

3. Mutual relationships between organisms and the environment



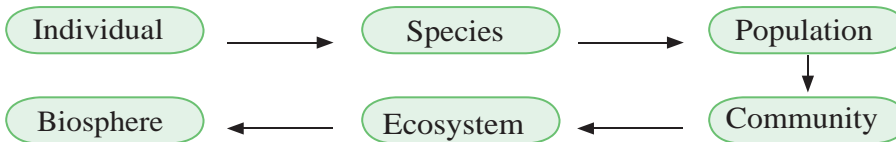
At the end of this chapter, you will be competent to....

- Analyse the environment biologically
- Contribute to maintain the balance of the eco-systems.
- Minimise harmful influences to the maintenance of the biosphere.

3.1 Levels of organization in the biosphere

Environmental scientists are concerned about the breaking down of natural interactions between the environment and humans. The concept of conservation of environment has been forwarded as a remedy. Before learning about the methods of conservation of environment, it is important to study about the inter relationships present in a natural environment.

Let us first pay our attention to the organisational levels in the environment. Organisms are organised from simple levels to complex levels. It can be shown by a simple flow diagram.



Let us learn more about each of these organizational levels.

Individual

A single organism living in the environment is called an individual.

This is the simplest organizational level. A Mango tree, a rabbit, an elephant are examples of individuals.

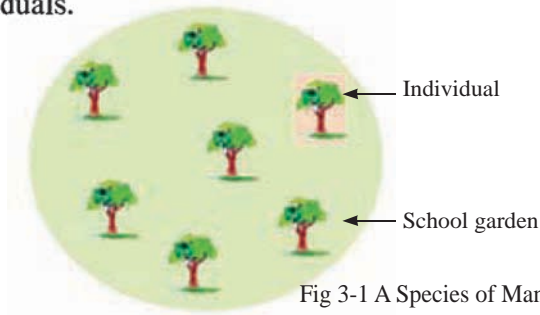


Fig 3-1 A Species of Mango

Species

Let us find a definition for a species. Individuals with many similar characteristics and can give birth to fertile offsprings by inter breeding are called a species. Mango plants where inter breeding takes place belong to the species mango. Deer who give birth to off springs by inter breeding with each other belong to the species deer.

Do you know?

Mango and Rambutan cannot give fruits by cross pollination because they do not belong to the same species.

Although inter breeding takes place between horse and donkey the mule they produce, is not a fertile animal.

Activity 3.1

Select a suitable environment such as your home garden or school garden or any other place. Name the biological species that you can find in it.

The second organizational level is population.

Population

In a given period of time, in a specified area the number of organisms belonging to a particular species is known as a population.

eg. In year **2001** the **human** population of **Sri Lanka** was **19238575**.

In a natural environment, we can see many species but for our studies we consider only one species.

The magnitude of a natural population varies. The main factors which control this are, births, deaths, emigration and immigration. Births and immigrations increase the magnitude of a population while deaths and emigrations decrease the magnitude of a population.

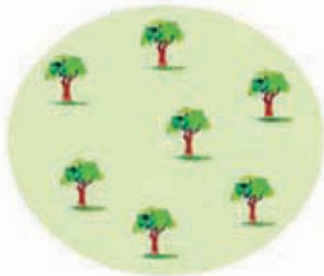


Fig. 3.2 A population of mango



Fig. 3.3 A part of an elephant population

Growth of a population

The organisms in a natural population changes with time according to a certain pattern. The Fig. 3.4 explains this.

Let us consider the changes in the number of organisms in various stage of the graph and the reasons for such changes.

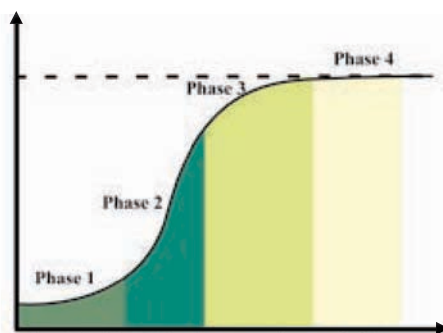


Fig. 3.4 Growth of a natural population

Phase 1 - Phase of slow growth rate

The growth is slow because the organisms are not properly adapted to the environment and the number of mature organisms who are able to reproduce are limited.

Phase 2 - Phase of rapid growth rate

The number of organisms increase rapidly because the organisms are well adapted to the environment, increase of the number of mature organisms of reproductive age, abundance of food and favourable environmental factors.

Phase 3 - Phase of decreasing growth rate

The rate of growth of a population decreases due to limiting factors like scarcity of food, competition for limited resources, action of predators and parasites and diseases.

Phase 4 - Phase of equilibrium of growth rate

Death rate and birth rate balance and the number of organisms change till the environment is able to hold them and they are able to adapt to the environment. Finally the population takes a stage of static equilibrium. At this moment the number of organisms in that environment is known as the carrying capacity.

The third organizational level of an environment is a community.

Activity 3.2

1. Observe the different populations in your school garden and list them.
2. Write an expression for one population you have selected according to the definition given for population.

Community

In the field study you carried out in Activity 3-1, you would have identified a number of populations. The populations like mango trees, ants, sparrows and all the other populations in your school garden belong to the organizational level community.

A community is a number of populations living in an area showing interrelationships among them. There are interrelationships among populations for needs such as food, shelter and safety. It can be shown in a diagram.



