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# THE TUNDRA BIOME

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## **Introduction:**

There are several different kinds of plants and animals living on the Earth. But, only certain kinds of them are naturally found at any particular place.

For example, cacti are found in the deserts, polar bears are found in the Arctic regions, and elephants are found in the central Africa and also in India.

Why it is so?. It is because, these animals are not adapted to live in the average weather conditions found in other places. These average weather conditions here refers to the range of temperature and rainfall that typically occur in a particular location. Some climates are hot, some are cold, some are wet and some are dry. The term "Adapted", here, means that a plant or animal has inherited to certain characteristics that enable it to live in one type of climate or another. If we see the polar bears, they have a layer of fat under their skin and a heavy fur coat to help them to withstand the coldness of that climate.

The same Polar bear would have a difficult time to survive in a very hot climatic zone. Plants and animals don't live in isolation. They live together with other plants and animals in an interdependent group called as an ecological community. If we think about it for a moment, we will realize that all of the plants and animals in a particular ecological community, must be adapted to the same climatic condition so that they can all live in the same location.

A distinct ecological community of plants and animals, living together in a particular climate, is called as a "biome." The geographical distribution (and productivity) of the various biomes is controlled primarily by two main climatic variables. One is precipitation and the other one is temperature. This is in addition to the global distribution of air, land and water. Based on these factors, scientists have divided the broad spectrum of climates and ecological communities found on Earth into various biomes.

The world's Biomes are defined as "the major communities, classified according to two parameters. One is the predominant vegetation and the other one is the characteristic adaptations of organisms to a particular environment".

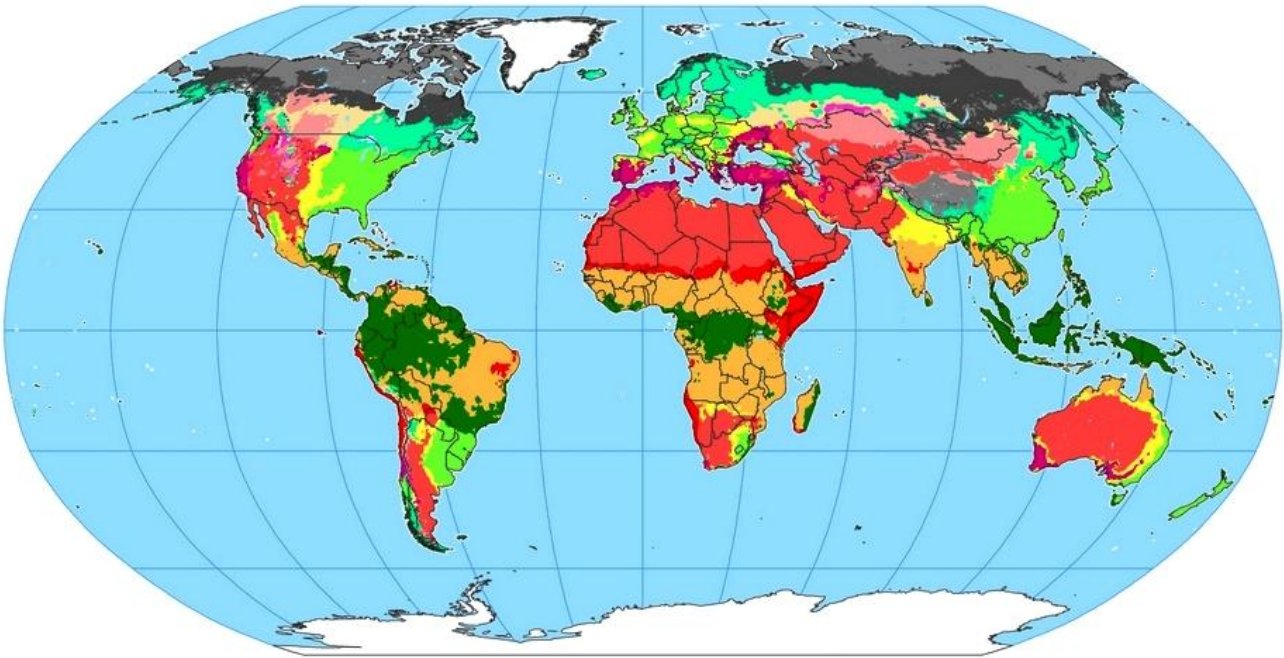
The globally recognized biomes of the world are 9 in number. They are:

