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UNIT I

Environment and Its Issues

Topics Covered

- a) Meaning, Types and Components of Environment
- b) Man–Environment Relationship and Importance of Environment
- c) Need for Public Awareness
- d) Ecosystem — Meaning and Major Components
- e) Case Studies: Forest, Grassland, Desert and Aquatic Ecosystems
- f) Stability of Ecosystem in Sustainable Environment

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A. Environment — Meaning, Types and Components

1. Meaning of Environment

The word “Environment” comes from the French word “Environner”, which means “to surround” or “to encircle”. In simple words, environment means everything that surrounds us — living and non-living things together — and affects our life and growth.

Easy Definition:

Environment = Sum total of all physical, chemical, biological and social factors that surround an organism and influence its life, growth, behaviour and survival.

In short: Whatever is around us — air, water, soil, plants, animals, sunlight, even other humans and society — together forms our environment.

2. Types of Environment

Environment is broadly divided into two main types:

- **1. Natural Environment:** Made by nature itself, without any human interference. It includes air, water, land, sunlight, plants, animals, mountains, rivers, forests, etc.
- **2. Man-made (Artificial) Environment:** Created by human beings to fulfil their needs and comforts. It includes buildings, roads, factories, vehicles, dams, bridges, cities, etc.

Natural Environment is further divided into:

- **a) Physical (Abiotic) Environment:** Non-living components like air (atmosphere), water (hydrosphere), land/soil (lithosphere).
- **b) Biological (Biotic) Environment:** Living components like plants, animals, microorganisms and human beings (biosphere).

Man-made Environment can be further divided into:

- **a) Social Environment:** Customs, traditions, culture, beliefs, religion, social institutions made by humans.
- **b) Economic Environment:** Industries, agriculture, trade, transport, technology developed by human effort.

Type	Example
Natural Environment	Forests, rivers, mountains, sunlight, animals
Man-made Environment	Buildings, roads, dams, factories, vehicles
Physical (Abiotic)	Air, water, soil, climate, minerals

Type	Example
Biological (Biotic)	Plants, animals, micro-organisms, humans

3. Components of Environment

The environment is made up of four major components (spheres). Easy way to remember: A-H-L-B (Air, Hydro, Litho, Bio).

- **1. Atmosphere (Air Envelope):** The layer of gases surrounding the earth, made up of nitrogen (78%), oxygen (21%), carbon dioxide and other gases. It protects life from harmful UV rays and controls temperature.
- **2. Hydrosphere (Water Component):** All water bodies on earth — oceans, seas, rivers, lakes, groundwater, glaciers. About 71% of the earth's surface is covered with water.
- **3. Lithosphere (Land Component):** The solid outer layer of the earth — soil, rocks, mountains, minerals. It supports plant growth and provides land for living.
- **4. Biosphere (Living Component):** The zone of the earth where life exists — includes all living organisms (plants, animals, humans, microorganisms) and their interaction with air, water and land.

Remember Trick:

A (Atmosphere) + H (Hydrosphere) + L (Lithosphere) + B (Biosphere) = Complete Environment. All four components are interconnected and depend on each other.

B. Man-Environment Relationship & Importance of Environment

1. Man-Environment Relationship

Man and environment share a very close, two-way relationship. Since ancient times, humans have depended on the environment for food, water, shelter, air and other resources. At the same time, human activities have continuously changed and shaped the environment.

Stages of Man-Environment Relationship:

- **1. Dependence Stage:** In early times, man was completely dependent on nature for survival — hunting, gathering food, using caves for shelter.
- **2. Domestication Stage:** Man learned agriculture and animal husbandry, started controlling nature to a small extent.
- **3. Exploitation Stage:** With industrialization and population growth, man started exploiting natural resources rapidly — cutting forests, mining, polluting water and air.
- **4. Conservation Stage (Present):** Now humans are realizing the importance of protecting environment and trying to balance development with conservation.

This relationship works in two directions:

- **Environment influences Man:** Climate, natural resources and geography affect human lifestyle, occupation, food habits and culture (e.g., people in cold regions wear warm clothes; people near rivers depend on fishing/farming).
- **Man influences Environment:** Human activities like deforestation, industrialization, urbanization and pollution change the natural environment, often causing damage.

