

ECOSYSTEMS

Learning outcomes

By the end of this theme, students will be able to:

- explain what an ecosystem is
- describe the biotic and abiotic factors in an ecosystem and the interactions between them
- interpret the relationships between the biotic factors of an ecosystem (food chains and food webs)
- describe interdependence relationships between organisms
- describe the flora and fauna of a forest ecosystem



Warm-up

Encourage students to complete the *Get going* section given at the beginning of the chapter.

GUIDELINES TO TEACH

Introduction

- Help students recall the following—
 - the meaning of the term habitat and the various types of habitat: aquatic, terrestrial, forest, grassland and desert, mountainous and polar
 - how organisms adapt themselves to live in a particular habitat that is suitable for them
 - how Darwin's finches adapted to different habitats and therefore the food available there, and the varied beaks of each of the finches helped the birds to get a specific type of food

Ask students:

What trees, shrubs and herbs do you see around you? Do you see insects, birds, lizards and squirrels?

- Give a general introduction about the Earth being home for innumerable varieties of plants and animals.
- Draw the attention of students to the figure of the desert ecosystem, given in the coursebook.

Ask students:

Can you name this habitat?

Name the organisms (both plant and animal) found in this habitat.

Ecosystems

- Define ecosystem and give examples of different ecosystems—pond, sea, forest and so on.
- List the abiotic and abiotic components of the environment.
- Use a branching diagram to explain the biotic and abiotic components of the environment.
- Discuss the interactions between the abiotic and biotic components.
- Help students to identify why living organisms need to interact with other organisms and with their environment.
- Explain how living things can only live in certain environment and not everywhere.
- Point out that the food an organism eats decides where it lives.

Ask students:

Can you list the reasons for an animal to inhabit a certain region?

What factors determine the types of plants or animals that can survive in an area?

- Explain the term producers (autotrophs); explain that they are the link between the biotic and abiotic factors and that all other organisms depend on them for food and so existence.
- Explain the different levels of consumers, as given in the coursebook.
- Describe the interaction and interdependence among the producer and the consumers, and the role of decomposers to maintain the balance of nature.
- Explain the role of saprophytes and decomposers and the difference between them.

Ask students:

Why does cooked food get spoilt?

How do nutrients get recycled?

- Explain the importance of the abiotic components in supporting life.

Ask students:

Name the abiotic components of an environment.

What gases are essential for living organisms?

- Share the information from SciTech.

Food chains and food webs

- **Review:** Construct a simple food chain on the board, consisting of a green plant, a herbivore and a carnivore and help students trace the primary food source in a food chain to the green plant.
- Help students identify the animals in a food chain as primary, secondary, tertiary and quaternary consumers.

Ask students:

What is the first source of energy on the Earth?

Can you identify the producer and consumers in the chain?

Why are all animals consumers? What type of consumer are you?

How many levels can a food chain have? Why?

Why are all members in the food chain important?

- Ask them to come up with more examples of food chains in different habitats.
- Point out that all energy on the Earth originates from the Sun and only plants have the ability to capture this energy and transform it to food.
- Explain why the energy flow is linear in a food chain (refer to 'Spotlight').


Ask students:

Why is the flow of nutrients cyclic?

- Explain the term trophic level.
- Draw two simple independent food chains on the board and link them into a food web to explain the concept.
- Distinguish between a food chain and a food web. Explain how food web maintains the balance in nature.

Ask students:

Why do food chains become entangled to form a web?

- Let students select any ecosystem like the pond or the sea and draw food chains and link them into a web.
- Explain food pyramid of numbers and biomass.
- Let students understand the concept by drawing a food pyramid.
- Explain how disappearance of one species affects the other remaining species in the food chain.
- Use **Stop and check** for a quick recap. 
- Explain the concept of symbiosis, parasitism and predation with examples.

Ask students:

What do the arrows indicate in a food chain?

Why are there more herbivores than carnivores?

Types of ecosystems

- Recall components and interactions in an ecosystem with a simple example.

Forest ecosystem

Ask students:

Have you ever seen a forest? Can you name a few forests in India?

What are the kinds of forests found in India?

We do not see any forest near cities and towns or even villages these days. So, are forests important in our lives?