1. Tropical Rainforest
2. Tropical Seasonal Forest
3. Temperate rainforest
4. Temperature Deciduous Forest
5. Tropical Savanna
6. Temperate grasslands & Temperate Desert
7. Taiga
8. Tundra.
9. Subtropical Desert.

Most of the classified biomes are identified based on three major factors as:

- a) the climate of the region,
- b) the dominant plants and their adaptations and
- c) dominant animals and their adaptations.

# Major Biomes



**Temperate**

- Semi-arid
- Humid

**Desert**

- Tropical
- Temperate
- Cold

**Tropical**

- Semi-arid
- Humid

**Ocean**

- Ocean

**Tundra**

- Permafrost
- Interfrost

**Boreal**

- Semi-arid
- Humid

**Mediterranean**

- Warm
- Cold

**Ice**

- Ice

We call it as biodiversity. There are three kinds of diversity existing in nature as species diversity, genetic diversity and ecological diversity.

Almost all of these aspects are reflected in the globally distributed nine bioclimatic zones.

Among these, the Polar regions show extreme climatic conditions.

The bioclimatic environment is classified as Tundra Biome.

This Tundra Biome is an extremely cold, frozen and treeless landscape. A study of this is a very essential part in not only Physical geography but also in biogeography. Hence, in this lesson, the following aspects of Tundra bioclimatic zones, are highlighted:

1. Biome Characteristics.
2. Climatic Conditions
3. Arctic Tundra
4. Alpine Tundra
5. Antarctic Tundra.

### 1. BIOME CHARACTERISTICS

The word 'tundra' originates from the Finnish 'tunturia', meaning 'barren land'. Another meaning from the Kildin Sami term 'tundar', means 'treeless mountain track' or 'uplands'.

The characteristics features of the Tundra Biomes are:

- 1) Fully frozen, too dry and cold regions.
- 2) A treeless landscape
- 3) Experiences Freezing temperature.
- 4) A kind of barren land with ice-desert.
- 5) Permafrost soils.
- 6) High altitude and top of mountains.
- 7) High latitudinal range. 75 degrees to 60 degrees North. Belongs to the frigid zone of the globe.
- 8) The most inhospitable and chaotic conditions.
- 9) Very bitter and severe cold wind blows.
- 10) Short summer with full sun shine of 24 hours- land of midnight sun. Long winter.
- 11) Unique growing season- long in high altitudes and short in polar regions.
- 12) Simplest biome with species composition and food chain.
- 13) Long cold and dark winters- nights can last for weeks.
- 14) Low levels of precipitation.- snow falls
- 15) No true soils. Soils with little nutrients and minerals.
- 16) Very fragile environment. Low in biodiversity.
- 17) Unique animal adaptations- large compact bodies, thick insulating cover of feathers and furs.
- 18) Ground-hugging and warmth preserving plant forms.
- 19) Cyclical fluctuations in population size. Native nomadic tribes.
- 20) Circumpolar distribution of plants and animals.

The tundra ecosystem is also very low in biodiversity. There are only about 1700 varieties of plants and about 48 varieties of land mammals found in the tundra region.

Such a situation exists only in a few regions of the world. They are the Arctic and Antarctic regions and their adjacent areas of the world.

Based on their geographic setting, the world's tundra biomes are classified into two types as:

- a) The Arctic Tundra
- b) Alpine Tundra.

The Antarctic also has the Arctic Tundra type of biome.

## 2. CLIMATIC CONDITIONS

The global geographic regions are classified into equatorial regions, temperate regions, torrid zones and frigid zones based of their increasing latitudes from the equator and also the distribution of global climatic conditions. The situation in the Frigid zone is very unique. Tundra is a Polar climatic biome belongs to this zone.

