Samyak
An Institute For Civil Services

ENVIRONMENT & ECOLOGY

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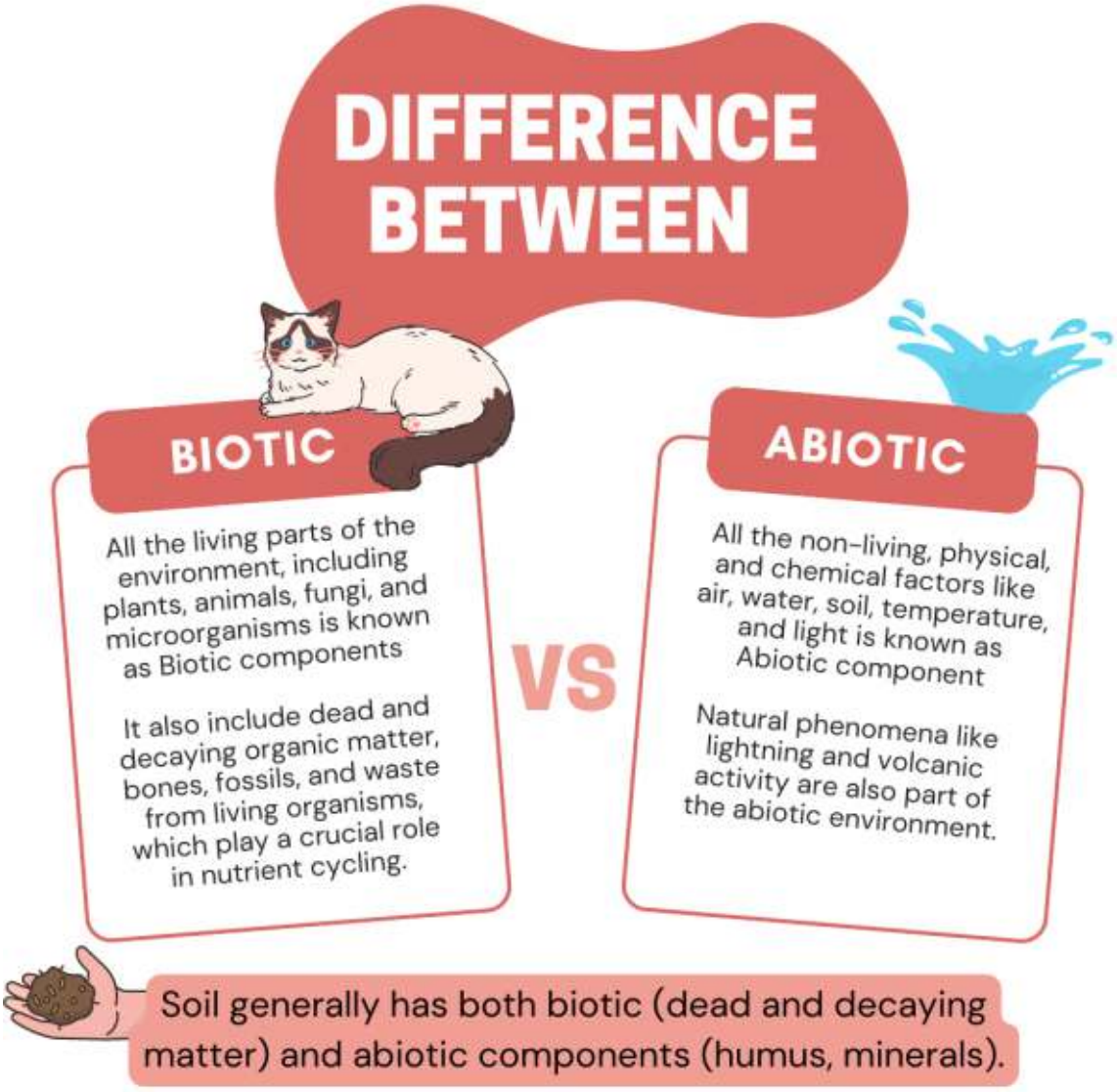
INDEX

Chapter-1 ENVIRONMENT, HABITAT AND ECOSYSTEM

1.1 Environment

Environment refers to the natural world that surrounds us, encompassing all living (biotic) and non-living (abiotic) components. It includes everything that influences life on Earth, ranging from air, water, and land to organisms, ecosystems, and human-made structures.

