and successively it keeps on becoming smaller with increasing order of trophic level. It happens in grasslands and aquatic ecosystem. The pyramid of numbers of organisms is very clearly understandable from the Figure 9.

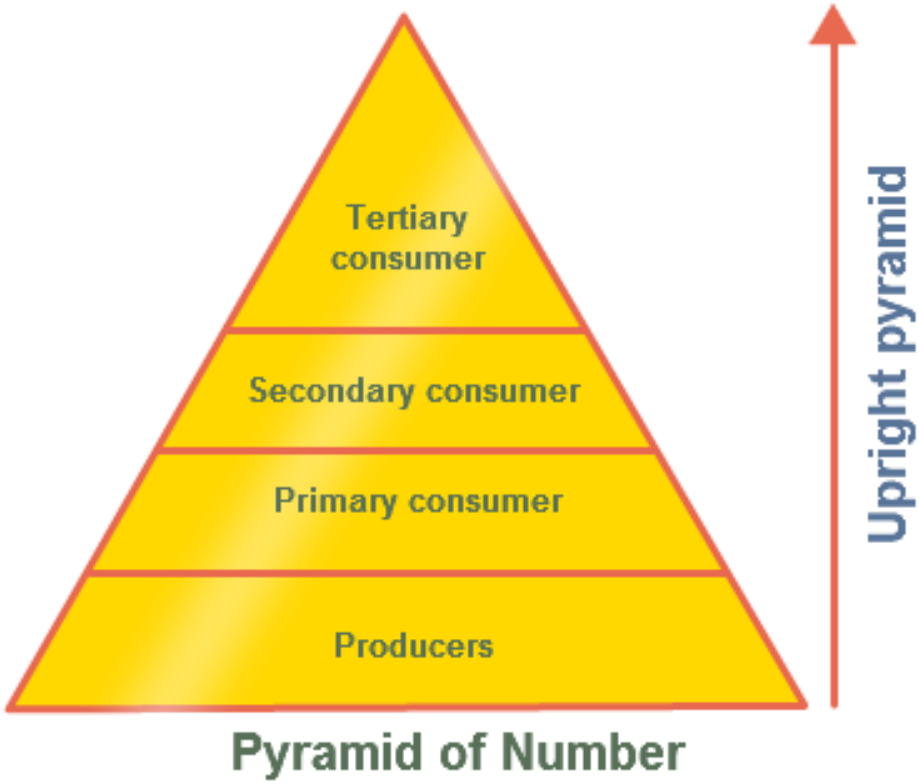


Figure 9: General pyramid of numbers

Source: http://images.tutorvista.com/cms/images/123/pyramid-of-number.PNG

In forest ecosystem, the producers are large sized trees. They support greater number of herbivores and smaller number of carnivore. This type of pyramid of the number of species is partly inverted or it is called spindle shaped. When a big tree supports large number of herbivores, they support further greater number of parasites and they in turn provide still larger number of hyper-parasites, this system of increasing numbers is known as inverted pyramid. It is quite obvious from the following illustration given in Figure 10.

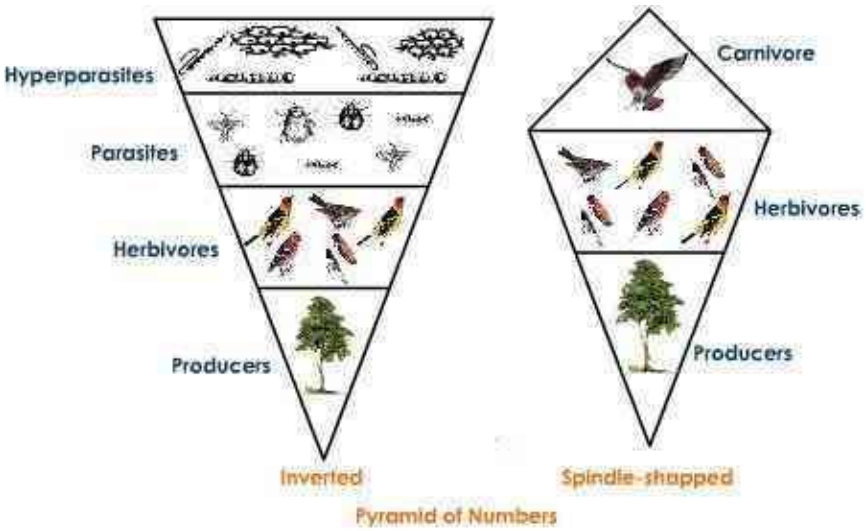


Figure 10: Inverted and partly inverted pyramids of numbers

Source: https://i0.wp.com/www.pmfias.com/wp-content/uploads/2016/05/Ecological-Pyramid-of-numbers-inverted-tree-ecosystem.jpg?resize=449%2C275

Biomass at Different Trophic Levels

Biomass is the total dry (without water content) mass of an organism or all organisms at a particular trophic level. The dry mass varies very widely because the water content held by tissues varies from one species to another. Theoretically, the dead bodies of organisms are to be dried and then weighing is done. It is more of a theory than practical because, for example, entire root of the trees are not possible to take out, dry up and weigh. Some parts of the plants are available for a certain period like the leaves of the trees. The leaves are dropped and the same is reprocessed to turn into the nutrient and finally reach to the soil.

