Chapter

8

Our Environment

Our Environment

- The team 'ecosystem' was introduced by Tansley in 1935.

Ecosystem

- An ecosystem may be defined as a structural and functional unit of the biosphere comprising living organisms and their non-living environment that interact by means of food chains and chemical cycles resulting in energy-flow, biotic diversity and material cycling to form a stable, self s upporting system.

Types of Ecosystem (Based on Nature)

- **Natural Ecosystem :** These ecosystems operate in the nature by themselves without any human interference. Common examples of natural ecosystem are : a pond, a lake, a meadow, a desert, a grassland, a forest, an ocean etc.
- **Artificial Ecosystem :** These are maintained by man and hence are also termed man-made or man-engineered ecosystems. In these ecosystems, man maintain/distrubs the natural balance by the addition of energy and planned manipulations.
- Common examples of artificial ecosystems are croplands, orchords, garden, aquarium etc.

Types of Ecosystem on Based Duration (Time Period)

1. **Temporary Ecosystem :**

   These are short lived ecosystems whcih may be natural or man-made. Common examples include rainfed pond and laboratory culture of protozoans.

2. **Permanent Ecosystems**

   These are self-supporting natural ecosystems that maintain themselves for relatively long duration. e.g. a lake, a forest, a desert etc.

Types of Ecosystem on Based Size

1. **Small Ecosystems :** Small sized ecosystems are also termed microecosystems e.g. a flowerpot, water in a dish, a site under a stone etc.
2. **Large Ecosystems :** Very large sized ecosystems are also termed microecosystems. e.g. an ocean, a forest, a desert etc.

Components of Ecosystem

- The various components of any ecosystem may be grouped into two main types :

A. Abiotic (non-living) components :

1. **Inorganic Substances :** These occur either in the form of co mpounds dissolved in waer in the soil or in free state in the air. e.g. carbon, nitrogen, oxygen, calcium etc.

2. **Organic Compounds :** These include carbohydrates, proteins, lipids, nucleic acids etc. These are present in living organisms and dead organic matter. The dead organic matter is broken down by the action of decomposers (e.g. bacteria fungi of decay) into inorganic substances for their recycling.

3. **Climate Factors :** These include light, temperature, humidity, wind, rainfall, water etc.

B. **Biotic (living) Components :** The living organisms present in an ecosystem from the biotic component.

1. **Produces :** Plants $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

2. **Consumers :**

(i) **Primary** or **First order consumers :** e.g. cattle, desert, goat, rabbit, rat etc.

(ii) **Secondary** or **Second order consumers :** Which eat flesh e.g. cats, dogs, foxes etc.

(iii) **Tertiary** or **Thirder order consumers :** Depend upon secondary consumers e.g. large fish, wolves, snakes etc.

(iv) **Quaternary** or **Fourth order consumers :** Depend upon tertiary consumers. e.g. Tigers, Lions and eagles/hawks.

3. **Decomposers (reduces) :** These include bacteria and fungi of decay. They obtain food from the organic materials of dead produces. e.g. plants, and consumers (e.g. animals) and their waste products.

Autotrophs		Heterotrophs	
(i)	They are produces organisms	(i)	They are consumer organisms
(ii)	These prepare their organic nutrient themselves	(ii)	These do not prepare organic nutrients themselves
(iii)	These get inorganic materials from outside	(iii)	These get both organic and inorganic materials from outside
(iv)	Obtain energy from sunlight or inorganic chemical reactions	(iv)	Obtain energy from organic nutrients.
(v)	They usually add O_2 to the environment	(v)	These add CO_2 to the environment
(vi)	These include plants and blue green algae	(vi)	These include animals, many protists, bacteria and fungi of decay
(vii)	They constitute the first trophic level	(vii)	They belong to second and higher tropic level

Food Chains

- The sequential interlinkng of organisms involving transfer of food energy from the producers, through a series of organisms with re peated eating and being eaten is called the food chains.

Length of Food Chains

- In ecosystems, different food chains may have two, three, four or maximum five trophic levels. A food chain may end at the (i) herbivore (primary consumer) level, (ii) primary caenivore (secondary

consumer) level, (iii) secondary caenivore (teritary consumer) level or (iv) tertiary caenivore (quarternary consumer) level.

Trophic Levels

- The distinct sequential ste ps in the food chain where transfer of energy occurs are referred to as different trophic level.

  For example **:** (i) Green Plants (producers) forms the first trophic level- the producer level.

  (ii) The plant eaters (herbivores), also called primary consumers, belong to second trophic level. The primary consumer level.

