Notes

10

BIOSPHERE, BIOMES AND BIODIVERSITY

You might be aware about different realms of the earth that are the lithosphere, the atmosphere and the hydrosphere. Life in all forms exists in all these three realms. Thus, the zone where life exists is known as the biosphere. You are also aware that our earth is the only planet in the solar system where life exists. This lesson will enable you to comprehend basic concepts of Biosphere and Biomes and their characteristics. There are several Biosphere reserves found in India. You will be able to locate them on the map of India. Moreover, this lesson will help you to sensitise others for protection of the environment and take necessary steps for its conservation.

OUTCOMES

After studying the lesson, learner:

- describes the term i.e Biosphere, Biodiversity and Biome;
- classifies different types of Biomes of the world;
- explains characteristics of different types of Biomes;
- locates biomes on the world map;
- illustrates various causes and consequences of loss of biodiversity and
- justifies the initiatives taken for conservation of biodiversity from local to global.

10.1 BIOSPHERE

You might have observed in your surroundings that different types of organisms or creatures are found on the land, water and air. Some animals or plants may be available everywhere while some may be found in any specific area.

All these enquire about an area where land, water and air are available is called a biosphere. It can be defined as "The narrow zone of contact between land, water and air, where life exists, is called Biosphere."

All the living creatures on the earth including plants, animals and humans are linked to each other as well as interact with other environmental realms i.e. lithosphere (land), hydrosphere (water) and atmosphere (air). Moreover, there are also many organisms that move from one realm to the other to survive.

Can you give any examples of organisms that live on land and water both? You might have read that the environment of the earth is made up of abiotic and biotic components.

a. Abiotic component

For the survival of living organisms various elements such as sunlight, water, minerals, and different gases are required. These elements do not have life but are essential for the living beings. They are called Abiotic components.

b. Biotic component

The biotic components may broadly be divided into the plants and the animals. All living beings whether plants or animals from micro to macro levels are called Biotic components.

ACTIVITY

Make a list of such organisms that live on land, water and air.

10.2 ECOSYSTEM

An ecosystem is a system in which plants and animals are linked to their environment through a series of links. For example, the ecosystem of small water bodies i.e. ponds or lakes. A lake or pond may be a water body of stagnant water. Generally such a lake receives water from rainfall or from any streams. The water from the lake evaporates due to solar energy. Due to direct sunlight the upper layers of the water body get warmer and there is a vertical difference in water temperatures. Thus the physical process is responsible for change in temperature in water, water flow, deposition of sediments in the bottom, etc. At the same time biological processes are also going on in the water body. The biological processes are more complex in which biotic organisms provide food to small larvae which are consumed by small fish. These small fish are eaten by larger fish, which provide food for other animals including humans. When the biotic organisms like plants and animals die and decay, they release chemicals back into the water body.

INTEXT QUESTIONS 10.1

Fill in the blanks:

1. The Banyan tree is ……..component of the environment.
2. Temperature of water changes due to ……. Process.
3. Biosphere includes ……. and …….. component.
4. All creatures of the environment including animals and plants are …… with each other.

10.3 FOOD CHAIN IN THE ECOSYSTEM

You know that all living beings whether micro organisms like insects or macro level such as tigers, elephants or humans get their food from plants, either directly or indirectly. Now you are aware about the lake ecosystem where a simple food chain is stretching from the millions of microscopic plants on a lake surface to humans as fishermen. There are different levels in a food chain. It can be understood through a pyramid diagram. In the pyramid each level is termed as a Trophic level. Trophic word originates from the Greek word trophies, which means food. The base level (T1) of the pyramid is composed of natural vegetation. The second level (T2) consists of herbivorous animals that feed on the plants; the third level of pyramid (T3) is composed of carnivorous animals that depend on herbivorous animals; carnivorous animals such as humans that consume other carnivorous animals and all others which are found in lower levels are on the fourth level (T4) of the pyramid. Decomposers are found on the fifth level, which break down the dead tissues of organisms at all the other levels of the food chain.

