

4. Ecosystem Dynamics

BVES-151: Environmental Studies

Unit 1: Fundamentals of Environmental Science and Ecology

Topic: Ecosystem Dynamics

□ What is an Ecosystem?

An **ecosystem** is a community of **living organisms (plants, animals, microorganisms)** interacting with their **non-living environment (soil, water, air, sunlight)**.

Examples:

- Forests
- Oceans
- Rivers and lakes
- Grasslands
- Deserts

□ What are Ecosystem Dynamics?

Ecosystem Dynamics refer to the continuous processes and interactions within ecosystems, involving energy flows, nutrient cycling, and species interactions.

Understanding these dynamics helps us appreciate how ecosystems maintain their balance and adapt to changes.

□ Key Components of Ecosystem Dynamics

Ecosystem dynamics include these main processes:

1. Energy Flow

- Energy moves through ecosystems via **food chains and food webs**.
- Begins with **producers** (plants), then to **consumers** (animals), and ends with **decomposers** (fungi, bacteria).

Example of a simple food chain:

Grass (Producer) → Deer (Herbivore) → Tiger (Carnivore) → Bacteria (Decomposer)

2. Nutrient Cycling

- Nutrients (carbon, nitrogen, water, phosphorus) continually recycle through ecosystems.
- Plants absorb nutrients from soil; animals consume plants; decomposers break down dead organisms, returning nutrients to the soil.



Example of nutrient cycling (Carbon Cycle):

- Plants absorb CO₂ → animals eat plants → animals breathe out CO₂ → dead organisms decay releasing carbon back to soil/air.

3. Population Dynamics

- Changes in number and types of organisms due to births, deaths, migration, and environmental factors.
- Populations grow or shrink based on resources and competition.

4. Species Interactions

- Relationships among species influence ecosystem stability.
- Types of interactions:
 - **Predation:** predator eats prey (lion-deer)
 - **Competition:** species compete for resources (plants for sunlight)
 - **Mutualism:** both species benefit (bees-flowers)
 - **Parasitism:** one benefits, other harmed (mosquito-human)

□ Factors Influencing Ecosystem Dynamics

Biotic factors (living things):

- Plants, animals, microorganisms, predators, diseases.

Abiotic factors (non-living things):

- Water, soil quality, sunlight, temperature, climate change.

□ Ecological Succession

Succession describes the gradual changes in species composition over time after disturbances.

Two types:

1. **Primary Succession**
 - Begins on bare rock or land without previous life (volcanic island).
 - Starts with moss/lichens → grasses → shrubs → trees.
2. **Secondary Succession**
 - Occurs in areas disturbed but still contain soil (forest after wildfire).
 - Faster recovery as soil nutrients are already present.

□ Human Impact on Ecosystem Dynamics

Human activities can significantly alter ecosystem balance, including:

- **Deforestation:** reduces habitats and biodiversity.
- **Pollution:** damages air, water, and soil quality.
- **Climate Change:** disrupts temperature, rainfall, species distribution.
- **Overfishing/Overhunting:** disrupts food webs and population balances.



♻️ Importance of Maintaining Ecosystem Dynamics

Balanced ecosystems:

- Support life by providing oxygen, clean water, food.
- Regulate climate and recycle nutrients.
- Provide economic benefits (fishing, farming, tourism).
- Improve health and quality of life.

📌 Actions to Protect Ecosystem Dynamics

- Practice conservation (save water, energy).
- Avoid single-use plastics, recycle and reuse.
- Plant native trees and protect wildlife habitats.
- Educate others about ecological responsibility.

📌 Quick Self-Check Questions

1. Define ecosystem dynamics in simple terms.
2. Explain the difference between primary and secondary succession.
3. Give an example of a food chain.
4. Why is nutrient cycling important in ecosystems?
5. List two human activities that negatively affect ecosystems.

📌 Summary of Ecosystem Dynamics

- **Ecosystem dynamics** include energy flow, nutrient cycling, population changes, and species interactions.
- Balanced ecosystems ensure sustainability and survival of all species, including humans.
- Human activities influence these dynamics greatly; responsible actions help protect ecosystems for future generations.