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15

BIOMES

In the previous lesson, you have learnt about the various aspects of biosphere. We have also discussed how various components of biosphere interact as well as complement each other. Energy which reaches from sun is the prime source for various lives on the earth. But, its distribution on the surface of the earth varies because of various reasons which you have already studied in the previous chapters. Because of this reason, the biotic life varies tremendously from hot humid to cold dry. Hence, they give rise to assemblage of plants and animal life in various geographical settings. In this context we will study the biotic lives and their interactions.

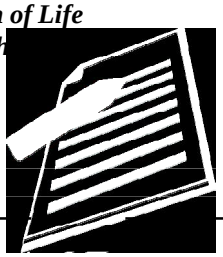
OBJECTIVES

After studying this lesson, you will be able to:

- recall the meaning of terms ecology, ecosystem, energy Flow etc.
- explain the term biome;
- identify different types of biomes;
- locate different types of biomes on the map of the world;
- describe environmental conditions of these biomes;
- establish the relationships between plant and animal communities;
- analyse the human responses with the biotic lives of that region.

15.1 MEANING OF BIOME

The word biome is a short form of biological home. There is no unanimity among the scientists as for as the definition as well as classification of biome is concerned. Biome may be defined as a large natural eco-system wherein we study the total assemblage of plant and animal communities. Here, all the biota have the minimum common characteristics and all the areas of biomes



are characterized by more or less uniform environmental conditions. Though a biome includes both plant and animal communities but a biome is usually identified and named on the basis of its dominant vegetation, which normally constitutes the bulk of the biomass. These vegetations are most obvious and conspicuous visible component of the landscape. By biomass we mean the total weight of all living organisms – plants and animals, found in the biome.

Factors Affecting Biomes

There are various factors which affects the size, location, and character of a biome. Important factors are as follow:

(i) Length of day light and darkness. This is mainly responsible for duration of photosynthesis.

(ii) Mean temperature as well as difference in temperature. Differences (both diurnal and annual) to find out extreme conditions.

(iii) Length of growing season.

(iv) Precipitation which includes total amount, variations over time and intensity.

(v) Wind flow that include speed, direction, duration and frequency.

(vi) Soil types

(vii) Slope

(viii) Drainage

(ix) Other plant and animal species.

15.2 CLASSIFICATION OF BIOME

There are two major bases of classifying biome.

In this section we will discuss two classifications which are simple and widely used. The bases of these two classifications and its various types are discussed below:

(A) On the basis of climate with special emphasis on availability of moisture

According to this basis biomes are determined by the degree to which moisture is available to plants in a scale hanging from abundant (forest biome) to almost scarce (desert biome). But within each biome, conditions of temperature are vastly different from low to high altitudes and low to high latitudes. Consequently there is a need to sub-divide each biome in to further sub-types. However, according to this classification, there are four major types of biomes:

(i) Forest biome

(ii) Savanna biome

(iii) Grossland biome

(iv) Desert biome

(B) On the basis of climate and vegetation

This classification argues that there is a close relationship between the world distributional patterns of plants and animal species and the climatic types of the world. Thus, based on this relationship the world has been divided into different biome types. The vegetation is the most dominant component of the biomes. As the vegetation and climate have intimate relationship the world is divided into various types on the basis of climates. Further, these climate based biomes are divided into various sub-types on the basis of vegetation. Look at the table No. 15.1 given below.