From one biome to another, the biomass varies considerably. It is expressed in grams per unit of area. The most common areal unit for measurement is square meter, i.e., grams/m^2 (or kg/m^2). In tropical rainforest biome, it is the greatest. It becomes very low in deserts (both hot and cold). It is quite natural that the biomass of a lower trophic level is, most of the time, greater than the biomass of higher level. It happens in terrestrial ecosystem but it is not the same in aquatic ecosystem. In ponds/ fresh water or marine ecosystem, the biomass gets inverted with increasing trophic level. It is very much understandable from the illustration given in Figure 11.

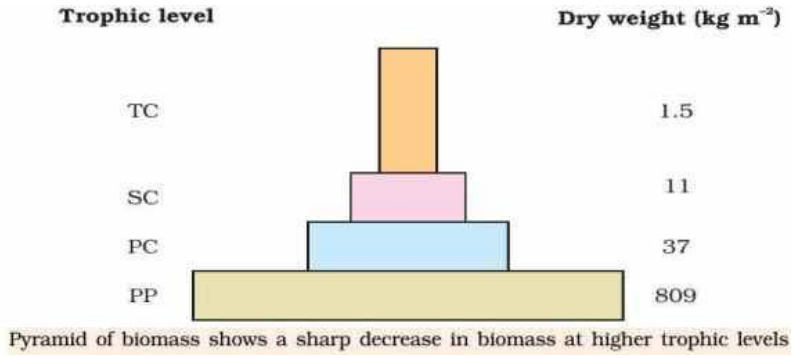


Figure 11: Biomass and trophic level

Source: https://i2.wp.com/www.pmfias.com/wp-content/uploads/2016/05/Ecological-Pyramid-of-Biomass.jpg?resize=573%2C252

Biome

In simple term, the meaning of biome is 'biological home'. Though, there is no unanimity in defining the term biome, but very widely it is accepted as the study of natural ecosystem as the total assemblage of the flora and fauna over a large area. In a particular biome, there are some common characteristics controlled by prevailing environmental/ physical/ climatic conditions. Both flora and fauna are part and parcel of the biome, but still biomes are categorized on the basis of leading flora/ vegetation. The vegetation is noticeable and conspicuous surface cover. The surface cover also varies depending upon the climatic conditions.

Factors Affecting Biomes

Differences in floral and faunal life of one region to another are caused by numerous factors. These factors are leading to various types of biomes. Important among them are:

- Mean temperature, range of temperature (both diurnal and annual)
- Precipitation, total amount, intensity and variability
- Duration of photosynthesis, i.e., length of day and night
- Wind direction, duration and frequency
- Soil types and fertility
- Slope and inclination of slope direction.
- Drainage, surface and subsurface
- Other plant and animal life.

Though, many of the factors mentioned above are related to climate, the most dominating factors of biome are temperature and precipitation. The following illustration is showing the

relationships of temperature and precipitation and the types of biome found over the globe. The illustration given in Figure 12 speaks very loudly about the factors affecting the biomes and their distribution over the globe.

