



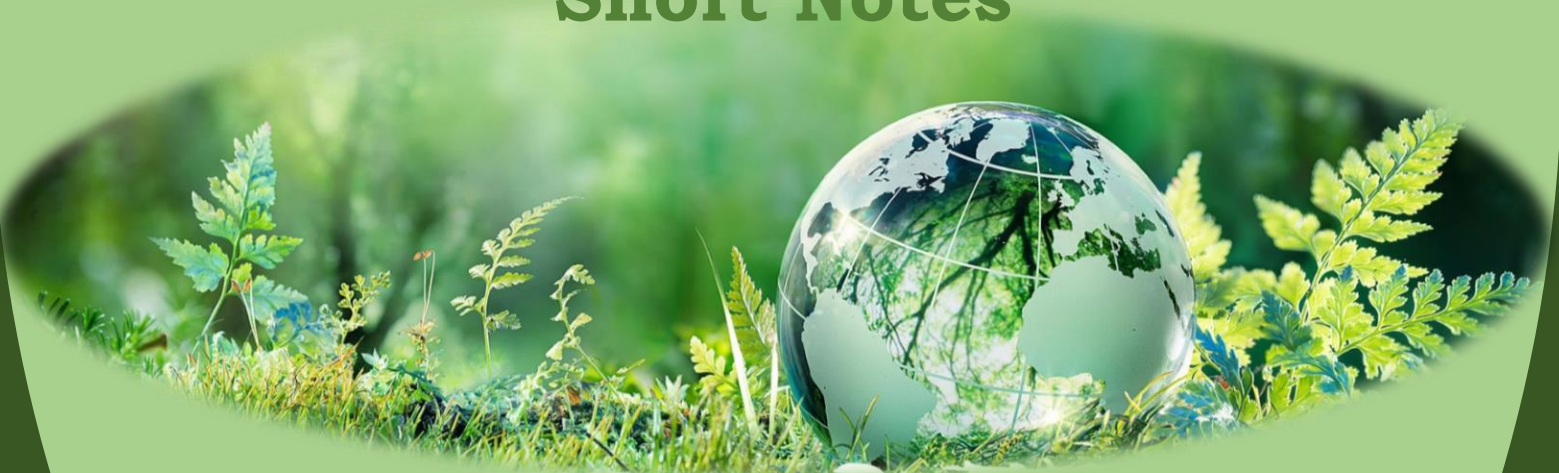
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Full Course on ENVIRONMENT

For UPSC/PCS & SSC exams

Ecology

Short Notes



mentored by:



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Ecology is made of two Latin words - 'Oikos' meaning home or place to live in and 'logos' meaning study.

Literally it is the study of the home of nature.

Ecology is defined "as a scientific study of the relationship of the living organisms with each other and with their environment."

It deals with the ways in which organisms are moulded by their environment, how they make use of environmental resources including energy flow and mineral cycling.

ENVIRONMENT AND ITS COMPONENT

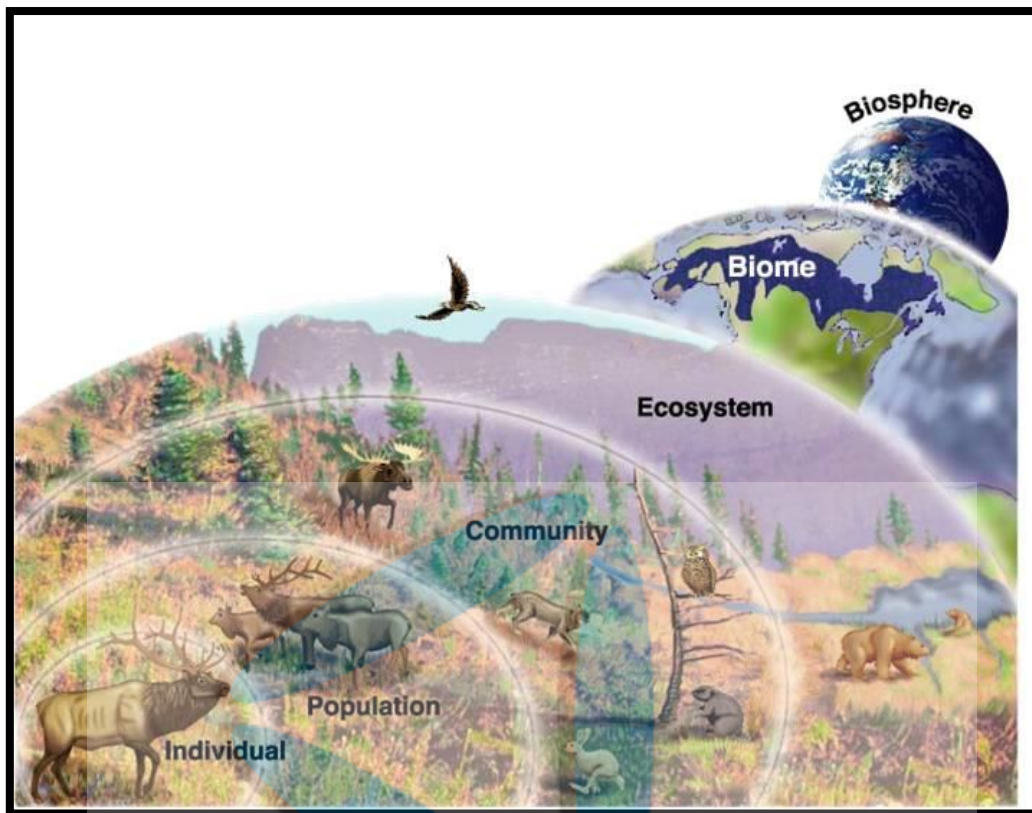
Everything that surrounds or affects an organism during its life time is collectively known as its environment.

