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Dear students,
I hope you all are well with your family.

Now I have some interesting assignment for you, I think we have completed a lot regarding epidemiology in your VPH lectures, so can you tell me what this type of outbreak like COVID19 we call? -------

PANDEMICS right, yes if there is an epidemic that's spread over multiple countries or continents.

- Now what is an EPIDEMIC is a disease that affects a large number of people within a community, population, or region.
- AN OUTBREAK is a greater-than-anticipated increase in the number of endemic cases. It can also be a single case in a new area. If it's not quickly controlled, an outbreak can become an epidemic.

Epidemic vs. Pandemic
A simple way to know the difference between an epidemic and a pandemic is to remember the "P" in pandemic, which means a pandemic, has a passport. A pandemic is an epidemic that travels.

Epidemic vs. Endemic
But what's the difference between epidemic and endemic? An epidemic is actively spreading; new cases of the disease substantially exceed what is expected. More broadly, it's used to describe any problem that's out of control. An epidemic is often localized to a region, but the number of those infected in that region is significantly higher than normal. For example, when COVID-19 was limited to Wuhan, China, it was an epidemic. The geographical spread turned it into a pandemic.

Endemics, on the other hand, are a constant presence in a specific location. Malaria is endemic to parts of Africa. Ice is endemic to Antarctica.

Now one assignment for you all 3rd year students is –

1.**Can tell what is economical and social impact of an disease may be zoonotic or non zoonotic ?**

2. What are the steps in investigating a disease outbreak?

(Explain using your personal experience as now during this COVID -19 outbreak)

Reference: https://intermountainhealthcare.org/blogs/topics/live-well/2020/04/whats-the-difference-between-a-pandemic-an-epidemic-endemic-and-an-outbreak/

Now as we have completed zoonotic infections in our class room lectures now coming to **unit IV** i.e. Environment and Environmental hygiene

Theory-(Topics)

Ecosystem: Scope and importance, Components structure and functions. **Biodiversity:** uses, threats and conservation.

Natural resources: types, uses and abuses.

Environmental contaminants in food chain, bioaccumulation, biomagnification and persistent organic pollutants.

Environmental pollution: Sources, nature of pollutants, effects on animal and human health. Rural and urban pollution. Air pollution, sources and hazard. Air pollution in animal houses, effect on health and productivity.

Airborne diseases – Classification, health hazard, prevention and control.

Water-Sources, contamination & their prevention. Water qualities- Physical, chemical, bacteriological and radiological. Water purification methods for community water supplies.

Waterborne diseases – Classification, health hazard, prevention and control.

Soil, marine and thermal pollution- Classification, sources, hazard, prevention and control.

Noise pollution – Sources, hazards, prevention and control.

Nuclear hazardsor radiological hazard-Types, hazards and radiation protection.

National rules and legislations related to environmental pollution and role of pollution control board in India.

Biosafety: Importance, classification and biosafety measures for prevention of risk hazards.

Disaster management and mitigation.

Solid and liquid waste management at farms and biomedical waste management.

Sanitation and disinfection of farm and hospital environment in veterinary public practice for infection control.

Global warming and greenhouse effect- Definition, greenhouse gases, impact of climate change and international treaties or protocols. **Management of waste from animal industries.**

Stray and fallen animal management and carcass disposal.

Vector and reservoir control.

PRACTICAL- (Topics)

Sampling methods for testing quality of air, water, soil and other environmental sources.

Physical, chemical and microbiological examination of water. Estimation of residual chlorine and chlorine demand.

Isolation & identification of pathogens from air, water and other environmental sources.

Disinfection of animal houses.

Determination of efficacy of disinfectants – Phenol coefficient, MIC and MBC.

Demonstrationorvisit to water purification system.

Demonstration of various ventilation systems in animal houses and specialized laboratories.

Demonstration of toxic residues in water and other environmental sources.

Visit to local polluted site and documentation of local environmental problems – like dumping grounds, local slum areas, crowded localities etc.

Topic 1

(Ecosystem- Scope and importance, Components structure and functions)

First of all what is difference between environment and ecosystem-

Environment is the surrounding,

Ecosystem involves the interaction between the **environment** and the organisms living in it. **Ecosystem**is the community, where the living-organism lives in **an area** and interacts with the other elements of the **environment**.

Comparison between Environment and Ecosystem:

	Environment	**Ecosystem**
Description	An environment is a surrounding, in which living organisms dwell.	An ecosystem is a community of biotic and aboitic elements.
Function	It provides a place for elements.	It provides an interaction between the elements.
Components	It consists of the physical environment provided by man and nature .	It involves the biological conversions.
Provides	It provides the condition to live.	It provides the relation between the components to live.
Includes	It includes the area to dwell.	It includes the processes of life and surrounding.

So ecosystem is a description of what is happening in the place and environment is that place.

