



SYLLABUS

1. Earth is a unique planet in the solar system — it has the right combination of several factors which support life :
 - Correct distance from the sun, to ensure adequate heat and light.
 - An atmosphere which protects living things from harmful radiation and has a combination of gases needed to sustain life.
 - Sufficient water for living beings.
 - Several minerals available in the soil, which organisms use to grow and reproduce.

2. The environment has three interactive components — abiotic, biotic and cultural:
 - Abiotic components — light, temperature.
 - Biotic components — plants, animals, micro-organisms.
 - Cultural components — owing to human influences on the environment.

Some details about each of these factors; interactions between these factors; how they influence life on earth.

3. Producers, consumers, scavengers and decomposers.
 Herbivores, carnivores, omnivores. Simple food chains and food webs.
 Energy chains — all start with the Sun.

- * Games involving the building of Food Chains.
- * Investigating the effect of light, water, excess heat, different kinds of soil on potted plants (E) (Teachers to explain the need for control and also ensure that only one variable is altered at a time. Good training in scientific method).

4. Plants and animals are interdependent.
 Maintaining the balance in nature — what happens when this balance is upset — how human beings can do this.

OUR EARTH

Our earth is one of the eight planets that revolves around the sun. The other seven planets are Mercury, Venus, Mars,

Jupiter, Saturn, Uranus and Neptune. The sun and its eight planets together constitute the **Solar system**. Each planet in the solar system travels in its own



Fig 8.1 The eight planets in the order of their distance from the sun and dwarf planet pluto

Note : Originally classified as the ninth planet from the sun, Pluto was recategorised as a dwarf planet owing to the discovery that it is only one of several large bodies.

path or orbit. Look at the Fig. 8.1 given below. Some planets are nearer to the sun, while some are farther from it. Can you name the planet nearest to the sun and the planet farthest from the sun? Mercury is closest to the sun, and as such, it is the hottest planet. It is so hot that no living organism, plant or animal, would be able to survive on it.

On the other hand, Neptune is farthest from the sun, and as such, it is the coldest planet. Do you think it is possible for any plant or animal to survive in such extreme cold conditions?

Our earth is the third planet from the sun. As a whole, it is neither too hot nor too cold. In fact, it is the only planet of the solar system which is most suitable for supporting life.

The earth we live on has plains, mountains, deserts, rivers, lakes, oceans, etc. Since the earth is very large, therefore, we can see only a very small part of it, even if you stand on the peak of a tall hill. This part usually appears almost flat to us. But astronauts travelling in spaceships have observed the earth from long distances. They took photographs, which show that earth is spherical in shape somewhat like a ball.



Fig 8.2 Earth as seen from space

The earth is not at rest. It keeps revolving around the sun, in an elliptical path called the **orbit** of earth. It completes one revolution around the sun in $365\frac{1}{4}$ days. Though the earth is always moving, we do not notice this motion because we are also a part of it.

As the earth moves around the sun along its orbit, it also rotates like a top about its own "axis". Due to this rotation, different parts of the earth face towards the sun one by one. You should know that the day and night occur due to this rotation. Furthermore, the axis of the earth is tilted to its orbit at an angle of $23\frac{1}{2}$ degrees. This helps in the formation of seasons on the earth.

CONDITIONS ESSENTIAL FOR LIFE

Have you ever thought of things which we need to live. Possibly, food is the basic necessity of life. Essentially, we get our food from the plants or animals. The animals, in turn, get their food again from the plants. Plants need water, air, soil and sunlight to prepare their food.

Our planet, **Earth** is indeed unique. All necessary requirements, for the existence of life, are available on it naturally, such as :

1. **Presence of water** : Water is extremely essential for living organisms. It is present in abundance on earth. The bio-chemical reactions taking place inside the living organisms need water.
2. **Presence of oxygen** : Earth has enough oxygen which is required by all living organisms for respiration.

3. **The distance from the sun** : The distance between the sun and the earth is such that earth is neither too hot nor too cold. The temperature at most of the places on earth remains between -20°C to $+48^{\circ}\text{C}$ which is favourable to sustain life. The heat from the sun is enough to warm earth's land and water. The sunlight also provides energy to the plants to prepare their own food.

4. **Presence of minerals** : Carbon, hydrogen, oxygen and nitrogen are the essential elements required by living organisms and are present in sufficient amounts in various usable form. Soil too contains nutrients required for the growth of the plants.

5. **Gravitational force** : The earth has the right mass to exert the right gravitational force to hold its atmosphere. If the gravitational force of earth would have been less, then all the gases on the earth would have escaped into the outer space.

BIOSPHERE

The part of the earth, including air, water, land, surface, that supports life is known as the Biosphere. It has *three* divisions: The entire part of earth's surface which is covered with rocks and soil is called **Lithosphere**. The depression in the lithosphere, filled with water is called the **Hydrosphere**, and surrounding the lithosphere and hydrosphere is an outer envelope of air, known as **Atmosphere**.

Lithosphere : It plays a very important role in the growth of plants

since it contains minerals and essential nutrients for their growth.

Hydrosphere : About 70% of the earth's surface is water found in oceans, seas, rivers, lakes, etc.

Atmosphere : The layer of gases that surround the lithosphere and hydrosphere is called the atmosphere. The gases in the atmosphere are nitrogen, oxygen, a small amount of CO_2 , argon, water vapour and other gases. It also contains another gas, ozone in the upper parts, which prevents the sun's harmful ultraviolet rays from reaching the earth.

ENVIRONMENT

Our surroundings include plants, animals, water, land, air, sun, sky, clouds and many other things. All these affect our life and constitute our environment.

All that surrounds and affects the life of an organism (plant or animal), is its environment.

Factors of Environment

(A) **Abiotic (non-living) factors** or **physical factors** as air, water, soil, light, temperature, etc.