What are the causes of forest depletion in India? (Extensive use of industrial timber, agricultural expansion, construction of large dams and so on.)

- Give a general introduction on what forest is and in what kind of climate it grows.
- Introduce the terms flora and fauna.
- Sensitise students to the importance of biodiversity.
- Point out that biodiversity exists everywhere, by citing the examples of biodiversity in deserts and rainforests (different habitats).

Ask students:

Why is biodiversity different in different places? (Different animal and plant species adapt to different habitats.)

- Describe the rich biodiversity of the Indian forests.
- Describe the different kinds of forests with their distinguishing features.

Protected areas

Ask students:

Can you name a few animals that are killed every year for their skin, bones, teeth, tusks, horns, feathers and so on?

- Explain the threats faced by animals due to human activities. Stress on the fact that if plants and animals are not protected they may become extinct.
- Inform students that in order to protect our flora and fauna the government has earmarked different protected areas.
- Explain the meaning of protected areas.
- Students should be aware of government's strict rules and policies for protection and conservation of these precious species of plants and animals.

Activity: *For students:* Find out more about the measures adopted by the government to conserve wildlife. Write a short report on your findings.

Discussion (For students: Form groups of five):

Have you heard of illegal logging? What is it? How does it destroy our forest cover and biodiversity? What are its consequences? What can we do to protect the trees? (criminal activities like cutting and smuggling of huge and precious trees like oak, sandalwood, teak, chestnut and so on—trees which were several hundreds of years old have been destroyed and it is impossible to replace such trees—we lose several species and habitat of animals—animals venture into human settlements—natural medicine, which is a part of our heritage, is rendered useless with many plant species getting extinct—the rain pattern is affected and the climate changes, resulting in plants not being able to adjust with changes in climate and hence their flowering and seed forming are affected—this would definitely create shortage of food...)

- You may wish to explain how exciting a forest officer's job can be (Career watch).

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Stop and Check

1. True 2. False 3. True 4. False 5. False

Checkpoint

- A.** 1. b, home 2. c, plants, animals, fungi and microorganisms 3. d, decomposers
4. a, the alga and the fungus in a lichen
- B.** 1. trophic level 2. symbiosis 3. Kaziranga
- C.** 1. Symbiosis is a relationship where two organisms live together such that both organisms benefit.
2. Parasitism is a relationship where one organism, the parasite, lives within or on another organism called the host such that only the parasite is benefited and the host is harmed.
3. A predator is an organism that hunts and kills other organisms for food.
4. A prey is an organism that is hunted and killed by another organism (predator) as food.
5. Flora refers to all the plants in an ecosystem.
6. All the animals in an ecosystem are called fauna

D. 1.

Biotic factors	Abiotic factors
It includes all living organisms in an ecosystem.	It includes all non-living components of an ecosystem.
Producers (plants), consumers—herbivores, carnivores and omnivores, decomposers and scavengers—make up the biotic factors.	Soil, water, air, sunlight, temperature make up the abiotic factors.

2.

Consumers	Decomposers
They are heterotrophs that cannot make their own food but depend on other organisms directly or indirectly for nutrients.	They are saprophytes that depend on dead and decaying organic matter for nutrients without directly eating them.
They include herbivores, carnivores, omnivores and scavengers.	They include fungi and bacteria.

3.	Food chain	Food web
	It is a linear sequence of organisms through which nutrients and energy pass. Each step is called a trophic level.	It is a network of interconnected food chains.
	It cannot exist on its own in an ecosystem. The removal of one organism from a food chain will disrupt the entire food chain.	It is a complex network where each organism is important and removal of one can disrupt the entire web.