2. Importance of Environment

Environment is essential for the survival and well-being of all living beings. Its importance can be explained under the following points:

- **1. Provides Basic Necessities:** Air to breathe, water to drink, food to eat, and land to live — all come from the environment.
- **2. Source of Natural Resources:** Minerals, fuels, timber, and raw materials for industries come from the environment.
- **3. Maintains Ecological Balance:** Environment supports the food chain, oxygen-carbon dioxide cycle, and water cycle that keep nature balanced.
- **4. Supports Biodiversity:** Provides habitat for millions of plant and animal species, maintaining variety of life on earth.
- **5. Climate Regulation:** Forests, oceans and atmosphere together regulate temperature, rainfall and weather patterns.

- **6. Economic Importance:** Agriculture, fishing, forestry, tourism and many industries are directly dependent on natural environment.
- **7. Health and Well-being:** A clean and healthy environment keeps humans physically and mentally healthy; pollution leads to diseases.
- **8. Aesthetic and Recreational Value:** Natural beauty (mountains, beaches, forests) provides recreation, peace of mind, and tourism opportunities.

C. Need for Public Awareness

Public awareness means making people understand environmental problems and motivating them to take action to protect the environment. Since environmental problems like pollution, deforestation, and climate change affect every person, it is necessary that every citizen is aware and responsible.

Why Public Awareness is Needed:

- **1. Most People are Unaware:** Many people do not know how their daily actions (wasting water, burning waste, using plastic) harm the environment.
- **2. Environmental Problems Affect Everyone:** Pollution, global warming, and resource depletion affect all of society, not just a few people — so collective public action is required.
- **3. Government Alone Cannot Solve Everything:** Laws and policies are effective only when citizens cooperate and follow them voluntarily.
- **4. Prevention is Better than Cure:** Aware citizens can prevent environmental damage before it becomes a big disaster, saving money and lives.
- **5. Sustainable Development:** Public participation is necessary to achieve a balance between development and environment conservation for future generations.
- **6. Changing Habits and Lifestyle:** Awareness encourages people to adopt eco-friendly habits — saving energy, reducing waste, recycling, planting trees.

Methods to Create Public Awareness:

- Education through schools, colleges and environmental studies subjects
- Mass media — television, newspapers, radio, social media campaigns
- NGOs and government environmental programmes (e.g., Swachh Bharat Abhiyan, Van Mahotsav)
- Celebrating environmental days — World Environment Day, Earth Day
- Workshops, seminars, rallies and street plays on environmental issues
- Eco-clubs in schools and colleges encouraging tree plantation and cleanliness drives
- Strict implementation of environmental laws along with public participation

Important Point:

Public awareness is the foundation of environmental protection — without people's cooperation, no law or technology can fully solve environmental problems.

D. Ecosystem — Meaning and Major Components

1. Meaning of Ecosystem

The term “Ecosystem” was first used by A.G. Tansley in 1935. An ecosystem is a community of living organisms (plants, animals, microorganisms) interacting with each other and with their non-living surroundings (air, water, soil, sunlight) in a particular area, exchanging energy and matter.

Easy Definition:

Ecosystem = Living organisms + Non-living environment + their interactions in a specific area, functioning together as a system.

Example: A pond ecosystem includes fish, plants, insects, water, sunlight, and minerals — all interacting together.

2. Major Components of Ecosystem

An ecosystem has two main components:

(I) Abiotic Components (Non-living)

These are the physical and chemical factors of the environment that support life.

- **Climatic factors:** Sunlight, temperature, rainfall, humidity, wind
- **Edaphic factors:** Soil type, minerals, pH, soil texture
- **Inorganic substances:** Water, oxygen, carbon dioxide, nitrogen, minerals
- **Organic substances:** Proteins, carbohydrates, lipids that link living and non-living parts

(II) Biotic Components (Living)

These are all the living organisms in the ecosystem, classified based on how they get their food/energy:

- **1. Producers (Autotrophs):** Green plants and algae that prepare their own food through photosynthesis using sunlight, water and carbon dioxide. They form the base of the food chain.
- **2. Consumers (Heterotrophs):** Organisms that depend on other organisms for food. They are further divided into:
 - Primary Consumers (Herbivores): animals that eat plants directly — e.g., deer, rabbit, cow
 - Secondary Consumers (Carnivores): animals that eat herbivores — e.g., snake, fox
 - Tertiary Consumers (Top Carnivores): animals that eat secondary consumers — e.g., lion, tiger
 - Omnivores: animals that eat both plants and animals — e.g., humans, bears
- **3. Decomposers (Saprotrophs):** Bacteria and fungi that break down dead plants and animals into simple substances, returning nutrients back to the soil. They complete the nutrient cycle.