Table No. 15.1
Classification of Biomes on the basis of climate and vegetation

Biomes of the first order (Based on climatic zones)	Biomes of the Second order (Based on Vegetation)	Biomes of the Third order (Combination of climate and vegetation)
1. Tropical Biome	(i) Tropical Forest Biome	(a) Evergreen Rain-Forest Biome
		(b) Semi-evergreen Forest Biome
		(c) Deciduous Forest Biome
		(d) Semi-deciduous Forest Biome
		(e) Monanne Forest Biome
		(f) Swamp Forest Biome
	(ii) Savanna Biome	(a) Savanna Forest Biome
		(b) Savanna Grassland Biome
	(iii) Desert Biome	(a) Dry and arid desert Biome
		(b) Semi-arid Biome
2. Temperate Biome	(i) Boreal Forest Biome (Taiga Forest Biome)	(a) North American Biome (b) Asiatic Biome (c) Mountain Forest Biome
	(ii) Temperate Deciduous Forest Biome	(a) North American Biome (b) European Biome
	(iii) Temperate Grassland Biome	(a) Soviet Steppe Biome (b) North-American Praries Biome (c) Pampa Biome
	(iv) The Mediterranean Biome	(i) Austration Grassland Biome (ii) Southern Hemisphere Biome
	(v) Warm Temperate Biome	
3. Tundra Biome	(i) Arctic Tundra Biome	
	(ii) Alpine Tundra Biome	

From the table 15.1 it is quite clear that a number of biomes are found in different parts of the globe. For detailed study, three Biomes – One from each climatic zone have been selected. Those three biomes are:-

(i) The Evergreen Rainforest Biome

(ii) The Temperate Grassland Biome

(iii) The Arctic Tundra Biomes

15.3 THE EVERGREEN RAINFOREST BIOME

(i) Geographical Background

This biome extends upto 10^0 latitude on both sides of the equator. It covers the area of Amazon low land of south America, Congo basin of equatorial Africa and South Eastern Asian Islands extending from Sumatra to New Guinea. This area is shown in the Fig. 15.2.

This area experiences high temperature throught the year with range as little as 2^0C. However, the daily range of temperature is much higher than the annual range of temperature. This area gets heavy rainfall ranging between 150cm-250cm. It is distributed throughout the year. Rainfall occurs in the afternoon almost on daily basis. This also happens because of huge amount of water vapor reaching in the atmosphere due to high temperature. Hence, this area is considered to be an equable climate as both temperature and rainfall are high for whole of the year.

