

## Chapter 15 - Our Environment (Class X)

### Introduction

In this chapter, we shall be studying how various factors in the environment interact with each other and how we impact the environment. In previous classes, we studied how different materials are cycled in the environment in separate biogeochemical cycles. In these cycles, essential nutrients like nitrogen, carbon, oxygen and water are changed from one form to another. We will study how human activities affect these cycles.

What happens when we add our waste to the environment?

Biodegradable : Substances that are broken down by biological processes.

Non-biodegradable : Substances that are not broken down by biological processes. These substances may be inert and simply persist in the environment for a long time or may harm the various members of the eco-system.

Q.) Why are some substances biodegradable and some non-biodegradable?

Ans) Substances that are broken down by biological processes using microorganisms such as bacteria and fungi which secrete enzymes to degrade substances are called biodegradable. Organic compounds present in dead remains of plants and animals and their waste products can be degraded into simpler harmless substances by biological processes.

Certain categories of wastes like plastics, glass etc, cannot be degraded by microorganisms or biological processes are termed as non-biodegradable.

Q.) Give any two ways in which biodegradable substances would affect the environment.

Ans) (i) Decomposition of biodegradable wastes produces foul smell which spreads in the environment and makes the life of people miserable.

(ii) Flies breed at huge heaps of biodegradable wastes carrying the germs and spread diseases such as typhoid, diarrhoea, tuberculosis, cholera etc.

Q.) Give any two ways in which non-biodegradable substances would affect the environment.

Ans) (i) Some of the non-biodegradable wastes (pesticides and heavy metals) convert the land into barren land and enter the food chain thus, affecting human beings and other biotic components of the environment.

(ii) Pesticides and other chemicals enter water and food chains. They affect the fertility of soil and harm all kind of living organisms. Human beings are harmed the most because they are at the top of the food chain.

## ECO-SYSTEM — What are its components.?

An ecosystem consists of biotic components comprising living organisms and abiotic components comprising physical factors like temperature, rainfall, wind, soil and minerals.

Examples of ecosystem:

Garden, forests, ponds and lakes.

Garden and crop-fields are human made (artificial) ecosystem.

Producers: All green plants and certain blue-green algae which can produce food by photosynthesis are called producers.

Consumers: Organism which consume the food produced, either directly from producers or indirectly by feeding on other consumers are called consumers.

Consumers can be classified:

- herbivores
- carnivores
- omnivores and
- parasites.

Decomposers: The microorganisms, comprising bacteria and fungi, break-down the dead remains and waste products of organisms. They break down the complex organic substances into simple inorganic substances that go into the soil and are used up once more by the plants.

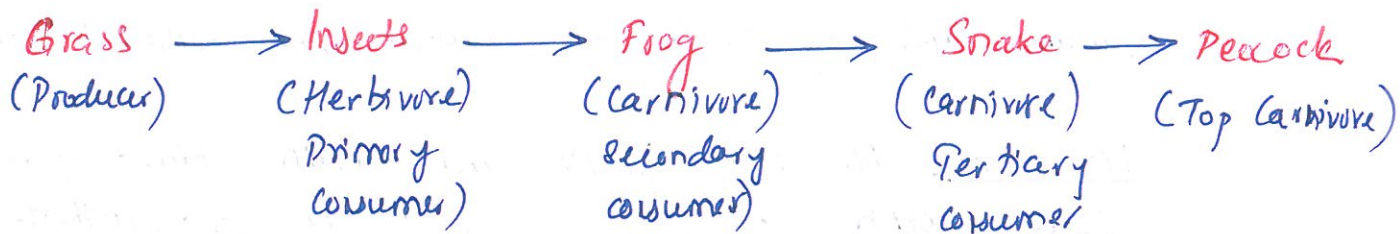
Q.) What is the role of decomposers in the ecosystem or environment.  
(See above)

## Food chain and webs

Q) What are trophic levels? Given an example of a food chain and state the different trophic levels in it.