Fig. 3.5- Community

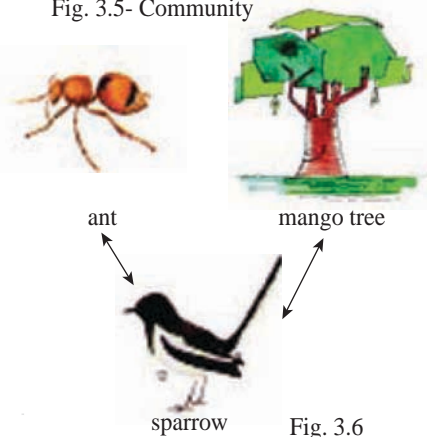


Fig. 3.6

Assignment 1

Make a list of inter-relationship among these three populations in Fig. 3.6. Discuss it with your teacher.

Inter-relationships among a community

The populations you studied in your school garden can be illustrated in a diagram.

The last and the most stable unit in an environment is an ecosystem. Let us identify an ecosystem.

Ecosystem.

All the populations in an area, together with the abiotic environment, with which they interact are known as an ecosystem.

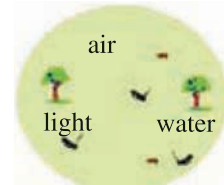


Fig. 3.7 An eco-system

In an ecosystem, there are inter-relationships between biotic and abiotic environments. Can you name some ecosystem?

A home garden, a big tree, a decaying log, a forest and a fresh water pond are some examples of eco-systems.

Biosphere

All the eco-systems on earth together are known as the biosphere. We can define biosphere in the way. The zone on earth where life is found is called the biosphere. The biosphere consists of the lithosphere, hydrosphere and atmosphere.

3.2 Maintaining the balance of an ecosystem

Factors affecting the maintenance of an eco-system

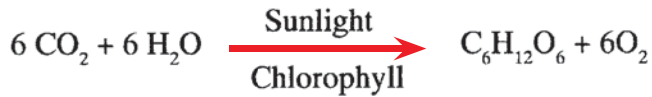
The organisms in an ecosystem have various inter-relationships with the abiotic environment. Living organisms influence the abiotic environment while the abiotic environment influence living organisms. Let us consider how biotic factors influence the maintenance of an ecosystem

Effect of biotic factors on the maintenance of an ecosystem

The biotic factors or living organisms in an environment are producers, consumers and decomposers.

Producers

Producers are the autotrophic organisms who produce their own food. Recall the photosynthesis equation you have studied earlier.



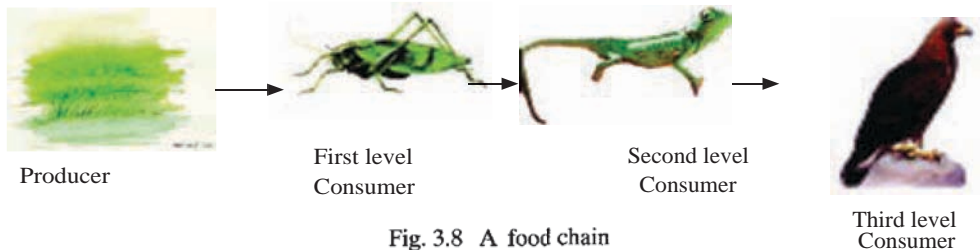
According to this equation the participation of producers is necessary to convert solar energy into chemical energy. Production of glucose by plants (photosynthesis) is an important biological activity. The main producers on earth are plants.

The main producers in aquatic environment are algae.

These producers are very important to maintain the biosphere, because they supply food for all the heterotrophic organisms. So the first link in a food chain is a plant or a producer.

Consumers

All organisms who depend on producers directly or indirectly are known as consumers. Look at this food chain.



In the above food chain the grass hopper, lizard and eagle are known as consumers of the first level, the second level and the third level respectively.

Do you know?

In an aquatic environment the main first level consumers are zoo planktons.

Assignment 2

Identify the producers and consumers in the environment.

Construct food chains using them.

Decomposers

The organisms living on dead organisms are known as decomposers. They secrete enzymes on dead organic matter and digest them, into simple substances. In this way the decomposers bring about the decay of dead organic matter and release simple substances to the ecosystem. Activities such as

- Burning litter frequently
- Adding oil and pigments to the soil
- Using agro-chemicals

can destroy decomposers which will influence the ecosystem adversely.

Effect of abiotic factors on the maintenance of an ecosystem

Abiotic factors play a main role to maintain the balance of an ecosystem. The main abiotic factors are soil, light, temperature, moisture and air.

Soil

Soil is a mixture of organic and inorganic substances. It supplies a medium for plant growth. There are four main components of soil. They are mineral components, organic matter, soil air and soil water.

A plant fixes it self to the soil by roots. Plant roots absorb necessary water and minerals from the soil. Soil supplies a medium for the growth of soil organisms and micro organisms.

Light

Sunlight supplies energy to plants to produce food for the living world. The process of photosynthesis depends on the period of obtaining light, the colour of light and the intensity of light.

Countries near the equator receive sunlight for about 12 hours of the day. Seasonal changes occur in countries closer to the poles according to the time they receive sunlight. Organisms change their life style according to the sunlight they get. Some of the changes taking place in plants due to light are falling of leaves, production of flowers and growth.

Temperature

In an eco system, the main source of temperature is the sun. Temperature is an important factor which affects the activities of living organisms. There is a temperature range which is suitable to carry on metabolic activities of organisms. When temperature falls, the enzyme activity decreases and with the rise of temperature, biological molecules like proteins get destroyed. The temperature varies with seasonal changes, geological structure of earth and the length of day time.