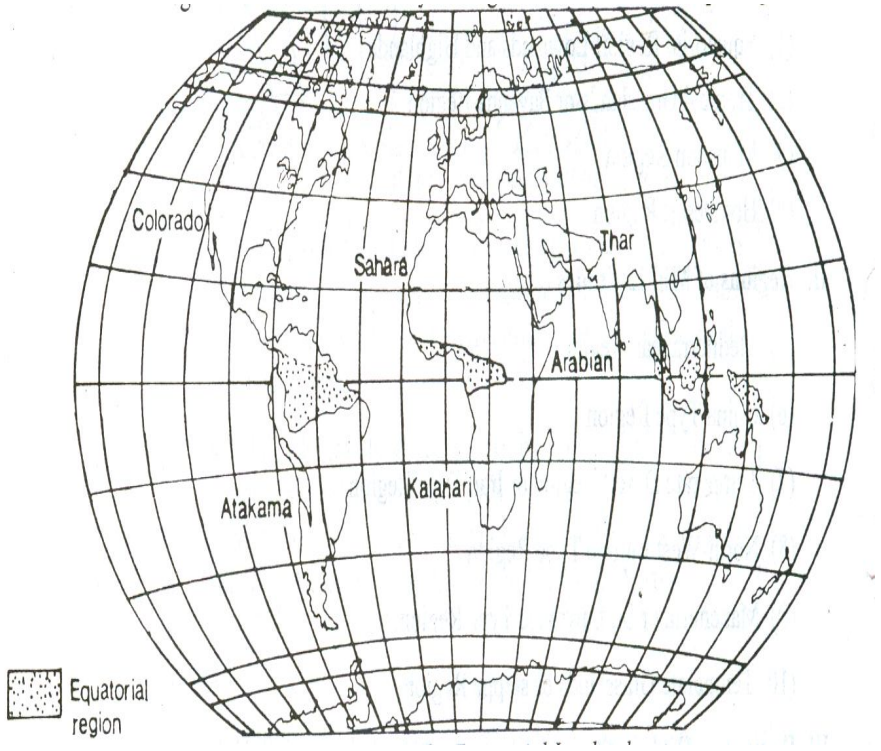


Fig. 15.1 The Evergreen Rainforest Biome

(ii) Natural Vegetation and Animal Life

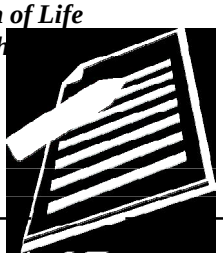
The combination of heat and moisture make this biome as perfect environment for a great variety of plants and animal species. The variety of plant species can be understood from the fact that one square kilometer may contain as many as about thousand of different types of plant species. Most of the trees have buttressed trunks, shallow roots and large dark evergreen leaves. The evergreen rainforest arranged in three levels. (a) The canopy or upper level where trees lies between about 20 metres to 50 metres. Most of them are hard wood trees like ebony, Mahogany, rose wood, sandalwood, cinchona, etc. (b) The second level of intermediary level where trees lies between about 10 meters to 20 meters. The most important plant of this group is palm trees. Apart from palm trees, epiphytic and parasitic plants are also found in this layer (c) The third or lower level lies from surface level to about 10 meters of heights. Under this category variety of plants are found namely orchids, ferns, mosses, herbs, bananas, pineapples etc. Because of tall and broad leaved dense plants, sunlight could not reach at the lowest level/surface. Because of poor photo-synthesis process at this level, number of plant species are very low.

Like vegetation, evergreen rainforest is inhabited by numerous birds, mammals, insets etc. Some important animals of this biome are Jaguar, lemur, orangutan, elephant, etc. Macaw parrot, sloth and toucan are some of the important birds of this area. Most of the birds are colorful. The water bodies of the equatorial areas are also rich in animal life with alligators, tactless, fishes, frogs, Hippopotamus etc. Because of the impenetrability and high vegetation growth in the lower part, most of the insects, birds and animals resides on the branches of the trees. Generally, they do not come down to the ground.

The productivity of the tropical rainforest biome is the highest of all biome types of the world. It may be pointed out that the rainforest biome represents only 13 percent of the total geographical area of the world but this biome accounts for the 40 percent of the total productivity of the world.

(iii) Human Response

Human being has also started to damage this biologically rich eco-system through various developmental activities. These activities are construction of large dams and reservoirs, roads and high ways, extraction of timber clearance for pasture or crops, encroachment and clearance by landless peasants etc.



Ecologists argue that if clearance continues at recent rates, all of the world's undisturbed rainforest is likely to have disappeared or to be damaged by 2020. This would lead to an irrepairable loss of biological assets. Rainforests contain about 40% of all known species of plants and animals. Clearance of rain forest causes the loss of valuable natural resources including hard wood trees and tree products such as quinine rubber vegetable gums etc.

This loss is just not ecological but also has very significant environmental consequences. The evergreen forest provides various environmental services by helping to regulate global weather patterns, soil erosion, river flooding in the tropics etc. Evidences show that tropical deforestation have lead to the green house effect and global warming by removing an important carbon sink.

INTEXT QUESTION 15.1

1. Answer not more than one sentence.

   (i) What is the latitudinal extent of the tropical evergreen forest in the northern and southern hemisphere.

   _____

   (ii) During which part of the day is most of the rainfall in the tropical evergreen forest occurs.

   _____

   (iii) Name the three levels in which plant species are arranged in tropical evergreen forest biome.

   (a)_____(b)_____ (c) _____

   (iv) Name any three factors responsible for deforestation in tropical evergreen forest.

   (i)_____(ii)_____ (iii) _____

   (v) What are the two major environmental consequences of deforestation in tropical evergreen forest.

   (a) _____ (b) _____

15.4 TEMPERATE GRASSLAND BIOME

(i) Geographical Background

Temperate grasslands are located in two typical locations i.e. interior of the continent in the northern hemisphere and margin of the continents

in the southern hemisphere. Therefore, the temperate grasslands of the southern hemisphere have moderate climate than their counterparts of the northern hemisphere because of more marine influences as they are closer to the coast. The temperate grasslands of the northern hemisphere are characterized by continental climate wherein extremes of summer and winter temperatures are well marked. Though grasslands in the southern hemisphere are located along the coast, these are located in the rain shadow areas of the high coastal mountains. These locations account for scanty rainfall in all these regions.