The environment is defined as 'the sum total of living, non-living components; influences and events, surrounding an organism.'

Components of Environment	
Abiotic	Biotic
Energy	Green plants
Radiation	Non-green plants
Temperature & heat flow	Decomposers
Water	Parasites
Atmospheric gases and wind	Symbionts
Fire	Animals
Gravity	Man
Topography	
Soil	
Geologic substratum	

LEVELS OF ORGANISATIONS IN ECOLOGY

The main levels of organisation of ecology are six and are as follows.



Credits: <https://socratic.org/questions/what-levels-of-organization-include-abiotic-factors>

Individual

- ✓ Organism is an individual living being that has the ability to act or function independently.
- ✓ It may be plant, animal, bacterium, fungi, etc.
- ✓ It is a body made up of organs, organelles, or other parts that work together to carry out on the various processes of life.

Population

- ✓ Population is a group of organisms usually of the same species, occupying a defined area during a specific time.
- ✓ Population growth rate is the percentage variation between the number of individuals in a population at two different times. Therefore the population growth rate can be positive or negative.

- ✓ The main factors that make population increase are birth and immigration.
- ✓ The main factors that make population decrease are death and emigration.
- ✓ Population density is the relation between the number of individuals of a population and the area they occupy.

Community

- ✓ In order to survive, individuals of any one species depend on individuals of different species with which they actively interact in several ways.

For eg: Animals require plants for food and trees for shelter. Plants require animals for pollination, seed dispersal, and soil microorganism to facilitate nutrient supply.

A community is a group or association of populations of two or more different species occupying the same geographical area at the same time.

Communities in most instances are named after the dominant plant form (species).

Example: A grassland community is dominated by grasses, though it may contain herbs, shrubs, and trees, along with associated animals of different species.

A community is not fixed or rigid; communities may be large or small.

Types of Community

On the basis of size and degree of relative independence communities may be divided into two types:

❖ Major Community

- ✓ These are large-sized, well organized and relatively independent.
- ✓ They depend only on the sun's energy from outside and are independent of the inputs and outputs from adjacent communities.
- ✓ E.g: tropical ever green forest in the North-East

❖ **Minor Communities**

- ✓ These are dependent on neighbouring communities and are often called societies.
- ✓ They are secondary aggregations within a major community and are not therefore completely independent units as far as energy and nutrient dynamics are concerned.
- ✓ e.g: A mat of lichen on a cow dung pad.

Structure of a community

In a community the number of species and size of their population vary greatly.

The environmental factors determine the characteristic of the community as well as the pattern of organisation of the members in the community.

The characteristic pattern of the community is termed as structure which is reflected in the roles played by various population, their range, the type of area they inhabit, the diversity of species in the community and the spectrum of interactions between them.

Ecosystem

- ✓ An ecosystem is defined as a structural and functional unit of biosphere consisting of community of living beings and the physical environment, both interacting and exchanging materials between them.
- ✓ It includes plants, trees, animals, fish, birds, micro-organisms, water, soil, and people.
- ✓ Ecosystems vary greatly in size and elements but each is a functioning unit of nature.
- ✓ Everything that lives in an ecosystem is dependent on the other species and elements that are also part of that ecological community. If one part of an ecosystem is damaged or disappears, it has an impact on everything else.
- ✓ When an ecosystem is healthy, it means that all the elements live in balance and are capable of reproducing themselves.
- ✓ Ecosystem can be as small as a single tree or as large as entire forest.

Components of Ecosystem

The components of ecosystem and environment are same.

Abiotic Components

- ✓ Abiotic components are the inorganic and non-living parts of the world.
- ✓ The abiotic part consists of soil, water, air, and light energy etc. It also involves chemicals like oxygen, nitrogen etc. and physical processes including volcanoes, earthquakes, floods, forest fires, climates, and weather conditions.
- ✓ Abiotic factors are the most important determinants of where and how well an organism exists in its environment.