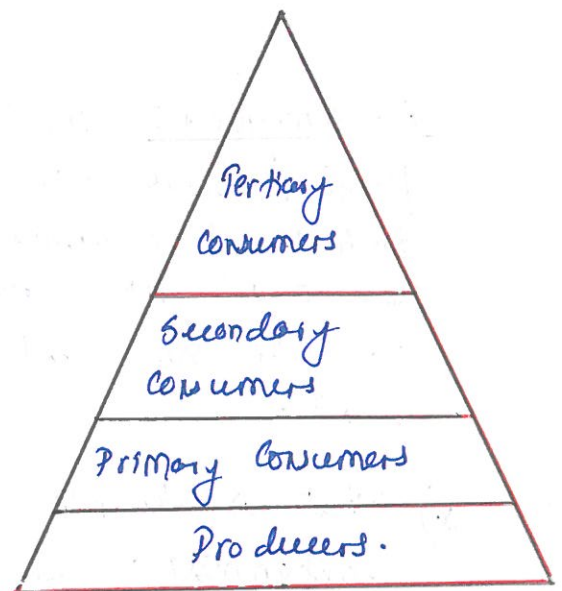
Ans) Each step or level of a food chain where transfer of energy occurs are called trophic levels.

Consider the following food chain:



Q) What will happen if we kill all the organisms in one trophic level?

Ans) If we kill all the organisms in one trophic level, the transfer of food energy to next level will stop. Also, there will be overpopulation of individuals belonging to the previous trophic level. The organisms of higher trophic level will also die. Hence it will result in imbalance in the ecosystem.



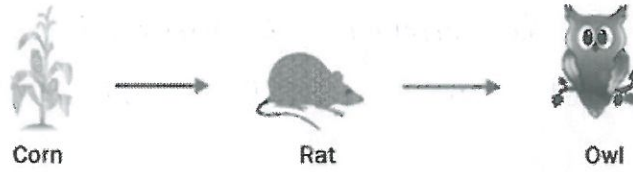
## The flow of energy between various components.

- 1) The green plants in a terrestrial ecosystem capture about 1% of the energy of sunlight that falls on their leaves and convert it into food energy.
- 2) An average of 10% of the food eaten by primary consumers is turned into its own body and made available for the next levels of consumers. A great deal of energy is lost.
- 3) Therefore, 10% can be taken as the average value for the amount of organic matter that is present at each step and reaches the next level of consumers.
- 4) The loss of energy at each step is so great that very little usable energy remains after for trophic levels.
- 5) In ecosystem, the greatest number is of the producers.
- 6) Food web: Each organism is generally eaten by two or more other kinds of organisms which in turn are eaten by several other organisms. So instead of a straight line food chain, the relationship can be shown as a series of branching lines called a food web.

### Flow of energy in a food chain is unidirectional.

The energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs. As it moves progressively through various trophic levels it is no longer available to the previous level.