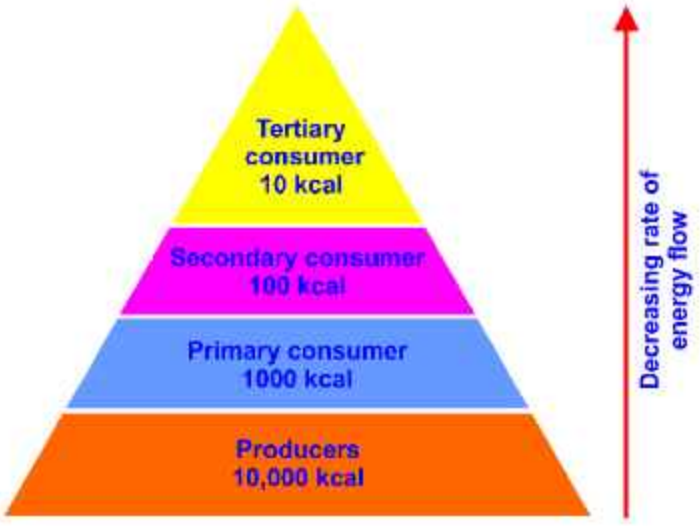


Fig. 10.1 Food Pyramid

Notes

Ecosystems can be of two types:

I. Terrestrial Ecosystem

II. Aquatic Ecosystem

I. Terrestrial Ecosystem

Terrestrial ecosystem covers about 29% of the land area on the earth surface. The major source of food and raw materials are found in this ecosystem because a variety of flora and fauna are available here for humans. The terrestrial ecosystems are further subdivided into various sub-types. Major sub types are (i) upland or mountain ecosystem (ii) low land ecosystem and (iii) desert ecosystem. You will be surprised to know that the maximum life forms are found in lowlands on the earth and this diversity decreases with increasing altitude since the level of oxygen and atmospheric pressure decreases with increase in height.

II. Aquatic Ecosystem

Aquatic ecosystem includes various forms of water available on the earth surface which covers about 71% of the entire earth. Aquatic ecosystems can further be divided as (i) fresh water, (ii) estuarine (iii) marine. In terms of size or extent it may range from open sea, lake, pond, etc. The biodiversity in aquatic ecosystems depends on the depth up to which sunlight can penetrate and the availability of nutrients and the concentration of dissolved oxygen. Keeping all these factors in view, estuarine ecosystems are found the most productive of aquatic eco-systems. On the ocean surface, shallow continental shelves are more productive than other configurations of ocean floor and open oceans. Open oceans are the least productive of all aquatic ecosystems. They are like the deserts in the terrestrial ecosystem. Some of the organisms exclusively live in water whereas some of the organisms can live in water and on land i.e. frogs, crocodiles, hippopotamus, etc. Moreover, some organisms live only in either fresh water or saline water and some others live in fresh and saline water both.

INTEXT QUESTIONS 10.2

Marks (✓) for True or (×) for False:

1. Humans are found on the base level of the pyramid depicting the food chain.
2. Herbivore animals feed on plants.
3. Carnivorous animals feed on plants.
4. Decomposers break down dead tissues of organisms.

Notes

ACTIVITY

Explore which organisms are found only in fresh waters.

10.4 BIOMES

A biome is a plant and animal community which comes under a terrestrial ecosystem that covers a large geographical area. The boundaries of different biomes on land are determined mainly by climate and types of vegetation. Therefore a biome can be defined as the total assemblage of plant and animal species interacting within specific geographical conditions. These conditions include specifically rainfall, temperature, humidity and soil conditions. Some of the major biomes of the world are: forest, grassland, desert and tundra biomes

Biome can be subdivided on the following basis:

1. On the basis of climatic conditions, primarily temperature and humidity: there are four major types of biomes:

   (i) Forest biome

   (ii) Savanna biome

   (iii) Grassland biome

   (iv) Desert biome

Table 10.1 - Biomes of the World

Biomes	Sub types	Regions	Flora and Fauna
Forest	A. Tropical 1. Equatorial 2. Deciduous B. Temperate C. Boreal	A1-10°N-S A2-10°-25°N-S B- Eastern North America, N.E. Asia, Western and Central Europe C- Broad belt of Eurasia and North America, parts of Siberia, Alaska, Canada and Scandinavia	A1-Multi-layered canopy, tall and large trees A2-Less dense, trees of medium height; many varieties co-exist, insects, bats, birds and mammals B. Moderately dense broadleaf trees, less diversity of plant species, Oak, birch, maple etc. are common