Energy

- ✓ Energy from the sun is essential for maintenance of life.
- ✓ In the case of plants, the sun directly supplies the necessary energy.
- ✓ Since animals cannot use solar energy directly, they obtain it indirectly by eating plants or animals or both.
- ✓ Energy determines the distribution of organisms in the environment.

Rainfall

- ✓ Water is essential for all living beings.
- ✓ Majority of biochemical reactions take place in an aqueous medium.
- ✓ Water helps to regulate body temperature.
- ✓ Further, water bodies form the habitat for many aquatic plants and animals.

Temperature

- ✓ Temperature is a critical factor of the environment which greatly influences survival of organisms.
- ✓ Organisms can tolerate only a certain range of temperature and humidity.

Atmosphere

The earth's atmosphere is responsible for creating conditions suitable for the existence of a healthy biosphere on this planet.

Materials

- ✓ *Organic compounds* such as proteins, carbohydrates, lipids, humic substances are formed from inorganic compound on decomposition.
- ✓ *Inorganic compounds* such as carbon dioxide, water, sulphur, nitrates, phosphates, and ions of various metals are essential for organisms to survive.

Latitude and altitude

- ✓ *Latitude* has a strong influence on an area's temperature, resulting in change of climates such as polar, tropical, and temperate.
- ✓ These climates determine different natural biomes.
- ✓ From sea level to highest peaks, wild life is influenced by *altitude*.
- ✓ As the altitude increases, the air becomes colder and drier, affecting wild life accordingly.

Biotic Components

Biotic components include living organisms comprising plants, animals and microbes and are classified according to their functional attributes into producers and consumers.

Primary producers - Autotrophs (self-nourishing)

- ✓ Primary producers are basically green plants (and certain bacteria and algae).
- ✓ They synthesise carbohydrate from simple inorganic raw materials like carbon dioxide and water in the presence of sunlight by the process of photosynthesis for themselves, and supply indirectly to other non-producers.
- ✓ In terrestrial ecosystem, producers are basically herbaceous and woody plants, while in aquatic ecosystem producers are various species of microscopic algae.

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Consumers – Heterotrophs or phagotrophs (other nourishing)

- ✓ Consumers are incapable of producing their own food (photosynthesis).
- ✓ They depend on organic food derived from plants, animals or both.
- ✓ Consumers can be divided into two broad groups namely micro and macro consumers.

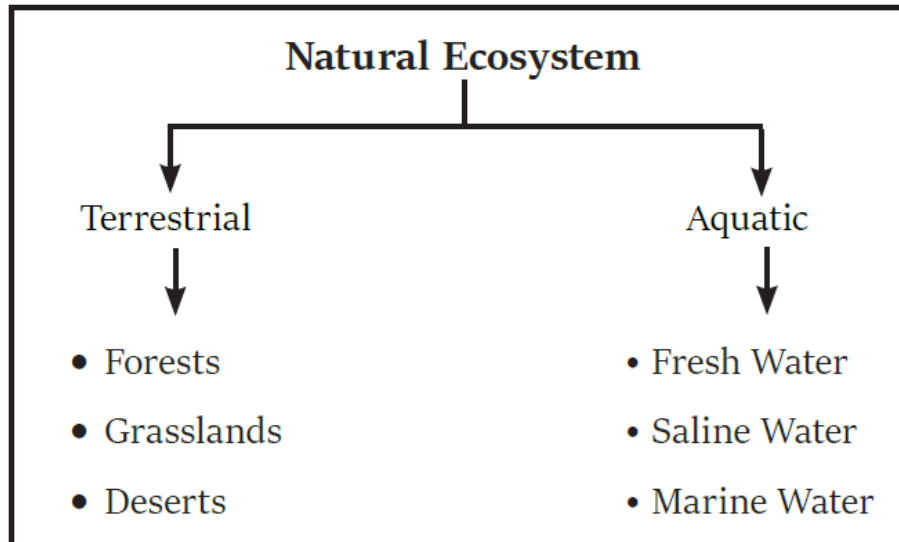
Macro consumers

- They feed on plants or animals or both and are categorised on the basis of their food sources.
- Herbivores are primary consumers which feed mainly on plants e.g. cow, rabbit.
- Secondary consumers feed on primary consumers e.g. wolves.
- Carnivores which feed on secondary consumers are called tertiary consumers e.g. lions which can eat wolves.
- Omnivores are organisms which consume both plants and animals e.g. man, monkey.

Micro consumers - Saprotrophs (decomposers or osmotrophs)

- They are bacteria and fungi which obtain energy and nutrients by decomposing dead organic substances (detritus) of plant and animal origin.
- The products of decomposition such as inorganic nutrients which are released in the ecosystem are reused by producers and thus recycled.
- Earthworm and certain soil organisms (such as nematodes, and arthropods) are detritus feeders and help in the decomposition of organic matter and are called detritivores.