The tundra climate is a transitional climate between the Subarctic and Ice cap climates.

It is a region of rolling to nearly level terrain almost entirely devoid of trees.

It is also characterized by very cold temperatures and generally dry conditions.

Temperature never rises above  $10^{\circ}\text{C}$  during the summer.

The tundra climate is found as a nearly unbroken ribbon of land on the Arctic ocean border lands of North America and Eurasia, and along the margins of Greenland.

Though nearly exclusive to the Northern Hemisphere, it can also be found on the peninsular land of the Antarctic continent.

Tundra region experiences a very cold winter temperatures of less than minus ten degree centigrade ( $< -10^{\circ}\text{C}$ ). It has a very short growing season with this cool temperatures ( $< 10^{\circ}\text{C}$ ).

The annual precipitation is around 100 - 200 mm, but precipitation is greater than potential evapotranspiration.

The regions may have cloudy skies, but getting 24-hour sunlight during the short summer.

This biome exists at places of latitudes  $> 66^{\circ}$ , in the northern hemisphere or in the southern hemisphere.

The interesting part about the Tundra Climate is that it is quite windy, with winds that blow upwards of 30 to 60 miles per hour.

Another interesting fact is that in the summer months when the ice begins to melt, it cannot be absorbed into the ground. This is because only the upper layers of the permafrost melt, while the bottom layers are still frozen.

The tundra is noted for its low temperature. The tundra is basically summer-less, having no monthly temperature averaging above  $10^{\circ}\text{C}$ , and having at least nine months below freezing.

Here the warmest month is August. The coldest temperatures may be in February.

The very cold temperature creates absolute humidities that are lower than those found in other places. As a result, precipitation is less than 250 mm a year.

The resulting humidity levels are so low that precipitation amounts may be similar to most of the deserts. Hence, climatologists have described these ice cap climates as a "polar deserts".

## 3. ARCTIC TUNDRA

The arctic tundra is located between the north pole and the coniferous forests or taiga region.

The following are the countries in which Arctic Tundra biomes are distributed:

- a) North America – which includes the Northern Alaska, Canada and Greenland
- b) Northern Europe – which includes only the Scandinavia and

c) Northern Asia which covers only the Siberia.



The arctic is known for its cold, desert-like conditions.

The growing season ranges from 50 to 60 days.

The average winter temperature is  $-34^{\circ}\text{C}$ , but the average summer temperature is  $3-12^{\circ}\text{C}$  which enables this biome to sustain life.

Rainfall may vary in different regions of the arctic.

The annual precipitation, including the melting of snow, is 15 to 25 cm (6 to 10 inches).

A layer of permanently frozen subsoil called permafrost exists, consisting mostly of gravel and finer material. When water saturates the upper surface, bogs and ponds may form, providing moisture for plants.

There are no deep root systems in the vegetation of the arctic tundra.

In spite of these, there are still a wide variety of plants that are able to resist the cold climate.

There are about 1,700 kinds of plants in the arctic and subarctic, and these include:

- low shrubs, sedges, reindeer mosses, liverworts, and grasses.
- 400 varieties of flowers
- crustose and foliose lichen.

All of the plants are adapted to the sweeping winds and disturbances of the soil.

