

Environment & Ecosystem

Environment

- Natural component where **biotic (living)** and **abiotic (non-living)** factors interact.
- Shapes the **habitat** and **ecosystem** of organisms.
- Includes physical (nutrients, water, air), biological (organisms, biomolecules), and chemical interactions (carbon, nitrogen cycles).
- All organisms depend on the environment for **food, energy, water, oxygen, and shelter**.

Biosphere

- Biological component of Earth supporting life: **lithosphere, hydrosphere, atmosphere**.
- Includes all living organisms + dead organic matter produced by them.
- Absent at extreme poles, the highest mountains, deepest oceans.
- Spores may occur above 8,000 m but are **dormant**, not metabolically active.

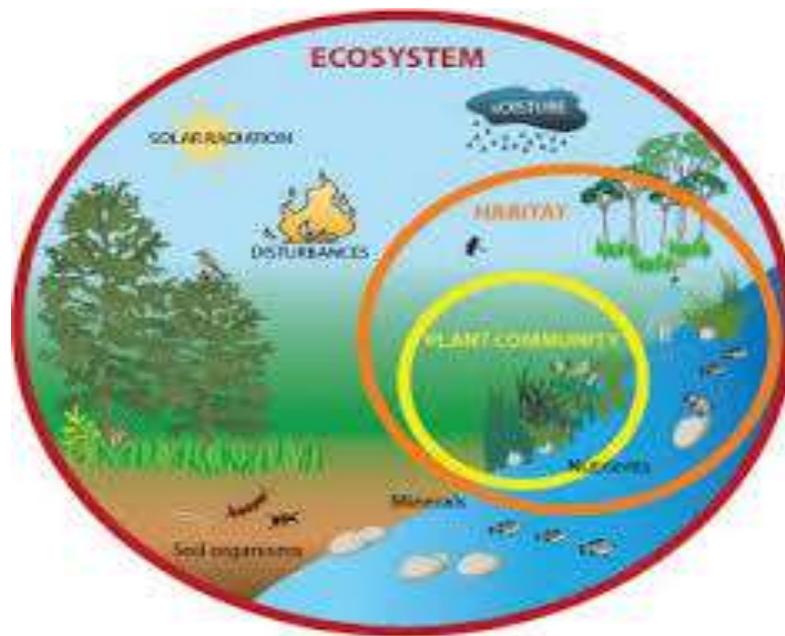
Habitat

- Physical environment where an organism lives (**address** of an organism).
- Many habitats together form an environment.
- One habitat may support multiple species with similar requirements (e.g., an aquatic habitat).

Difference: Habitat vs Environment

- Habitat always has life; environment may or may not.
- All habitats \Rightarrow environments; all environments \Rightarrow not habitats.
- Habitat = preference of one species; environment = may suit many species.
- The environment influences habitat, not vice versa.

Ecosystem



- A **functional unit of nature** where producers, consumers, and decomposers interact with the physical environment.
- Specific and limited species (e.g., aquatic ecosystem).
- Linked by **nutrient cycles** and **energy flow**.
- If one part is damaged, the entire system is affected.

Classification

- **Terrestrial:** Forest, grassland, desert
- **Aquatic:** Pond, lake, wetland, river, estuary
- **Man-made:** Crop fields, aquarium

Difference: Ecology, Environment & Ecosystem

- **Ecology:** Study of interactions between organisms and the environment.
- **Environment:** A Group of ecosystems (can be a large/small region).
- **Biosphere:** A Region on Earth that supports life.
- **Habitat:** Place where a species lives.
- **Ecosystem:** Producers–consumers–decomposers and their relationships (functional unit).

Components of an Ecosystem

Two types: **Abiotic & Biotic**

Abiotic Components

Non-living inorganic parts act as **limiting factors**.

Limiting Factor

- A single major factor that restricts survival.
- Example:
 - Rainforest → soil heavily leached → **poor soil = limiting factor** → slow regeneration.
 - Dense canopy → less light → saplings die → **light = limiting factor**.

Major Abiotic Factors

Light

- High intensity → more root growth; small leaves.
- Low intensity → poor growth, flowering, fruiting.
- Below minimum → plant death due to CO₂ accumulation.
- Red & blue light are effective for photosynthesis.
- Blue light → small plants; red → elongated; UV → dwarf.