Classification of Eco-system



*Ecosystems are capable of maintaining their state of equilibrium. They can regulate their own species structure and functional processes. This capacity of ecosystem of self-regulation is known as **homeostasis**.*

Ecosystem Services

As per Millennium Ecosystem Assessment (MEA), 2005 ecosystem services are grouped into four categories

Provisioning services

- food, crops, and spices
- water
- building materials
- pharmaceuticals, biochemicals, and industrial products
- energy (hydropower, biomass fuels)

Regulating services

- carbon sequestration and climate regulation
- waste decomposition and detoxification
- purification of water and air
- crop pollination
- pest and disease control

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Supporting services

- nutrient dispersal and cycling
- seed dispersal

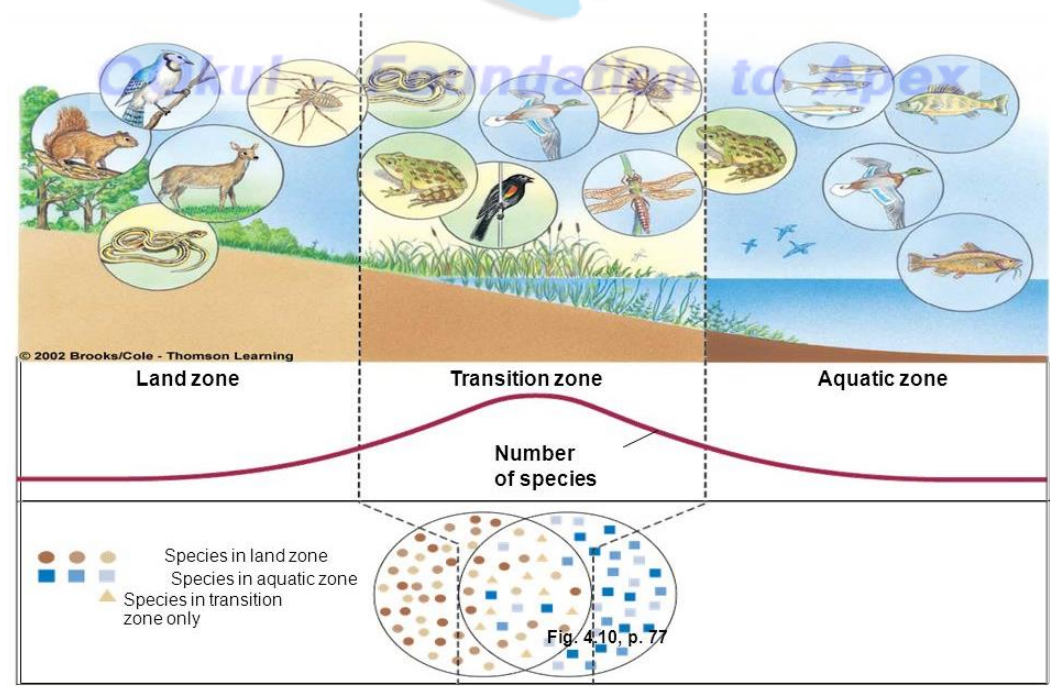
Cultural services

- cultural, intellectual and spiritual inspiration
- recreational experiences (including ecotourism)

Ecotone

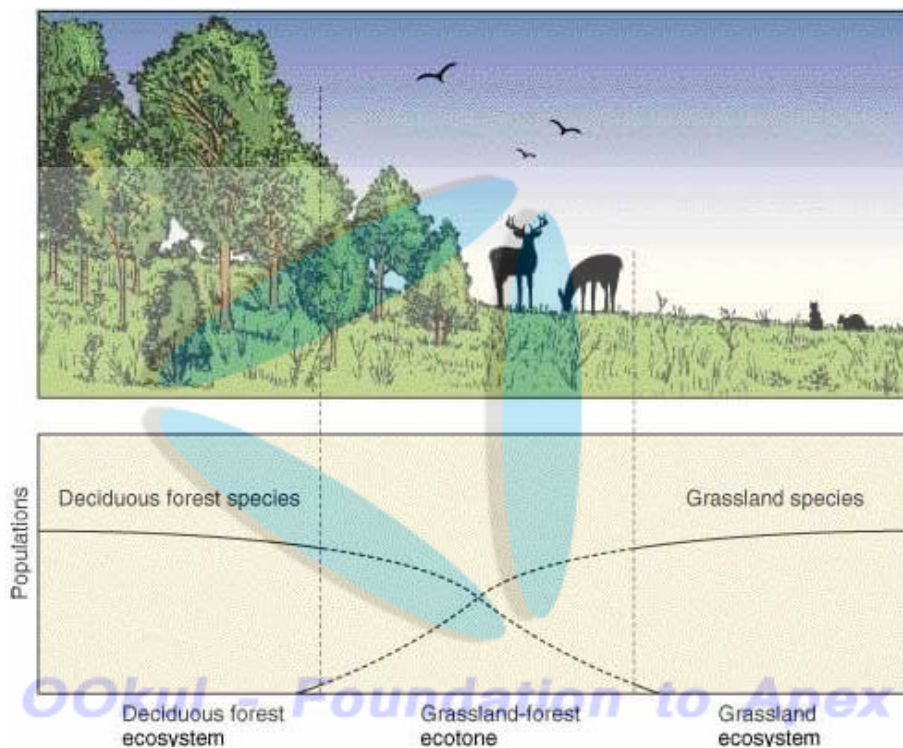
Ecotone is a zone of junction between two or more diverse ecosystems. For e.g. the mangrove forests represent an ecotone between marine and terrestrial ecosystem.