(B) **Biotic (living) factors** such as plants, animals and all such other life forms which influence the organism's life either directly or indirectly.

(C) **Cultural factors** : Man is a social being. Any activity of a person as an individual can affect his social environment.

Let us study more about the different factors of the environment and know how they influence and interact with each other ?

(A) ABIOTIC FACTORS

Abiotic factors of an environment consist of non-living factors, such as light, air, temperature, water, soil, etc.

1. Light

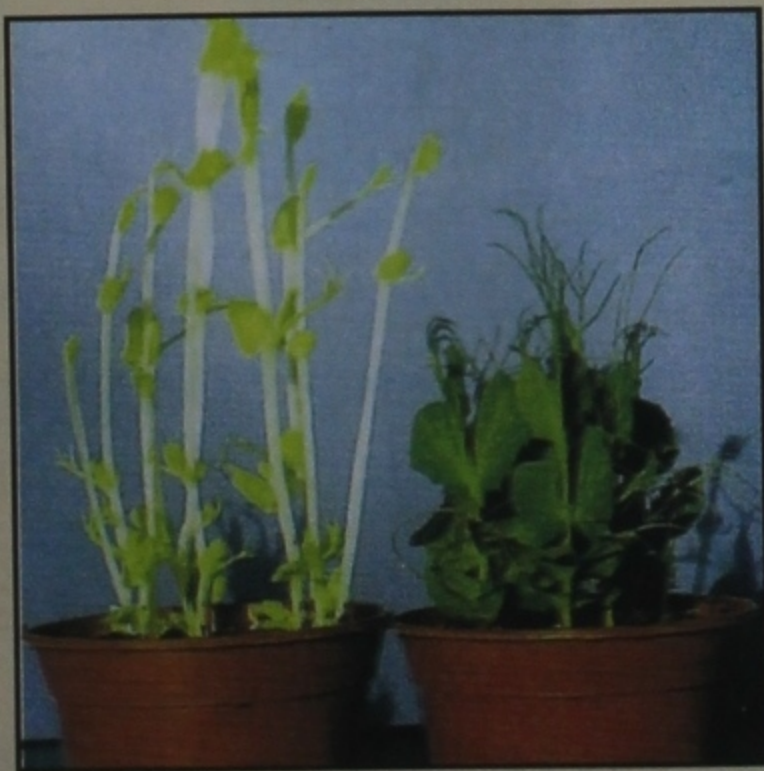
Light intensity, and its duration control the body structure and the activities of organisms. The different effects of light are as follows:

Photosynthesis in plants : Light is essential for photosynthesis in plants which produce food for themselves. Such food is used by the animals while eating the plant parts.



ACTIVITY 1

Take any two healthy potted plants such as balsam. Keep one plant in the open so that it continues to get light, and the other plant in a dark room where no light is available to it. Water both the plants regularly and observe them for 4-5 days. You will notice that the plant kept in the open continues to grow normally with its healthy leaves, whereas leaves of the plant kept inside the dark room have become pale and some of them might have even fallen.



The above activity shows that light is an important factor for the normal growth of a plant.

Animal activity : Some animals are more active during the day. These are called **diurnal** (active during daytime), e.g., butterflies, sparrow, cow, pigeon, etc. Some other animals which are active during night are called **nocturnal** e.g., owl, bat, cockroach, etc.

2. Air

Air affects plants and animals in a number of ways:

(i) **Pollination** : Many plants are pollinated by wind.

(ii) **Dispersal** : Wind is an agent for dispersal of many fruits, seeds, spores, etc.

(iii) **Transpiration** : Wind increases the rate of transpiration.

(iv) **Respiration** : All plants and animals use atmospheric air in order to get oxygen for respiration.

3. Temperature

The temperature determines which kind of plants and animals would best survive at a certain place. For example, pines grow best in cold climate, whereas mangoes grow best in warmer regions.

Among animals, some can survive in very cold snow-covered regions, e.g., penguins, polar bears. On the contrary, insects, frogs, etc. are mainly inhabitants of warmer regions.



ACTIVITY 2

This activity should be performed during **summer** months when the day temperature remains about 40-44°C.

Take two healthy potted plants (A and B) such as balsam. Keep plant A in the open sun and plant B in a shady place. Water both the plants regularly. After 5-7 days, you will notice that the leaves of plant A (kept in open sun) get wilted during hot mid-day. If sufficient water is not available to such plants, the wilted leaves may not recover whereas plant B (kept in verandah) remained healthy.



This activity shows that exposure to excess heat is harmful to plants.

4. Water

Water is an essential constituent of the body of all organisms. The land plants absorb it from the soil to prevent drying up, as well as to use it as a raw material in photosynthesis. Some plants are water-dwelling, for example, lotus, water-chestnut ("*singhara*").

Amongst animals, some live inside water (fishes, etc.) and breathe by means of their gills. Land animals need water primarily for drinking.

5. Soil

Soil is essential for a great majority of plants for the fixation and for the absorption of water and mineral salts