Frost

- Freezes soil moisture → plants die from transpiration stress.
- Freezing water increases salt concentration → cell dehydration.
- Causes **canker**.

Snow

- Acts as a thermal blanket.
- Can break branches.
- Shortens vegetative growth period.

Temperature

- High temp → protein coagulation → plant death.
- Disturbs the balance between respiration & photosynthesis.
- Causes tissue desiccation.
- **Dieback**: shoots die, roots survive (e.g., sal).

Additional Factors

- **Atmosphere**: O₂ = 21%, CO₂ = 0.038%
- **Organic compounds**: proteins, carbohydrates, lipids
- **Inorganic compounds**: carbon, water, nitrates, phosphates
- **Altitude**: vertical zonation due to temperature changes
- **Buffering capacity**: maintains neutral pH
- **Salinity**:
 - Euryhaline = wide tolerance
 - Stenohaline = narrow tolerance

Biotic Components

1. Producers (Autotrophs)

- Green plants, bacteria, and algae perform photosynthesis.
- Aquatic primary producers: **phytoplankton**.

2. Consumers (Heterotrophs)

Macro-consumers:

- **Herbivores** (primary): sheep, rabbit
- **Secondary**: wolves, dogs, snakes
- **Tertiary**: lions, snakes
- **Omnivores**: humans, bears, pigs

3. Decomposers (Saprotrophs / Osmotrophs)

- Bacteria & fungi feed on dead organic matter.
- **Detritivores**: earthworms, nematodes, arthropods (feed on detritus; aid decomposition).

MCQs

1. Which one of the following is the best description of the term “ecosystem”?

- a) A community of organisms interacting with one another
- b) That 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

Answer: c

Explanation: Ecosystem = biotic community + the environment in which they live.

2. The biosphere does NOT include which of the following?

- a) Lithosphere
- b) Hydrosphere
- c) Atmosphere
- d) Uppermost regions of the poles

Answer: d

Explanation: Biosphere is absent at extreme poles, high mountains, and deep oceans due to hostile conditions.

3. Which of the following correctly differentiates habitat and environment?

- a) All environments are habitats
- b) All habitats are environments
- c) A habitat does not support life
- d) Environment is always a preference of one species

Answer: b

Explanation: All habitats qualify as environments, but not all environments may support life.

4. Why do tropical rainforests regenerate slowly compared to tropical deciduous forests?

- a) Soil is deficient in nutrients
- b) Propagules have poor viability
- c) Rainforest species are slow-growing
- d) Exotic species invade fertile soil

Answer: a

Explanation: Continuous rainfall leaches nutrients from topsoil → seeds do not germinate → slow regeneration.

5. Which of the following is a *limiting factor* for seed germination in evergreen rainforests?

- a) High rainfall
- b) Dense canopy preventing light penetration
- c) Abundant vegetation
- d) High humidity

Answer: b

Explanation: Absence of sunlight due to dense canopy → limiting factor.

6. Which of the following are primary producers?

1. Green plants
2. Fungi
3. Algae
4. Certain bacteria

- a) 1 and 2
- b) 1, 3, and 4
- c) 1, 2, 3, and 4
- d) 2 and 4

Answer: b

Explanation: Producers = green plants + algae + certain bacteria. Fungi are decomposers.

7. Organisms that thrive in a *wide* range of temperatures are called:

- a) Stenothermal
- b) Eurythermal
- c) Euryhaline
- d) Stenohaline

Answer: b

Explanation: Eurythermal = wide temperature tolerance.

8. Dieback refers to:

- a) Freezing of soil moisture
- b) Death of shoots while roots remain alive
- c) Death due to high protein coagulation
- d) Rapid leaf shedding

Answer: b

Explanation: Adaptive mechanism: shoots die back, roots survive.

9. Which of the following best describes "detritivores"?

- a) Organisms feeding on living plants
- b) Organisms feeding on both plants and animals
- c) Organisms feeding on dead organic matter
- d) Organisms producing their own food

Answer: c

Explanation: Earthworms, nematodes, etc. feed on detritus.

10. What causes vertical zonation of vegetation?

- a) Salinity
- b) Altitude
- c) Rainfall alone
- d) Soil pH

Answer: b

Explanation: Temperature changes with altitude → distinct vegetation layers.