  (iii) and the flash eaters (carnivores), also called secondary. consumers, represent the third consumer level - the secondary consumer level and so on.

- Always remember that the quantum of available energy in a food chain successively gets decreased at each trophic level as a result of waste of energy as heat. This phenomenon (loss of energy at successive trophic levels) restricts the size of food chain in an ecosystem to maximum of 4 to 5 steps.

Bacteristics of Food Chain

- A food chain involves a nutritive interaction between the living organisms (biotic components) of an ecosystem. In a food chain, there occurs repeated eating, i.e. each group eats the other group and subsequently is eaten by some other gro up of organisms.
- A food chain is always straight and proceeds in a progressive straight line.
- In a food chain, there is undirectional flow of energy from sun to produces and subsequently to series of different types of consumers.
- Usually, there are 3 or 4 trophic levels in the food chain. In few chains, there may be maximum of 5 trophic levels.
- Some organisms are (**Omnivores**). These occupy different trophic positions in different fod chains.
- At each transfer, generally 80-90% of energy is lost as heat in accordance with second law of thermodynamics.

Food Webs

- Food webs is a network of food chains which become interconnected at various trophic levels so as to form a number of feeding connections amongst different organisms of a biotic community.

Characteristics of Food Webs

- Unlike food chains, food web are never straight. Instead, each food web is formed by interlinking of food chains.
- A food web provides alternative pathways of food availability. For example, if a particular species of producers is destroyed by a disease in the ecosystem, the herbivores of that area can feed on other species of producers.
- Greater alternatives available in a food web make the ecosystem more stable.

- Food webs also help in checking the overpopulations of highly facundive species of plants and animals.
- Food web also help in ecosystem development.

Ecological Pyramids (Not Essential)

- Idea of ecological pyramids was developed by **Charles Elton** (1927) "An ecological parameter (number or biomass or amount of accumulated energy) at different trophic levels in a food chain in an ecosystem".

  On the basis of ecological parameters, ecological pyramids are of three types :

  (a) **Pyramid of Numbers**

  (i) **Upright :** The shape of Pyramids of numbers be upright. e.g. in pond ecosystem and in grassland ecosystem.

  (ii) **Inverted :** Depending upon whether producer individuals are greater in number or lesser in number respectively.

- In upright pyramid of numbers, the number of organisms decrease from producer level to top carnivore level. On the contary, in inverted pyramid of numbers, single oak tree (producers) supports a large number of h erbivores birds which, in then, support a still large number of parasites like lice and buys. Hyperparasites (e.g. bacteria, fungi) are the greatest in number in this inverted pyramid of numbers.

  (b) **Pyramid of Biomass :** A pyramid of biomass is the representation of biomass (total amount of living or organise matter in an ecosystem at any time) per unit area in differen trophic levels.

  Pyramid of biomass may also be upright (e.g. in a grassland ecosystem) or inverted (e.g. in a pond ecosystem) d epending upon whether the biomass of organisms gradually decreases or gradually increases at successive trophic levels from producers onward to top carnivores.

  (c) **Pyramid of Energy :** A pyramid of energy is a graphic representation of amount of energy per unit area at different trophic levels of a food chain in an ecosystem.

  The available energy is the highest at producer level. Ace to secondary law of thermodynamics, there is gradual decrease in available energy at successive trophic levels. Therefore, the pyramid of energy is always upright.

Ozone layer and How it is getting depleted

- Ozone (O_3) is a molecule formed by three atoms of oxygen.
- While O_2, which is normally referred to as oxygen, is essential for all aerobic forms of life.

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \rightarrow \underset{(ozone)}{O_3}$$

- Ozone is a deadly proison.
- However, at the higher levels of the atmosphere, ozone performs an essential function.
- It shields the surface of the earth from ultraviolet (UV) radiations from the sun.

- This radiation is highly damaging to organisms, for example, it is known to cause skin cancer in human beings.
- The amouont of ozone in the atmosphere began to drop sharply in the 1980S.
- This decrease has been linked to synthetic chemicals like **Chlorofluorocarbons (CFS)** which are used as refrigerants and in fire extinguishers.
- In 1987, the united Nations environment Progremme (UNEP) succeeded in forging an agreement to freeze CFC production at 1986 levels.
- **Global Warming :** At present, concentrations of green house gases (CO_2, methane, CFCs, NO_2 etc.) are increasing in the atmosphere. Consequently, there is slow rise in the atmosphere temperature. This phenomenon is called global warming. In the 20th century, increased concentrations of green houses gases has resulted in slow rise in atmospheric temperature by about 0.6ºC. Global warming has adverse effects on climate, food production and results in size in sea (due to melting of of glaciers), submerging number of levels lying areas/islands.