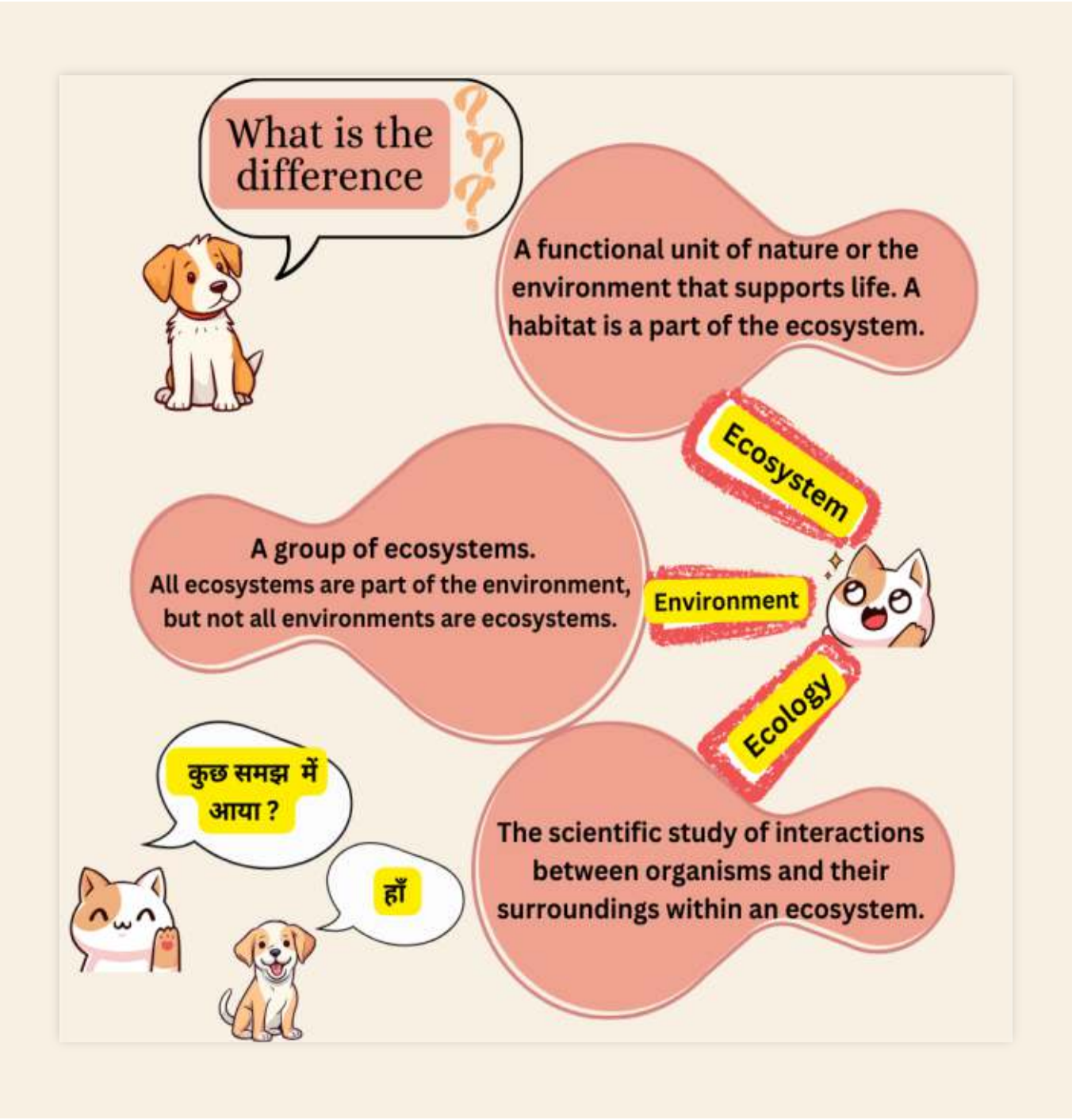


1.2 Habitat

- A **habitat** is the natural environment where an organism lives, grows, and thrives. It provides the essential conditions needed for the survival of a species, including food, water, shelter and the right temperature and climate.
- A habitat can be as **small** as a **leaf** for an insect or as **large** as an **ocean** for marine life.

