Ecology

Ecology comes from the Greek words *oikos* (home) and *logos* (study).
In simple terms, it examines how living organisms interact with one another and with the physical environment around them. It covers everything—from an individual plant or animal to the functioning of the entire biosphere.

Levels of Ecological Organisation

1. Individual / Organism

This is the basic unit of ecological study. It refers to a single living being that can function on its own.

2. Species

A species is a group of similar organisms capable of interbreeding and producing fertile offspring.
Example: *Homo sapiens*.

3. Population

A population consists of individuals of the **same species** living in a specific area at a given time. Its size changes depending on birth, death, immigration, and emigration.

Pugmark studies for tigers can identify:

- Which species are present
- Individual animals
- Sex and age
- Population size

4. Community

A community is made up of populations of different species living and interacting together. Communities are usually named after the dominant plant type—like grasslands dominated by grasses.

- **Major communities** are large, self-sustained (e.g., tropical evergreen forest).
- **Minor communities** depend on neighbouring communities (e.g., lichens growing on cow dung).

5. Ecosystem

An ecosystem consists of a community interacting with its physical surroundings.
Energy flow and nutrient cycling are its key processes.

6. Biome

A biome is a large ecological region with distinct climate and typical plant and animal life, like tundra, deserts, or rainforests.

7. Biosphere

The biosphere includes all life on Earth along with the organic matter produced by it.

Principles of Ecology

Principle	Meaning	Key Examples
Adaptation	Traits that help organisms survive in a specific environment.	Desert plants with thick cuticle, Opuntia spines; Kangaroo rat water conservation; Allen's Rule (short limbs in cold regions).
Variation	Differences among individuals due to genetic changes or environmental factors.	Skin colour, hair type, eye colour, and blood groups.
Adaptive Radiation	One ancestral species evolves into many species to occupy different niches.	Darwin's finches, Australian marsupials.
Speciation	Formation of new species when populations become reproductively isolated.	Allopatric speciation due to mountains, rivers, and oceans.
Mutation	A sudden change in DNA introduces new genes.	Point mutations that create new traits.
Recombination	New gene combinations are formed during sexual reproduction.	Genetic mixing during meiosis and fertilisation.
Natural Selection	The environment selects individuals with advantageous traits to survive and reproduce.	Peppered moth example: fitter organisms leave more offspring.
Evolution	Long-term changes in populations give rise to new species.	Neo-Darwinism combines genetics + natural selection.
Acclimatisation	Short-term reversible changes within an individual organism.	Increased RBC count at high altitude; rapid breathing.
Extinction	The disappearance of species when they cannot adapt to environmental change.	Ongoing 6th mass extinction (anthropogenic).

MCQs

1. Which sequence shows the correct order of ecological levels of organisation?

A. Community → Population → Ecosystem → Biosphere
B. Organism → Population → Community → Ecosystem
C. Population → Community → Organism → Ecosystem
D. Organism → Community → Population → Ecosystem

Correct Answer: B

2. Which of the following is correctly matched?

A. Population – Interacting species in an area
B. Community – Interacting populations of different species
C. Ecosystem – Biotic and Abiotic components
D. Organism – Highest level of ecological organisation

Correct Answer: B and C