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CHAPTER NOTES

Our Environment Class 10 Notes | CBSE Chapter 13 Science

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Our Environment Class 10 Notes | CBSE Chapter 13 Science

Our Environment is Chapter 13 of CBSE Class 10 Science. This chapter explains how ecosystems work — the flow of energy through food chains and food webs, the cycling of nutrients, and how human activities like waste disposal and the use of harmful chemicals damage the environment. It also covers the ozone layer and its depletion.

This chapter carries 3–5 marks in board exams. Food chains, food webs, the 10% energy rule, biodegradable vs non-biodegradable waste, and ozone depletion are the most frequently tested topics.

Key Concepts

1. Ecosystem

An **ecosystem** is a self-sustaining system where living organisms (biotic components) interact with each other and with the non-living environment (abiotic components).

Components of an Ecosystem

Component	Examples
Abiotic (non-living)	Sunlight, temperature, water, air, soil, minerals
Biotic (living)	Plants, animals, microorganisms (producers, consumers, decomposers)

Types of Ecosystems

- **Natural:** Forest, pond, lake, ocean, grassland, desert
- **Artificial (man-made):** Garden, crop field, aquarium

2. Producers, Consumers, and Decomposers

Category	Also Called	What They Do	Examples
Producers	Autotrophs	Make their own food using sunlight (photosynthesis)	Green plants, algae, phytoplankton
Consumers	Heterotrophs	Cannot make their own food; depend on others	Animals, humans, insects
Decomposers	Saprotrophs	Break down dead organisms and waste into simple substances	Bacteria, fungi

Types of Consumers

Type	Also Called	What They Eat	Examples
Primary consumers	Herbivores	Plants (producers)	Deer, rabbit, grasshopper, cow
Secondary consumers	Small carnivores	Herbivores	Frog, snake, small fish
Tertiary consumers	Top carnivores	Secondary consumers	Eagle, lion, shark
Omnivores	—	Both plants and animals	Humans, bear, crow

3. Food Chain

A **food chain** is a linear sequence showing who eats whom in an ecosystem. Energy flows from one organism to the next.

Example (Grassland food chain):

Grass → Grasshopper → Frog → Snake → Eagle

(Producer → Primary consumer → Secondary consumer → Tertiary consumer → Top consumer)

Example (Aquatic food chain):

Phytoplankton → Zooplankton → Small fish → Large fish → Shark

Each step in the food chain is called a trophic level:

Trophic Level	Organisms
1st (T_1)	Producers (plants)
2nd (T_2)	Primary consumers (herbivores)
3rd (T_3)	Secondary consumers (small carnivores)
4th (T_4)	Tertiary consumers (top carnivores)

Food chains are generally short — usually 3–4 trophic levels — because energy is lost at each level.

4. Food Web

In nature, organisms eat more than one type of food and are eaten by more than one predator. This creates interconnected food chains called a **food web**.

A food web is more stable than a single food chain because if one organism disappears, others can still find alternative food sources.

5. Flow of Energy in an Ecosystem

The Sun is the **ultimate source of energy** for almost all ecosystems.

The 10% Law (Lindeman's Law)

Only **10% of the energy** at one trophic level is transferred to the next trophic level. The remaining 90% is used by the organism for its own life processes (respiration, movement, growth) or lost as heat.

Example: If plants capture 10,000 J of energy from the sun:

Trophic Level	Energy Available
Producers (plants)	10,000 J
Primary consumers (herbivores)	1,000 J (10%)
Secondary consumers (carnivores)	100 J (10% of 1000)
Tertiary consumers (top carnivores)	10 J (10% of 100)

Key points:

- Energy flow is **unidirectional** — it flows only from lower to higher trophic levels (never backwards)
- Energy is not recycled in an ecosystem (unlike nutrients)

- This is why food chains rarely have more than 4–5 trophic levels — too little energy reaches the top
 - Producers always have the maximum energy; top carnivores have the least
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6. Biological Magnification (Biomagnification)

Biological magnification is the increase in concentration of harmful, non-biodegradable chemicals (like pesticides) at each successive trophic level in a food chain.