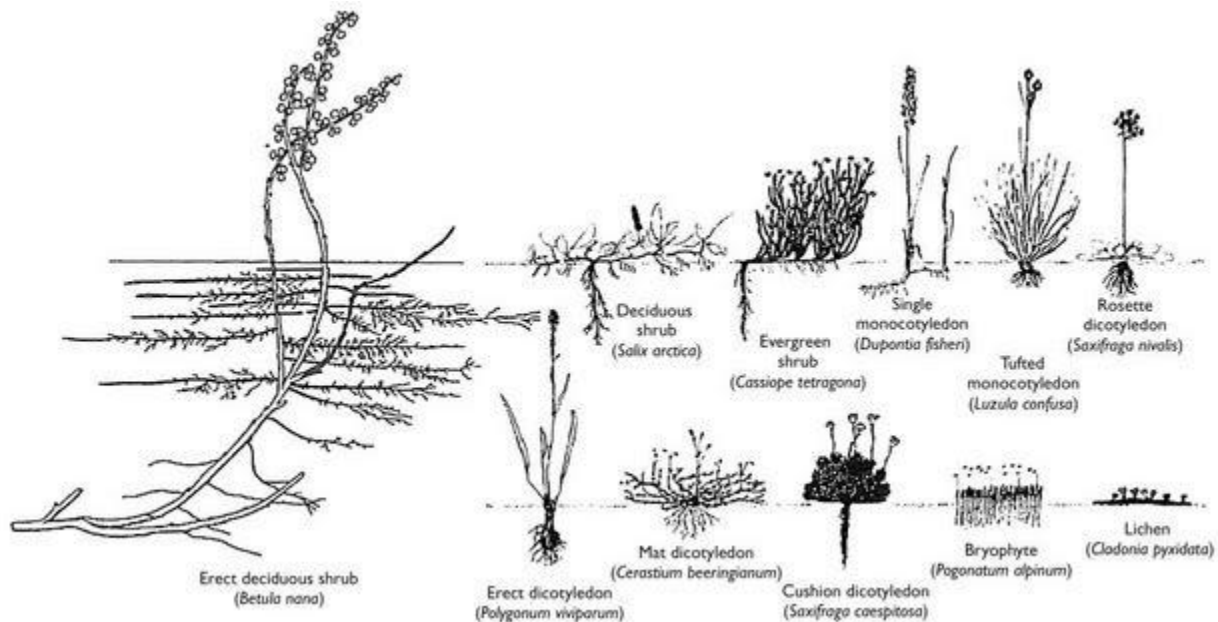
Plants are short and group together to resist the cold temperatures and are protected by the snow during the winter.

They can carry out photosynthesis at low temperatures and low light intensities.

The growing seasons are short and most plants reproduce by budding and division rather than sexually by flowering.



Not many kinds of animals live year-round in the Arctic tundra. Most birds and mammals only use the tundra as a summer home. Mammals that do live year-round in the tundra include the muskox, Arctic wolf, and brown bear; and each has its own way of adapting to the extreme climatic conditions. Animals need to find ways to stay warm and to provide nourishment for themselves in order to survive the long, cold, winter months.



**The fauna in the arctic is also diverse:**

- Herbivorous mammals: lemmings, voles, caribou, arctic hares and squirrels
- Carnivorous mammals: arctic foxes, wolves, and polar bears
- Migratory birds: ravens, snow buntings, falcons, loons, ravens, sandpipers, terns, snow birds, and various species of gulls
- Insects: mosquitoes, flies, moths, grasshoppers, blackflies and arctic bumble bees
- Fish: cod, flatfish, salmon, and trout.



Animals are adapted to handle long, cold winters and to breed and raise young quickly in the summer. Animals such as mammals and birds also have additional insulation from fat. The main animal population in the Arctic Tundra consists of reindeer, polar bears, arctic fox, arctic hare, snowy owls, lemmings and musk ox.