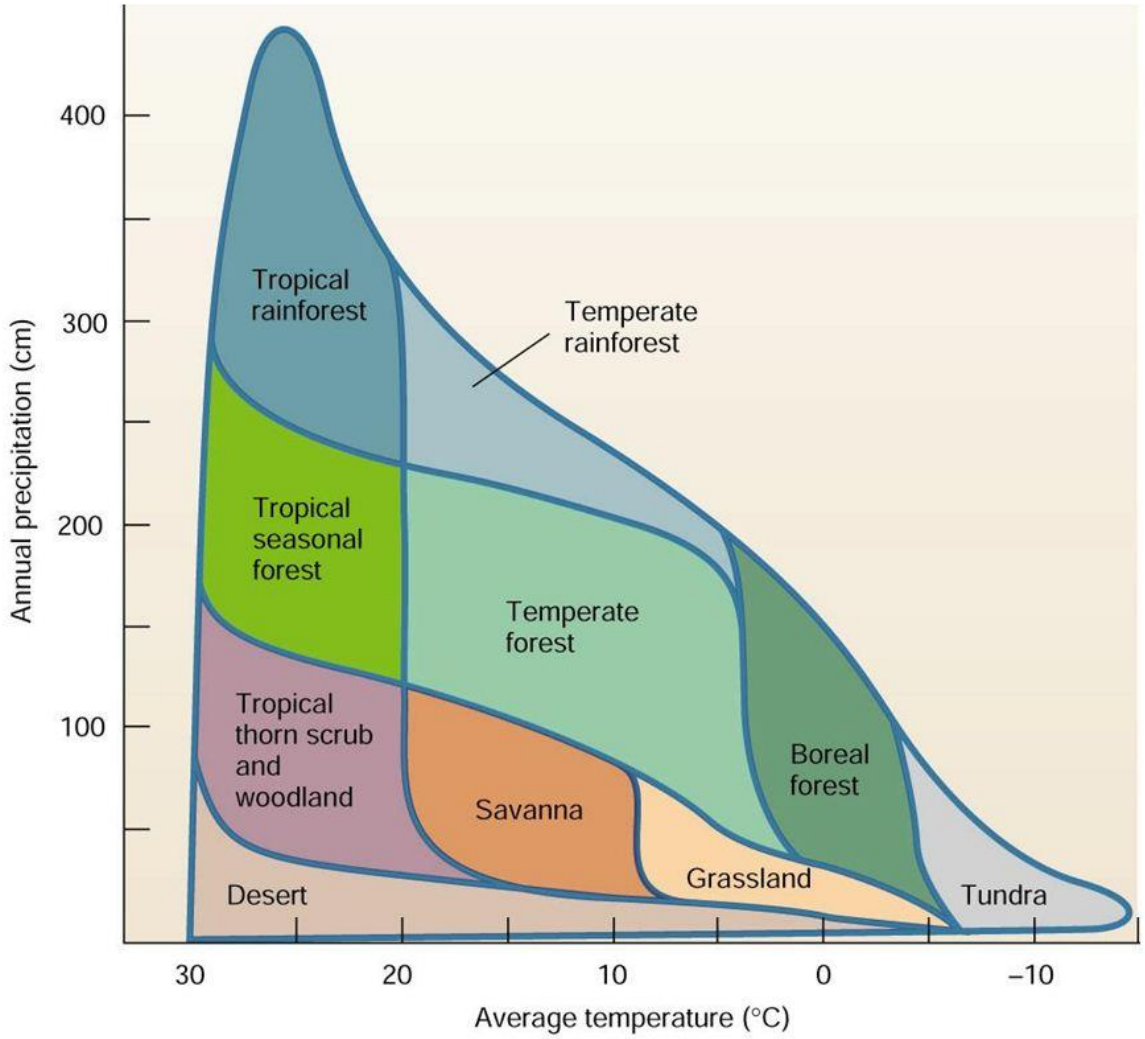


Figure 12: Relationships between temperature and precipitation with biomes

Source: http://www.mugansbiologypage.com/images/precip_vs_temp_biomes.JPG

Types of Biome

From the above illustration, it is vivid that a number of biomes may be identified. They are distinct from one another. The main features of five important biomes of the world my very clearly be presented in a tabular form. They are — forest, desert, grassland, aquatic and altitudinal biomes.

Table-1: World Biomes and their main features (the given table was really vague without taking rows/different of types/subtypes of different biomes into consideration. I have rearranged the same as per the need below. Even the book also shows the same

wrongly tabulated (no coherence of rows) information)

Biomes	Subtypes	Regions	Climatic Characteristics	Soil	Flora and Fauna
Forest	A. Tropical A1. Equatorial A2. Deciduous B. Temperate C. Boreal	A1. 10° N-S A2. 10° - 25° N-S B. Eastern North America, NE Asia, Western and Central Europe C. Broad belt of Eurasia and North America (parts of Siberia, Alaska, Canada and Scandinavia)	A1. Temp. 20-25°C, evenly distributed, Average annual rainfall more than 200 cm A2.Temp.25-30°C, Average annual rainfall 100cm, it is seasonal B. Temp. 20-30° C Rainfall evenly distributed 75-150 cm, well defined seasons and distinct winter. C. Short moist moderately Warm summers and long cold dry winter; very low temperatures. Precipitation mostly snowfall 40 -100 cm	A1. Acidic, poor in nutrients A2. Rich in nutrients B. Fertile, enriched with decaying litter C. Acidic and poor in nutrients, thin soil cover	A1.Multi-ayered canopy, tall and large trees A2. Less dense, trees of medium height; many varieties coexist. Insects, bats, birds and mammals are common species in both. B. Moderately dense broad leaved trees, with less diversity of plant species. Oak, Beach, Maple etc. are some common species. squirrels, rabbits, skunks, birds, black bears, mountain lions etc. C. Evergreen conifers like pine, fur and spruce etc. Woodpeckers, hawks, bears, wolves, deer, hares and bats are common