			trees. Squirrels, rabbits, black bears, mountain lions, etc. are common animals. C. Evergreen conifers like pine, firand spruce etc. Woodpeckers, hawks, bears, wolves, deer, hares and bats are common animals.
Desert	A. Hot and Dry B. Semi -Arid C. Coastal D. Cold	A. Sahara, Kalahari, Thar, Rub-al-e-Khali B. Marginal areas of hot deserts C. Atacama D. Tundra climatic regions	A-C- Scanty vegetation; few large mammals, insects, reptiles and birds D-Rabbits, rats, antelopes, and ground squirrels
Grassland	A. Tropical Savannah B. Temperate Steppe	A. Large areas of Africa, Australia, South America , and India B. Parts of Eurasia and North America	A. Grasses: trees and large shrubs absent; giraffes, zebras, buffaloes, leopards, hyena, elephants, mice, moles, snakes, worms, etc. are common animals B. Grasses; occasional trees such as cottonwoods, oaks and willows, gazelles, zebras, rhinoceros, wild horses, lions, varieties of birds, worms, snakes etc. are common animals
Aquatic	A- Freshwater B- Marine	A- Lake, river, streams and wetlands B- Oceans, coral reefs, lagoons and estuaries	Algal and other aquatic and marine plant communities with varieties of water dwelling animals

Altitudinal	Slopes of high mountain ranges like the Himalayas, the Alps etc.	Deciduous to tundra vegetation varying according to altitude

2. On the basis of climate and vegetation-

For detaied study these biomes have been identified:

(i) The Evergreen Rainforest Biome

(ii) The Temperate Grassland Biome

(iii) The Arctic Tundra Biomes

i. The Evergreen Rainforest Biome

The evergreen rainforest biome is found in the equatorial zone extending 10° North and South latitudes from the equator. These evergreen forests are found in the equatorial belt including areas of Amazon lowland of South America, Congo basin of Africa and islands of South East Asia. As you are aware the sun rays fall directly on the equator throughout the year therefore the area experiences high temperature .This area also gets heavy rainfall throughout the year ranging between 150 cm - 250 cm. Every day in the afternoon heavy rainfall (convectional rainfall) occurs in this region. You might have read about convectional rainfall in the lessons on climate. In equatorial areas high temperature and rainfall are helpful for the growth of a variety of natural vegetation and wildlife.