Other examples are – grassland, estuary, marshlands and mangrove forests.



Characteristics of Ecotone

- ✓ It may be very narrow or quite wide.
- ✓ It has the conditions intermediate to the adjacent ecosystems. Hence it is a zone of tension.
- ✓ It is linear as it shows progressive increase in species composition of one incoming community and a simultaneous decrease in species of the other outgoing adjoining community.



- ✓ A well developed ecotones contain some organisms which are entirely different from that of the adjoining communities.
- ✓ Sometimes the number of species and the population density of some of the species is much greater in this zone than either community. This is called edge effect.
- ✓ The organisms which occur primarily or most abundantly in this zone are known as edge species.

Niche

A niche is the unique functional role or place of a species in an ecosystem. It is a description of all the biological, physical and chemical factors that a species needs to survive, stay healthy and reproduce.

A niche is unique for a species, which means no two species have exact identical niches.

Niche plays an important role in conservation of organisms.

If we have to conserve species in its native habitat we should have knowledge about the niche requirements of the species and should ensure that all requirements of its niche are fulfilled.

Types of Niche

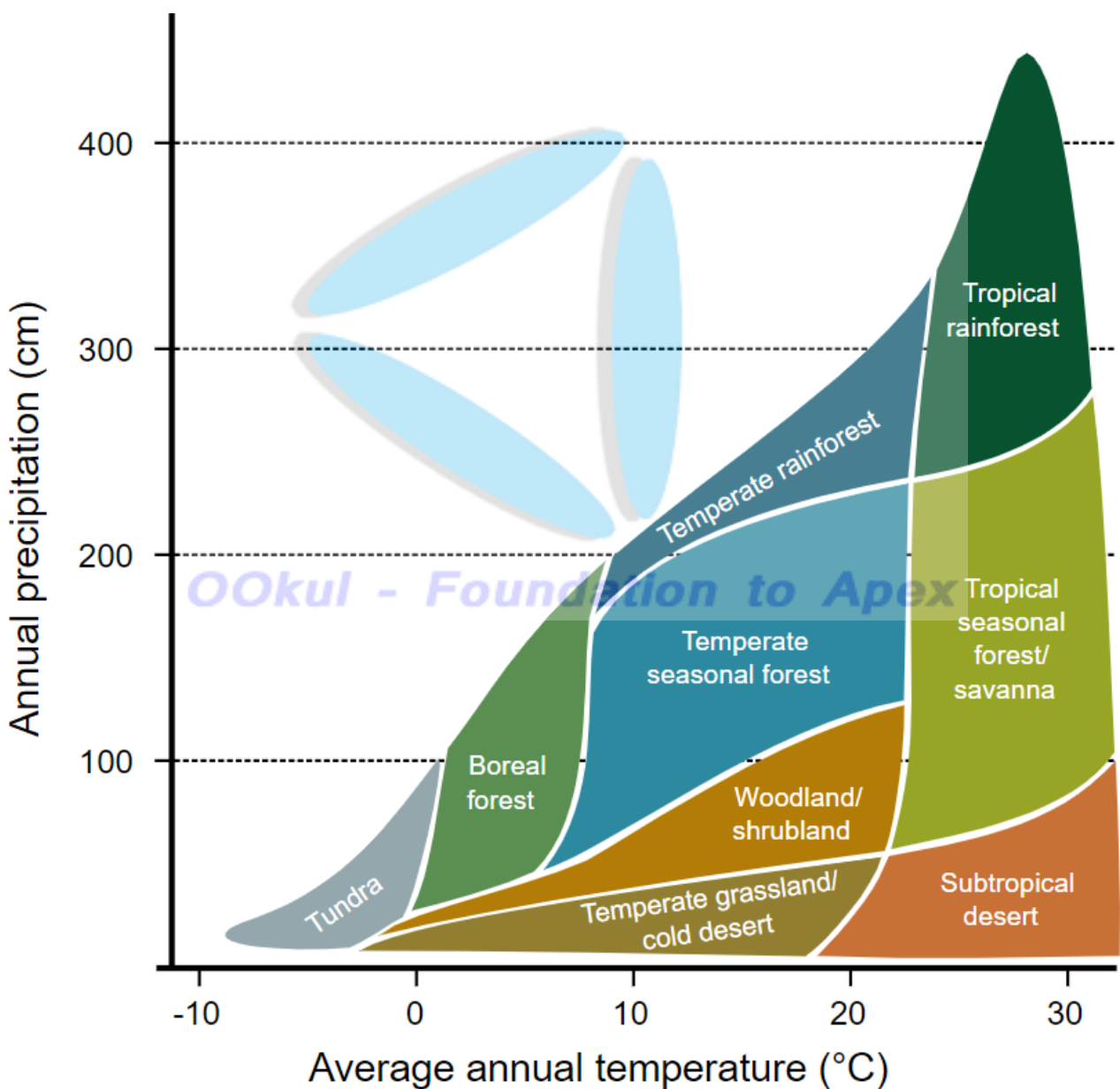
1. **Habitat niche** – where it lives
2. **Food niche** – what it eats or decomposes & what species it competes with
3. **Reproductive niche** – how and when it reproduces.
4. **Physical & chemical niche** – temperature, land shape, land slope, humidity & other requirements.