- E.**
1. Herbivores or plant-eating animals are primary consumers. Deer and cow are two examples of primary consumers. (Other primary consumers may also be mentioned.)
 2. Decomposers breakdown dead animal and plant material. The broken-down materials become nutrients, which are taken up by plants to make food. Thus, the decomposers help restore nutrients to the environment.
 3.
 - i. grass → grasshopper → frog → snake
 - ii. leaves → deer → tiger
 4.
 - i. Coniferous or montane forest
 - ii. Deciduous forest
 - iii. Thorn forest
 5. Jim Corbett National Park, Ranthambore National Park and Bandipur National Park are three examples of National Parks in India that protect tigers. (Other National Parks may also be mentioned.)
- F.**
1.
 - i. *Sunlight*. Sunlight is the main source of energy on Earth. Plants trap this energy to make their own food during photosynthesis. The life cycles of all organisms are dependent on the duration of sunlight during the day and across seasons.
 - ii. *Water*. Water makes up a major part of the body of organisms. It is required for all metabolic processes in organisms including photosynthesis in plants. The availability of water influences life in an ecosystem.
 - iii. *Soil*. The breakdown of rocks results in soil formation. Plants obtain water and minerals from the soil. Atmospheric nitrogen is made available to plants in usable forms by certain microorganisms that live in the soil. Some animals like the earthworm live in soil
 - iv. *Air*. Most organisms require oxygen for life. Plants use the carbon dioxide in air for photosynthesis. It traps sunlight and keeps the Earth warm and also regulates the temperature of the Earth. Wind is necessary for pollination and seed dispersal in many plant species.
 2. Diagram: Refer to the coursebook.

The flow of nutrients and energy is linear in a food chain. The plants, that is, the producers trap sunlight to carry out photosynthesis and make food. Part of the food is used by the plant and rest is stored. The energy that is stored in the plants is passed on to the primary consumers (herbivores) when they eat the plants. Carnivores eat the herbivores and get energy. Thus, energy is passed from one trophic level to the next. Finally, the decomposers break down the dead plants and animals to return the nutrients back to the soil.

3. A food web is a complex network of interconnected food chains. Thus, in an environment, multiple food sources may be present for the same organism. This ensures that food is available for an organism if any one source is absent. Thus, there are alternate pathways for energy and nutrient flow in a food web. This ensures that energy and nutrients are passed from one trophic level to another. Food webs play an important role in the cycling of nutrients. The food web thus helps to keep the ecosystem stable.
4. A food pyramid is used to show the number of organisms, biomass (or total weight of the organisms), or energy available at each trophic level of a food chain. The first level of a food pyramid is always the largest and decreases as we move up the pyramid. For example, in the food chain: plants → insects → frogs → snakes → eagles, the pyramid for number of organisms has plants (producers) at the base of the pyramid. This level will be the largest in terms of number of organisms, biomass and energy available. The number, biomass and energy available in the next level (insects) will be lesser than the bottom level. Thus, the level for frogs will be lesser than the insect level but will be more than the level for snakes. Ultimately, the level for the eagles will be the smallest level of the food pyramid.
Diagram: Refer to the coursebook.

5. i. Evergreen forests.

Flora: bamboo, mahogany, ebony

Fauna: tigers, leopards, elephants, wild dogs, Nilgiritahrs, Nilgiri macaques, lion-tailed macaques, sloth bears, gaur, hornbills and king cobras.

- ii. Mangrove forests.

Flora: Mangrove and palm trees.

Fauna: Tigers, crocodiles, monitor lizards, gharials, turtles, mudskippers, egrets, flamingos, pelicans, painted storks, ospreys, sea eagles and crabs.

Think and Answer

1. The Venus fly trap, pitcher plant and other insectivorous plants are both producers and consumers. They can carry out photosynthesis like other plants do as they contain chlorophyll. Also, they trap and engulf insects or small organisms like consumers do.
2. Plants are the only organisms that are able to use the light energy to produce their own food; hence, they are called producers. Animals depend directly or indirectly on them for food. Thus, they are the connecting link between abiotic and biotic components of the ecosystem. This is why every food chain begins with a producer.
3. No. Each organism is adapted to its environment and is a part of a food chain and food web. Displacing (moving) an animal from its habitat will result in it losing its food source(s). Thus an animal that lives on high mountains will not be able to live in the plains.

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A. Match the following.

1. biotic	a. fungi
2. abiotic	b. intestinal bacteria
3. symbiosis	c. plants
4. scavenger	d. vulture
5. Gir national park	e. soil
6. decomposer	f. lion

Ans: 1. c 2. e 3. b 4. d 5. f 6. a

B. Answer the questions.

1. What is the importance of producers?

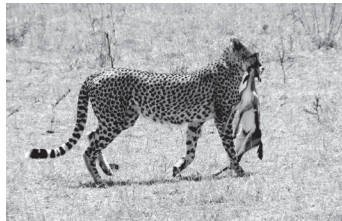
Ans: Producers or autotrophs trap the energy in sunlight and make food through photosynthesis. This energy is then passed on to herbivores or primary consumers. Producers are thus the link between abiotic and biotic factors in an ecosystem.