These grasslands are found in all the continents under different names. In the northern hemisphere, the grasslands are far more extensive. In Eurasia, they are called the steppes and stretch east wards from the shores of the Black sea to the plains of Manchuria in china. In North America, the grasslands are quite extensive and they are called praries. They lie between the foot hills of the Rockies and the Great Lakes. In the southern hemisphere, these grasslands are less extensive. These are known as Pampas in Argentina and Uruguay. In South Africa, these grasslands are sandwitched between Darkensberg mountains and the Kalahari desert and are called veldt. In Australia, these grasslands are known as Downs and are found in the Murrary – Darling basins of South Australia. Since all these grassland are located in the temperate zones, they are also known as temperate grasslands (see figure no. 15.3).

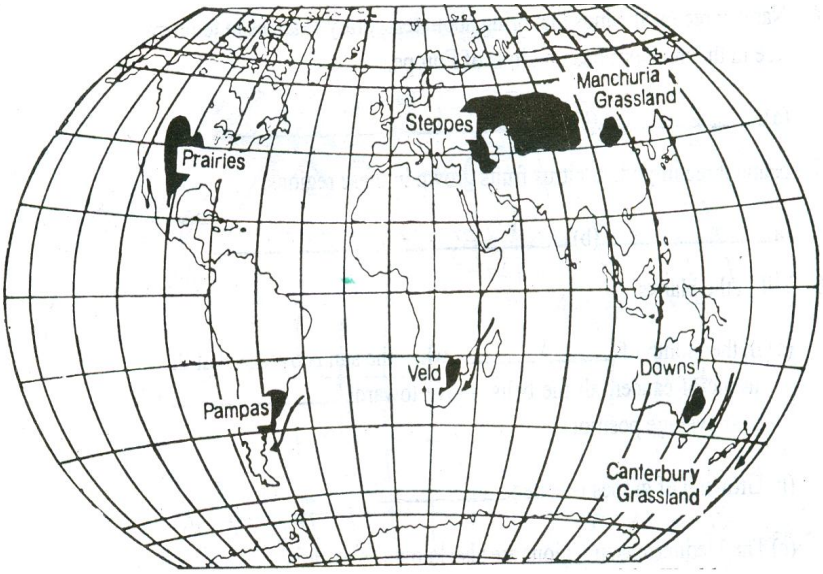
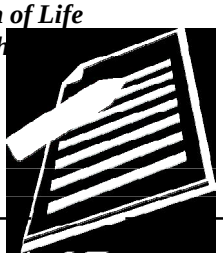


Fig. 15.2 Temperate Grassland Biome

(ii) Natural Vegetation and Animal Life

As the precipitation is too low for the growth of trees but is sufficient



for the growth of grass. The natural vegetation of these regions comprises treeless grasslands. Trees appear only on slopes of mountains where precipitation is more. The height of grass varies from place to place according to the amount of precipitation and fertility of the soil. Steppes in particular are known for short and nutritious grass. The appearance of these grasses on these lands varies with the seasons. In springs, the grass beings to appear green, fresh and blooming with small and colourfull flowers. In summers, due to the scorching heat and evapouration, the green grass turns yellow and then brown. Towards autumn, the grass withers and dies, but, the roots remain alive and lie dormant throughout the cold winter season. When spring comes, the whole cycle is repeated.

These grasslands are natural habitat of a variety of animals. Note worthy among them are antelopes, wild asses, horses, wolves, kangaroo, emu, and dingo or wild dog.