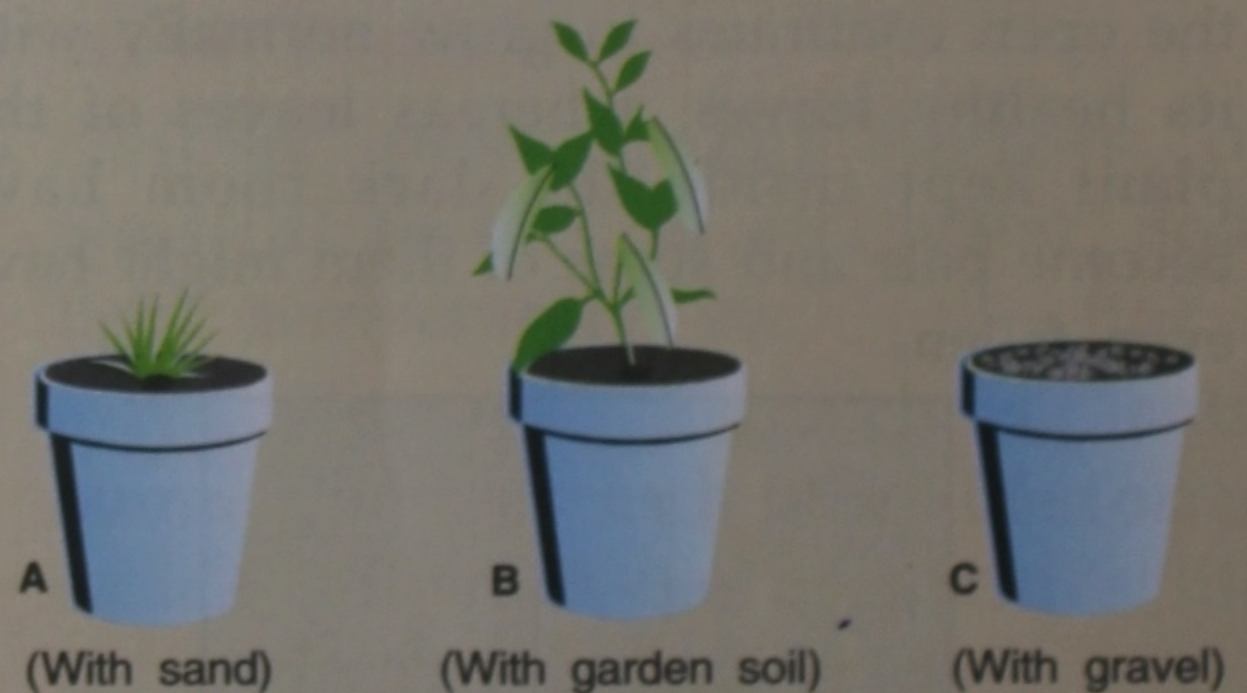
through the roots. Many animals live in burrows and caves inside the earth and make their homes. *Examples* : rats, snakes, bear, lion and certain insects such as termites ("*deemak*"), etc.



ACTIVITY 3

Take three small flower pots (A, B and C). Fill pot A with sand, pot B with garden soil, and pot C with gravel. Pour some water in each pot.

Now fix in each pot a few saplings (very young germinated plants) of pea or gram. Keep these pots in a suitable place with sufficient sunlight, and water them regularly. Observe the growth of the plants in each of the pots. After 5-6 days, you will notice that the saplings in pot C (with gravel) have not grown at all and many of them have even died. In pot B (with garden soil), the saplings have grown normally, whereas pot A (with sand) saplings have grown only upto a certain stage and later on, their growth has stopped.



This experiment shows that garden soil is best for the normal growth of plants.

(B) BIOTIC FACTORS

The biotic factors of our environment include the living organisms — plants, animals and even micro-organisms.

Plants

All green plants have green chlorophyll. The green leaves produce food in the presence of sunlight. For this, they use carbon dioxide and water. This process of the production of food by green plants is called **photosynthesis**. The plants can prepare their own food, hence they are called **autotrophs** (*auto* = self; *trophe* = feed).