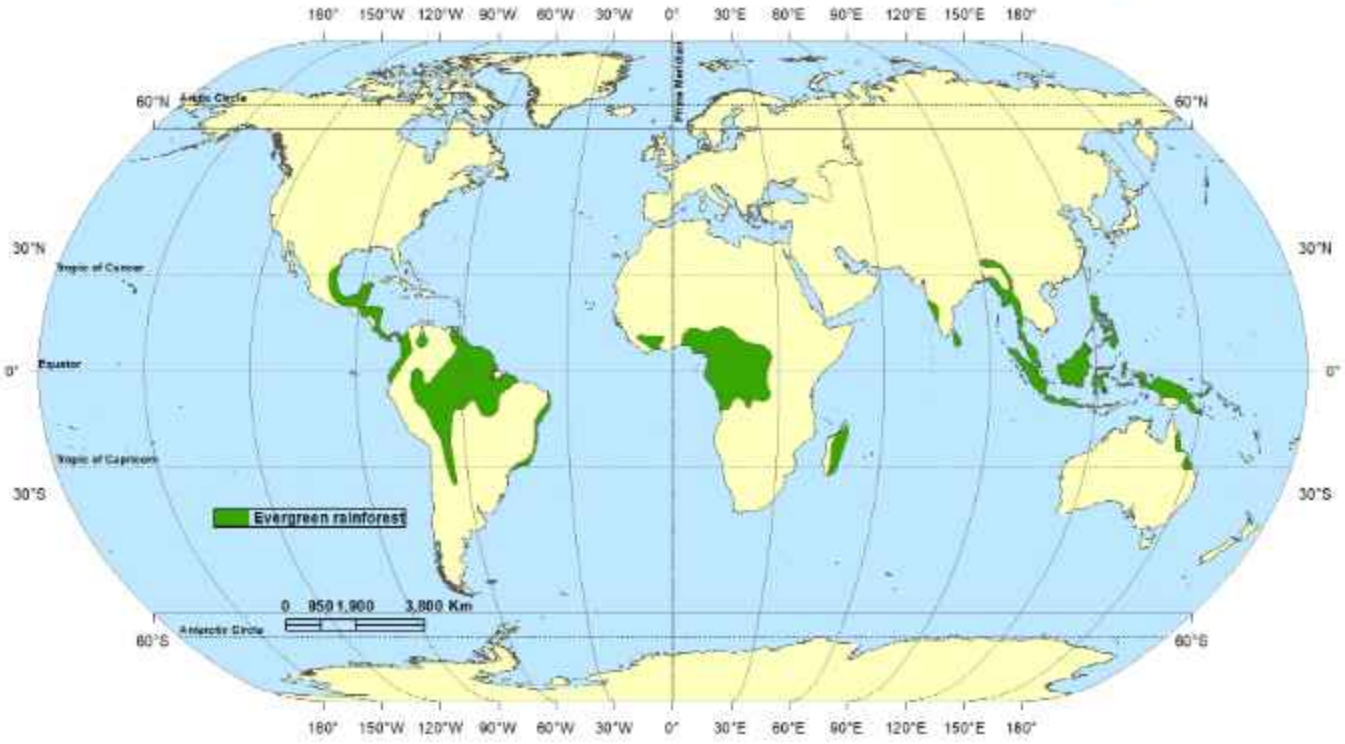


Fig. 10.2 The Evergreen Rain forest Biome

Trees of evergreen forests have generally buttressed trunks and shallow roots. There are three levels of evergreen rainforests,

i. The canopy or upper level where height of trees are about 20 metres to 60 metres. These are hardwood trees for example ebony, rose wood, sandalwood, cinchona, mahogany, etc.

ii. The intermediary level or second level where the height of trees is about 10 metres to 20 metres. Palm is an important species of this level. Besides that other parasitic plants are also found in this layer

iii. The lower level or third level where height of vegetation is about 10 metres from the surface. In this level a variety of plants such as ferns, mosses, orchids, etc. are found. Because of tall and broad leaf dense plants here sunlight does not reach the ground. Therefore the surface layer is always wet and muddy. Evergreen rainforest is inhabited by numerous wildlife species like elephants, lemur, birds, reptiles, insects, etc. The water bodies of the equatorial areas are also rich in animal life with alligators, fishes, frogs, Hippopotamus etc. Because of the impenetrability and high vegetation growth in the lower part, most of the insects, birds and animals reside 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 40 percent of the total productivity of the world.

For the last several decades people from other areas have encroached this area and started exploiting natural resources in the name of various developmental activities. These rainforests contain about 40% of all known species of plants and animals of the world. Deforestation of rainforest is just not ecological but also has very adverse environmental consequences. These evergreen forests are known for carbon sinks which help to reduce the impact of global warming on the earth.

ii. Temperate Grassland Biome

Temperate grasslands located in temperate zones, by the northern hemisphere i.e. Eurasia and North America have continental types of climate. Whereas grasslands in the southern hemisphere are located along the coastal areas of Australia and South America. Since these areas are located in the rain shadow areas of the high mountains, therefore receive scanty rainfall. These grasslands are called by different names in all these areas. For example in Eurasia, the grasslands are called the Steppes which extend towards east from the coasts of the Black sea to the plains of Manchuria in China. In North America, the grasslands lie between Rockies mountains and Great Lakes are called Prairies. In

South America these grasslands are known as Pampas in Argentina and Uruguay. In Africa these grasslands are found in South Africa and called Veldt. The same temperate grasslands of Australia are called Downs and are located in the Murrary - Darling river basins.