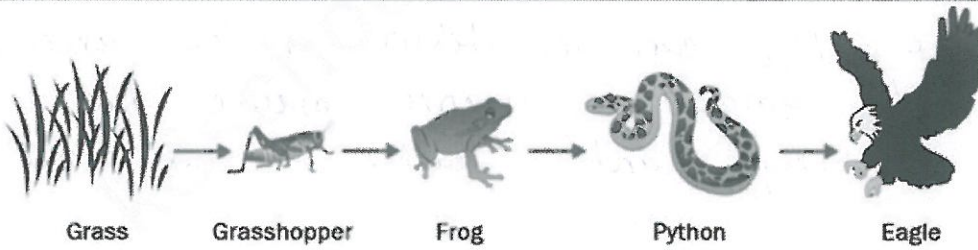
## Food Chains



A three linked food chain

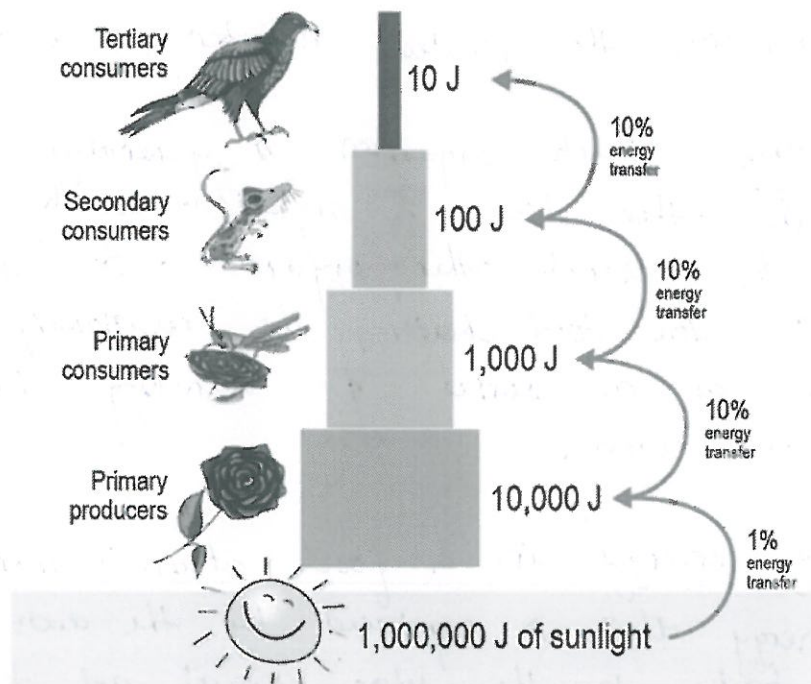


A four linked food chain



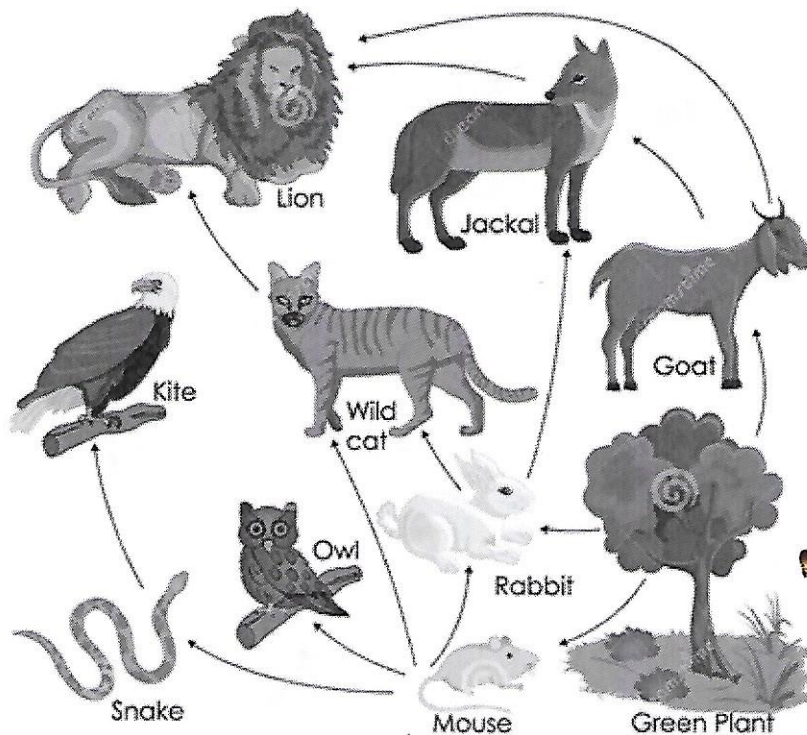
A five linked food chain

## Energy Flow Diagram

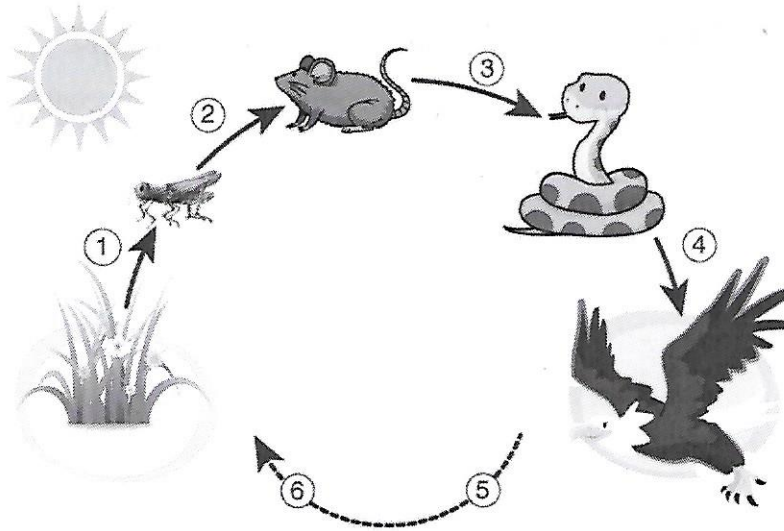


# Food web

Each organism is generally eaten by two or more other kinds of organisms which in turn are eaten by several other organisms. So instead of a straight line food chain, the relationship can be shown as series of branching lines called a food web.