2. Identify the relationship between the organisms.

a.



b.



Ans:

a. *Parasitism*: the mosquito is the parasite and the animal is the host.

b. *Predation*: The antelope is the prey and the cheetah is the predator.

3. Write a short note on thorn forests in India.

Ans: Thorn forests are found in dry areas in west, central and south India.

Flora: Acacia trees and cacti plant grow here.

Fauna: Camels, blackbuck, rabbits, desert foxes, great Indian bustard and chinkara are the fauna found here.

4. Discuss the advantages when large areas of land are set aside as protected areas by the government.

Ans: Declaring several large areas of land, which are rich in biodiversity, as protected and reserved for wildlife helps conserve the natural habitats of plant and animal species. Human interference is strictly prohibited here. Forestry, grazing, cultivation and other forms of commercial activity are banned in such areas to conserve the habitats.

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1. Draw arrows to form a food chain using the organisms given. Write what kind of consumer each organism is.



Producer





What will happen to the food chain if the beetles are removed from it?

2. Classify the flora and fauna into the right columns.

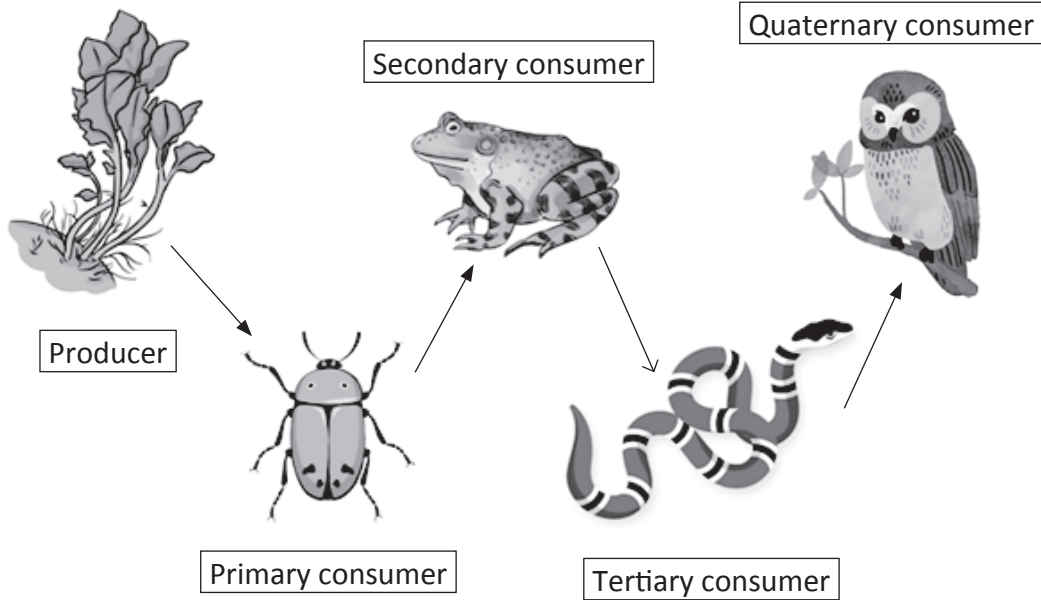
pine	cactus	palm trees	bamboo	neem
elephants	crocodile	pelicans	buffalo	leopards
camels	blackbuck	king cobras	babblers	pheasants

Montane forests	
Deciduous forests	
Evergreen forests	
Thorn forests	
Tidal forests	

ANSWER KEY FOR THE WORKSHEET

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1.



If the beetles are removed from the food chain, the plants will grow more than usual since there will be no beetles to eat them. The frogs will get no food and will die. The snakes will get no food and die. Ultimately, the owls will also die.

2.

Montane forests	pine, babblers, pheasants
Deciduous forests	neem, Malabar squirrel, wild buffalo
Evergreen forests	bamboo, wild dogs, king cobra
Thorn forests	cactus, camels, desert fox
Tidal forests	palm trees, crocodiles, pelicans