(iii) Human Response

No other biomes has ever undergone so many changes as the temperate grassland biomes. This has happened due to the human activities. (i) Majority of the grasslands have been converted into agricultural lands which have now become famous 'granaries of the world' (ii) The second crucial factor responsible for alteration of this virgin grasslands is pastoralism or domesticated of animals. Today virgin grass lands are very rare sight (iii) Large scale hunting of animals has resulted into phenomenal decrease of the population of some animals and disappearance and extinction of some animals. For example many species of animals such as antelope, Zebra, lions, leopards, hayenas have disappeared from the African Veldts by the mass hunting of animals by the European immigrants. (iv) The introduction of new animal and plant species has altogether changed the composition of native vegetation. For example introduction of sheep by the European settlers in Australia have changed the composition of vegetation community which was originally suited to the native marsupial animals. Like this introduction of few leguminous plants in Australian temperate grasslands suppressed several species of native perennial grasses.

INTEXT QUESTION 15.2

1. Fill in the blanks by selecting appropriate words from those given in the bracket:
(granaries, interior, low, more, less)

(a) Mid-latitude grasslands of the northern hemisphere are located in the _____ parts of the continents.

(b) The annual precipitation in mid-latitude grasslands are very _____.

(c) In the northern hemisphere grasslands are for extensive whereas in the southern hemisphere grass lands are _____ extensive.

(d) Mid-latitude grasslands are known as the _____ of the world.

2. Match the following

Continents	Name of the grasslands
(a) South Africa	(i) Praries
(b) Eurasia	(ii) Pampas
(c) North America	(iii) Veldt
(d) Australia	(iv) Steppes
(e) South America	(v) Downs

15.5 THE ARCTIC TUNDRA BIOME

(i) Geographical Background

This is essentially a cold desert in which atmospheric moisture is scarce and summers are so short and cool that trees are unable to survive. This biome is distributed along the northern edge of the Northern Hemisphere. It covers parts of Alaska, northern parts of Canada, the coastal areas of Greenland and the Arctic Coastal regions of Russia and Northern Siberia (see map No. 15.4).

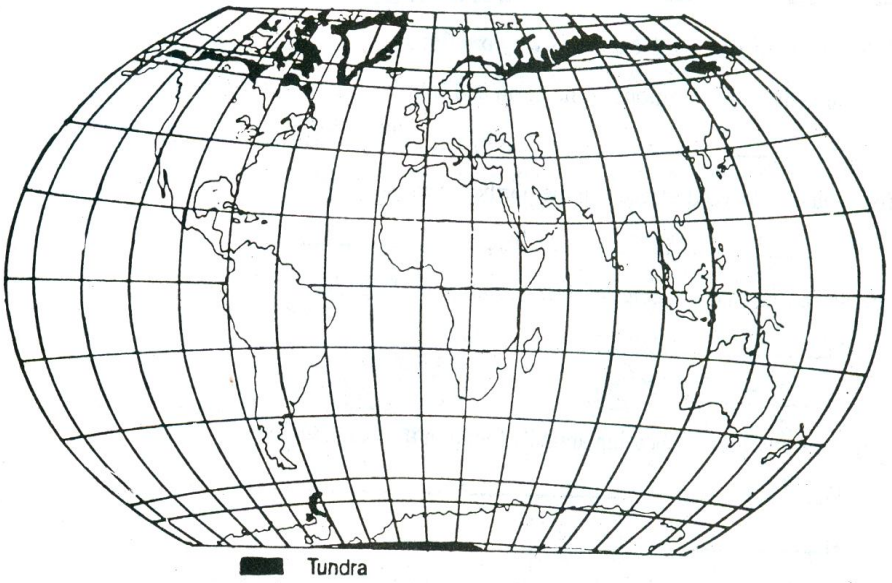
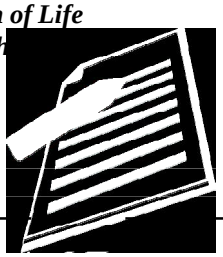


Fig. No. 15.3 Arctic Tundra Biome



(ii) Natural Vegetation and Animal Life

The plant cover consists of a considerable mixture of species. Many of these species are dwarf form such as grasses, mosses, lichens, flowering herbs, and a scattering of low shrubs. These plants often occur in a dense, ground hugging arrangements. The plants complete their annual cycle hastily during the brief summers, when the ground is often moist and waterlogged because of inadequate surface drainage.