# FOOD WEB



1 The grasshoppers eat the plants

2 The mice eat the grasshoppers

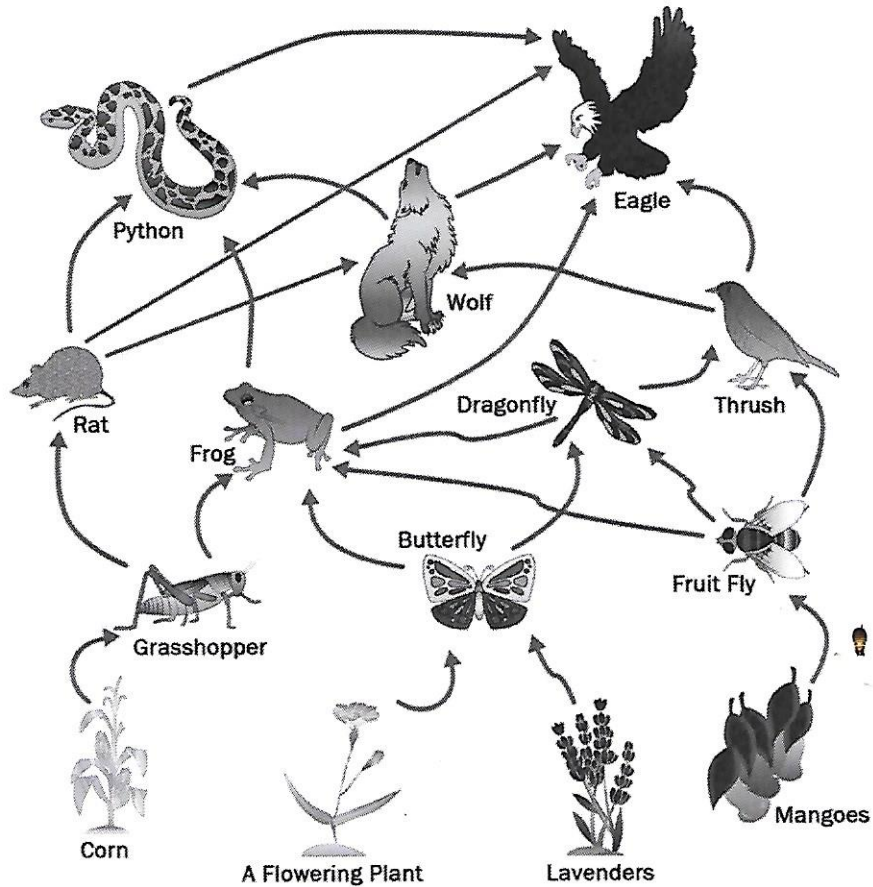
3 The snake eat the mice

4 The eagles eat the snake

5 When the hawks die, fungi breaks the bodies down and turns into nutrients

6 The nutrients, along with sun and water, cause the grass to grow

## A Food Web



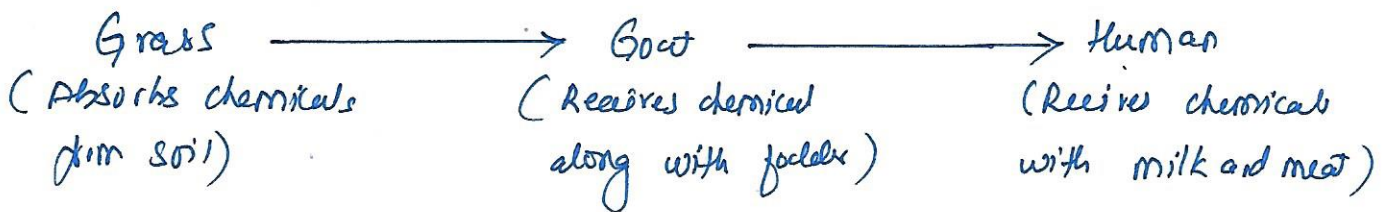


## Biological Magnification

Use of several pesticides and other chemicals to protect our crops from diseases and pests; some harmful chemicals enter our bodies through the food chain. These chemicals are washed down into soil and the water bodies, then absorbed by plants and taken up by aquatic plants and animals. This is the way in which they enter the food chain.