Moisture

Water is a necessary factor for life and it becomes a limiting factor on land. The main method of getting water to earth is rain. Plants absorb water from soil. Due to less rain fall, increase in the rate of flow of water over soil, and excess evaporation the amount of water in the soil decreases. The plants and animals living in areas with scarcity of water show adaptations to get water and to conserve water. Less rain fall and excess evaporation increases the salty nature of soil. It disturbs the absorption of water in soil organisms.

Air

Atmosphere is a main component of the biosphere. Solar heat heats up the atmosphere and makes it movable. Because of this, the evaporated water vapour is taken to various places, and hence we get rain. The movement of air is wind. The wind takes gases like sulphur dioxide to far away places and pollute the environment. This harms the organisms in those places. The wind helps evaporation in transpiration. It changes the direction of migratory birds. Air supplies oxygen for respiration and carbon dioxide for photosynthesis to organisms.

Flow of energy and cycling of material in an ecosystem

Maintenance of the biosphere is controlled by the sun which is situated about millions of kilometers away from earth. The flow of energy and cycling of materials are important for the existence of organisms. In an ecosystem, the energy and materials flow along food chains.

Food chains and food webs

In a food chain, the herbivores obtain energy and materials by eating autotrophs. Energy of the plant is gained by carnivores by eating herbivores. A food chain starts from a producer.

Can you remember the food chain you constructed in the Assignment 2? Food chains do not exist singly. They get inter-connected to form food webs.

The diagram below shows how a number of food chains make a food web by inter-connecting.

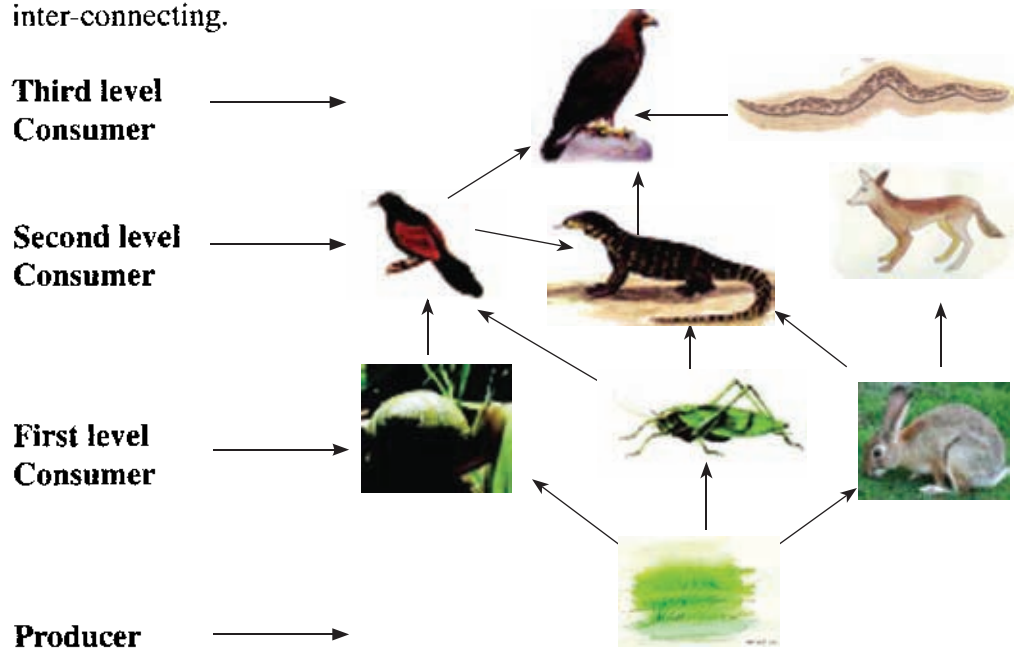


Fig. 3.9 - A food web

For the circulation of energy and materials food webs are more suitable than food chains. An animal depending on one type of food only is not favourable for the organism as well as for the existence of the ecosystem.

Assignment - 3

Select any ecosystem and write some food chains in it. Try to connect them to form a food web.

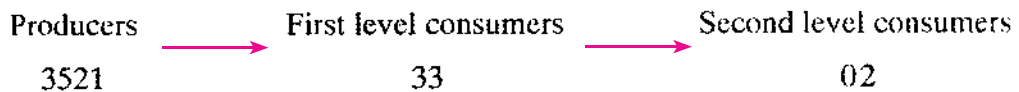
Relationships about the number of members in a food chain, mass of living organisms, the percentage of energy in each energy level shows a special pattern. This pattern when connected takes the shape of a pyramid. They are called ecological pyramids.

Ecological pyramids

There are three types of ecological pyramids. They are number pyramids, biomass pyramids and energy pyramids.

Number pyramids

In a field study, we frequently meet producers. The number of herbivores or first level consumers are less than the number of producers. We meet herbivores like insects, snails, grasshoppers and butterflies less frequently than plants. The total of secondary level consumers like cat, rat snake and mynah are further less in number. Shown below is some statistics obtained in a field study.



This can be shown by a pyramid.



Fig. 3.10 - A number pyramid

Activity 3.3

Construct a number pyramid in relation to food chains existing around a Jack or Mango tree with fruits. The pyramid you constructed takes a different shape from the pyramid in Fig. 3-10. Discuss the reason with your teacher.

Biomass pyramids

You would have understood that a large number of herbivores depend on one producer, [activity 3.3.] The number pyramid you got does not match with pyramid pattern. As a solution for such incidents **bio-mass pyramids** are constructed. The bio-masses of each trophic level are measured separately and a pyramid is shown using the bio masses. Then the mass of the mango tree is more than the mass of consumers who depend on it.