Managing the Garbage We Produce

- In our daily life, we generate a lot of materials and throw them away. the useless left over a discarded materials are termed as wastes. The waste materials can be
  (i) gaseous (e.g. automobile exhausts, stroke from chimneys of industries and houses.
  (ii) liquid (e.g. effluents from industries, sewage water)
  (iii) **Solid wastes :** The different kinds of solid wastes can be conveniently categorized into following categories :
  (a) **Food waste :** It includes waste of vegetable and fruit markets and kitchens, waste of slaughter houses.
  (b) Cow dung, Human excreta and fern waste.
  (c) **Trash and Rubbish :** It includes dirt, ash, sand, bricks, polythene bags, waste paper, waste rubber, warnut clothes.
  (d) Use of disposable plastic/paper in trains and marriage parties.

Biodegradable and Non-Biodegradable Solid Wastes

- Solid wastes that accumulate in the environment due to human activities can be categorized into two types :
  (i) **Biodegradable waste :** These include substances such as household garbage, human urine and faecal, matter (sewage), agricultural residues, cattle dung, wood, paper, cloth, hay, cotton, and several industrial wastes. All these substances can easily be degraded by natural means (i.e. by the action microorganiss such as bacteria and fungi of decay) into simples, harmless substances in due course of time. Microorganisms such as bacteria and fungi of decay are present in abundance in our environment. These secrete specific enzymes. The enzymes breakdown complex organic substances (present in biodegradable wastes) into simpler easily disolvable substances. The latter reach the resevoir pool (air, water or soil) and are again available to autotrophs for photosynthesis.

Harmful Effects of Biodegradable Wastes

- Decomposition of biodegradable waste results in the production of **foul smell** which spreads to surrounding areas and makes the life miserable.
- **Flies breed :** At huge heaps of solid wastes containing biodegradable substances, carry the germs and spread diseases s uch as **diarrhoea**, **typhoid**, **tuberculosis**, **cholera** etc.
- These wastes also block the drains, creating pools of water which becomes the breeding sites of mosquitoes. The latter are the carriers of diseases like malaria and dengue.
- Dumping of industrial wastes reduces the fertility of the soil leading to reduction in crop yields.

Non-Biodegradable Wastes :

- In our daily life, we also generate lot of waste that can not be deg ra ded by natural means i.e. by the actions of microorganisms, into simpler, haemless substances in due course of time. Only physical processess such as heat and pressure can affect such type of waste substances. These are commonly called non-biodegradable wastes. E.g. plasic objects, ball-point pen refill, synthetic fibres, glass objects, pesicides (DDT), industrial chemicals and heavy metals (mercury, lead, arsenic, cadmium etc.), metal articles (iron nails, aluminiumcans, silver foil etc), radioactive wastes etc.
  Polythene bags are also non-biodegradable.

Harmful Effects of Non-Biodegradable Wastes :

- These enter the food chains and their concentration goes on increasing from one trophic level to the next.
- They affects the soil fertility. The soil may become acidic or alkaline.

Modes of Waste disposal

- Waste disposal means getting rid of waste. Disposal of waste should be done scientifically. The method of water disposal depends on the nature of the waste.

Some prominent methods of waste disposal are :

1. **Land fills :** In urban areas, majority of the solid wastes are buried in low lying areas to level the uneven surface of land.
2. **Recycling of Wastes :** e.g. paper, plastics, metals etc.
3. **Preparation of compost :** Used as manure.
4. **Incineration or burning at high temperature (1000°C)**.
5. **Production of biogas and manure :** Biodegradable wastes can also be used in biogas plants to generate biogas and manure Biogas is a cheap source of fuel, and manure, a cheap fertilizer.

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EXERCISE

I. Very Short Answer Type Questions :

1. What are the two main components of our environment?
2. Name three major bioic components of an ecosystem.
3. Name two decomposers.
4. Name any two biodegradable pollutants.
5. Write an aquatic food chain.
6. What is incrination?
7. List four common waste disposal methods?
8. Why is it necessary to conserve our environment?
9. Draw a food chain with four trophic levels.
10. Why are crop fields known as artificial ecosystems?