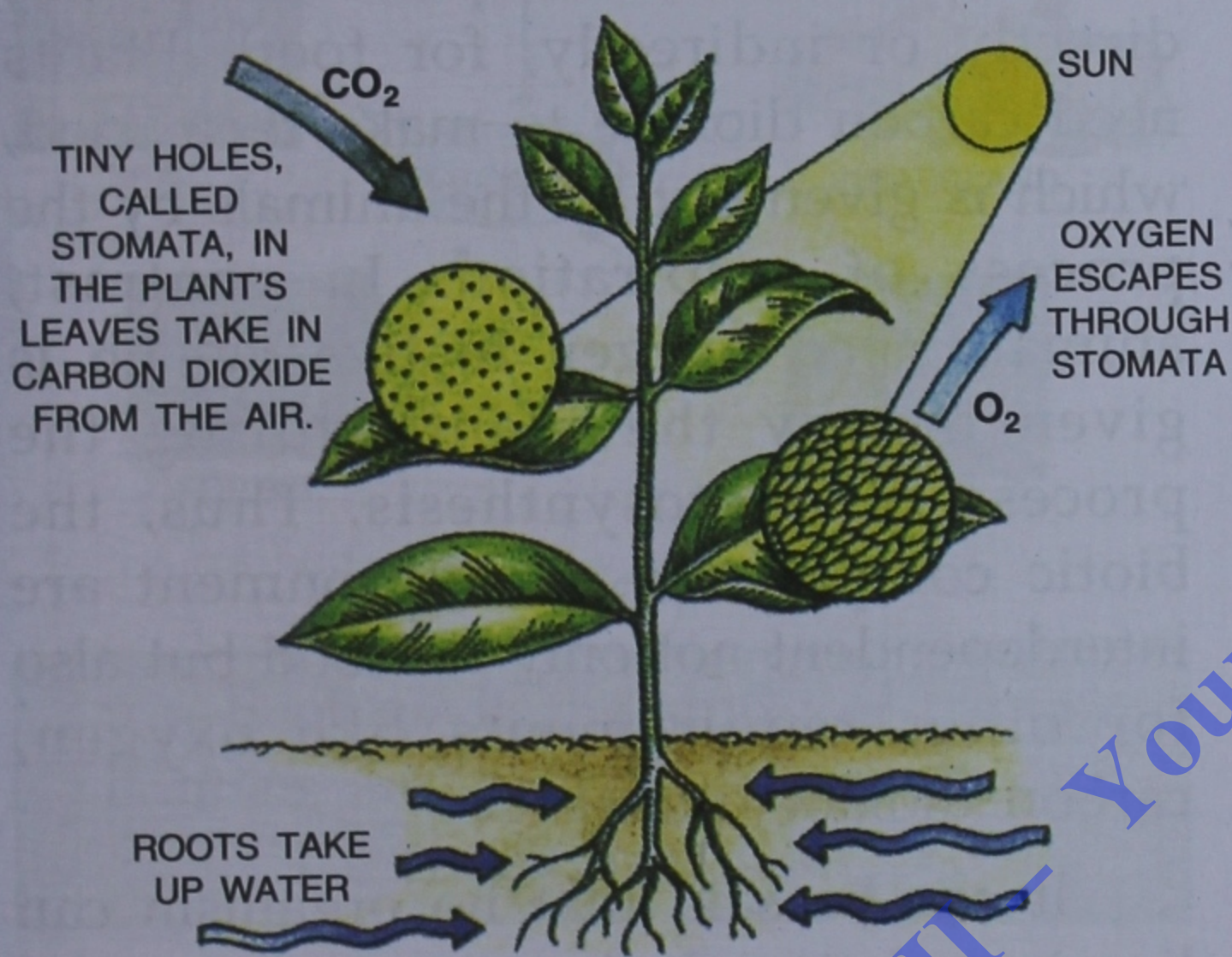


Fig 8.3 The process of photosynthesis

Animals

Animals cannot prepare their own food. They eat either plants or the flesh of animals which in turn feed on plants. As such, animals are called **heterotrophs** (*hetero* = other). According to the **mode of feeding**, animals can be categorized as follows :

- **Herbivores** (*herb* : plant, *vore* : eater). Feed on plants and plant products. **Examples:** Cow, parrot, butterfly.
- **Carnivores** (*carni* : flesh). Eat other animals. **Example :** Tiger preying

upon other animals like cow, deer or rabbit.

- **Lower grade carnivores eaten by the higher grade carnivores.** For example, frog (which eats an insect or a worm) can itself be eaten by a snake, and similarly a snake can be the food for a peacock.
- **Omnivores** (*omni* : all). Feed on both plants as well as animals. **Examples:** humans, crow, bat, dog.

Human beings are omnivores. They eat grains, vegetables, fruits, *etc.*, from the plants. They drink milk which is an animal product. They eat fish, eggs, meat, *etc.*, which are obtained from animals. Thus, they eat all kinds of things, so they are omnivores.

- **Scavengers** (*scavenge* : clean up). They eat dead animals. **Example:** Vultures feed on dead cow or deer, etc.

- **Parasites** live on or inside the body of other organisms (plants and animals) and feed on their body fluids.

Examples :

- Aphids (plant lice) suck plant juices.
- Lice and ticks feed on animal blood.
- Tapeworms, living inside the human intestine, simply absorb our digested foods.

- **Decomposers** are the **micro-organisms** (e.g. certain bacteria) which feed on dead bodies of organisms and organic wastes of living organisms. These micro-organisms secrete digestive

enzymes to digest the organic matter externally. Thus, the dead bodies are decomposed into minute particles (minerals) that get mixed with the soil. These minerals are again taken up from the soil by the plants. This process is called **recycling of minerals**.

(C) CULTURAL FACTORS

With the advancements in science and technology, our environment is fast changing.

- The high rising buildings have blocked natural light and air.
- The chemical waste from the factories and the fertilisers and chemicals used in our farms, spoil the quality of water in ponds, rivers and even seas.
- The high speed vehicles and jet planes, which emit loud noises, are disturbing our mental health.

Thus, our present environment is no more, the same **natural environment**. We can say that the environment has now become chiefly a **man-made environment** which may also be called a **socio-cultural environment**.

ALL LIFE ULTIMATELY DEPENDS ON GREEN PLANTS

If there were no green plants, all life on earth would come to an end. Two main reasons for this are:

1. **Plants produce food.** If there are no green plants there will be no food. As such all plant eating animals as well flesh-eaters including human beings will starve to death.

2. **Plants give out oxygen.** If there is no oxygen, animals can not survive as they will not be able to respire.

All animal life depends on plants directly for oxygen, and directly or indirectly for food.

INTERACTION BETWEEN BIOTIC AND ABIOTIC FACTORS

You know that plants make their own food. Animals depend on plants, directly or indirectly, for food. Plants need carbon dioxide to make their food, which is given out by the animals by the process of respiration. In contrast, animals need oxygen to live, which is given out by the plants during the process of photosynthesis. Thus, the biotic components of environment are interdependent not only for food but also for other requirements like oxygen, carbon dioxide, etc.

It can be said that no organism can live in isolation. It lives in a community called a **biotic community**. A biotic community includes plants, animals and micro-organisms. The place where a biotic community lives is called a **habitat**. The habitat not only includes the biotic components, e.g. plants and animals, but also includes the abiotic components, such as air, light, water, soil, etc. These biotic and abiotic components too interact with each other.

A system formed by the interaction of the biotic (living) components with their abiotic (non-living) components of a habitat, is known as an **ecosystem**. *Examples of ecosystems* : a pond, a

grassland, a garden, a forest and a sea. In any ecosystem, there is a definite interaction between the producers, consumers and decomposers and the physical environment to maintain the balance in nature. The study of an ecosystem is called **ecology**.