Component	Sub-type	Example
Abiotic	Climatic / Edaphic / Inorganic	Sunlight, soil, water, air
Biotic — Producers	Autotrophs	Green plants, algae
Biotic — Consumers	Herbivore / Carnivore / Omnivore	Deer, lion, humans
Biotic — Decomposers	Saprotrophs	Bacteria, fungi

3. Functions of Ecosystem

- Energy Flow: Energy flows from sun → producers → consumers → decomposers (one-directional)
- Nutrient Cycling: Nutrients move in a cycle between living organisms and the environment (carbon cycle, nitrogen cycle, water cycle)
- Food Chain & Food Web: Transfer of energy from one organism to another in a sequence (food chain) or interconnected network (food web)
- Ecological Balance: Maintains a stable balance between different organisms and their environment

E. Case Studies of Ecosystems

Let us study four major types of natural ecosystems in detail — their meaning, components and characteristics.

1. Forest Ecosystem

A forest ecosystem is a community of plants (mainly trees) and animals living together in a region with dense tree cover. It is one of the most productive and biodiverse ecosystems on earth.

Components:

- **Abiotic:** Sunlight (limited due to canopy), moderate-to-high rainfall, fertile soil rich in humus, suitable temperature
- **Producers:** Trees (teak, sal, banyan), shrubs, climbers, grasses, ferns
- **Consumers:** Herbivores (deer, elephant, monkey), Carnivores (tiger, leopard), Omnivores (bear)
- **Decomposers:** Fungi, bacteria, earthworms breaking down fallen leaves and dead organisms

Types of Forest Ecosystem:

- Tropical Rainforest — dense, evergreen, very high rainfall (e.g., Amazon, Western Ghats)
- Tropical Deciduous Forest — trees shed leaves in dry season (common in India)
- Temperate Forest — moderate climate, found in hilly regions
- Coniferous Forest — cone-bearing trees like pine, fir, found in cold regions

Importance:

- Largest source of oxygen and carbon dioxide absorption
- Maintains rainfall and regulates climate
- Prevents soil erosion through root systems
- Provides timber, medicinal plants, and habitat for wildlife
- Supports the highest biodiversity among all ecosystems

2. Grassland Ecosystem

A grassland ecosystem is dominated by grasses, with very few trees, found in regions with moderate rainfall — too little for forests but too much for deserts.

Components:

- **Abiotic:** Moderate rainfall (25-75 cm/year), fertile soil, seasonal temperature variation, strong sunlight
- **Producers:** Various grass species, small herbs and shrubs

- **Consumers:** Herbivores (deer, zebra, bison, rabbits, grasshoppers), Carnivores (wolves, lions, foxes)
- **Decomposers:** Bacteria, fungi breaking down dead grass and animal matter

Types:

- Tropical Grasslands (Savanna) — found in Africa, with scattered trees (e.g., African Savanna)
- Temperate Grasslands — found in Asia, North America (e.g., Steppes, Prairies)

Importance:

- Used extensively for cattle grazing and livestock farming
- Provides fertile land suitable for agriculture
- Supports large herbivore populations and their predators
- Helps in soil conservation through grass root systems

3. Desert Ecosystem

A desert ecosystem is found in regions with very low rainfall (less than 25 cm/year), extreme temperatures, and scarce vegetation. Organisms here are specially adapted to survive with very little water.

Components:

- **Abiotic:** Very low rainfall, extreme temperature (very hot days, cold nights), sandy/rocky soil, strong sunlight, low humidity
- **Producers:** Cactus, thorny shrubs, succulent plants that store water (xerophytes)
- **Consumers:** Herbivores (camel, desert rabbit), Carnivores (fox, snakes, scorpions), reptiles and insects adapted to heat
- **Decomposers:** Limited bacteria and fungi due to dry conditions

Adaptations of Desert Organisms:

- Plants have small/no leaves (reduce water loss), thick waxy skin, and deep or widespread roots
- Animals are mostly nocturnal (active at night) to avoid daytime heat
- Animals like camels can survive long periods without water

Importance:

- Supports unique, highly-adapted species not found elsewhere
- Source of minerals and natural resources
- Maintains ecological balance in arid regions