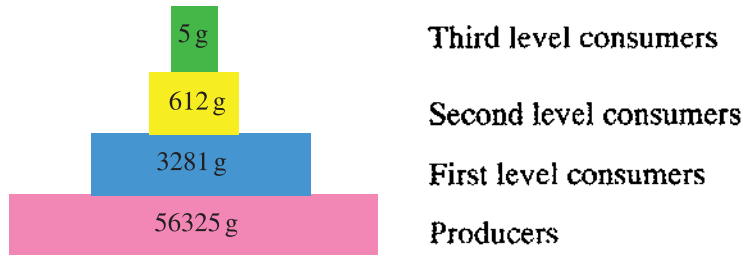


Fig. 3.11 - A pyramid of bio-mass

The bio mass is measured in grams per square metre. (gm^{-2})

Let us identify energy pyramids.

An energy pyramid is better to express the connections among various trophic levels. It is constructed by calculating the amount of energy present in each trophic level. The producers fix about 0.1% of solar energy which falls on earth. This energy decreases gradually when it flows through food chains.

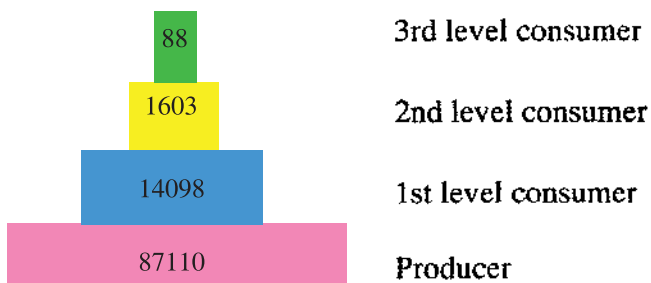


Fig. 3-12(a) - A pyramid of energy.

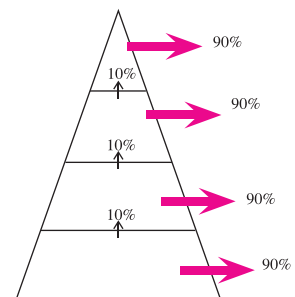


Fig. 3.13 (b) - Energy flow and wastage along food chains.

The unit of measuring energy here is kilojoules per square metre per year. ($\text{kJm}^{-2}\text{yr}^{-1}$) The energy contained in organisms living in one square meter in one year is measured in kilojoules.

There is a depletion of energy from one trophic level to another trophic level. This is roughly about 90%. The energy flow from one trophic level to another level is 10%. The number of links in a food chain cannot increase without a limit

because of this reason. You will understand that the number of links in a food chain is limited to 4 or 5.

The loss of energy in trophic levels is known as energy dissipation. It is clearly understood from Fig. 3.14. The reason for not depositing the whole energy obtained by a herbivore, in its body tissues is shown in Fig. 3.14.

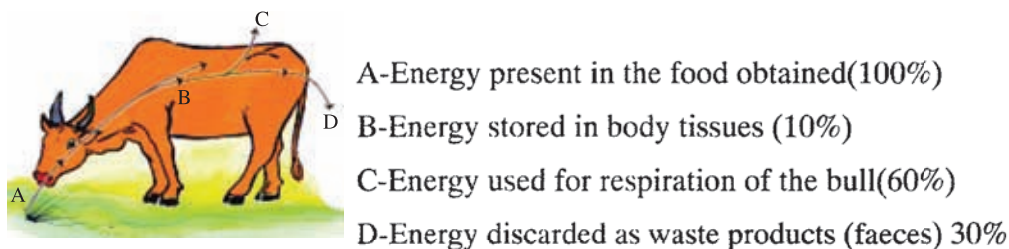


Fig. 3.14 Fate of food obtained by a bull.

This information explains that 90% of energy is dissipated and 10% is stored in body tissues.

Activity 3.4

In an ecosystem the energy fixed by producers is 37800 units and the energy stored in first level consumer is 3800 units. The second level consumer stores 378 units in its body tissues and the third level consumer stores 38 units in its body.

1. Construct an energy pyramid with the above information.
2. Calculate the percentage of energy dissipated in each trophic level.
3. What are the reasons for energy dissipation in each trophic level.

Cycling of elements

It is clear that the energy flows in one direction, that is from lower trophic levels to higher trophic levels in an ecosystem.

The substances obtained by organisms from the environment are added to the environment again after undergoing some changes in their bodies.

There are many elements which are used to construct the bodies of organisms. Some of them are carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorous and calcium. The manner of exchanging these elements between the environment and the organisms is known as cycles of elements. Let us consider how nitrogen and carbon circulate in a cyclic manner in an ecosystem.

Nitrogen cycle

The highest percentage of air (78%) is nitrogen, but the plants cannot use this nitrogen. The circulation of nitrogen can be shown by the diagram shown below.