The animal of this biome may be categorized as (i) resident and (ii) migrant. Resident animals like ptarmigan can adjust themselves to the changing climatic conditions. The migratory animals, in contrast, begin migrating to the warmer places in the very beginning of winter. Examples are birds such as water fowl, ducks, swans, geese etc. which leave their places of origin in the first half of autumn and return in the following spring or early summer. Mosquitoes, flies and other insects proliferate astoundingly during the short warm season, laying eggs that can survive the bitter winter. Other forms of animal life are scarce – a few species of mammals and freshwater fishes but almost no reptiles or amphibians. Besides, the rein deer, wolves, foxes, musk-ox, artic hare, seal and lemmings also live in this region. Productivity in tundra biome is exceedingly low.

Productivity is defined as the total accumulated amount of energy stored by the autographic primary producers per unit area per unit time is called productivity.

The reasons for low productivity are (i) minimum sunlight and insolation (ii) absence or scarcity of nutrients such as nitrogen and phosphorous in the soils, (iii) poorly developed soils (iv) scarcity of moisture in the soils, (v) permanently frozen ground and (vi) very short growing period.

The tundra comes alive diving the summer thaw, when flowering plants support large populations of mosquitoes and flies, which in turn provide food for large numbers of migratory waterfowl.

(iii) Human Response

The harsh environment supports less population. The tribes of Samoyeds, Lapps, Finns and Yakuts in Eurasian Tundra and Eskimos of Canada and Alaska are some of the original inhabitants of this place and lead nomadic life for centuries. These tribes are now leading permanent or seminomadic life. They have adapted to new technologies. For example, deadly rifles have replaced the traditional and outdated harpoons. Thus the modern Eskimos equipped with modern technologies are now in a position to damage the tundra ecosystem in

the same way as is done by already technologically advanced man in other biomes. The Samoyeds and other tribes of the Eurasian Tundra have also adapted new way of life. Some of them are leading permanently settled life. They rear reindeers and fur animals and foods crops mainly wheat in Siberian Tundra. The recent discoveries of minerals such as gold and mineral oil in Alaska, iron ore in Labrador, nickel in Siberia have encouraged the growth of mining settlements and development of transport facilities. But mining activities have also lead to pollution and other environmental problem to this fragile eco-system.

INTEXT QUESTION 15.3

Answer the following questions briefly.

(a) Name any three animals of Tundra region.

(i)_____(ii)_____(iii)_____

(b) Which are the three important minerals found in these regions.

(i)_____(ii)_____(iii)_____

(c) Why productivity is low in tundra region. Give any two reasons.

(i)_____ (ii)_____

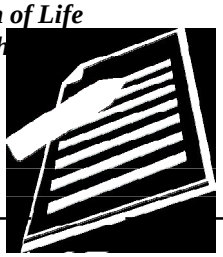
(d) Name any two tribes found in the tundra region.

(i)_____and (ii)_____

WHAT YOU HAVE LEARNT

The word biome is a short form of biological home. Biome may be defined as a large natural ecosystem wherein we study the total assemblage of plant and animal communities. Here all the biota have minimum common characteristics and all the biomes are characterized by more or less uniform environmental condition. There are various factors which affect the size, location and character of a biome. These factors are length of daylight and darkness, mean temperature, length of growing season, precipitation, windflow, soil types, slope, drainage etc. There are two major bases of classifying biome – on the basis of climate with special emphasis on availability of moisture and on the basis of climate and vegetation.