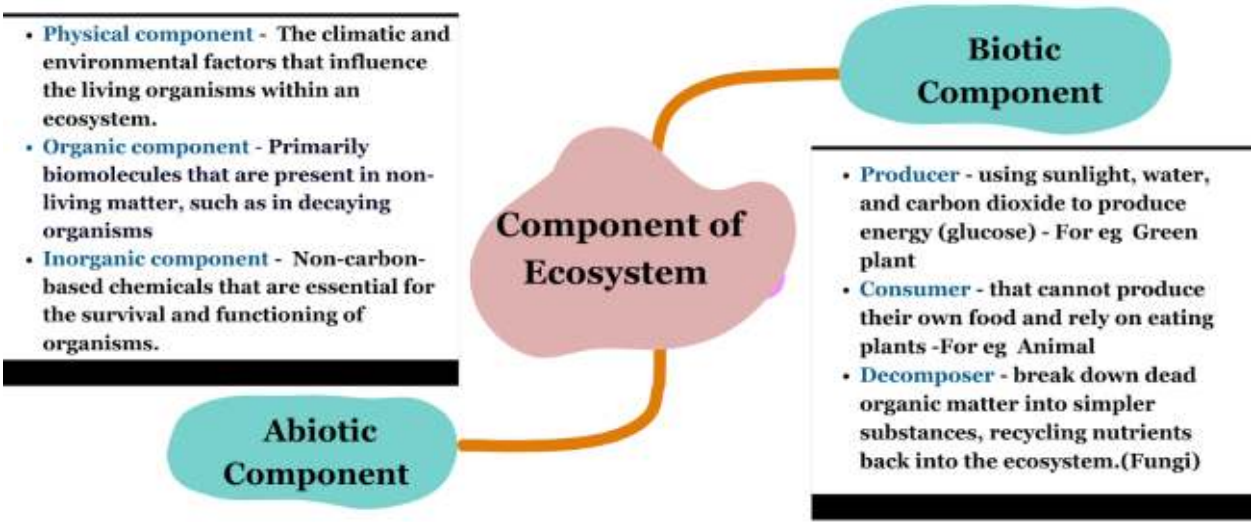
1.3 Ecosystem

- An **ecosystem** is a community of living organisms (plants, animals, and microorganisms) interacting with each other and their non-living (abiotic) environment (air, water, soil, sunlight, etc.) in a specific area.
- These interactions form a **complex web** of relationships that enable the flow of energy, cycling of nutrients, and regulation of biological processes, making life possible within that environment.



1.4 Classification Of Ecosystem

1.5 Component Of Ecosystem



1.5.1 Abiotic Components

Abiotic components refer to the non-living physical and chemical factors that affect the ecosystem and influence the survival of living organisms. These include limiting factors, physical elements, and chemical compounds.

1. **Limiting Factors**
   - Certain abiotic factors can limit the survival and growth of organisms, even if other factors are favorable. For instance, seeds in evergreen rainforests may not germinate well due to nutrient-leached soil, making **inferior surface soil** the **limiting factor.**
2. **Major Abiotic Limiting Factors**
   - **Light:** The spectral quality of solar radiation is essential for life processes. While visible light supports photosynthesis, ultraviolet (UV) light can be harmful to many organisms. The intensity of light also affects plant growth: low-intensity light inhibits growth and flowering, while extremely high light intensity favors root growth and increases transpiration.
   - **Rainfall: As** most biochemical reactions occur in an aqueous medium, water availability is crucial for life. Organisms rely on rainfall to sustain metabolic activities.
   - **Temperature: O**rganisms are classified based on their tolerance to temperature:
     - **Eurythermal:** Organisms that can survive in a wide range of temperatures.
     - **Stenothermal:** Organisms that are limited to a narrow temperature range.
   - Temperature affects respiration, photosynthesis, and overall plant health. High temperatures may lead to protein coagulation, dehydration, and tissue damage, while frost can freeze soil moisture, causing plant dehydration.
   - **Atmosphere:** The composition of the atmosphere significantly impacts life.
     - **Oxygen** (21%) supports respiration in most organisms.
     - **Nitrogen** (78%) prevents spontaneous combustion.
     - **Carbon dioxide** (0.038%) is essential for photosynthesis by primary producers.
   - **Organic Compounds:** These include essential biomolecules like proteins, carbohydrates, and lipids which facilitate energy transfer in living organisms.
   - **Inorganic Compounds:** Elements like carbon dioxide, water, sulfur, nitrates, phosphates, and metal ions (e.g., calcium, potassium) are vital for sustaining life.