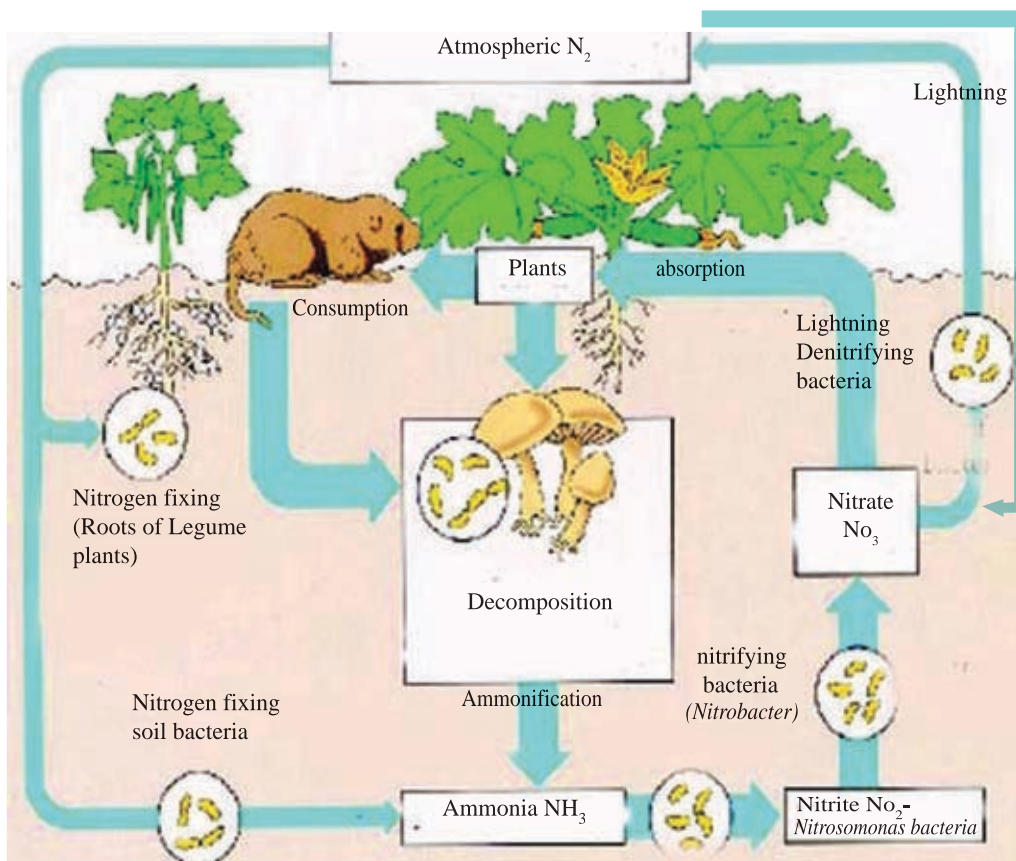


Fig.3.15 - Nitrogen cycle.

- ❖ Nitrogen is present in bodies of animals as proteins and amino acids.
- ❖ Animals get necessary nitrogen from plants.
- ❖ Plants obtain nitrogen compounds as NO_3^- or NH_4^+ ions dissolved in water
- ❖ Some micro-organisms can directly turn atmospheric nitrogen into nitrogen compounds. An example for this are the bacteria living in root nodules of leguminous plants.
- ❖ Death and decay of organisms produce ammonia gas which is turned into NO_2^- ions by **Nitrosomonas** bacteria which live in soil. NO_2^- ions are turned into NO_3^- ions by Nitrobacter. Plants absorb this NO_3^- . This process is called nitrification.

- ❖ Denitrifying bacteria living in soil releases N_2 from nitrogen compounds in soil. This N_2 gas is added to the atmosphere.
- ❖ During lightning, atmospheric N_2 is converted to nitrogen compounds and is added to the soil.

Carbon cycle

Carbon is an important element to living organisms. Let us examine the cycling of carbon in nature.

Carbon cycle

The main sources of carbon obtained by living organisms are atmospheric CO_2 and CO_2 dissolved in water. Carbon is deposited in under ground pits of fossil fuels and as pits in the sea beds. Let us see how carbon circulates in nature.

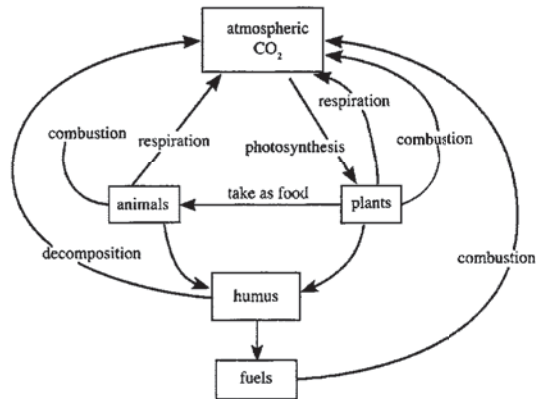


Fig-3.16 Carbon cycle

- ❖ Plants absorb CO_2 and prepare food. Then plants get carbon.
- ❖ By eating plants and animals carbon enters animal bodies.
- ❖ When plants and animals respire to obtain energy CO_2 is released to the atmosphere.
- ❖ The remaining carbon is added to the atmosphere after death and decay of organisms.
- ❖ When we burn organic matter, the carbon present in them is released to the atmosphere as CO_2 .

3.3 Use of strategies to minimize harmful effects on the existence of the biosphere

Man is a major participant in the process of destroying the maintenance of the biosphere.

Effect of man on ecosystems

The effect of human activity plays a large role in upsetting the balance of nature. Let us consider some of these activities of man which are responsible for this.

i) Growth of populations

One of the main factors which affect the balance of nature is the rapid growth of population. The graph given here shows that the world population in 1830 A.D. was about one billion. The reasons for the slow growth of population seen in the graph were natural calamities, spreading of diseases and other common reasons.

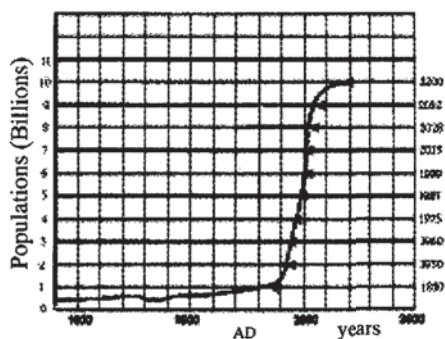


Fig. 3.17 Growth of populations

About two centuries ago, due the industrial revolution and the advancement of science and technology the life style of man started to change rapidly.