					animals
Desert	A. Hot and Dry desert B. Semi-arid desert C. Coastal desert D. Cold desert	A. S a h a r a , K a l a h a r i , Marusthali, Rub-el-Khali B. Marginal areas of hot deserts C. Atacama D. Tundra climatic regions	A. Temp. 20 - 45°C. B. 21 - 38°C. C. 15 - 35°C. D. 2 - 25°C A-D Rainfall is less than 10 cm	Rich in nutrients with little or no organic matter	A-C. Scanty vegetation; few large mammals, insects, reptiles and birds D. Rabbits, rats, antelopes and ground squirrels
Grassland	A. Tropical Savannah. B. Temperate Steppe	A. Large areas of Africa, Australia, South America and India B. Parts of Eurasia and North America	A. Warm hot climates, Rainfall 50-125 cm B. Hot summers and cold winter. Rainfall 50 - 90 cm	A. Porous with thin layer of humus. B. Thin flocculated soil, rich in bases	A. Grasses; trees and large shrubs absent; giraffes, zebras, buffalos, leopards, yenas, elephants, mice, moles, snakes and worms etc., are common animals B. Grasses; occasional trees such as cottonwoods, oaks and willows; gazelles, zebras, rhinoceros, wild horses, lions, varieties of birds, worms, snakes etc., are common animals
Aquatic	A. Freshwater	A. Lakes, streams, rivers and wetlands	A-B Temperatures vary widely	A. Water, wamps and marshes	Algal and other aquatic and marine

	B. Marine	B. Oceans, coral reefs, lagoons and estuaries	with cooler air temperatures and high humidity	B. Water, tidal swamps and marshes	plant communities with varieties of water dwelling animals
Altitudinal	-	Slopes of high mountain ranges like the Himalayas, the Andes and the Rockies	Temperature and precipitation vary depending upon latitudinal zone	Regolith over slopes	Deciduous to tundra vegetation varying according to altitude

Biogeochemical Cycles

The sun is the prime source of energy. This energy is the mother of all life existing on the earth. Due to this energy, life processes in the biosphere are initiated through photosynthesis. The term photosynthesis is made up of two words – photo and synthesis. Photo is meant for light and synthesis is for together. Therefore, synthesis is a process by which plants make their foods by themselves in the presence of light. For this, they take the water and different types of nutrients from the soils through their roots and carbon dioxide from the atmosphere. During photosynthesis, carbon dioxide is converted into organic compounds and oxygen.

Out of the total solar insolation that reaches the earth's surface, only a very small fraction (0.1 per cent) is fixed in photosynthesis. More than half is used for plant respiration and the remaining part is temporarily stored in the body of the plant. Life on earth consists of a great variety of living organisms. These living organisms exist and survive in a diversity of associations. Such survival involves the presence of systemic flows such as flows of energy, water and nutrients. These flows show variations in different parts of the world, in different seasons of the year and under varying local circumstances.

Studies have shown that for the last one billion years, the atmosphere and hydrosphere have been composed of approximately the same balance of chemical components. This balance of the chemical elements is maintained by a cyclic passage through the tissues of plants and animals. The cycle starts by absorbing the chemical elements by the organism and is returned to the air, water and soil through decomposition. These cycles are largely energised by solar insolation. These cyclic movements of chemical elements of the biosphere between the organism and the environment are referred to as biogeochemical cycles.

Bio refers to living organisms and geo to rocks, soil, air and water of the earth. Thus, a biogeochemical cycle is a pathway by which a chemical substance moves through both biotic and abiotic components of the earth. The circulation of chemical nutrients like carbon,

oxygen, nitrogen, phosphorus, calcium, water etc. through the biological and physical world are known as biogeochemical cycles.

A cycle is a series of change which comes back to the starting point and which can be repeated again and again. For example, water is always recycled through the water cycle, which undergoes the process of evaporation, condensation and precipitation etc.

Types of biogeochemical cycles:

There are two types of biogeochemical cycles:

i) **The gaseous cycle:** In the gaseous cycle, the main reservoir of nutrients is the atmosphere and the ocean.

ii) **The sedimentary cycle:** In the sedimentary cycle, the main reservoir is the soil, sedimentary and other rocks of the earth's crust.