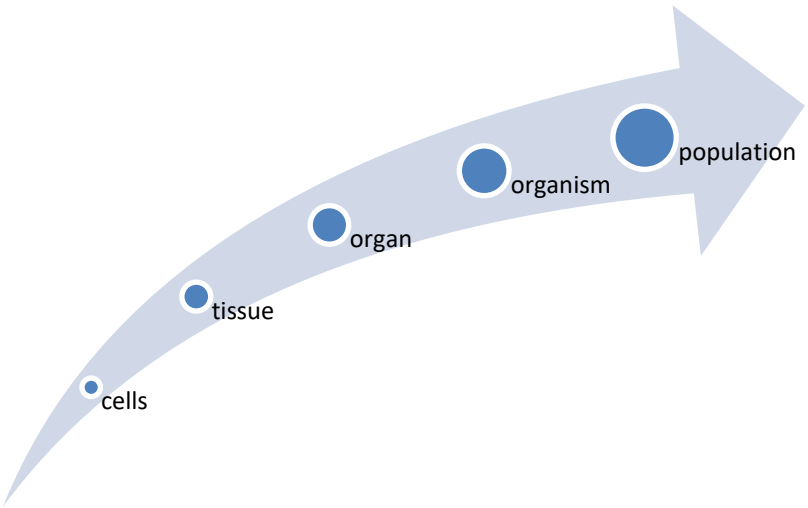
Holocoenosis - Applied to a network of relationships (e.g. among the components of an ecosystem **)**

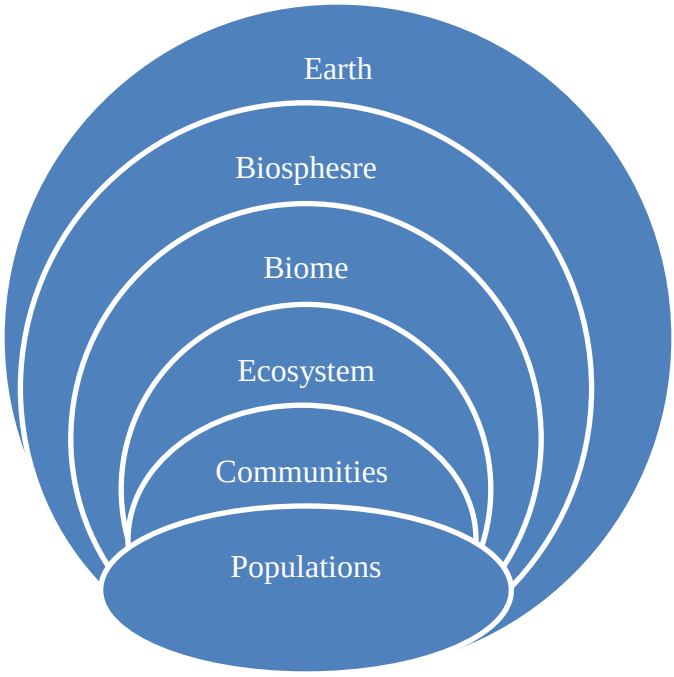
Biocenosis - describes the **interacting organisms** living together in a habitat

Some important definitions –

1. **Ecology –Ecology is the study of the interactions of living** organisms with one another and with their environment.The study of ecology ranges from the study of a single organism to the entire biosphere.
   Autecology is the study of **individual organism** or **individual species**. It is also known as **population ecology**.
   Synecology is the study of group of organisms of different species which are associated together as a unit in form of a community. It is also known as **community ecology**.
2. **A habitat -**is a place where an organism usually lives.
3. **A niche -**is the unique position occupied by a species,
   both in terms of its physical use of its habitat and its function in an ecological community
4. **Organism**- An individual form of life that has the ability to act or function independently.
5. **Population-**A group of organisms of the **same species** (a group of organisms that **can breed**) that live in a specific geographical area.
6. **Community**-A group of **different populations** that live **together** in a defined area.
7. **Ecosystem**-A collection of all the organisms that live in a particular place with their physical environment.
8. **Biome**-A large region characterized by a specific climate and certain kinds of plants and animal communities.
9. **Biosphere**-The part of Earth in which life exists including land, water, and the atmosphere.

Levels of ecological organization-





Structure and Function of an ecosystem-

An ecosystem has two components the **biotic** components consisting of living things, and the **abiotic** portion, consisting of elements that are not alive. The non living constituents are said to include the following category, habitat, gases, solar radiation, temperature, moisture and inorganic and organic nutrients. The living organisms may be sub divided into producers, consumers and decomposers.

(A) Producers:

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and

carbon dioxide. This process is known as photosynthesis. As the green plants manufacture their own food they are known as Autotrophs (i.e. auto = self, trophos = feeder)

The chemical energy stored by the producers is utilised partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

(B) Consumers:

The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e. heteros = other, trophos = feeder)

The consumers are of four types, namely:

(a) Primary Consumers or First Order Consumers or Herbivores:
These are the animals which feed on plants or the producers. They are called herbivores. Examples are rabbit, deer, goat, cattle etc.