Example with DDT (a pesticide):

Water (very low DDT) → Phytoplankton (small amount) → Zooplankton (more) → Small fish (even more) → Large fish (high concentration) → Fish-eating birds (highest concentration)

Why does this happen?

- Non-biodegradable chemicals are not broken down or excreted by organisms
- They accumulate in the body (especially in fat tissue)
- At each trophic level, an organism eats many organisms from the level below, concentrating the chemicals further
- Top predators end up with the highest concentration

Consequences: DDT caused egg-shell thinning in birds, nearly driving some species (like bald eagles) to extinction. Humans, as top consumers, are also at risk.

7. Waste and Its Management

Biodegradable vs Non-biodegradable Waste

Feature	Biodegradable	Non-biodegradable
Definition	Can be broken down by biological processes (decomposers)	Cannot be broken down by biological processes
Examples	Food waste, paper, cotton, wood, cow dung, dead leaves	Plastic, polythene, glass, aluminium cans, DDT, radioactive waste
Decomposition time	Days to months	Hundreds to thousands of years (or never)
Environmental impact	Generally safe; can be composted	Pollutes land and water; harms animals (e.g., plastic ingestion)

Problems Caused by Non-biodegradable Waste

- Soil pollution — plastics prevent water absorption

- Water pollution — chemicals leach into groundwater
 - Harm to animals — plastic bags choke animals; microplastics enter food chains
 - Biomagnification of pesticides and heavy metals
 - Clogging of drains → flooding
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8. The Ozone Layer

Ozone (O₃) is a molecule made of three oxygen atoms. It forms a layer in the upper atmosphere (stratosphere, 15–35 km above Earth).

Importance of the Ozone Layer

The ozone layer absorbs harmful **ultraviolet (UV) radiation** from the sun, preventing it from reaching the Earth's surface. Without it, UV radiation would cause:

- Skin cancer and sunburn
- Cataracts (eye damage)
- Weakened immune system
- Damage to crops and aquatic ecosystems

Ozone Depletion

Human-made chemicals called **CFCs (Chlorofluorocarbons)** — used in refrigerators, air conditioners, aerosol sprays, and foam — are the main cause of ozone depletion.

How CFCs destroy ozone:

1. CFCs rise to the stratosphere
2. UV radiation breaks down CFCs, releasing chlorine atoms
3. Each chlorine atom destroys thousands of ozone molecules in a chain reaction
4. $\text{Cl} + \text{O}_3 \rightarrow \text{ClO} + \text{O}_2$ (ozone destroyed)

Ozone hole: Severe depletion of the ozone layer, first discovered over Antarctica in 1985.

UNEP and the Montreal Protocol (1987)

The **United Nations Environment Programme (UNEP)** led efforts to phase out CFCs and other ozone-depleting substances. The **Montreal Protocol** was signed in 1987 — an international agreement to stop production of CFCs. This has been largely successful, and the ozone layer is slowly recovering.

Important Definitions

Term	Definition
Ecosystem	A self-sustaining system of living organisms interacting with each other and their non-living environment
Producer	Organism that makes its own food through photosynthesis (autotroph)
Consumer	Organism that depends on other organisms for food (heterotroph)
Decomposer	Organism that breaks down dead matter and waste into simple substances
Food chain	Linear sequence showing the transfer of food energy from one organism to another
Food web	Network of interconnected food chains in an ecosystem
Trophic level	Position of an organism in a food chain (1st = producer, 2nd = herbivore, etc.)
10% law	Only 10% of energy at one trophic level is passed to the next level
Biological magnification	Increase in concentration of non-biodegradable chemicals at higher trophic levels
Biodegradable	Substances that can be broken down by biological processes (bacteria, fungi)
Non-biodegradable	Substances that cannot be broken down by biological processes
Ozone layer	Protective layer of O ₃ in the stratosphere that absorbs harmful UV radiation
CFC	Chlorofluorocarbons — synthetic chemicals that destroy the ozone layer

Solved Examples (NCERT-Based)

Example 1

If 10,000 J of energy is available at the producer level, how much energy will be available to the secondary consumer?