4. Aquatic Ecosystem

An aquatic ecosystem consists of organisms living in water bodies, interacting with their watery environment. It is broadly divided into two types:

- **a) Freshwater Ecosystem:** Found in rivers, lakes, ponds and streams (low salt content)
- **b) Marine Ecosystem:** Found in oceans and seas (high salt content)

Components:

- **Abiotic:** Water, dissolved oxygen, temperature, sunlight penetration, salinity, pH
- **Producers:** Phytoplankton, algae, aquatic plants (hydrilla, water lily)
- **Consumers:** Zooplankton, small fish (primary), bigger fish (secondary), sharks/whales (tertiary)
- **Decomposers:** Aquatic bacteria and fungi that break down dead organic matter in water

Importance:

- Covers about 71% of earth's surface; produces a major part of the world's oxygen (through phytoplankton)
- Source of food (fish, prawns), drinking water, and irrigation
- Supports huge biodiversity including coral reefs, fish, and marine mammals
- Regulates global climate by absorbing carbon dioxide and heat

Ecosystem	Rainfall	Key Producers	Key Consumers
Forest	High	Trees, shrubs	Deer, tiger, monkey
Grassland	Moderate	Grasses	Zebra, lion, bison
Desert	Very low	Cactus, xerophytes	Camel, fox, reptiles
Aquatic	N/A (water body)	Phytoplankton, algae	Fish, whales, prawns

F. Stability of Ecosystem in Sustainable Environment

1. Meaning of Ecosystem Stability

Ecosystem stability refers to the ability of an ecosystem to maintain its structure and function over time, and to return to its original (balanced) state after facing a disturbance like a natural disaster, pollution, or human interference.

Easy Definition:

A stable ecosystem is one where the populations of producers, consumers and decomposers remain balanced, and energy/nutrient flow continues smoothly without major disruption.

2. Characteristics of a Stable Ecosystem

- **1. Resistance:** The ability of an ecosystem to withstand disturbance without changing much.
- **2. Resilience:** The ability of an ecosystem to recover and return to its original state after a disturbance.
- **3. Balance Between Components:** Producers, consumers and decomposers exist in proper proportion, maintaining the food chain.
- **4. Proper Energy Flow:** Energy flows smoothly from sun to producers to consumers without major loss or blockage.
- **5. Nutrient Cycling:** Nutrients (carbon, nitrogen, water) are continuously recycled between living organisms and environment.

3. Factors Affecting Ecosystem Stability

- **a) Biodiversity:** Higher biodiversity (more species) generally makes an ecosystem more stable, as it provides multiple paths for energy flow.
- **b) Human Activities:** Deforestation, pollution, overgrazing, and urbanization disturb ecosystem balance.
- **c) Natural Disasters:** Floods, droughts, earthquakes and forest fires can disturb ecosystem stability temporarily or permanently.
- **d) Climate Change:** Rising temperatures and changing rainfall patterns affect species survival and ecosystem balance.
- **e) Invasive Species:** Non-native species entering an ecosystem can disturb the natural balance by competing with native species.

4. Sustainable Environment — Meaning

A sustainable environment means using natural resources in such a way that they meet the needs of the present generation without compromising the ability of future generations to meet their own needs (as defined in the Brundtland Report, 1987).

5. How Ecosystem Stability Supports Sustainability

- A stable ecosystem ensures continuous supply of clean air, water and food resources
- Maintains biodiversity, which is essential for long-term ecological balance
- Reduces the risk of natural disasters like floods and soil erosion
- Supports agriculture and economic activities dependent on natural resources
- Helps regulate climate and reduces the impact of global warming

6. Measures to Maintain Ecosystem Stability and Sustainability

1. Afforestation and reforestation — planting more trees to restore forest cover
2. Controlling pollution — air, water and soil pollution through proper waste management
3. Sustainable use of resources — using renewable energy and avoiding overexploitation
4. Biodiversity conservation — protecting endangered species and their habitats
5. Promoting public awareness and environmental education
6. Strict implementation of environmental laws and policies
7. Adopting eco-friendly technologies and reducing carbon footprint

Key Takeaway:

A stable ecosystem is the foundation of a sustainable environment. Protecting biodiversity, controlling pollution, and using resources wisely today ensures that future generations also have a healthy planet to live on.

— End of Unit I —

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