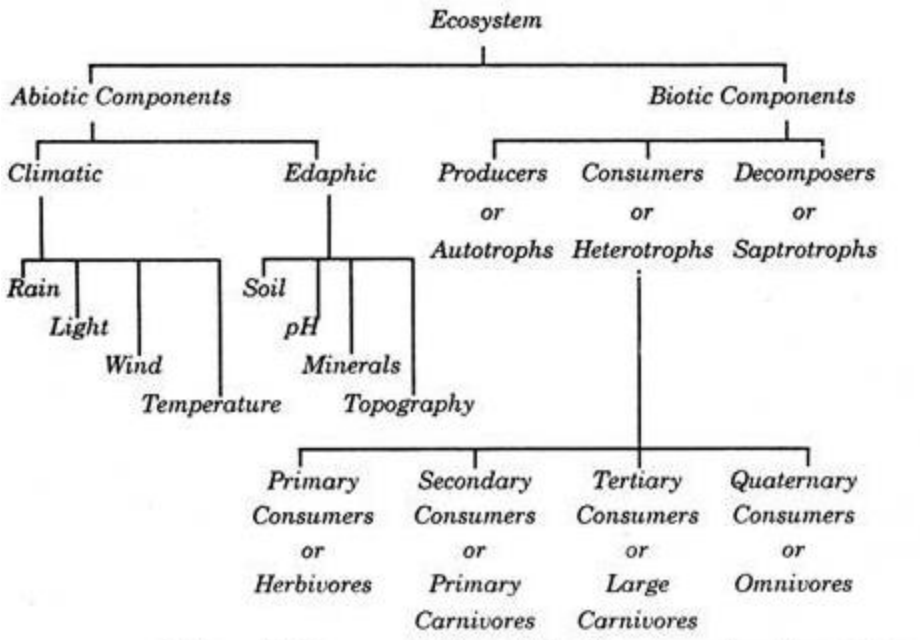
(b) Secondary Consumers or Second Order Consumers or Primary Carnivores:
The animals which feed on the herbivores are called the primary carnivores. Examples are cats, foxes, snakes etc.

(c) Tertiary Consumers or Third Order Consumers:
These are the large carnivores which feed on the secondary consumers. Example are Wolves.

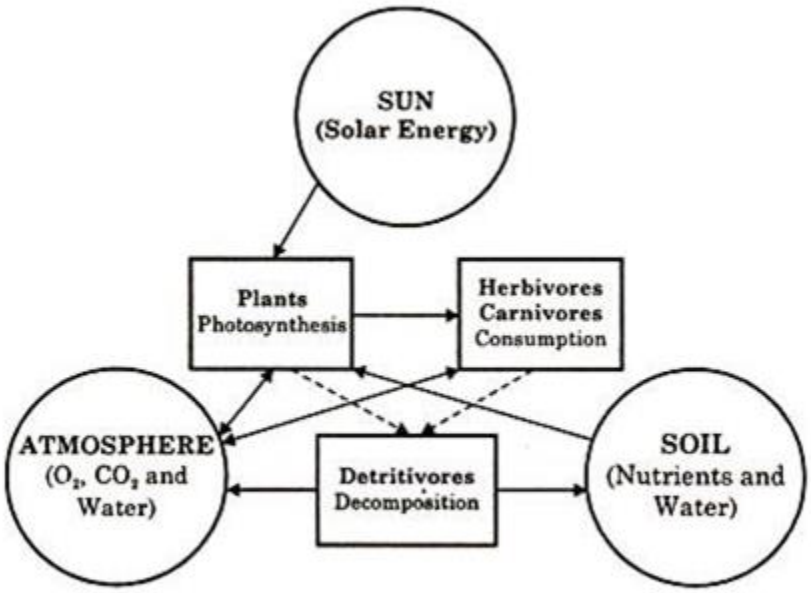
(d) Quaternary Consumers or Fourth Order Consumers or Omnivores:
These are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal. Examples are lions and tigers.

(C) Decomposers or Reducers:
Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release to the environment the simple inorganic and organic substances produced as by-products of their metabolisms.

These simple substances are reused by the producers resulting in a cyclic exchange of materials between the biotic community and the abiotic environment of the ecosystem. The decomposers are known as Saprotrophs (i.e., sapros = rotten, trophos = feeder)



Schematic Representation of the Structure of an Ecosystem.



Relationship within an Ecosystem.

Functions of an Ecosytem-

Ecosystem function is the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly. Ecosystem functions are subset of ecological processes and ecosystem structures. Each function is the result of the natural processes of the total ecological sub-system of which it is a part. Natural processes, in turn, are

the result of complex interactions between biotic (living organisms) and abiotic (chemical and physical) components of ecosystems through the universal driving forces of matter and energy. There are four primary groups of ecosystem functions

(1) regulatory functions,

(2) habitat functions,

(3) production functions and

(4) information functions.

This grouping concerns all ecosystems, not only for forests. General characterization of ecosystem functions are:

(1) **Regulatory functions**: this group of functions relates to the capacity of natural and semi-natural ecosystems to regulate essential ecological processes and life support systems through bio-geochemical cycles and other biospheric processes. In addition to maintaining the ecosystem (and biosphere health), these regulatory functions provide many services that have direct and indirect benefits to humans (i.e., clean air, water and soil, and biological control services).