Some of the important biogeochemical cycles are as follows:

1. The Water Cycle:

Next to air, water is the most essential item required for the existence of life on the earth. All living organisms require water for their survival and even their body also contain sufficient water. The water is circulated in the biosphere called the water cycle. This circulation exists in atmosphere, lithosphere and a thin belt of both of them. It may be found in the form of liquid (water), gas (vapour) and solid (ice). The water cycle describes the movement of water on and above the earth and also below the surface of the earth. The hydrological cycle is the continuous circulation of water within the earth's hydrosphere from one reservoir to another. This happens by moving from river to ocean, from the ocean to the atmosphere by various processes of evaporation and evapotranspiration. Again from atmosphere to earth by going through the process of condensation and precipitation. Movement of water on the surface like runoff and within the subsurface in moves by infiltration.

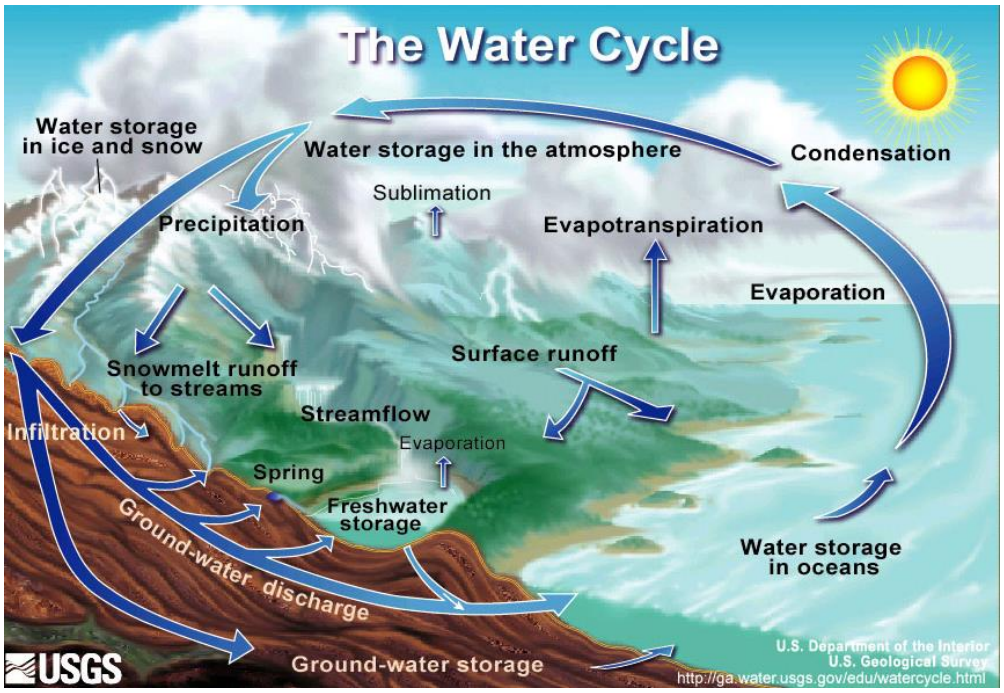


Figure 13: The water cycle

Source: https://upload.wikimedia.org/wikipedia/commons/9/94/Water_cycle.png

2. The Carbon Cycle:

Carbon is one of the basic elements of all living organisms. It forms the basic constituent of all the organic compounds. The biosphere contains over half a million carbon compounds. The carbon cycle is mainly the conversion of carbon dioxide. This conversion is initiated by the fixation of carbon dioxide from the atmosphere through photosynthesis. Such conversion results in the production of carbohydrate, glucose that may be converted to other organic compounds such as sucrose, starch, cellulose etc. Here, some of the carbohydrates are utilised directly by the plant itself. During this process, more carbon dioxide is generated and is released through its leaves or roots during the day.

The remaining carbohydrates not being utilised by the plant become part of the plant tissue. Plant tissues are either being eaten by the herbivorous animals or get decomposed by the microorganisms. The herbivores convert some of the consumed carbohydrates into carbon dioxide for release into the air through respiration. The micro-organisms decompose the remaining carbohydrates after the animal dies. The carbohydrates that are decomposed by the micro-organisms then get oxidised into carbon dioxide and are returned to the atmosphere. **(Figure 14)**