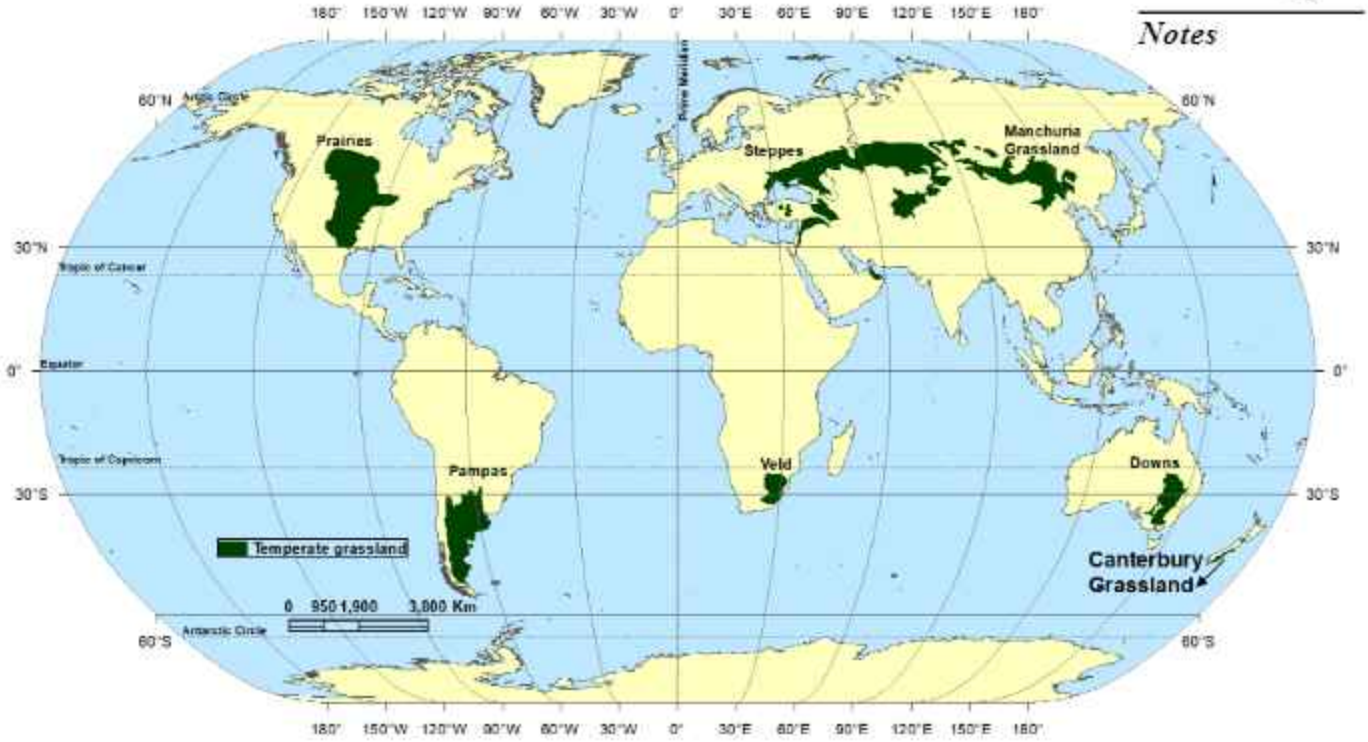


Fig. 10.3 Temperate Grassland Biome

ACTIVITY

Locate areas lying in the Temperate Zone on the outline map of the world.

As you are aware that regions that lie in temperate climates receive very less precipitation. The amount of precipitation is not sufficient for the growth of trees but is suitable for grass, therefore in this region extensive grasslands are found. In Eurasia Steppes grasslands are known for short and nutritious grass. These grasslands are known for different types of animals like antelopes, horses, wolves, kangaroos, emu, wild asses, wild dogs, etc.

These Areas are extensively affected by human interventions. Due to human intervention these temperate grasslands have been converted into agricultural fields and are known as 'granaries of the world'. Temperate grasslands are suitable for production of wheat. Another major activity in these grasslands is pastoralism or domestication of animals.

iii. Tundra Biome

Tundra biome is located in the northern parts of North America including Alaska, northern most areas of Canada, Greenland and the Arctic regions of Russia. This is a cold desert area where summers are very short and cool.

Natural vegetation includes grasses, mosses, lichens, etc. The animal species include resident and migrant animals. Resident animals are those which can adjust to the changing climatic conditions. Whereas migratory animals are those which start migrating to the warmer places in the very beginning of winter for example several birds such as water fowl, ducks, swans, geese etc. Some other animals of this region are reindeer, wolves, foxes, musk-ox, aortic hare, seal, etc. Productivity in tundra biomes is very low since this region receives very less amount of solar energy and most of the surface in the region is frozen throughout the year. Soils are also not developed and suitable for plants. In such circumstances the crop growing season is also very short.