(2) **Habitat functions:** natural ecosystems provide refuge and a reproduction habitat to wild plants and animals and thereby contribute to the (in situ) conservation of biological and genetic diversity and the evolutionary process.

(3) **Production functions**: Photosynthesis and nutrient uptake by autotrophs converts energy, carbon dioxide, water and nutrients into a wide variety of carbohydrate structures which are then used by secondary producers to create an even larger variety of living biomass. This broad diversity in carbohydrate structures provides many ecosystem goods for human consumption, ranging from food and raw materials to energy resources and genetic material.

(4) **Information functions**: Since most of human evolution took place within the context of an undomesticated habitat, natural ecosystems contribute to the maintenance of human health by 3 providing opportunities for reflection, spiritual enrichment, cognitive development, recreation and aesthetic experience. Components of an ecosystem: Complete ecosystem consists of four basic components such as producers, consumers, decomposers and abiotic components e.g. Pond. If anyone of these four components are lacking, then it is grouped under incomplete ecosystem e.g. Ocean depth or a cave.

Whereas materials are recycled through ecosystems, the flow of useful energy may be viewed as essentially a **one-way process.**

Every ecosystem has several interrelated mechanisms that affect human life. These are the water cycle, the carbon cycle, the oxygen cycle, the nitrogen cycle and the energy cycle.

Food Chains and Food Webs

Food chains and food webs are diagrams that represent feeding relationships. Essentially, they show who eats whom. In this way, they model how energy and matter move through ecosystems.

Food Chains

A **food chain** represents a single pathway by which energy and matter flow through an ecosystem. Most organisms consume—and are consumed by—more than one species.

There are two types of food chains:

Grazing food chain, beginning with autotrophs, and the detrital food chain, beginning with dead organic matter (Smith & Smith 2009). In a grazing food chain, energy and nutrients move from plants to the herbivores consuming them, and to the carnivores or omnivores preying upon the herbivores.

Detrital food chain -In a detrital food chain, dead organic matter of plants and animals is broken down by decomposers, e.g., bacteria and fungi, and moves to detritivores and then carnivores.

A **food web** represents multiple pathways through which energy and matter flow through an ecosystem. It includes many intersecting food chains. It demonstrates that most organisms eat, and are eaten, by more than one species.

The **trophic level** of an organism is the position it occupies in a food web.

Ecological pyramid

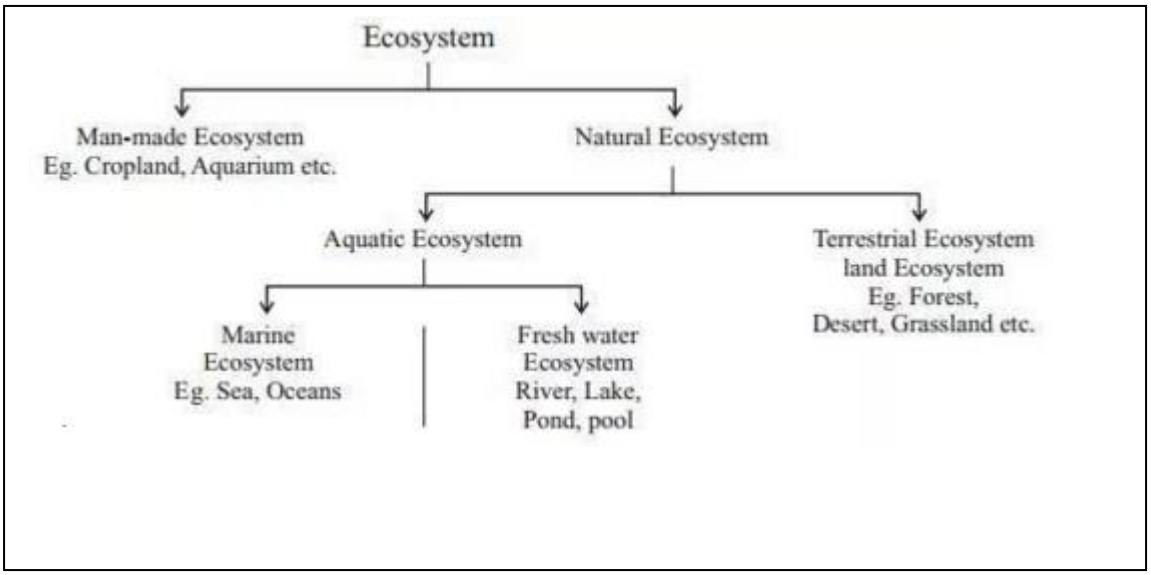
An **ecological pyramid** (also **trophic pyramid**, **Eltonian pyramid**, **energy pyramid**, or sometimes **food pyramid**) is a graphical representation designed to show the biomass or bioproductivity at each trophic level in a givenecosystem. The concept of pyramid of numbers ("Eltonian pyramid") was developed by Charles Elton (1927).[3] Later, it would also be expressed in terms of biomass by Bodenheimer (1938).[4]The idea of pyramid of productivity or energy relies on works of G. Evelyn Hutchinson and Raymond Lindeman (1942)

