

VAC-151(EVS), FYUG 2ND SEM

Dr. Manash Dey

Date: 13-03-2026

1. Energy Flow in an Ecosystem

Energy flow refers to the transfer of energy from one trophic level to another in an ecosystem through food relationships. The primary source of energy for most ecosystems is the Sun.

Flow of Energy:

Sun → Producers → Primary Consumers → Secondary Consumers → Tertiary Consumers
→ Decomposers

Key Points:

1. Energy flow is unidirectional.
2. Energy cannot be recycled unlike nutrients.
3. Most energy is lost as heat at each trophic level.

10% Law:

Only about 10% of energy is transferred to the next trophic level.

Example:

Producers – 1000 kcal
Primary consumers – 100 kcal
Secondary consumers – 10 kcal
Tertiary consumers – 1 kcal

2. Food Chain

A food chain is a linear sequence of organisms where each organism is eaten by the next organism.

Types of Food Chain:

1. **Grazing Food Chain:**
Starts with green plants.
Example: Grass → Grasshopper → Frog → Snake → Hawk
2. **Detritus Food Chain:**
Starts with dead organic matter.

Example:

Dead leaves → Earthworm → Bird → Hawk

Trophic Levels:

1. Producers
2. Primary consumers
3. Secondary consumers
4. Tertiary consumers

3. Food Web

A food web is a network of interconnected food chains within an ecosystem.

Example:

Grass → Grasshopper → Frog

Grass → Rabbit → Fox

Grasshopper → Bird → Hawk

Importance:

1. Provides stability to ecosystems
2. Organisms have multiple food sources
3. Prevents ecosystem collapse if one species disappears

4. Ecological Pyramids

Ecological pyramids represent the structure of trophic levels in terms of number, biomass or energy.

Types:

1. Pyramid of Numbers:
Shows the number of organisms at each trophic level.
2. Pyramid of Biomass:
Shows the total mass of organisms at each trophic level.
3. Pyramid of Energy:
Shows energy transfer at each trophic level.
This pyramid is always upright.

5. Ecological Succession

Ecological succession is the gradual and predictable change in species composition in an area over time.

Types:

Primary Succession:

Occurs in areas where life never existed before.

Example: bare rocks, volcanic lava.

Secondary Succession:

Occurs in areas where life previously existed but was disturbed.

Example: forest fire, flood.

Stages of Succession:

1. Nudation – Formation of a bare area without life due to disturbances such as volcanic eruptions, floods, landslides, or glacier retreat.
2. Invasion – Arrival and establishment of species in the bare area through migration, ecesis (establishment), and aggregation (increase in population). Example: lichens growing on bare rocks.
3. Competition and Co-action – Organisms compete for resources such as sunlight, water, nutrients, and space.
4. Reaction – Organisms modify the environment (e.g., soil formation, increased organic matter), making it suitable for other species.
5. Stabilization (Climax Community) – A stable and balanced community is formed that remains relatively unchanged unless disturbed.

Example: Bare rock → Lichens → Mosses → Grasses → Shrubs → Trees

6. Nutrient Cycles

Nutrient cycles (biogeochemical cycles) involve the circulation of nutrients between organisms and the environment.

Two major cycles are Carbon Cycle and Nitrogen Cycle.

Carbon Cycle

The carbon cycle is the movement of carbon between the atmosphere, organisms, oceans and soil.

Major Processes:

1. Photosynthesis – Plants absorb CO_2
2. Consumption – Animals eat plants
3. Respiration – CO_2 released back to the atmosphere
4. Decomposition – Dead organisms release carbon
5. Combustion – Burning fossil fuels releases CO_2

Nitrogen Cycle

Nitrogen cycle is the circulation of nitrogen between atmosphere, soil and living organisms.

Steps:

1. Nitrogen Fixation – Conversion of atmospheric nitrogen to ammonia
2. Nitrification – Ammonia converted to nitrites and nitrates
3. Assimilation – Plants absorb nitrates
4. Ammonification – Decomposition releases ammonia
5. Denitrification – Nitrates converted back to nitrogen gas

7. Major Ecosystems

Two major ecosystems discussed here are Forest (Terrestrial) and Pond (Aquatic).

Forest Ecosystem (Terrestrial)

A forest ecosystem is a terrestrial ecosystem dominated by trees and woody vegetation.

Components:

Abiotic Components:

1. Sunlight
2. Temperature
3. Water
4. Soil
5. Minerals

Biotic Components:

Producers – Trees, shrubs, grasses
Consumers – Deer, insects, tiger, fox
Decomposers – Bacteria and fungi

Pond Ecosystem (Aquatic)

A pond ecosystem is a freshwater ecosystem with still water.

Zones of Pond:

1. Littoral Zone – shallow region near shore
2. Limnetic Zone – open water region
3. Profundal Zone – deep water region

Components:

Producers – Phytoplankton, algae, aquatic plants
Consumers – Zooplankton, fish, frogs, insects
Decomposers – Bacteria and fungi

Example Food Chain: Phytoplankton → Zooplankton → Small Fish → Large Fish → Birds