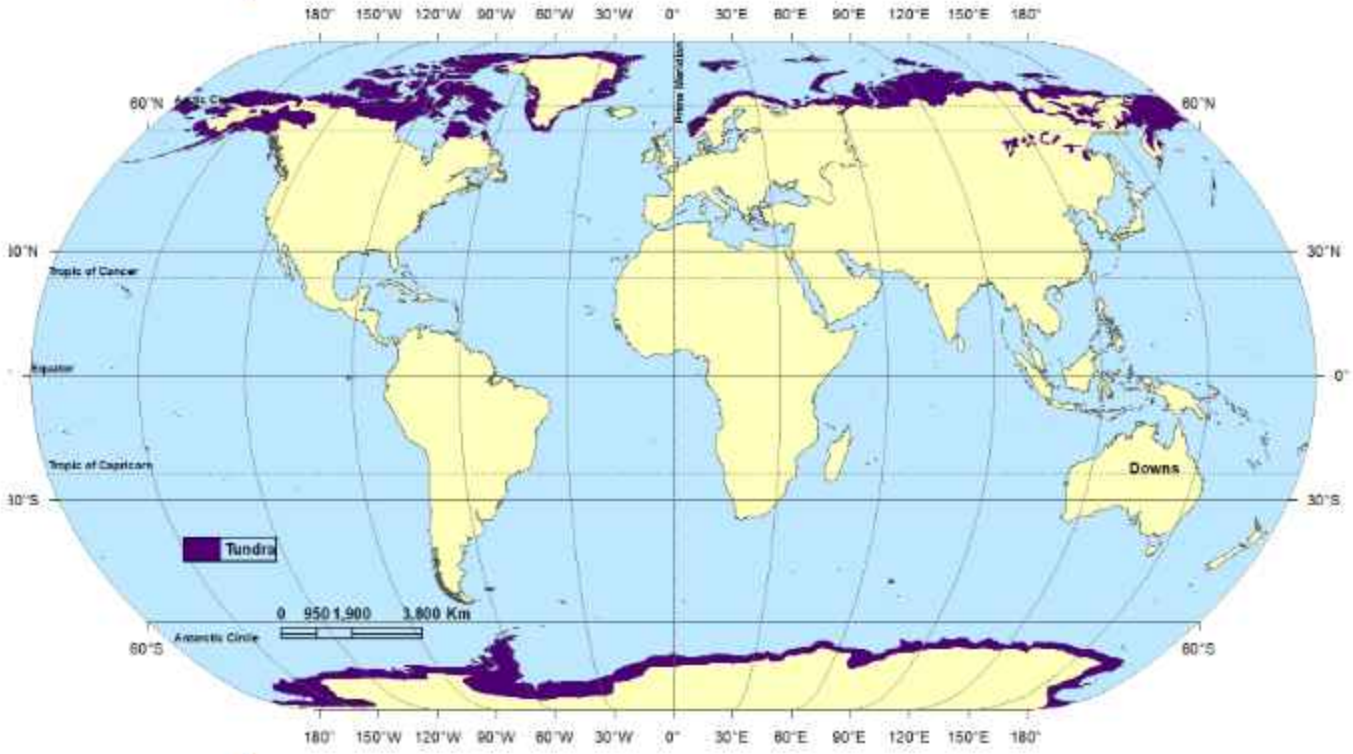


Fig. 10.4 Tundra Biome

Due to very harsh climatic conditions, the population here is very low. Some tribes such as Samoyeds, Lapps, Finns and Yakuts, Eskimos live in tundra regions of Eurasia, Canada and Alaska respectively. By introducing developmental work and modern technologies a lot of efforts are being done to bring these tribes into the mainstream.

Notes

INTEXT QUESTIONS 10.3

1. Explain the meaning of Biomes.

2. Name any two region where desert types of biomes are found.

ACTIVITY

Collect visuals of animals found in different Biomes and prepare a chart.