Difference between niche and habitat

- The habitat of a species is like its '**address**' (i.e. where it lives) whereas niche can be thought of as its "**profession**" (i.e. activities and responses specific to the species).
- A niche is unique for a species while many species share the habitat.
- No two species in a habitat can have the same niche. This is because of the competition with one another until one is displaced.
- For example, a large number of different species of insects may be pests of the same plant, but they can co-exist as they feed on different parts of the same plant.

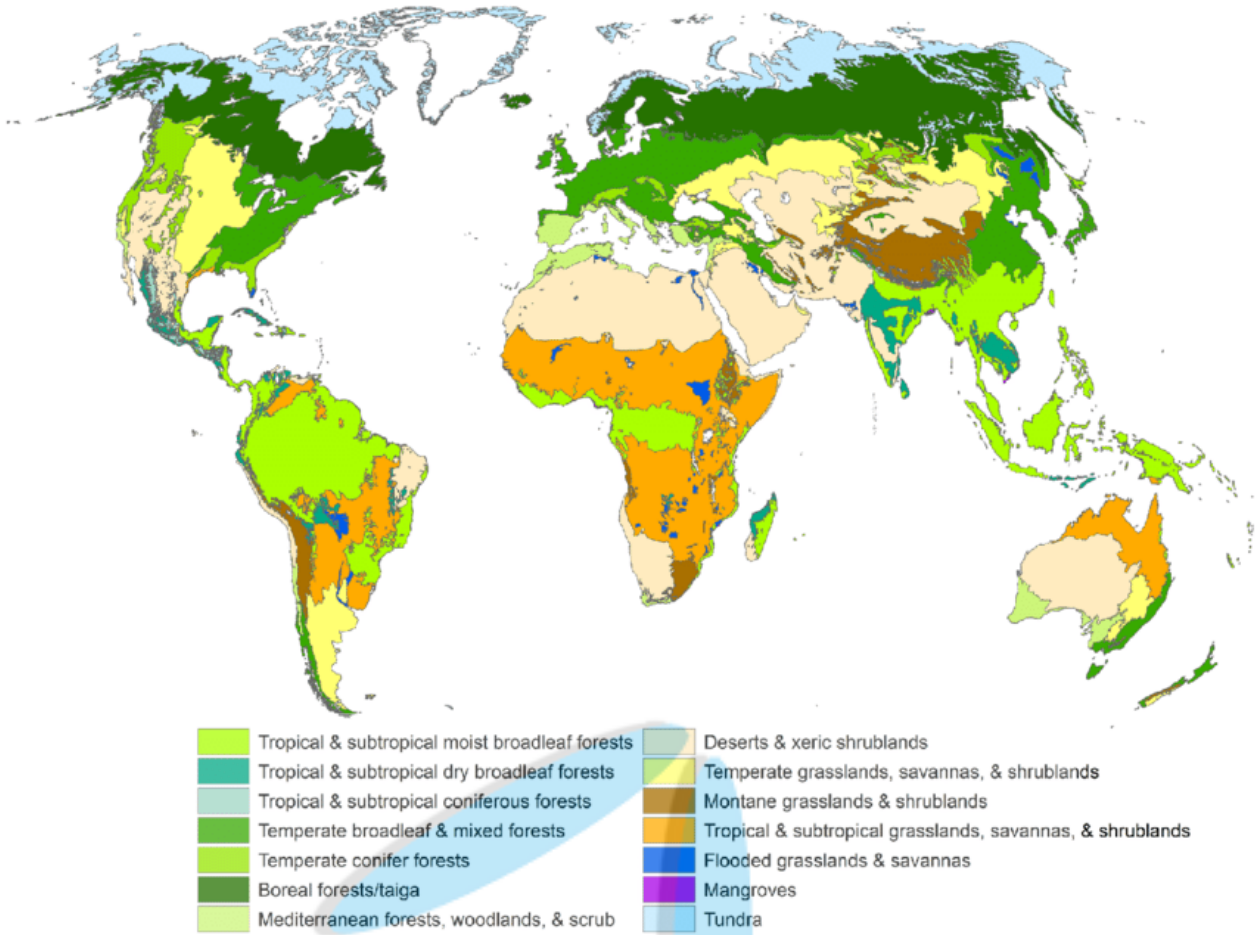
Biome

- ☑ The terrestrial part of the biosphere is divisible into enormous regions called biomes, which are characterized, by climate, vegetation, animal life and general soil type.
- ☑ No two biomes are alike.
- ☑ The climate determines the boundaries of a biome and abundance of plants and animals found in each one of them.
- ☑ The most important climatic factors are temperature and precipitation.



S.No.	Name of Biome	Region	Flora and Fauna
1	Tundra	Northern and Southern most region of world adjoining the ice bound poles	Devoid of trees except stunted shrubs in the southern part of tundra biome, ground flora includes lichen, mosses and sedges. The typical animals are reindeer, arctic fox, polar bear, snowy owl, lemming, arctic hare, ptarmigan. Reptiles and amphibians are almost absent.
2	Taiga	Northern Europe, Asia and North America. Moderate temperature than tundra. Also known as boreal forest.	The dominating vegetation is coniferous evergreen mostly spruce, with some pine and firs. The fauna consists of birds, hawks, fur bearing carnivores, little mink, elks, puma, Siberian tiger, wolverine, wolves etc.