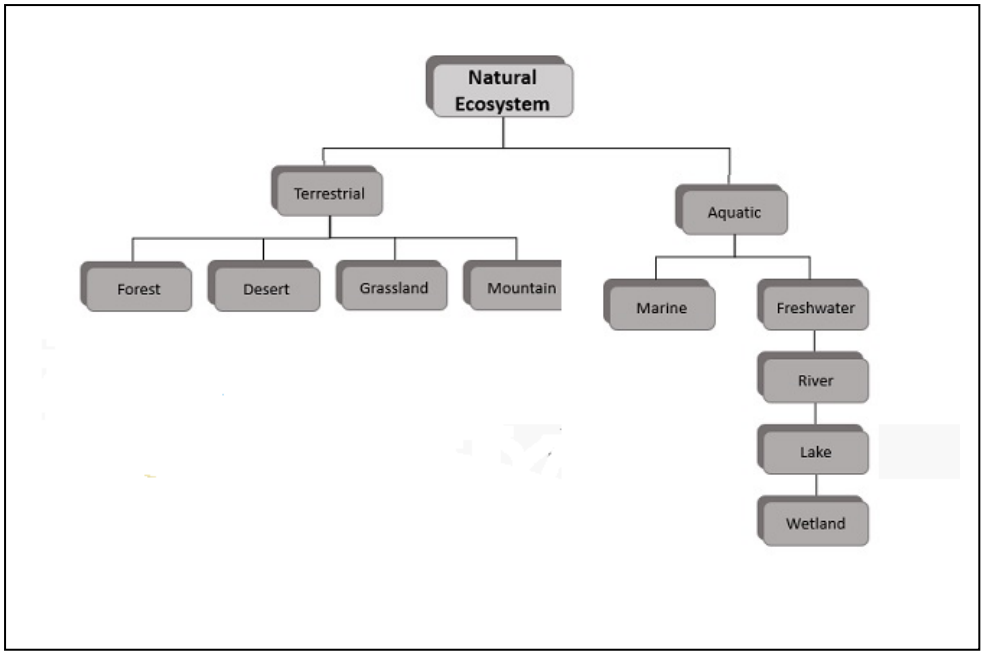
A *pyramid of energy* shows how much energy is retained in the form of new biomass at each trophic level, while a*pyramid of biomass* shows how much biomass (the amount of living or organic matter present in an organism) is present in the organisms. There is also a *pyramid of numbers* representing the number of individual organisms at each trophic level. Pyramids of **energy are normally upright**, but other pyramids can be inverted or take other shapes.

Eg In a grassland or forest ecosystem, there is gradual decrease in biomass of organisms at successive levels from producers to consumers. However, in a pond, producers are small organisms,

so their biomass is also less. But the primary and secondary consumers are bigger, so their biomass is more.

Types of ecosystem –





Terrestrial Ecosystems

Terrestrial ecosystems are exclusively land-based ecosystems. There are different types of terrestrial ecosystems distributed around various geological zones. They are as follows:

1. Forest Ecosystems

2. Grassland Ecosystems
3. Tundra Ecosystems
4. Desert Ecosystem

Forest Ecosystem

A forest ecosystem consists of several plants, animals and microorganisms that live in coordination with the abiotic factors of the environment. Forests help in maintaining the temperature of the earth and are the major carbon sink.

Grassland Ecosystem

In a grassland ecosystem, the vegetation is dominated by grasses and herbs. Temperate grasslands, savanna grasslands are some of the examples of grassland ecosystems.

Tundra Ecosystem

Tundra ecosystems are devoid of trees and are found in cold climate or where rainfall is scarce. These are covered with snow for most of the year. The ecosystem in the Arctic or mountain tops is tundra type.

Desert Ecosystem

Deserts are found throughout the world. These are regions with very little rainfall. The days are hot and the nights are cold.

Terrestrial ecosystems are those ecosystems that exist on land. Water may be present in a terrestrial ecosystem but these ecosystems are primarily situated on land. These ecosystems are of different types such as forest ecosystem, desert ecosystem, grassland and mountain ecosystems.

Terrestrial ecosystems are distinguished from aquatic ecosystems by the lower availability of water and the consequent importance of water as a limiting factor. These are characterized by greater temperature fluctuations on both diurnal and seasonal basis, than in aquatic ecosystems in similar climates.

Availability of light is greater in terrestrial ecosystems than in aquatic ecosystems because the atmosphere is more transparent on land than in water. Differences in temperature and light in terrestrial ecosystems reflect a completely different flora and fauna.