The birth ratio has taken a higher value and the death ratio has come down.

The reasons for this can be listed as the advancement in the medical field, getting sufficient food and the advancement of health facilities.

The result of this was the rapid growth of population after 1830. It has been calculated that the world population will increase upto 8 billion in 2028 A.D.

There is doubt whether the biosphere is able to supply the necessary resources to provide space, food, clothing, housing, education and other necessities, to future populations. The rate of increase in population is higher in developing countries than in developed countries.

Among the problems arising due to this are urbanization, spreading of diseases like AIDS, a polluted society, unemployment, migration to other countries and the increase in the population of elders. These are very complex issues and it is very difficult to address them.

The increase of population can be controlled by controlling the birth rate and education of the people.

ii) Deforestation

Among the influences created by man on the maintenance of the biosphere, deforestation takes a major place.

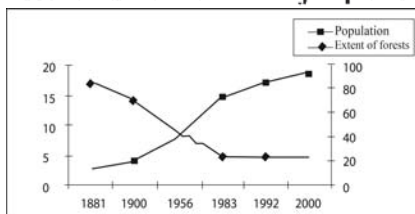


Fig. 3.18 Growth of population and deforestation in Sri Lanka.

Do you know?

About 3.8 millions of hectares of forests are destroyed from earth in one year.

A natural forest is a very stable eco system. Due to various reasons man has to cut down forests. The above graph shows how the forests are destroyed with the growth of population. (Fig. 3.18)

The reasons for destroying forests

People deforest for agricultural purposes, to make buildings and roads. People cut down the forest to get timber and wood to use as a fuel. Deforestation may take place due to natural disasters too. In 1998 due to El Niño effect on climate change a large area of forests were destroyed.

Harmful effects of deforestation

- Decreasing the amount of absorption of rain water to the soil.
- Soil erosion due to the increased rate of flowing water.
- Loss of fertility of soil due to erosion.
- Deposition of silt and other sedimented substances cause over flowing of rivers.
- Global warming due the lesser absorption of carbon dioxide by trees.
- Decrease of biodiversity.
- Disorders in the water cycle.
- Decrease in the under ground water level.
- Destruction of medicinal sources. (There are experiments going on to find medicines for leukaemia, AIDS and cancer from plants.)

iii) Irrigation for agriculture

Sending water for cultivation through canals and tunnels is known as irrigation. To supply water to agricultural fields special devices are used. Spraying water by perforated tubes, releasing water only to cultivated area through pipes, and spraying water using rotating instruments are few methods used in irrigation purposes.

A disadvantage in using irrigation methods is the increasing of the saltiness of soil due to the evaporation of water. Because of this the cultivated land turns to a barren land.

Using compost fertilizers and by supplying only the necessary amount of water are solutions for this problem.

iv) Industrialization

Industrialization started in West Europe around 1800 A.D. due to the advancement of science and technology. As a result new investigations and productions increased. This raised the conditions of life in man but created many problems. Because of this deforestation, urbanization, pollution of the environment, global warming, changing of climate, spreading of diseases, and the increase of unexpected deaths were caused. Developed countries identified these problems and started to minimize them. Now there is a vast advancement in industry in developing countries too. Countries like Sri Lanka are also facing the above problems.

Let us identify some suitable solutions for these problems

- Releasing industrial effluents to the environment after purifying them.
- Using alternate energies which minimize the pollution of the environment.
- Constructing well planned cities.



Fig. 3.19 a polluted city

v) Urbanization

Millions of people migrate to cities for various purposes. This is the start of modern urbanization. Because of this instant migration, unplanned and polluted cities were created. Many common problems have been identified in these cities.

Increased burning of fuels, scarcity of water, air pollution, increasing cost of land, unhygienic housing, spreading of diseases and crime, weak infrastructure, traffic jams and wasting time for transport are some of these problems.

When constructing cities in developed countries various strategies are used to overcome this condition. Some of the strategies used to overcome this condition, are given below.

- ◆ Building well planned high ways, flats, service stations, play grounds and other important buildings.
- ◆ Supplying health facilities and maintaining regular services.
- ◆ Using high ways and tunnel ways.
- ◆ Supplying bullet train facilities.



Fig. 3.20 a well planned city

- ◆ Controlling the number of private vehicles entering cities, and supplying a good public transport service.

iv) Pollution of the environment

Among the negative influences created by human activities on the biosphere, pollution of the environment has become a problem which has been discussed very often. Till the 20th century this problem was not a considerable one. But now it has become a problem of the world. Releasing energy and materials to the environment at a rate higher than the absorbing power of the environment is called pollution.

It can be considered separately as air pollution, water pollution and soil pollution.

Air pollution

The main factors which cause air pollution are burning of fuels in factories, in vehicles and in houses, releasing various particles, burning of forests, burning of oil wells, eruption of volcanoes. The main pollutants are chlorofluoro carbon (CFC), sulphur dioxide, hydrocarbons, oxides of nitrogen, carbon monoxide and particles like lead, asbestos dust, mercury and carbon.

Bad effects of air pollution are respiratory diseases, cancer, brain defects, loss of immunity in humans. It is poisonous to animals, causes acid rain, reduces the harvests and destroys important ruins.

To minimize air pollution various devices are used. They are, releasing gaseous pollutants after cleaning, using alternate energy sources as fuels and conservation of forests.

Water pollution



Fig. 3.21 Water pollution

Water gets polluted by the addition of various pollutants to water. Man is mainly responsible for polluting water.