"The increase in concentration of harmful chemical pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification."

The concentration of harmful chemical will be different at different trophic level, because the animals at the highest trophic level or at the extreme right side of the food chain will have the maximum concentration of harmful chemicals in the body, and grass which is at the lowest trophic level will have minimum concentration of harmful chemicals.



## Questions

(1) What will be the amount of energy available to the organisms of the 2nd trophic level of a food chain, if the energy available at the first trophic level is 10,000 Joules?

Ans) On applying the 10% law to the food chain, the organism of the 2nd trophic level of the food chain will have  $\frac{10}{100} \times 10,000 = 1,000$  Joules of energy.

(2) In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes?

Plants  $\longrightarrow$  Rats  $\longrightarrow$  Snakes  $\longrightarrow$  Hawks.

Ans) On applying the 10% law to the food chain.

Plants  $\longrightarrow$  Rats  $\longrightarrow$  Snakes  $\longrightarrow$  Hawk.

(500 J)                      10% of 500                      10% of 50

$= \frac{10}{100} \times 500$                        $= \frac{10}{100} \times 50$

$= 50 \text{ J}$                                        $= 5 \text{ J}$ .

$\therefore$  Energy available to Hawk is 5 Joules.

(3) Calculate the amount of energy available to Tiger in the following food chain if plants have, 30,000 J of energy available from Sun.

Plant  $\longrightarrow$  Deer  $\longrightarrow$  Tiger

Ans) Sun  $\xrightarrow{1\% \text{ absorbed}}$  Plant  $\xrightarrow{10\%}$  Deer  $\xrightarrow{10\%}$  Tiger

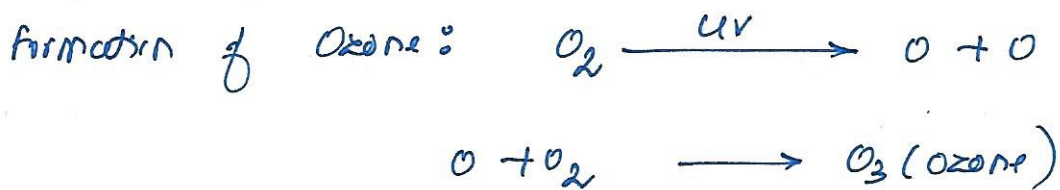
(30,000 J)                      (300 J)                      (30 J)                      (3 J)

# How do our activities affect the environment.

## Ozone Layer and How it is Getting Depleted.

Ozone ( $O_3$ ) is a molecule formed by three atoms of oxygen. Ozone, is a deadly poison.

However, at higher levels of atmosphere, it shields the surface of the earth from ultraviolet (UV) radiation from the Sun. This radiation is highly damaging to organisms. It is known to cause skin cancer in human beings.



High energy UV radiations split  $O_2$  into free oxygen (O) which combine with  $O_2$  to form ozone.

The amount of ozone in the atmosphere began to drop sharply in the 1980s. This decrease has been linked to synthetic chemicals like chlorofluorocarbons (CFCs) which are used as refrigerants and in fire extinguishers. In 1987, the United Nations Environment Programme (UNEP) succeeded in forging an agreement to phase CFC production at 1986 levels.

## Managing the Garbage we Produce.

We can help reducing the waste disposal problem by changing our life style and attitude. If we minimize the use of disposable articles and start using only those articles which can easily be recycled, the quantity of waste can be reduced.

1.) Non-biodegradable waste : Most often the non-biodegradable waste is recycled. It is taken away by rag-pickers.

2.) Biodegradable waste : Biodegradable waste is putrescible. It can be composted or vermicomposted to prepare compost for our kitchen gardens.

Some prominent methods of waste disposal are landfills, production of bio-gas and manure and incineration.