Three biomes – one from each climatic zone have been selected for detailed study. These are (i) the Evergreen Rainforest biome (ii) the Temperate



Grassland biome and (iii) the Arctic Tundra Biome. The evergreen rainforest biome extends upto 10^0 latitude on both sides of the equator. This area experiences high temperature and heavy rainfall throughout the year. The combination of heat and moisture make this biome as perfect environment for a great variety of plants and animal species. Important plants found in this area are ebony, Mahogany, rosewood, sandal wood etc. Along with plants, there are various types of orchids, term, mosses, herbs are also found at the ground level. These plants are mostly hard-wood trees. Like vegetation, evergreen rainforest is inhabited by numerous birds, mammals, insects etc. both in land as well as in water. The productivity of the tropical rainforest biome is highest of all biome types of the world. Today, human being has also started to damage this biologically rich eco-system through various developmental activities. Due to this, various ecological as well environmental problems have emerged like green house effect and global warming. The temperate grasslands are located in two typical locations – interior of the continents in northern hemisphere and margins of the continent in the southern hemisphere. Both the locations receive scanty rainfall. These grasslands are known by different names in different parts of the world – steppes in Eurasia, prairies in North America, downs in Australia and veldt in South Africa. The natural vegetation of these regions comprises treeless grasslands. Trees appear only on mountain stapes where precipitation is more. These grasslands are inhabited by antelopes, wild asses, horses, wolves, kangaroos, emu and dingo or wild dog. No other biomes has ever undergone so much change than the temperate grassland biomes. This has happened due to various human activities. The Arctic Tundra Biome is essentially a cold desert in which atmospheric moisture is scarce and summers are short and cool. This biome is distributed along the northern edge of the northern hemisphere. The plant and animal species are Few. The plant cover consists of a considerable mixture of species. Many of the species are dwarf forms such as grasses, mosses, lichens, flowering herbs and a scattering of low shrubs. The animals of this biome may be categorized as (i) resident and (ii) migrant. Important species are rindeer, wolves, foxes, musk-ox, artic-hare, seal and lemmings. The harsh environment of this biome supports less population. The tribes of Samoyeds, Lapps, Finns and Yakuts in Eurasia, Eskimos of Canada and Alaska are the original inhabitants of this biome and lead nomadic life for centuries. They inflected damage to Tundra animals through hunting. Now many of these tribes have adopted settled life. The recent discoveries of minerals have encouraged the growth of mining settlements. But mining activities have also lead to pollution and other environmental problems to this fragile eco-system.

TERMINAL QUESTIONS

1. What is a biome? Describe the classification of biomes on the basis of climate and vegetation.
2. Explain the location, climate, natural vegetation and animal life in the evergreen rainforest biome.
3. Describe various factors responsible for the size, location, and character of a biome.
4. "No other biomes has undergone so much changes as the temperate biomes" Justify the statements with suitable arguments.
5. Analyse the role of climate on the plants and animal life in the Tundra region.

ANSWER TO INTEXT QUESTIONS

15.1

1. (i) 10^0 North and South

   (ii) Afternoon

   (iii) (a) Construction of large dams and reservoirs (b) Construction of roads and highways (c) Extraction of timber (d) Clearance for pasture or crops (e) Encroachment and clearance by landless peasants.

   (iv) (a) green house effect (b) global warming.

15.2

1. (a) interior

   (b) low

   (c) more, less

   (d) granaries.

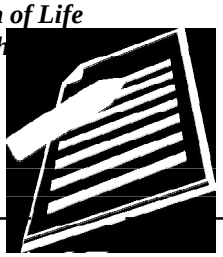
2. a. iii

   b. iv

   c. i

   d. v

   e. ii



15.3

(a) rein deer, wolves, foxes, musk-ox, arctic hare, seal, lemmings (any three)

(b) gold, iron and mineral oil.

(c) (i) minimum sunlight and insolation (ii) absence of nutrients (iii) poorly developed soil (iv) scarcity of moisture in the soils, (v) permanently frozen ground and (vi) very short growing period (any three)

(d) Samoyeds, Lapps, Finns, Yakuts, Eskimos (Any two)

HINTS TO TERMINAL QUESTIONS

1. Refer to section 15.1 and 15.2
2. Refer to section 15.3
3. Refer to section 15.1
4. Refer to section 15.4 (iii)
5. Refer to section 15.5