Water gets polluted by addition of effluents with nitrate compounds from factories, heavy metals like mercury, lead, copper and arsenic, oils, warm water and dyes. Chemical fertilizers, fungicides, insecticides and weedicides from cultivated lands, oil from ships, and radioactive rays from nuclear power stations.

Because of water pollution spreading of diseases, concentration of ions like NO_3^- and PO_4^{3-} in water (eutrophication) and the death of aquatic organisms are caused. Many devices are used to minimize water pollution. Some of them are:

implementation of rules to control the releasing of industrial waste to water ways, cleaning such waste materials before mixing with water and minimizing the usage of agrochemicals

Soil pollution

Soil pollution is caused by adding various pollutants to soil. Such pollutants are paper, rubber, leather, cloth, oils, polythene, plastic and agro-chemicals. Many problems are caused by soil pollution. Some of them are obstruction to natural cycles in soil, inability to use land for cultivation, blocking of water ways, destruction of soil organisms and pollution of underground water.



Pic-3.22 soil pollution

To minimize these bad effects, recycling and reusing solid waste materials, minimizing the usage of polythene and plastic and using alternate items and implementation of rules to stop addition of chemicals to soil, can be practised.

v) Environmental Conflicts

Global warming

Collection of green house gases in excess cause the solar heat to stay in the atmosphere without reflecting back. This increases the atmospheric temperature and causes global warming. Increase of atmospheric temperature is known as green house effect. The green house gases which cause this are carbon dioxide, methane, nitrogen oxide and water vapour.

Results of global warning

- ◆ Melting of glaciers in polar resions and increase in the sea level.
- ◆ Changing of weather patterns and subsequent changes in wildlife behavior and survival.
- ◆ Loss of biodiversity.

To control global warming the following steps can be used.

Legislature to minimize the releasing of green house gases, conservation of forests and growing of forests.

Acid rain

The main agents which cause acid rain are sulphur dioxide, nitrogen oxide and carbon dioxide which are released by burning fossil fuels in factories. It has been reported that acid rains with a pH. less than 4 have been received by highly industrialized countries such as western Europe, Eastern America, Japan and North-East of china.

Effects of acid rain

- ◆ Trees get destroyed, organisms die when added to soil and water matalic, structures, marbal
- ◆ Buildings and ruins get destroyed.

To minimize acid rain, releasing of acidic gases from factories and vehicles has to be minimized and using of alternate energy sources can be carried out.



Pic-3.23 Trees destroyed by acid rain

Depletion of the Ozone layer

The molecules of oxygen present in the higher levels of the atmosphere react with oxygen atoms to form ozone gas. This forms the ozone layer which helps to stop the entry of harmful ultra violet rays to the earth.

Chloro fluoro carbon (CFC) which was released from refrigerators and air conditioners is broken down to chlorine and fluorine. These two gases break down ozone gas into oxygen molecules. Because of this, depletion of the ozone layer is caused.

Bad effects of depletion of ozone layer

- ◆ Genetic disorders, among humans and animals
- ◆ Skin cancers
- ◆ Reduction of biodiversity

To minimize ozone depletion, we can control the usage of appliances which give CFC gases and can use forest conservation methods.

Desertification

Desertification is the changing of forests and cultivated lands to barren and unsuitable lands for plant growth. Extreme droughts, changes in weather, green house effect, increase in salinity of land and cutting down forests are some causes for desertification. Disadvantages such as loss of biodiversity occur due to this.



Fig. 3.24 a desertified area

Bringing water from polar areas to deserts, using purified sea water for agricultural work, growing plants gradually from the margin of the deserts to the centre, conservation of forests and reforestation are some remedies for this.

Loss of biodiversity

Reduction of the number of species in the biosphere is known as loss of biodiversity. Stable ecosystems possess higher biodiversities. Sri Lanka is a country which is rich in biodiversity, but it is also a country which loses biodiversity rapidly.

Reasons for the loss of biodiversity

Deforestation, environmental pollution and global warming are some reasons for the above incident. The organisms who are more sensitive to environmental changes will be eradicated quickly. To minimize the loss of biodiversity we can follow these strategies.

1. Conservation of forests.
2. Minimizing environmental pollution.
3. Minimizing man's influences on natural environment.

Eutrophication

Eutrophication is the process of increasing the concentration of ions like NO_3^- and PO_4^{-3} in water which are released by industry, agriculture and from garbage. Due to the presence of excess nutrients in water, algae grow very fast and reduce the transparency of water. Then sunlight cannot reach the deeper levels of water and photosynthesis is reduced. Organisms die due to the scarcity of food and oxygen. The dead bodies decompose under anaerobic conditions releasing gases like H_2S , NH_3 and CH_4 which give an unpleasant smell.

The following are ill effects of eutrophication

1. Limits the uses of water to mankind (due to water pollution).
2. Loss of biodiversity in reservoirs.
3. The reservoirs lose their beauty.

Methods used to prevent eutrophication

1. Control the release of waste matter into water
2. Remove ions like NO_3^- and PO_4^{-3} present in waste matter and prevent their release to water.
3. Create awareness among people.

Environmental conservation strategies

Now that we know about the nature of the natural environment, and how it becomes harmful to organisms, let us identify some strategies to minimize the harmful influences.

1. Biodiversity conservation

Allowing organisms to live freely in their natural habitat or conserving them by means of alternate methods is known as biodiversity conservation. There are two main methods which could be followed.

1. In-situ conservation
2. Ex-situ conservation

In-situ conservation

Conserving a living species in their own habitat is called in-situ conservation. We have to be certain that they are having enough space, opportunities for reproduction and for natural behaviour.