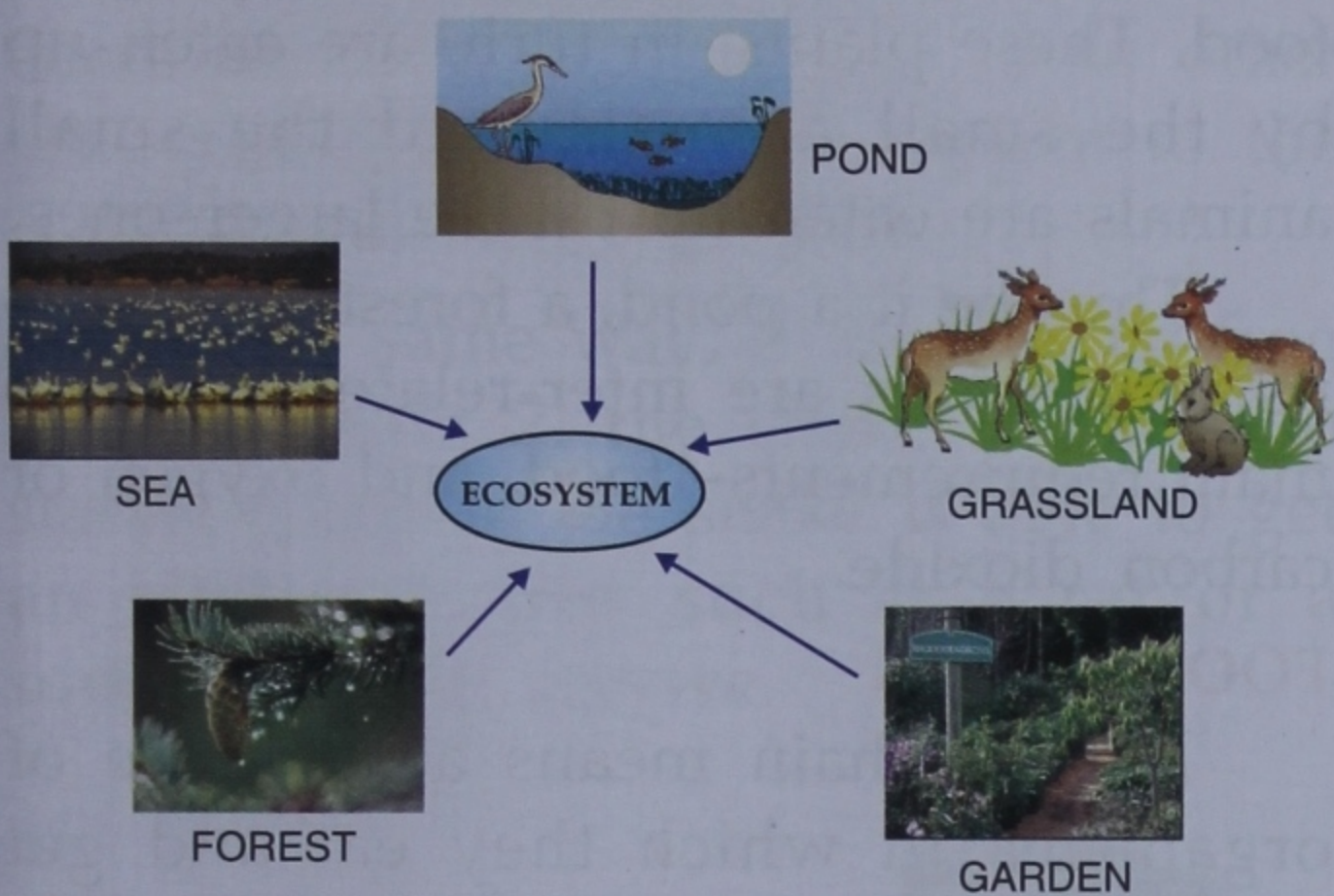


Fig 8.4 Ecosystem

Ecology is the study of plants, animals and humans in relation to their environment.

Interaction in a Pond

Consider a large village pond. One can find **frogs** in it. There would be some **fishes**. There may be some tiny **insects** too. You can find a variety of **small plants** in it, some are submerged, some float on the surface of water, and some emerge above the water surface. Some birds like **ducks** may be swimming in it, and some like **kingfishers** may be waiting alongside to catch fishes. All these living things are just a few out of hundreds of living organisms in a pond. All these are inter-related with each other in some manner or the other.

Let us start with the plants in the pond. Plants prepare their own food. This food is the source of life for all the animals in the pond. Some small animals eat the plants directly. Larger animals, like fishes and frogs, eat small fishes and insects which in turn had eaten plants.



Fig. 8.5 Interaction in a pond

The water-plants require carbon dioxide for making their food. This carbon dioxide comes from the dissolved air in water, and not directly from the atmospheric air. The dissolved carbon dioxide is given out by the pond animals during respiration. Pond animals need oxygen. The source of this oxygen is green plants. Plants give out oxygen during photosynthesis.

Photosynthesis is a process of making food by green plants in the presence of sunlight.

Interaction in a Forest

In a forest, there are a large number of trees of different kinds. Living on the trees are birds. Crawling on the leaves and on the bark of the trees are numerous kinds of insects. In the bushes below the trees, live rabbits, squirrels, rats, and so on. Below the bushes are, small grasses, hopping along which are, grasshoppers, crickets and other insects. Also, there would be deers, jackals, foxes, leopards, etc. and in some forests, even lions and tigers.



Fig. 8.6 Interaction in a forest

Interaction in Sea

In the sea, there are many kinds of green plants, and a large variety of animals — some very small, some of moderate size and some huge ones like sharks and whales.

Here also, the green plants prepare food. These plants, in turn, are eaten up by the small animals, and the small animals are eaten up by the larger ones.

Thus be it a pond, a forest, or a sea its inhabitants are inter-related for two main requirements— food, and oxygen or carbon dioxide.

FOOD CHAIN

A food chain means a sequence of organisms in which they eat and get eaten in a chain.

A series of organisms which are linked with each other through a process of eating and being eaten up form a food chain.

As examples, two food chains are shown in figure 8.7.

Food chain 1

In food chain 1 (Fig. 8.7), deer eats plants, and that deer is eaten up by a lion. Is there an animal which eats lion ? Perhaps, there is none. But, the lion too dies sometime or the other. The dead lion is eaten up by vultures, dogs and other animals. Those that eat corpses of dead animals are called **scavengers**. Finally, if any bit of the flesh of the dead animals is left uneaten, it is broken down into chemical elements by the bacteria. Such bacteria are called **decomposers**.