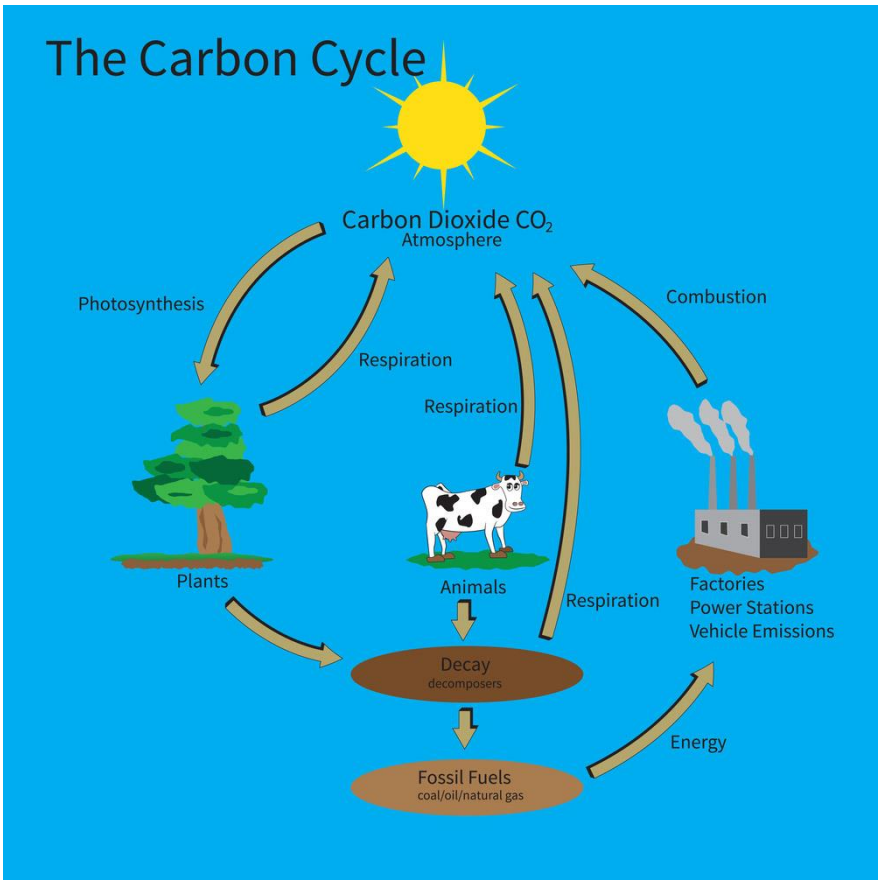


Figure 14: The carbon cycle

Source: http://www.edinburghgardenschool.com/wp-content/uploads/2016/05/carbon-cycle.jpg

3. The Oxygen Cycle:

Oxygen is the main by-product of photosynthesis. It is also utilized by plants and animals to convert the carbohydrate and glucose into energy (Figure 15). The cycling of oxygen is a highly complex process. Oxygen occurs in a number of chemical forms and combinations. It combines with nitrogen to form nitrates and with many other minerals and elements to form various oxides such as the iron oxide, aluminium oxide and others. Much of oxygen is produced from the decomposition of water molecules by sunlight during photosynthesis and is released in the atmosphere through transpiration and respiration processes of plants.

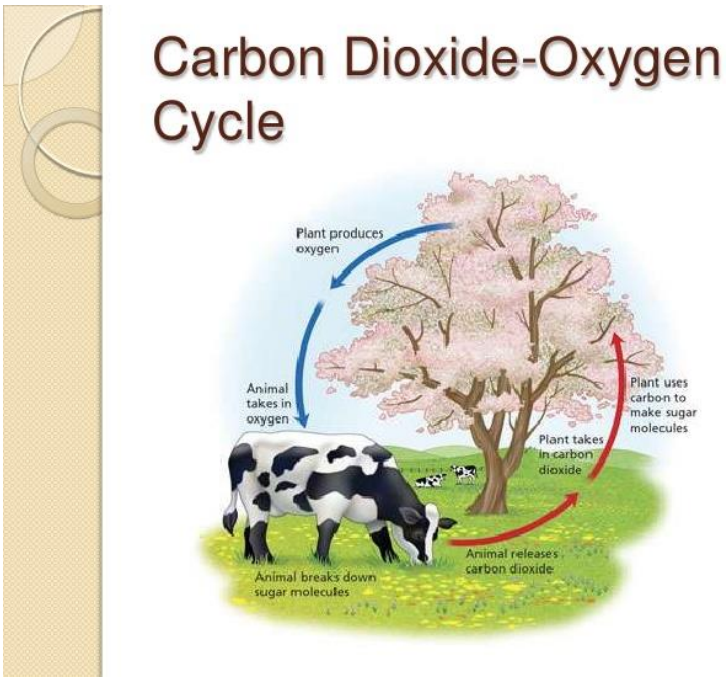


Figure 15: The carbon – oxygen cycle

Source: http://image.slidesharecdn.com/pptecolphotosynthesis-090909125705-phpapp01/95/ppt-ecol-photosynthesis-10-728.jpg

4. The Nitrogen Cycle:

Nitrogen is a major constituent of the atmosphere comprising about seventy-nine per cent of the atmospheric gases. It is also an essential constituent of different organic compounds such as the amino acids, nucleic acids, proteins, vitamins and pigments. Only a few types of organisms like certain species of soil bacteria and blue green algae are capable of utilising it directly from its gaseous form. Generally, nitrogen is usable only after it is fixed in the soil. Ninety per cent of fixed nitrogen is biological. The prime source of free nitrogen is the action of soil micro-organisms and associated plant roots on atmospheric nitrogen found in pore spaces of the soil.