Aquatic Ecosystem

Aquatic ecosystems are ecosystems present in a body of water. These can be further divided into two types, namely:

1. Freshwater Ecosystem

2. Marine Ecosystem

Freshwater Ecosystem

The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams, and wetlands. These have no salt content in contrast with the marine ecosystem. Freshwater ecosystem includes lakes, rivers, streams, and ponds. Lakes are large bodies of freshwater surrounded by land.

Plants and algae are important to freshwater ecosystem because they provide oxygen through photosynthesis and food for animals in this ecosystem. Estuaries house plant life with the unique adaptation of being able to survive in fresh and salty environments. Mangroves and pickle weed are examples of estuarine plants.

Many animals live in freshwater ecosystem. Freshwater ecosystem is very important for people as they provide them water for drinking, energy and transportation, recreation, etc.

Marine Ecosystem

The marine ecosystem includes seas and oceans. These have a larger salt content and greater biodiversity in comparison to the freshwater ecosystem.

These ecosystems are the biggest of all ecosystems as all oceans and their parts are included in them. They contain salt marshes, intertidal zones, estuaries, lagoons, mangroves, coral reefs, the deep sea, and the sea floor.

Marine ecosystem has a unique flora and fauna, and supports a vast kingdom of species. These ecosystems are essential for the overall health of both marine and terrestrial environments.

Salt marshes, sea grass meadows, and mangrove forests are among the most productive ecosystem. Coral reef provides food and shelter to the highest number of marine inhabitants in the world. Marine ecosystem has a large biodiversity.

In this 1. Earth domains and

2. Environmental contaminants in food chain, bioaccumulation, biomagnification and persistent organic pollutants.

1st **Earth domains**

- Introduction -The earth is the only place where life exists because of life-sustaining elements like land, water and air. The surface of the earth is the place where the three zones meet, overlap and interact.

  We can divide earth domains into four –

  1. ***Lithosphere-*** The lithosphere is a domain concerning land. When land is measured, it is measured by taking sea level as it's base. The height of the land is also measured

by denoting it as either ASL (Above Sea Level) or BSL (Below Sea Level). The Earth is divided into 7 continents. Asia, Europe, Africa, North America, South America, Antarctica, and Australia. Continents are the most important domain as they inhibit the largest number of lifeforms.

Continents

Asia

- It is the largest continent and covers one-third of the land on the earth.
- It lies in the Eastern Hemisphere and the ***Tropic of Cancer*** passes through it.
- Ural mountains act as a wall between Europe and Asia and together the two continents are called as ***Eurasia.***

Africa

- It is the second largest continent and ***the Equator*** cuts through it.
- It is the only continent through which all the major latitude lines, i.e The Equator, the Tropic of Cancer, and the Tropic of Capricorn pass.
- The largest desert in the world, the ***Sahara***, and the longest river in the world, the ***Nile***, are both parts of Africa.
- It looks like a massive island since it is surrounded by seas and oceans on all sides.

Europe

- It lies to the east of Asia and is smaller in size.
- It is surrounded on three sides by water and the ***Arctic Circle*** passes through it.

North America

- It is the third-largest continent and is linked to South America by a thin strip of land called the ***Isthmus of Panama***.
- It lies completely in the Northern and Western Hemispheres.

South America

- It lies completely in the Southern Hemisphere and is surrounded by the South Pacific and South Atlantic oceans.
- The world's longest mountain range, the ***Andes,*** and the largest river in the world, the ***Amazon***,are a part of South America.

Australia

- It is the smallest continent in the world and is surrounded by water on all sides.
- It is also called the ***island continent***.

Antarctica

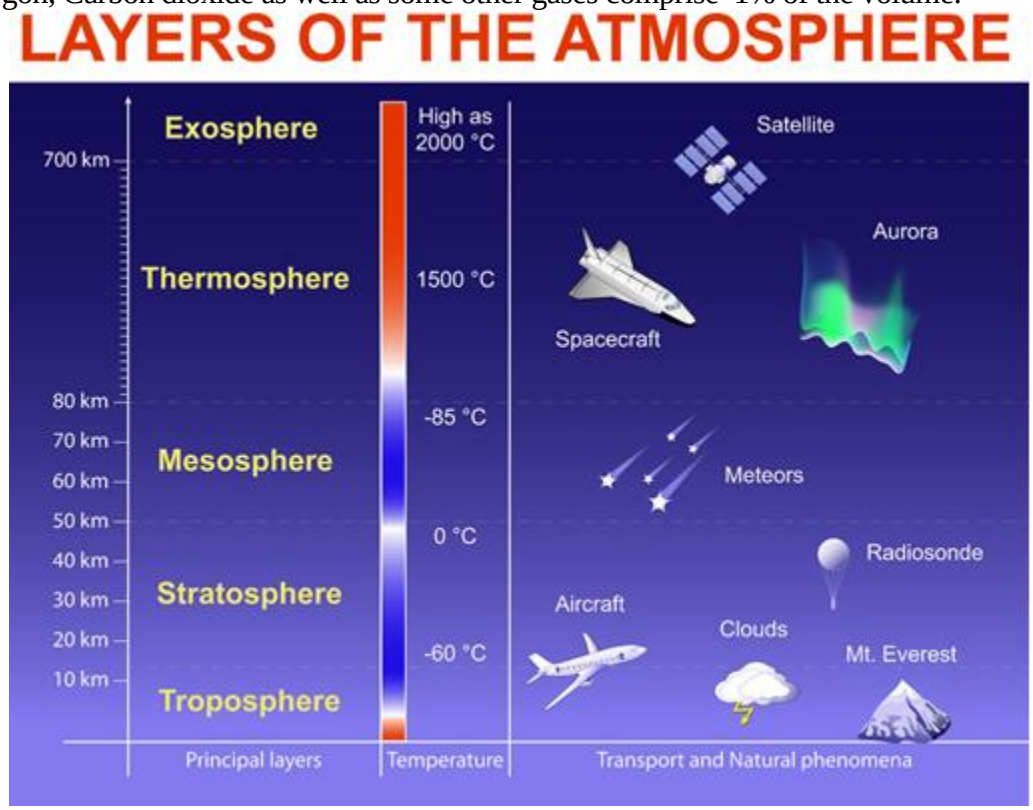
- It is completely in the Southern Hemisphere and the ***South Pole*** is at its heart.
- It is a Polar region and is covered in thick sheets of ice, so there are no permanent human settlements.
- Many countries have research stations there, such as the Indian stations ***Maitri*** and***DakshinGanga***.