Food chain 2

In food chain 2 (Fig. 8.7), the grasshopper eats grass, frog eats the grasshopper, and snake eats the frog. Is there any enemy of the snake that eats it? Yes, the hawk or the peacock.

Suppose in food chain 1, all the deers are finished and there is no other prey available, what will happen to the lion? It will starve to death.

In the same way, if there is no frog in food chain 2, the snake is likely to starve. Suppose the snake is able to get an alternate prey such as a rat or a squirrel, it will survive.

Food Chain 1



Food Chain 2

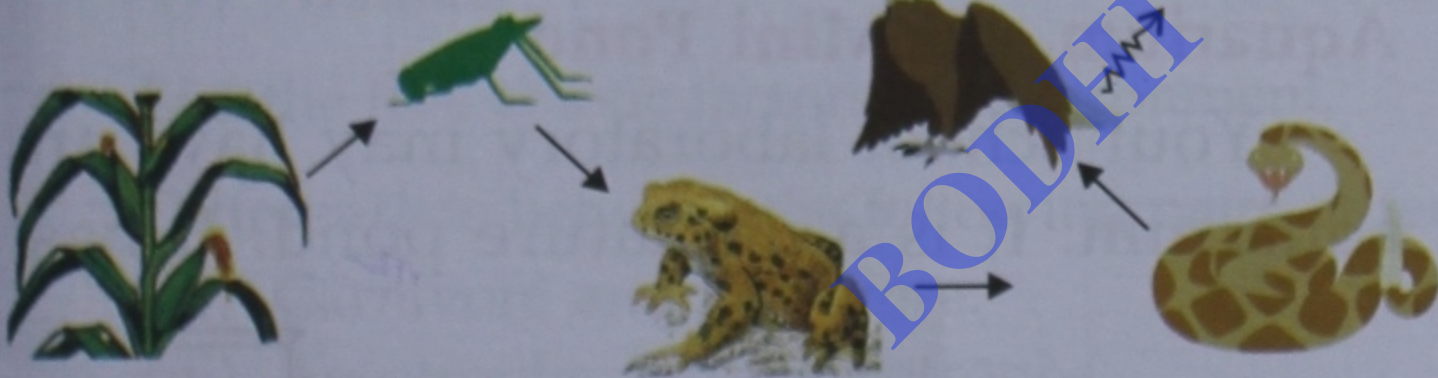


Fig. 8.7 Two food chains

Let us have a look at three more examples of food-chains :

A. Grass → Rabbit or
Deer or
sheep → Lion

B. Grass → Grasshopper → Bird

C. Grass → Insect → Frog → Snake → Eagle

Thus, we have different categories of

organisms according to their food relations :

Producers → Herbivores → Small carnivores → Big carnivores

Producers : All green plants (autotrophs) are **producers**. They produce food by making use of carbon dioxide and water in the presence of sunlight (by photosynthesis).

Sun is the ultimate source of energy. No animal can use the sun or solar energy directly. Green plants use only 1% of sunlight to prepare food, with the help of a green pigment called chlorophyll present in their cells. Thus, solar energy is converted into chemical energy and then stored in the food prepared by plants and gets transferred to other organisms through the food chain.

Consumers : The **first stage (or primary) consumers** are **herbivores** (plant-eaters) which feed on plants and plant products. They also use up only a part of energy stored in plants and store the rest in their body.

The **second stage (or secondary) consumers** are the **carnivores**. These are the animals which kill and eat other animals. Carnivores consume herbivores. The **third stage consumer**, if any, will be a second carnivore which eats the first carnivore.

In this way, energy passes from producers to primary consumers, then to secondary consumers, and so on.