10.4 BIODIVERSITY AND ITS IMPORTANCE

The term Biodiversity originated from two words, Bio (life) and diversity (variety). Biodiversity may be defined as a specified geographical area where a variety of organisms including flora and fauna are found. It encompasses terrestrial and aquatic ecosystems formed by the varieties of plants, animals, and micro-organisms, including the genes these organisms contain. Biodiversity is related to the variability within the species and between the species and that within and between the ecosystems. As you are aware that biodiversity on the earth is very precious for all including living or non-living things. Actually biodiversity is a result of millions of years of evolutionary history of different species on the earth.

The impact of biodiversity on humans and humans on biodiversity is visible at all places of the earth. Biodiversity has contributed in various ways to the development of human cultures in all geographical regions of the world as well as Human societies in all parts of the globe have also played an important role in shaping the diversity of nature at different levels.

DO YOU KNOW?

Every year on 22 May is celebrated as International Biodiversity Day.

In an ecosystem each and every organism extracts its needs from others and also contributes something useful to other organisms. If an ecosystem is more diverse then there are more chances for species to survive through adversities and attacks and as a result the whole ecosystem becomes more productive. Therefore the loss of species in any ecosystem will decrease the capability of the ecosystem to maintain itself. Hence, the variety of species in an ecosystem makes it more stable.

Biodiversity is an important resource for all human beings in their daily life. In terrestrial ecosystems an important part of agro-biodiversity is 'crop diversity'. Apart from that other economic commodities such as food crops, livestock, forestry, fish, medical resources, etc. are also provided by the natural biodiversity to humans.

ACTIVITY

Enlist the commodities provided by nature to humans.

Biodiversity enables us to understand how life functions and the role of each and every species in sustaining the ecosystems of which humans are also a species. That is why biodiversity is necessary to sustain life on the earth and it is the responsibility of humans to consider that each and every species along with us have a basic right to exist on the earth. If the level of biodiversity is high that means the state of our relationships with other living species in the ecosystem is good.

Loss of Biodiversity

Fast growth of population and subsequently increasing demands of resources have accelerated the rate of consumption of natural resources tremendously in the world over. It has also increased the loss of different species and their habitations in all parts of the world. The impact of the growing population may be seen in tropical regions which occupy only about one -fourth of the total area of the world and contain about three fourth of the world population. In these areas over exploitation of the natural resources and deforestation to fulfil the needs of a large population have become a great cause of concern. The tropical rain forests contain about fifty per cent of the different species on the earth therefore destruction of natural habitats of wild flora and fauna in these forests have proved disastrous for the biosphere of the entire world.

Natural calamities such as earthquakes, floods, volcanic eruptions, forest fires, droughts, etc. cause damage to the flora and fauna of the earth. Pesticides such as hydrocarbons and toxic heavy metals and other pollutants destroy the weak and sensitive species. Species which are not the natural habitants of the local habitat but are introduced in the systems, are called "exotic species". There are many examples when a natural biotic community of the eco systems suffered extensive damage because of the introduction of exotic species.

DO YOU KNOW?

Chir is an exotic species which was planted in the Himalayan areas during colonial time in India.

Notes

Conservation of Biodiversity

Biodiversity is important for human existence. All forms of life are so closely interlinked that disturbance in one gives rise to imbalance to the others. If species of plants and animals become endangered they cause degradation in the environment, which may threaten human beings' own existence.

There is an urgent need to educate people to adopt environment-friendly practices and reorient their activities in such a way that our development is harmonious with other life forms and is sustainable. There is an increasing consciousness of the fact that such conservation with sustainable use is possible only with the involvement and cooperation of local communities and individuals.

DO YOU KNOW?

Every year World Sparrow Day is celebrated on 20th March. This is the most common bird species in urban areas in India. Sparrows are generally found in groups and feed on grains. Now numbers of these house sparrows are declining due to various reasons.

Can you find out the reasons?

ACTIVITY

The Bishnois community living in north India is known for conservation of natural vegetation and wildlife in India. There are several other communities in India who depend on forests for their livelihood. Collect information about them.

There is a need to develop local level institutions like Van Panchayat for forest management and to promote practices for conservation of species and their habitats. Such institutions are very active in some states like Uttarakh and. Moreover, school students can also take initiatives by organising local level events for sensitising and motivating local communities in the process of forest and wildlife conservation and management.