II. Short Answer Type Questions

11. Give reason why ozone layer in the stratosphere is considered useful.
12. why is improper disposal of waste a curse to environment?
13. The number of malarial patients in a village increased tremendously when large number of frogs were exported from the village. What could be the cause for this?
14. Considered the food chain :

    Grass $\rightarrow$ Deer $\rightarrow$ Lion

    What will happen if lions are removed from the above food chain?
15. Give three characteristics of food chain.

III. Long Answer Type Question

1. Why does vegetarian habit help us in getting more energy? In terms of energy who is at an advantageous position (vegetarian or a non-vegetarian)? Why?
2. What are the advantages of cloth bags over plastic bags during shopping?
3. Give difference between food chain and food web.
4. How is ozone formed in the upper atmosphere? What causes its damage?
5. What is biological magnification? Will the levels of this magnification be different at different levels of the ecosystems?
6. (i) What are the problems caused by the non-biodegradable wastes that we generate?

   (ii) How can you help in reducing the problem of waste disposal? Give any two methods.

7. (i) Indicate the flow of energy in an ecosystem. Why is it undirectional? Justify.

(ii) Why does a food chain consist of only three to four steps?

8. (i) Name the wastes which are generated in your house daily. What measures would you take for their disposal?

(b) Explain some harmful effects of agricltural practices on environment.

9. Why is damage o the ozone layer a cause for concern? What steps are being taken to limit this damage?

10. (i) Draw a line diagram to show flow of solar energy in ecosystem.

(ii) Why is the government stressing u pon the use of jute or cloth carry bags?

(iii) List any two artificual ecosystems.

V. Objecive Type Questions :

1. Which one is the example of biodegradable waste

(a) Plastic (b) Glass

(c) Sewage (d) Insecticides

2. Biotic components includes

(a) All the non-living components

(b) Physical factors like temperature, sunlight

(c) All the living components

(d) Edaphic factor like soil

3. The forest is the part of

(a) Aquatic ecosystem (b) Artificial ecosystem

(c) Terrestrial ecosystem (d) Both (a) and (b)

4. The abiotic component includes

(a) Decomposed by microorganisms

(b) Substances that can be decomposed by microorganisms

(c) Synthetic chemicals like chlorofluorcarbons

(d) Undirectional flow of energy

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WORKSHEET - 1

1. What do you mean by environment?

2. Define decomposer. Give two examples of decomposer organisms.

3. What are the biodegradabel wastes. Give examples.

4. What are the non-biodegradable waste. Give examples.

5. Define an ecosystem. Give some examples.

WORKSHEET - 2

1. What are the components of an ecosystem?

2. Give some examples of physical factors or climate factors of abiotic components of an ecosystem.

3. How the functioning of an ecosystem is start with?

4. Define :

(i) Producers (ii) Consumers (iii) Decomposers

5. What are the components of consumer? Give example to explain them.

6. What is the importance of the decomposer in the environment?

WORKSHEET - 3

1. What do you mean by a food chain?

2. Give an example of three steps food chain.

3. Give one example of four step food chain.

4. In the above four steps chain, categories with producers and consumers.

5. Give one example of food chain which operating in an aquatic ecosystem.

WORKSHEET - 4

1. What do you mean by a food webs?

2. Give a diagramatic representation for a food web according to their producer and consumer level?

3. Define trophic level.

4. Describe the various type of representation in trophic levels in a food chian.

5. How the trophic levels in a food ch ain can also be represented by pyramid of numbers?

6. Describe the Man's activities on the ecosystem when :

(i) if all the lions are removed

(ii) if all the deer are removed

(iii) if all the producers are removed

WORKSHEET - 5

1. Which of the following belong to the same trophic level? Gras, Hawk, Rabbit, Frog, Deer.

2. Which of the following belong to the same trophic level?

Frog, Grasshopper, Grass, Snake, Algae.

3. From where all the organisms get energy and how they are passed from one organism to another.

4. Make a diagram to show the transfer of energy in a food chain.

5. Explain how the flow of materials in ecosystem is cyclic but flow of energy is undirectinal.

6. Explain the ten percent law of the energy in different trophic level with an sitable example.

WORKSHEET - 6

1. Why the number of trophic levels in a food chain is limited?

2. What do you mean by bio concentration of pesticides?

3. What do you mean by bio concentration of harmful chemical in its body?

Peacock, Frog, Grass, Snake, Grasshopper

4. How do our activities affect the environment?

5. Explain the following :

(i) Ozone layer

(ii) Chlorofluorocarbons (CFC)

(iii) Recycling

(iv) Preparation of compost

(v) Incineration

(vi) Landfill

(vii) Sewage Treatment