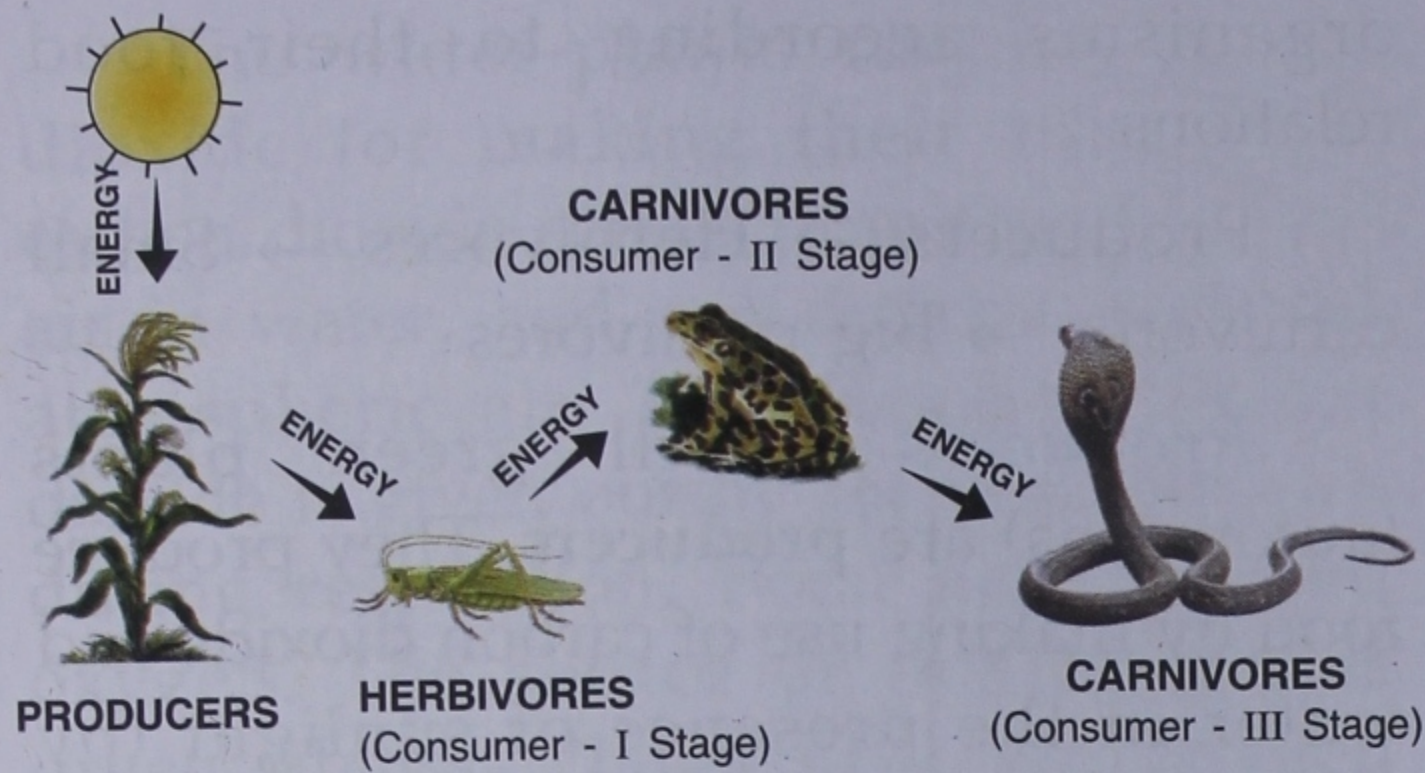


Fig. 8.8 The ultimate source of energy for any food chain is the sun

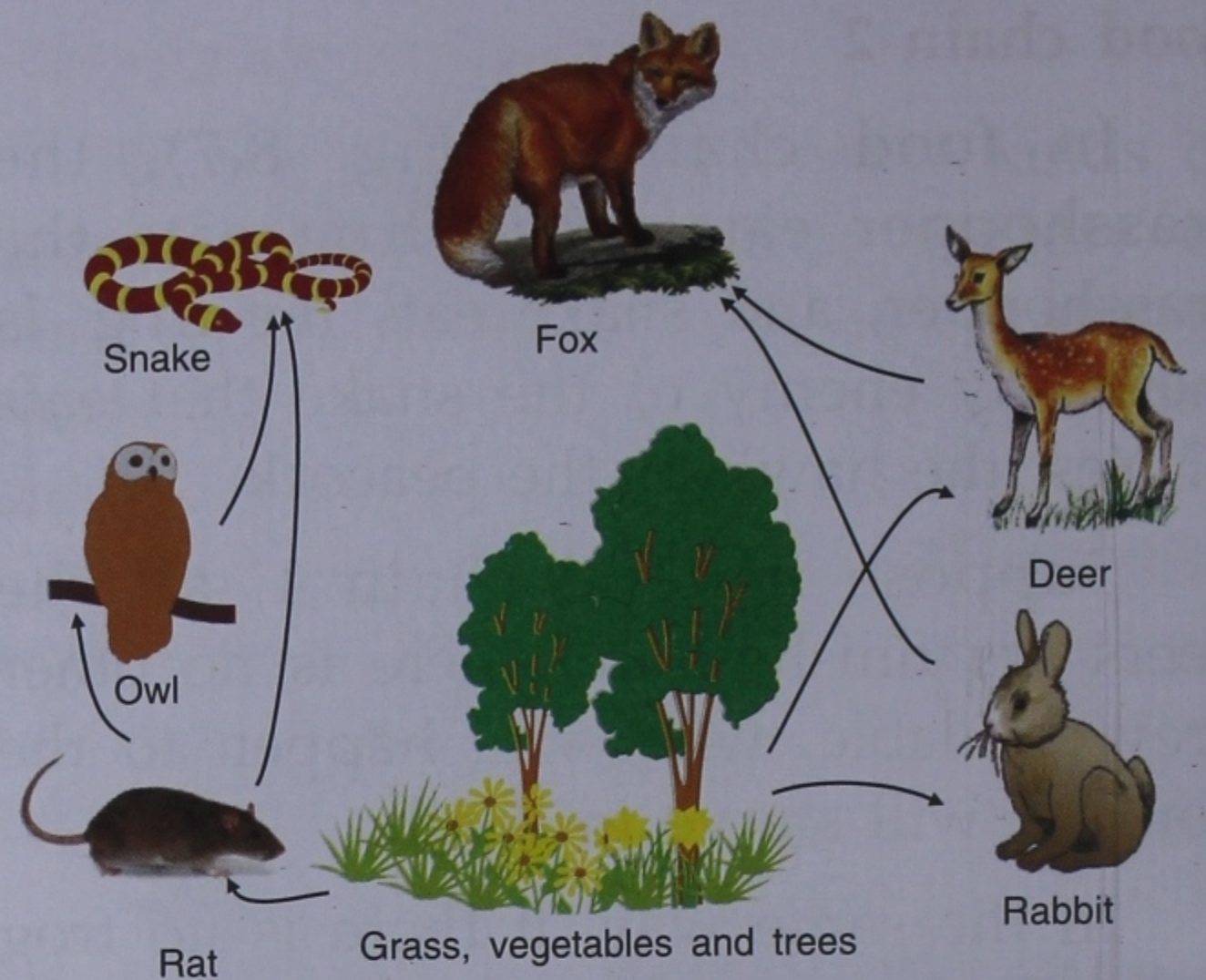


Fig. 8.9 Food web

Food chains, as given above in some examples, are never so simple running in a single direction. It shows several food chains crossing each other at different points.

Nature maintains a sort of balance between all plants and animals in a food web. All organisms live happily in an ecosystem without affecting others.

