

Introduction to Ecosystems

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Key concepts, components, and processes

1. What Is an Ecosystem?

Definition A community of living organisms (plants, animals, microbes) interacting with each other and with their non-living (abiotic) environment, forming a functional unit.

Scope Can be as small as a puddle or as large as a biome (e.g., a rainforest).

Main Idea Energy flows through the system while matter cycles within it.

2. Major Components

Component	Description	Examples
Biotic (living)	All organisms that occupy the ecosystem.	Producers (grass), consumers (deer), decomposers (fungi)
Abiotic (non-living)	Physical and chemical factors that influence life.	Sunlight, temperature, water, soil, minerals, atmospheric gases
Habitat	The physical place where a species lives.	Forest canopy, riverbed, coral reef
Niche	The role an organism plays (its "job") – how it obtains energy, reproduces, interacts.	Pollinator (bee), top predator (wolf)

3. Energy Flow

1. Solar Energy ? Primary Production

- *Producers* (photosynthetic plants, algae, some bacteria) capture sunlight and convert it to chemical energy (glucose).

2. Trophic Levels

- **1st level – Producers** (autotrophs)
- **2nd level – Primary consumers** (herbivores)
- **3rd level – Secondary consumers** (carnivores that eat herbivores)
- **4th level – Tertiary/Quaternary consumers** (top predators)

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3. Energy Loss

- Only ~10% of energy moves to the next trophic level (the “10% rule”).
- The rest is lost as heat (metabolism, respiration) or used for growth and reproduction.

Visual cue: **Energy pyramid** – broad base (plankton) → narrow tip (apex predator).

4. Matter Cycling

Cycle	Core Process	Key Participants
Carbon Cycle	Photosynthesis (CO ₂ → organic C) ? Respiration, decomposition (organic C → CO ₂)	Plants, animals, microbes, oceans
Nitrogen Cycle	Nitrogen fixation ? Nitrification ? Assimilation ? Ammonification ? Denitrification	Legume bacteria, nitrifying bacteria, fungi, plants
Water (Hydrologic) Cycle	Evaporation ? Condensation ? Precipitation ? Runoff ? Infiltration	All organisms (transpiration), atmosphere, soils
Phosphorus Cycle	Weathering ? Uptake ? Decomposition ? Sedimentation	Plants, animals, soils, sediments (no atmospheric phase)

Important: Matter is **recycled**, not lost; energy is **flowing** and eventually dissipates as heat.

5. Types of Ecosystems

Category	Scale	Typical Characteristics
Terrestrial	Land-based	Forests, grasslands, deserts, tundra
Aquatic	Water-based	Freshwater (lakes, rivers), marine (oceans, coral reefs)
Artificial / Managed	Human-influenced	Agricultural fields, urban parks, reservoirs
Micro-ecosystems	Very small	Pond micro-habitat, leaf