Nitrogen can also be fixed in the atmosphere by lightning and cosmic radiation. In the oceans, some marine animals can also fix it. After atmospheric nitrogen has been fixed into an available form, green plants can assimilate it. Herbivorous animals feeding on plants, in turn, consume some of it. Dead plants and animals, excretion of nitrogenous wastes are converted into nitrites by the action of bacteria present in the soil. Some bacteria can even convert nitrites into nitrates that can be used again by green plants. There are still other types of bacteria capable of converting nitrates into free nitrogen, a process known as denitrification (Figure 16).

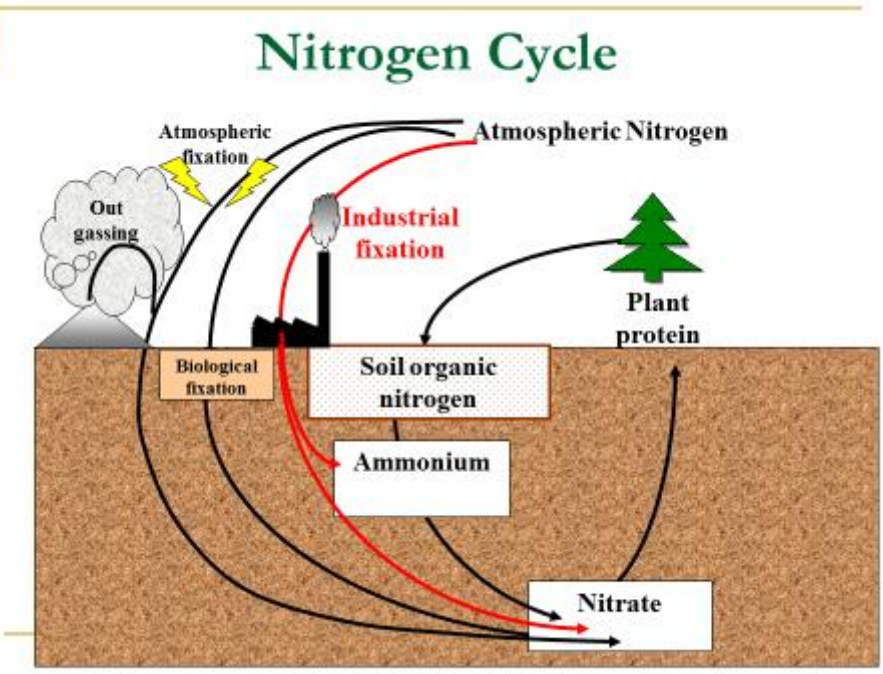


Figure 16: The nitrogen cycle

5. Mineral Cycles

The important geochemical components of the biosphere like carbon, oxygen, nitrogen etc. are dealt above. Apart from them, there are several other minerals which are very critical nutrients for plant and animal life. These mineral elements required by living organisms are obtained initially from inorganic sources such as phosphorus, sulphur, calcium and potassium and many others. They usually occur as salts dissolved in soil water or lakes, streams and seas. Mineral salts come directly from the earth's crust by weathering where the soluble salts enter the water cycle and eventually reach to the sea. Other salts are also deposited through sedimentation, and after weathering of the same, they again enter the mineral cycle. All plants/producers receive their mineral requirements from the soils in the form of nutrients. Animals receive their mineral needs from the plants and animals by consuming them. After the death of living organisms, the minerals are returned to the soil and water through decomposition of dead bodies. The scavengers, micro bacterial and fungal growth disintegrate the mineral compounds and stored minerals in their bodies are partly returned to the soil.