- **Altitude:** As altitude increases, temperature drops, which affects the type of vegetation. This results in vertical zonation of vegetation, where different species dominate at different elevations.
- **pH (Buffering Capacity):** The Earth's buffering capacity maintains a neutral pH (around 7) in soils and water bodies, which is conducive to the survival of most organisms.
- **Salinity:** Organisms are classified based on their tolerance to salinity:
  - **Euryhaline:** Can survive in a wide range of salinities.
  - **Stenohaline:** Restricted to narrow salinity ranges.

Effects Of Abiotic Components On Terrestrial Autotrophs

- **Light:** Plants depend on the intensity and quality of light. Only red and blue wavelengths of visible light are effective for photosynthesis. Different light types affect plant growth differently:
  - **Blue light** results in smaller plants.
  - **Red light** causes cell elongation.
  - **Ultraviolet light** leads to dwarf plants.
- **Frost:** Frost freezes soil moisture, causing plant roots to struggle in supplying water, which increases transpiration and leads to dehydration. Frost also freezes water within plant cells, leading to increased salt concentration, cell damage, and diseases like cankers.
- **Snow:** Snow can both shorten the growing season by delaying vegetative growth and protect plants by acting as a blanket, preventing a drop in temperature. However, the accumulation of snow can break tree branches or uproot them.
- **Nitrogen:** Plants compete with microbes for limited nitrogen in the soil, making nitrogen a limiting nutrient in both natural and agricultural ecosystems.
- **Dieback:** Some plants adapt to adverse conditions, like drought, through dieback, where the shoots die while the roots stay alive. This allows the plant to survive until favorable conditions return (e.g., sal, red sanders).

1.5.2 Biotic Components

Biotic components encompass all living organisms within an ecosystem. These are divided into **producers, consumers** and **decomposers** each playing a vital role in maintaining the balance of the ecosystem.

1. **Primary Producers (Autotrophs)**

   Autotrophs, such as green plants, cyanobacteria, and algae, produce their own food through photosynthesis. They form the base of the food chain. In aquatic ecosystems, microscopic algae (plankton) act as primary producers.

2. **Consumers (Heterotrophs)**

   Heterotrophs rely on consuming organic matter produced by autotrophs. They are categorized as macro consumers and micro consumers.

Aspect	Macro Consumers	Micro Consumers
Definition	Organisms that consume other organisms (plants or animals).	Organisms that feed on organic matter at a microscopic level.
Types	Herbivores, Secondary Consumers, Tertiary Consumers, Omnivores	Phagotrophs, Osmotrophs, Saprotrophs/Decomposers, Detritivores
Feeding Mechanisms	Ingest organic matter (plants or animals).	Ingest organic matter or absorb dissolved nutrients.
Role in the Ecosystem	Act as consumers in the food chain, transferring energy.	Break down organic matter and recycle nutrients.
Examples	Sheep, rabbits, wolves, lions, humans, bears	Various microorganisms, fungi, bacteria, earthworms
Size	Typically larger organisms.	Typically microscopic organisms.

CHAPTER-1

1. Which one of the following is the best description of the term "ecosystem"? [UPSC 2015]

(a) A community of organisms interacting with one another

(b) Part of the earth which is inhabited by living organisms

(c) A community of organisms together with the environment in which they live.

(d) The flora and fauna of a geographical area.

2. If a tropical rainforest is removed, it does not regenerate quickly as compared to a tropical deciduous forest. This is because (UPSC 2012)

(a) the soil of rain forest is deficient in nutrients

(b) propagules of trees in a rainforest have poor viability

(c) the rainforest species are slow growing

(d) exotic species invade the fertile soil of rainforest

3. What type of organism can survive in a wide range of temperatures?

(a) Eurythermal

(b) Stenothermal

(c) Euryhaline

(d) Stenohaline

4. Which of the following statements regarding light as an abiotic factor are correct?

1. Visible light supports photosynthesis.
2. Ultraviolet (UV) light promotes plant growth.
3. High-intensity light increases transpiration.
4. Low-intensity light inhibits flowering.

Choose the correct option

(a) 1 and 2 only

(b) 1, 3, and 4 only

(c) 2 and 4 only

(d) 1, 2, and 3 only

5. Which of the following statements regarding atmospheric gases are correct?

1. Oxygen is essential for respiration in most organisms.
2. Nitrogen forms 78% of the atmosphere and prevents spontaneous combustion.
3. Carbon dioxide is present in the atmosphere at 0.038% and is crucial for photosynthesis.
4. Methane is the most abundant gas in the atmosphere.

Choose the correct option

(a) 1 and 2 only (b) 1, 2, and 3 only

(c) 2 and 4 only (d) 3 and 4 only

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