

Introduction to Ecology

Introduction to Ecology – Study Notes

1. What Is Ecology?

- **Definition:** The scientific study of how organisms interact with each other and with their physical environment.
 - **Scope:** Ranges from tiny microbes in a drop of water to the entire biosphere.
 - **Key Question:** *How do living things depend on, affect, and are affected by their surroundings?*
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2. Levels of Ecological Organization

Level	Description	Example
Organism	Individual living entity.	A single oak tree.
Population	Group of individuals of the same species living in a defined area.	All white-tailed deer in a forest.
Community	All populations (multiple species) interacting in a location.	Forest understory plants, insects, birds, and mammals.
Ecosystem	Community + abiotic (non-living) components (soil, water, climate).	A lake with its fish, algae, plankton, and surrounding shoreline.
Biome	Large geographic region with characteristic climate and life forms.	Temperate deciduous forest, tropical rainforest.
Biosphere	Sum of all ecosystems on Earth.	The global network of life and its habitats.

3. Fundamental Ecological Concepts

Concept	Meaning	Typical Indicator
Habitat	Physical place where a species lives.	Soil type, water depth, temperature.
Niche	The role a species plays (resource use, behavior, interactions).	Predator-prey dynamics, pollination.

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Concept	Meaning	Typical Indicator
Energy Flow	Unidirectional transfer of energy through trophic levels.	Sun ? producers ? herbivores ? carnivores ? decomposers.
Matter Cycling	Re?use of elements (C, N, P, etc.) via biogeochemical cycles.	Carbon cycle: photosynthesis ? respiration.
Carrying Capacity (K)	Maximum population size an environment can sustain long?term.	Logistic growth curve.
Succession	Sequential change in community composition after disturbance.	Primary (bare rock ? lichens ? forest) vs. secondary (post?fire regrowth).
Disturbance	Event that alters ecosystem structure (natural or human?caused).	Storm, wildfire, logging.

4. Energy in Ecosystems

1. Primary Production

- *Gross Primary Production (GPP)*: total solar energy captured by photosynthesis.
- *Net Primary Production (NPP)*: GPP minus plant respiration; energy available to herbivores.

2. Trophic Levels

- **Producers (autotrophs)** – plants, algae, some bacteria.
- **Primary Consumers** – herbivores.
- **Secondary/Tertiary Consumers** – carnivores, omnivores.
- **Decomposers** – fungi, bacteria, detritivores.

3. Energy Efficiency

- Approx. **10?% rule**: only ~10?% of energy passes to the next trophic level; the rest lost as heat, waste, or used for metabolism.

4. Ecological Pyramids

- **Pyramid of Energy** (most reliable).
- **Pyramid of Biomass** (varies with ecosystem type).

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- **Pyramid of Numbers** (may be inverted in some marine systems).
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5. Matter Cycling (Biogeochemical Cycles)

| Cycle | Main Processes |