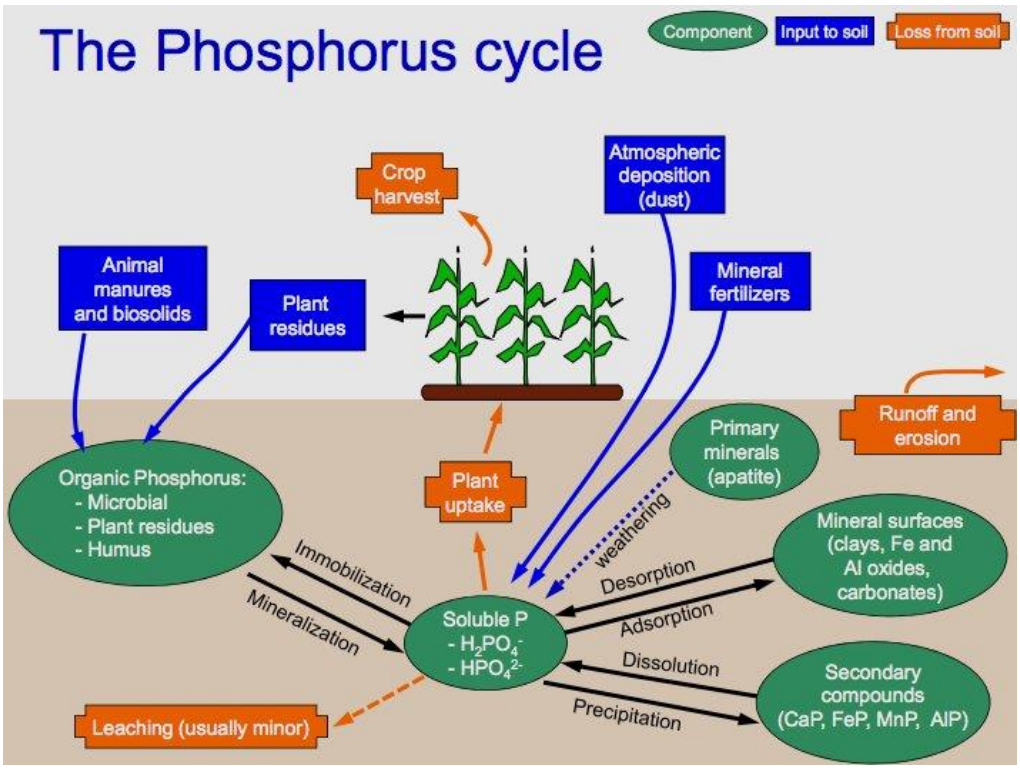


Figure 17: The phosphorus cycle

Source: https://en.wikipedia.org/wiki/Phosphorus_cycle

The above figure shows the phosphorus cycle. Phosphorus is very essential nutrient for plants and animals. It is an important nutrient for aquatic organisms as it forms life sustaining molecules that are very common in the biosphere. It remains mostly on land and in rocks and soil minerals. However, humans have brought major changes to the global phosphorus cycle by mining of phosphorus minerals and using phosphorus in making fertilizers, and transporting it in food from farms to cities where it is lost as effluent. Though excessive amounts of nutrients, especially P and N are detrimental to aquatic ecosystems

Ecological Balance

Ecological balance is a state of dynamic equilibrium within a community of organisms in a habitat or ecosystem. It can happen when the diversity of the living organisms remains relatively stable. Gradual changes do take place but that happens only through natural succession. It can also be explained as a stable balance in the numbers of each species in an ecosystem. This occurs through competition and cooperation between different organisms where population remains stable. This balance is brought by certain species which compete with one another determined by the environment in which they grow. This balance is also attained by some species depend on others for their food and sustenance. Such accounts are

encountered in vast grasslands where the herbivorous animals (deer, zebras, buffaloes etc.) are found in plenty. On the other hand, the carnivorous animals (tigers, lions etc.) that are not usually in large numbers, hunt and feed on the herbivores, thereby controlling their population. In the plants, any disturbance in the native forests such as clearing the forest for shifting cultivation usually brings about change in the species distribution. This change is due to competition where the secondary forest species such as grasses, bamboos or pines overtakes the native species changing the original forest structure. This is called succession.

Factors affecting the ecological balance: Ecological balance may be disturbed due to

i. The introduction of new/foreign species
ii. Land degradation, desertification and soil erosion
iii. Industrial and air pollution
iv. Natural hazards and forest fire
v. Increasing human population and pressure
vi. Human induced causes

Human interference has affected the balance of plant communities leading to disturbances in the ecosystems. Such disturbances bring about numerous secondary successions. Human pressure on the earth's resources has put a heavy toll on the ecosystem. This has destroyed its originality and has caused adverse effects to the general environment. Ecological imbalances have brought many natural calamities like floods, landslides, diseases, erratic climatic occurrences, etc.

Summary

There is a very close relationship between the plant and animal communities within a particular habitat. Diversity of life in a particular area can be considered as an indicator of the habitat factor. Proper knowledge and understanding of such factors provide a strong base for protecting and conserving the ecosystems.