The government of India along with other nations have signed the Convention of Biodiversity at the Earth Summit held at Rio -de-Janeiro, Brazil in June 1992. The Convention of biological diversity covers biodiversity at all levels including ecosystems, species and genetic resources.

In India several national parks and sanctuaries have been established to protect, preserve and propagate the variety of wildlife species within natural boundaries.

ACTIVITY

Prepare a list of national parks and show them on the map of India.

Countries which are situated in the tropical region possess a large number of the world's species diversity. There are some countries namely, Mexico, Columbia, Ecuador, Peru, Brazil, Zaire, Madagascar, China, India, Malaysia, Indonesia and Australia in which mega biodiversity places are located. In order to concentrate resources on those areas that are most vulnerable, the International Union for Conservation of Nature and Natural Resources(IUCN) has identified certain areas as biodiversity hotspots As you are aware that different types of vegetation are very significant since these determine the primary productivity of any ecosystem. Hence, hotspots are defined according to different vegetation species found in the area.

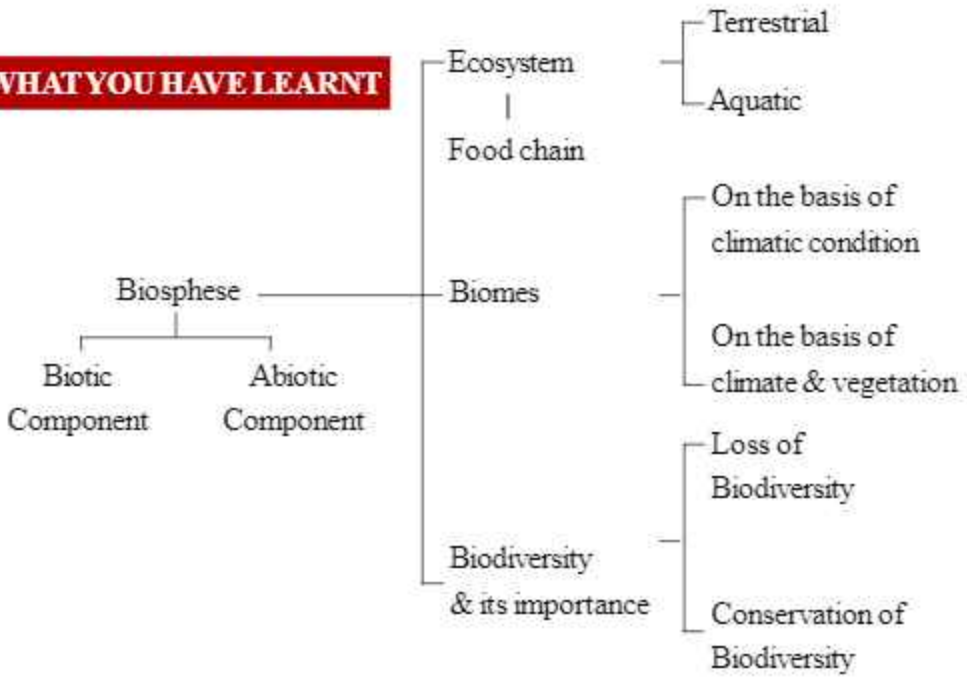
ACTIVITY

Locate countries situated in tropical regions known for rich biodiversity. Identify Biodiversity Hotspot on the map of India.

INTEXT QUESTIONS 10.4

1. Name any 3 countries which has mega Biodiversity hotspots.
2. In which year India has signed the convention of biodiversity.

WHAT YOU HAVE LEARNT



TERMINAL QUESTIONS

1. What is a biome? Explain types of biomes.
2. Explain the characteristics of the evergreen rainforest biome.
3. Distinguish between Tundra and Temperate biomes.
4. What is the importance of Biodiversity?
5. What efforts should be done to conserve Biodiversity?

ANSWERS TO INTEXT QUESTIONS

10.1

1. Biotic
2. Physical
3. Biotic, Abiotic
4. linked

10.2

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

10.3

1. A biome is plant and animal community which comes under a terrestrial ecosystem that covers a large geographical area.
2. Sahara, Valahar, Thar, etc. (any 2)

10.4

1. Mexico, Peru, India, China, Indonasia etc (any 2)
2. 1992

Notes

MODULE -6

Physical Geography of India

11. Physical Settings
12. Climate
13. Natural Hazards and Disasters