Aquarium – a Mini Pond

Your school laboratory may have an aquarium. It is a miniature pond. It has

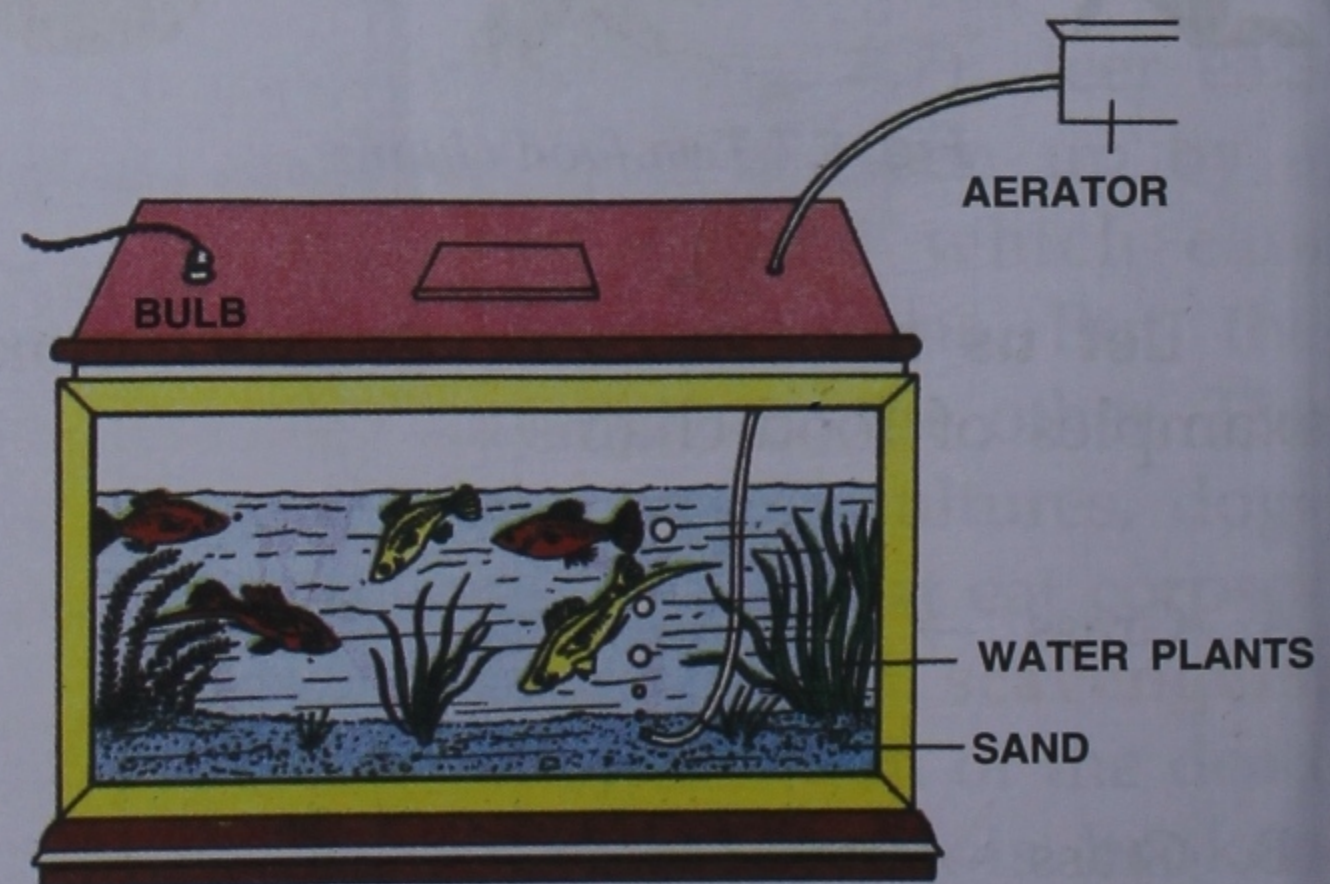


Fig. 8.10 An Aquarium



ACTIVITY 4

Divide the students of your class into batches, with four students in each batch. In each batch, one student will represent a plant (producer), the 2nd student will represent a herbivore, 3rd student as a carnivore (grade I) and the 4th as the higher grade carnivore.

All these four members of each group will stand in a row side by side by holding the hands of each other in an order in which one eats the other as shown in the sequence given below :

Producer → Herbivore → Carnivore (grade I) → Carnivore (higher grade)

This is how a food chain proceeds in nature.

FOOD WEB

Inter-woven pattern of several inter-connected food chains is called a **food web**.

sand with some water plants fixed in it. A few fishes swim in its water. There may be a couple of snails too. The electric bulb provides the light-energy for the plants to produce food. The carbon dioxide given out by the fishes is used by the green plants to produce food. The oxygen given out by the plants during this process is

used by the fishes, snails, *etc.* Sometimes an aerator is also fixed to provide extra air (oxygen) in the water. The excreta of fish provides nutrients in the sand for the plants to grow well. Some decomposers (bacteria) may also be present in the soil to break down any possible dead remains of the living things.

REVIEW QUESTIONS

1. What do you understand by solar system ?
2. How many planets are included in the solar system. Name the planet which is farthest from the sun.
3. State the *five* conditions essential for life.
4. What is an environment ? What are the *three* types of factors of environment ?
5. Match the items given under **column I** with those given under **column II** :

Column I

- (i) Plants
- (ii) Hydrosphere
- (iii) Lithosphere
- (iv) Light
- (v) Animals

Column II

- (a) Biotic
- (b) Abiotic
- (c) Rocks
- (d) Water
- (e) Autotrophs

6. List the *five* abiotic factors of environment.
7. Differentiate between the following pairs of terms :
 - (i) Carnivore and herbivore.
 - (ii) Scavengers and decomposers.
 - (iii) Autotrophs and heterotrophs.
8. "All life ultimately depends on green plants". Explain this statement.
9. What is a food-chain ? Give *two* examples.
10. Define the following terms :
 - (i) Ecology
 - (ii) Habitat
11. With the help of suitable examples, briefly explain a food-web.
12. What do you understand by the term biosphere ? Name its *three* divisions.
13. How photosynthesis is important to human beings ?