2. Hydrosphere

Hydrosphere is a domain that contains water or water bodies. If we take the earth into consideration. Only 1/4th (29%) of the earth is covered in soil/land while the rest 3/4th (71%) portion is covered in water. 97% of the earth's water is found in oceans and is not suitable for use as it is saltwater.

Oceans cover a large part of the globe. There are four primary oceans on Earth, which are Pacific Ocean, Atlantic Ocean, Indian Ocean and the Arctic Ocean.

3. The Atmosphere is a domain that consists of layers which are the troposphere, stratosphere, mesosphere, thermosphere as well as the exosphere. Lifeform sustains on troposphere which is the first layer of the atmosphere. The density of Atmosphere is maximum at sea level and decreases with increasing height. The atmosphere consists of 78% Nitrogen, 21% oxygen and other gases like Argon, Carbon dioxide as well as some other gases comprise 1% of the volume.



a. Troposphere is the lowest layer of Earth's atmosphere. It extends from Earth's surface to an average height of about 12 km (7.5 mi; 39,000 ft), although this altitude varies from about 9 km (5.6 mi; 30,000 ft) at the geographic poles to 17 km (11 mi; 56,000 ft) at the Equator, with some variation due to weather. The troposphere is bounded above by the tropopause, a boundary marked in most places by a temperature inversion (i.e. a layer of relatively warm air above a colder one), and in others by a zone which is isothermal with height.

Although variations do occur, the temperature usually declines with increasing altitude in the troposphere because the troposphere is mostly heated through energy transfer from the surface. Thus, the lowest part of the troposphere (i.e. Earth's surface) is typically the warmest section of the troposphere. This promotes vertical mixing (hence, the origin of its name in the Greek word τρόπος, *tropos*, meaning "turn"). The troposphere contains roughly 80% of the mass of Earth's atmosphere. The troposphere is denser than all its overlying atmospheric

layers because a larger atmospheric weight sits on top of the troposphere and causes it to be most severely compressed. Fifty percent of the total mass of the atmosphere is located in the lower 5.6 km (3.5 mi; 18,000 ft) of the troposphere.

Nearly all atmospheric water vapor or moisture is found in the troposphere, so it is the layer where most of Earth's weather takes place. It has basically all the **weather-associated cloud** genus types generated by active wind circulation, although very tall cumulonimbus thunder clouds can penetrate the tropopause from below and rise into the lower part of the stratosphere. Most conventional aviation activity takes place in the troposphere, and it is the only layer that can be accessed by propeller-driven aircraft.

b. The stratosphere is the second-lowest layer of Earth's atmosphere. It lies above the troposphere and is separated from it by the tropopause. This layer extends from the top of the troposphere at roughly 12 km (7.5 mi; 39,000 ft) above Earth's surface to the stratopause at an altitude of about 50 to 55 km (31 to 34 mi; 164,000 to 180,000 ft).

The atmospheric pressure at the top of the stratosphere is roughly 1/1000 the pressure at sea level. It contains the ozone layer, which is the part of Earth's atmosphere that contains relatively high concentrations of that gas. The stratosphere defines a layer in which temperatures rise with increasing altitude. This rise in temperature is caused by the absorption of ultraviolet radiation (UV) radiation from the Sun by the ozone layer, which restricts turbulence and mixing. Although the temperature may be −60 °C (−76 °F; 210 K) at the tropopause, the top of the stratosphere is much warmer, and may be near 0 °C.