Answer: Using the 10% law: Producer → 10,000 J; Primary consumer → 10% of 10,000 = 1,000 J; Secondary consumer → 10% of 1,000 = **100 J**.

Example 2

Why is the flow of energy in an ecosystem unidirectional?

Answer: Energy flows from producers to consumers (herbivores → carnivores) but cannot flow in the reverse direction. At each trophic level, most energy (90%) is lost as heat during respiration, movement, and other life processes. The energy

that is used up as heat cannot be re-used by the organisms at lower trophic levels. Therefore, energy moves only from lower to higher trophic levels — it is a one-way flow.

Example 3

What is biological magnification? Explain with an example.

Answer: Biological magnification is the progressive increase in concentration of non-biodegradable toxic chemicals at each trophic level of a food chain. For example, when pesticides like DDT are sprayed on crops, they enter water bodies through rain. Phytoplankton absorb small amounts. Zooplankton eat many phytoplankton, accumulating more DDT. Small fish eat many zooplankton, getting even higher concentrations. Large fish and birds at the top accumulate the highest levels. This is why top predators like eagles suffered from DDT-induced egg-shell thinning.

Example 4

Why should we reduce the use of plastic bags? Give three reasons.

Answer: (1) Plastic is non-biodegradable — it persists in the environment for hundreds of years, polluting land and water. (2) Animals often mistake plastic for food — cows, turtles, and marine animals choke or die from plastic ingestion. (3) Burning plastic releases toxic gases that pollute the air and cause respiratory problems. Additionally, plastic bags clog drains, leading to waterlogging and flooding in cities.

Important Questions for Board Exams

1-Mark Questions

1. What is the 10% law of energy transfer?
2. Name one non-biodegradable pollutant that causes biomagnification.
3. What is the role of decomposers in an ecosystem?
4. Which chemical is mainly responsible for ozone depletion?
5. What is the ultimate source of energy in most ecosystems?

2-Mark Questions

1. Differentiate between biodegradable and non-biodegradable waste with examples.
2. What are the harmful effects of ozone depletion?
3. Why are food chains generally short (3–4 levels)?
4. What is a food web? Why is it more stable than a food chain?
5. Give an example of a food chain with four trophic levels.

3-Mark Questions

1. Explain the 10% law with a suitable example. Why is energy flow unidirectional?
2. What is biological magnification? How does it affect organisms at the top of the food chain?
3. What is the importance of the ozone layer? How is it being depleted? What steps have been taken to protect it?
4. What are the components of an ecosystem? Explain the role of producers, consumers, and decomposers.
5. Why is improper disposal of waste a major environmental concern? Suggest three ways to manage waste.

5-Mark Questions

1. What are food chains and food webs? Explain the flow of energy in an ecosystem with a diagram. Why do food chains rarely have more than 4 trophic levels?
 2. What is the ozone layer? Explain its importance and the causes of its depletion. What is the Montreal Protocol?
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Quick Revision Points

- Ecosystem = biotic (living) + abiotic (non-living) components interacting together
 - Producers (plants) → Primary consumers (herbivores) → Secondary consumers → Tertiary consumers
 - Decomposers (bacteria, fungi) break down dead matter → return nutrients to soil
 - Food chain: linear energy flow; Food web: interconnected chains (more stable)
 - 10% law: only 10% energy passes to next trophic level; 90% lost as heat
 - Energy flow is unidirectional (one-way); nutrients are recycled
 - Biological magnification: non-biodegradable chemicals concentrate up the food chain
 - Biodegradable waste: broken down by decomposers (food, paper, wood)
 - Non-biodegradable waste: cannot be broken down (plastic, glass, DDT)
 - Ozone (O₃) layer: stratosphere; absorbs harmful UV radiation
 - CFCs from refrigerators/ACs destroy ozone → ozone hole (Antarctica)
 - Montreal Protocol (1987): international agreement to phase out CFCs
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Previous Chapter: Chapter 12 — Magnetic Effects of Electric Current

Next Chapter: Chapter 14 — Sustainable Management of Natural Resources



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