3	Temperate Deciduous Forest	Extends over Central and Southern Europe, Eastern North America, Western China, Japan, New Zealand etc. Moderate average temperature and abundant rainfall.	The flora includes trees like beech, oak, maple and cherry. Most animals are the familiar vertebrates and invertebrates. These are generally the most productive agricultural areas of the earth
4	Tropical rain forest	Tropical areas in the equatorial regions, which is abound with life. Temperature and rainfall high.	Tropical rainforest covers about 7% of the earth's surface & 40% of the world's plant and animal species. Multiple storey of broad-leafed evergreen tree species are in abundance. Most animals and epiphytic plants are concentrated in the canopy or tree top zones.
5	Savannah	Tropical region: Savannah is most extensive in Africa.	Grasses with scattered trees and fire resisting thorny shrubs. The fauna include a great diversity of grazers and browsers such as antelopes, buffaloes, zebras, elephants and rhinoceros; the carnivores include lion, cheetah, hyena; and mongoose, and many rodents.
6	Grassland	North America, Ukraine, etc. Temperate conditions with low rainfall.	Grasses dominate the vegetation. The fauna include large herbivores like bison, antelope, cattle, rodents, prairie dog, wolves, and a rich and diverse array of ground nesting bird.
7	Desert	Continental interiors with very low and sporadic rainfall with low humidity. The days are very hot but nights are cold.	The flora is drought resistance such as cactus, euphorbias, sagebrush. Fauna: Reptiles, Small Mammals and birds.