By absorbing dangerous UV radiation, the ozone in the stratosphere protects us from skin cancer and other health damage. However chemicals (called CFCs or freons, and halons) which were once used in refrigerators, spray cans and fire extinguishers have reduced the amount of ozone /**ozone depletion** in the stratosphere, particularly at polar latitudes, leading to the so-called **"Antarctic ozone hole".**

Now humans have stopped making most of the harmful CFCs we expect the ozone hole will eventually recover over the 21st century, but this is a slow process.

c. The Mesosphere

The region above the stratosphere is called the mesosphere. Here the temperature again decreases with height, reaching a minimum of about -90°C at the "mesopause".

d. The Thermosphere and Ionosphere

The thermosphere lies above the mesopause, and is a region in which temperatures again increase with height. This temperature increase is caused by the absorption of energetic ultraviolet and X-Ray radiation from the sun.

The region of the atmosphere above about 80 km is also caused the "ionosphere", since the energetic solar radiation knocks electrons off molecules and atoms, turning them into "ions" with a positive charge. The temperature of the thermosphere varies between night and day and between the seasons, as do the numbers of ions and electrons which are present. The ionosphere reflects and absorbs radio waves, allowing us to receive shortwave radio broadcasts in New Zealand from other parts of the world.

e. The Exosphere

The region above about 500 km is called the exosphere. It contains mainly oxygen and hydrogen atoms, but there are so few of them that they rarely collide - they follow "ballistic" trajectories under the influence of gravity, and some of them escape right out into space.

4. **Biosphere: The Supporter of Life Forms**

- Geologist Eduard Suess coined the term “Biosphere” in 1875. The biosphere is the point where all the three domains, viz. land, water and air meet as well as interact with each other. The biosphere is a zone of contact between air, water as well as land. All these three zones come together to form the ***Biosphere***, the circle of life.
- It is in this zone that life, that is unique to Earth exists and flourishes. The biosphere is divided into two kingdoms, Plant kingdom, and the Animal kingdom. Deforestation and pollution are rapidly damaging the Biosphere.

2. Environmental contaminants in food chain, bioaccumulation, biomagnification and persistent organic pollutants(pop).

Biomagnification, also known as **bioamplification** or **biological magnification**, is any concentration of a toxin, such as pesticides, in the tissues of tolerant organisms at successively higher levels in a food chain. This increase can occur as a result of:

- Persistence – where the substance cannot be broken down by environmental processes
- Food chain energetics – where the substance's concentration increases progressively as it moves up a food chain

- Low or non-existent rate of internal degradation or excretion of the substance – mainly due to water-insolubility

Biomagnification is the build up of toxins in a food chain. The DDT concentration is in parts per million. As the trophic level increases in a food chain, the amount of toxic build up increases. The x's represent the amount of toxic build up accumulating as the trophic level increases. Toxins build up in organism's fat and tissue. Predators accumulate higher toxins than prey.

Biological magnification often refers to the process whereby certain substances such as pesticides or heavy metals work their way into lakes, rivers and the ocean, and then move up the food chain in progressively greater concentrations as they are incorporated into the diet of aquatic organisms such as zooplankton, which in turn are eaten perhaps by fish, which then may be eaten by bigger fish, large birds, animals, or humans. The substances become increasingly concentrated in tissues or internal organs as they move up the chain. Bioaccumulants are substances that increase in concentration in living organisms as they take in **contaminated air, water, or food**because the substances are very slowly metabolized or excreted.

Examples-

Fish and shellfish concentrate mercury in their bodies, often in the form of methylmercury, a highly toxic organomercurycompound. Fish products have been shown to contain varying amounts of heavy metals, particularly heavy metal and mercury and fat-soluble pollutants from water pollution. Species of fish that are long-lived and high on the food chain, such as marlin,tuna, shark, swordfish, king mackerel and tilefish (Gulf of Mexico) contain higher concentrations of mercury than others

1.Niigata Minamata disease is a neurological syndrome caused by severe mercury poisoning. The disease was caused by severe mercury poisoning, the source of which was methylmercury released in the wastewater. Locals called it the "***cat dancing disease***" in cats due to neurological symptoms.

2. **"itai-itai disease"** was coined by locals for the severe pains (**Japanese**: 痛い itai) people with the condition felt in the spine and joints due to cadmium. **Cadmium poisoning** can also cause softening of the bones and kidney failure.

Some of the most well-known POPs, such as PCBs, DDT, and dioxins are also have tendency of biomagnifications due to low biodegradability.

* **Four big pollution diseases of Japan** (were a group of man-made diseases all caused by environmental pollution due to improper handling of industrial wastes by Japanese corporations.[1] The first occurred in 1912, and the other three occurred in the 1950s and 1960s.

Name of disease	Japanese prefecture affected	Cause	Source	Year
Itai-itai disease	Toyama Prefecture	Cadmium poisoning	Mitsui Mining & Smelting Company	1912
Minamata disease	Kumamoto Prefecture	Methylmercury	Chisso Corporation	1956
Niigata Minamata Disease	Niigata Prefecture	Methylmercury	Showa Denko	1965
Yokkaichi Asthma	Mie Prefecture	Sulfur dioxide	**Air pollution within Yokkaichi**	1961