By this method a large number of species can be conserved with a small cost and effort. These living species face competition among the members of their own species and among the members of other species. They make interactions with predators and parasites and are subjected to evolution naturally, while undergoing conservation. Some examples for areas under insitu conservation are the sanctuaries, national parks, forests reserves and strict natural reserves.

Sinharaja forest, Horton plain, Hikkaduwa Coral reefs are such conserved areas.

Ex-situ conservation

Breeding and growing organisms in an environment similar to their own habitat is ex-situ conservation. This is an expensive method and have to be dealt with more effort.

Eg- Elephant orphanage at Pinnawala, Turtle breeding centres, Botanical gardens and Zoological gardens. (zoo) This method is not as fruitful as in-situ conservation but it is an alternate method for conserving bio-diversity.

There are three botanical gardens and one zoological garden in Sri Lanka.



Fig. 3.25 botanical garden

Do you know?

Effective protection and controlled utilization of the environmental resources is known as environmental conservation.

2. Community awareness

Educating the community is important to make better programmes on conservation of environment. It can be done at various levels.

For school children

It is easier to carry out programmes about the conservation of environment at school level. The children could be educated through programmes of environmental guidance.

Environmental societies

Environmental societies can educate the public and influence them to minimize environmental problems.

Mass media

Special programmes can be organised to inform people about the importance of conserving the environment. Through songs, poems and drama it is easier to influence people to conserve the environment.

Farmer education

Farmers can be educated about the bad results of using too much of agrochemicals, and the usage of natural pesticides, traditional technologies which can give them a good harvest. By these, pollution of soil, air and water could be minimized.

Campaigns

We can organize campaigns to clean reservoirs, clean the surroundings and replanting programmes.

Introducing "5 S" method

By following "5 S" method the environmental problems can be minimized. People can be influenced to reduce the usage of polythene, plastic, polystyrene and glass because they do not decay. They can be encouraged to recycle and reuse substances when ever possible.

3. Laws on environmental conservation

The government has formulated acts, laws, rules and regulations for environmental conservation. Let us discuss about some of them.

- 1. 1980 - National environmental Act.** This is an act which formulate laws and regulations about environmental conservation, and was introduced in 1980. This act has enabled the establishment of the Central

Environmental Authority and a " licence for environmental protection" for the removal of garbage.

- 2. 1994** - Orders and regulations on prohibiting substances which deplete the Ozone layer from 2000-01-01.

Eg:- Gases like CFC(CFCl_3) Helon (CH_3Br)

- 3.1996** - National environmental regulations for controlling noise.

Eg:-An area of 100m around a school is a silent area.

(The minimum limit of the sound is 50 decibles)

- 4. 2000** - National environmental order on importing standards of gas releasing fuels and vehicles.

Eg:-A petrol motor cycle after starting the engine and when not running should release CO gas at a percentage less than 6%.

- 5.2004** - According to the orders of national environmental act,Muthurajawela has been declared as a buffer zone for environmental protection.

- 6. 2006** - Prohibiting of manufacturing and selling polythene below the thickness of 20 microns.

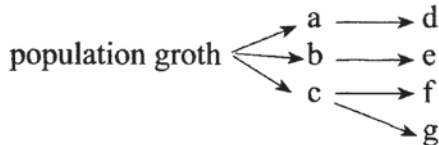
International conventions

Various nations in the world have seconded certain agreements, protocols and conventions to conserve the environment. They are known as international conventions.Let us discuss some of these conventions.

1. 1972-United Nations Environmental Programme was started in Sweden in 1972. The main aim of this is to take steps about environmental problems in the world.(UNEP)
2. Vienna convention
In 1982-Vienna,Austria-Convention of conserving ozone layer.
3. Montreal Protocol- In 1984, atMontreal Canada on minimizing the use of CFC.
4. Bonn Convention-Convention for conserving migratory animals at Bonn, Germany.
5. Kiyotho Convention-Convention of controlling the evolving of green house gases.(Japan)
6. CITES Convention-Convention of prohibiting the international trade of endangered animal.

Exercises

1. A large Jack tree is an ecosystem. Explain this.
2. Mango \longrightarrow Squirrel \longrightarrow Rat snake \longrightarrow Eagle
 - i) Who is the second level consumer in this food chain?
 - ii) Rewrite this food chain after substituting a suitable organism in place of squirrel.
 - iii) Write an important life activity happening in the mango tree which helps to continue the above food chain.
 - iv) Why can't you construct a number pyramid using only this food chain?
 - v) All the organisms in this food chain obtain materials from the environment. How are these materials released back to the environment? Write two organisms who help this process? What is the common name given to them?
3. Increase of population brings about the following directly or indirectly



Water pollution, desertification, acid rain, pollution of the environment, green house effect, eutrophication, deforestation are some expressions, denoted by the above letters.

Select suitable expressions for a-g. from the following questions.

a, b, c are effects resulted by the growth of population. d, e, f, g are effects you get from a, b, c.

- i) Select suitable phrases for a, b and c.
 - ii) Explain how, one of these results are caused by increased population.
 - iii) Select suitable phrases for d, e, f and g.
 - iv) Explain how C result affects f, g results.
4. Sri Lanka is a country which is rich in biodiversity.
 - i) What are the strategies used at national level to protect our bio diversity?
 - ii) What are the actions you can take to protect our biodiversity?
 - iii) Sri Lankans depends on irrigation methods used about thousands of years ago for their food production. Forward your ideas about this.
 - iv) When constructing new high ways in Sri Lanka, loss of bio diversity takes place, but it is a good trend for the development of the country. Forward your ideas.