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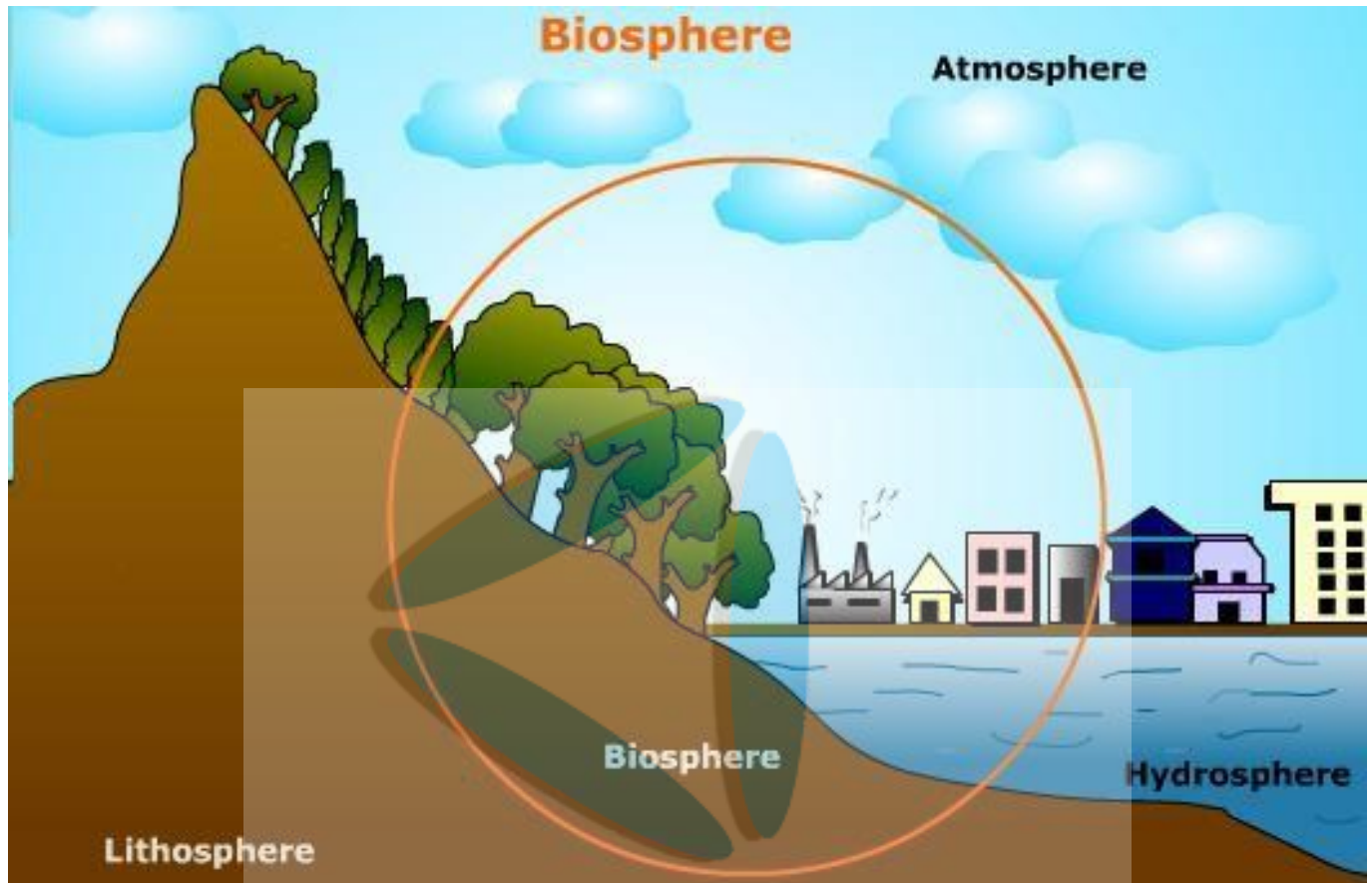
Aquatic Zones

- ☑ Aquatic systems are not called biomes, however they are divided into distinct life zones, with regions of relatively distinct plant and animal life.
- ☑ The major differences between the various aquatic zones are due to salinity, levels of dissolved nutrients, water temperature, depth of sunlight penetration.

S.No	Aquatic ecosystem	Characteristics
1.	Fresh Water Ecosystem	Fresh water ecosystem are classified as lotic (moving water) or lentic (still or stagnant water). Lotic water system includes freshwater streams, springs, rivulets, creeks, brooks, and rivers. Lentic water bodies include pools, ponds, some swamps, bogs and lakes. They vary considerably in physical, chemical and biological characteristics.
2.	Marine Ecosystem	Nearly three - quarter of earth's surface is covered by ocean with an average depth of 3,750 m and with salinity 35 ppt, (parts per thousand), about 90 per cent of which is sodium chloride.
3.	Estuaries	Coastal bays, river mouths and tidal marshes form the estuaries. In estuaries, fresh water from rivers meet ocean water and the two are mixed by action of tides. Estuaries are highly productive as compared to the adjacent river or sea.
4.	Coral reef	
5.	Mangrove	

Biosphere

- ☑ Biosphere is a part of the earth where life can exist.
- ☑ Biosphere represents a highly integrated and interacting zone comprising of atmosphere (air), hydrosphere (water) and lithosphere (land).



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Source: Pinterest

- ☑ It is a narrow layer around the surface of the earth. If we visualise the earth to be the size of an apple the biosphere would be as thick as its skin.
- ☑ Life in the biosphere is abundant between 200 metres (660 feet) below the surface of the ocean and about 6,000 metres (20,000 feet) above sea level.

Biosphere is absent at extremes of the North and South poles, the highest mountains and the deepest oceans, since existing hostile conditions there do not support life.

Occasionally spores of fungi and bacteria do occur at great height beyond 8,000 metres, but they are not metabolically active, and hence represent only dormant life.

- ✓ The energy required for the life within the biosphere comes from the sun.
- ✓ The nutrients necessary for living organisms come from air, water and soil. The same chemicals are recycled over and over again for life to continue.
- ✓ Living organisms are not uniformly distributed throughout the biosphere. Only a few organisms live in the polar regions, while the tropical rain forests have an exceedingly rich diversity of plants and animals (50% of Global Biodiversity).



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