Cotton Plants



Lichen



Caribou Moss



Labrador Tea

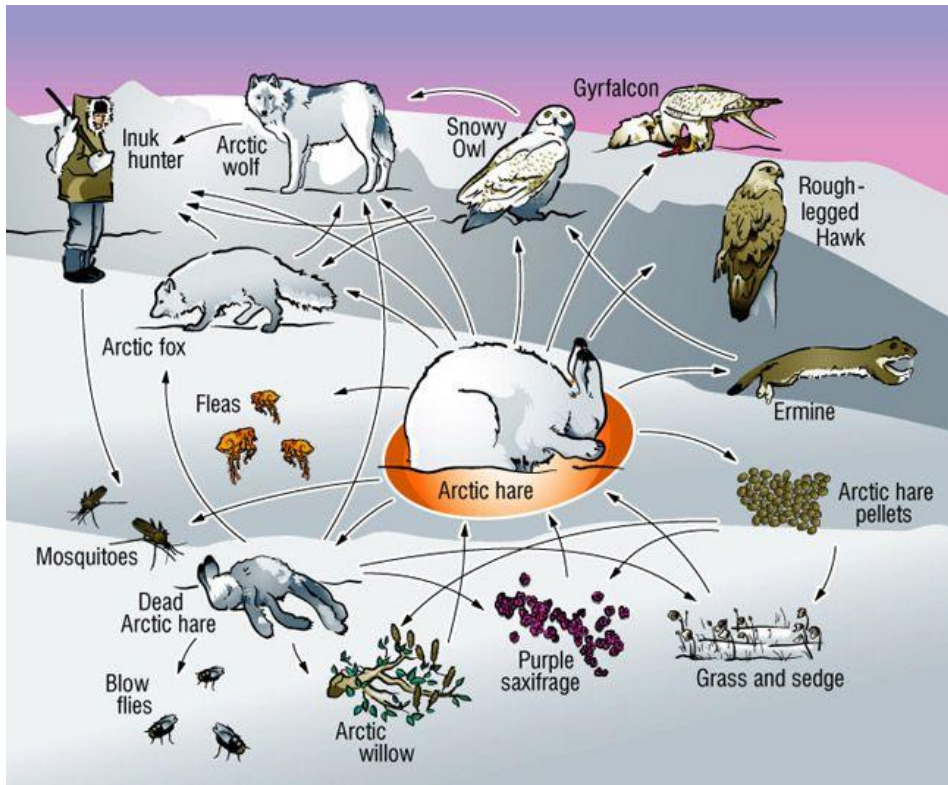


Arctic Willow



Bearberry

Many animals hibernate during the winter because food is not abundant. Another alternative method is to migrate towards south in the winter, like birds do. Reptiles and amphibians are few or absent because of the extremely cold temperatures. Because of constant immigration and emigration, the population continually oscillates. It is interesting to note that the Tundra region is also a vast storehouse of natural resources such as oil and uranium.



During the summer, Arctic tundra is characterized by lots of surface water. When snow melts, the water percolates through the active layer but is unable to penetrate the permafrost. Since the water has nowhere to go, the active layer becomes saturated and pools of water form on the surface.

Within the tundra biome a latitudinal zonation of communities is realized as High Arctic Tundra, Middle Arctic Tundra and Low Arctic Tundra.

The arctic tundra formed 10,000 years ago, and is the world's youngest biome.

#### 4. ALPINE TUNDRA

Alpine tundra is that area of the earth's surface which does not support any vegetation due to its high altitudes. This can happen anywhere on the surface of the earth. This area also can contain permafrost soils.

The Alpine tundra occurs in frigid mountaintop regions at very high elevations.

The Alpine Tundra is distributed in the following countries:

North America - Alaska, Canada, U.S.A., and Mexico

Northern Europe - Finland, Norway, Russia, and Sweden

Asia - Southern Asia (Himalayan Mountains), and Japan (Mt. Fuji)

Africa - Mt. Kilimanjaro

South America - Andes Mountains.



Alpine tundra can be found in high elevations anywhere in the world, even in tropic regions. Although the land is not frozen all through the year, as in arctic tundra regions, these lands are typically covered in snow for most of the year.

The alpine tundra biome is also a cold climate region with temperatures averaging below freezing point at nights.

This area receives more precipitation throughout the year than the arctic tundra.

The average annual precipitation is around 45 cm. Most of this precipitation is in the form of snow.

The alpine tundra is also a very windy area. Strong winds blow at speeds exceeding 200kmph.

The growing season is approximately 180 days.

The nighttime temperature is usually below freezing.

Unlike the arctic tundra, the soil in the alpine is well drained.

The plants are very similar to those of the arctic ones and include:

- tussock grasses, dwarf trees, small-leafed shrubs, and heaths

Animals living in the alpine tundra are also well adapted:

- Mammals: pikas, marmots, mountain goats, sheep, elk
- Birds: grouselike birds
- Insects: springtails, beetles, grasshoppers, butterflies

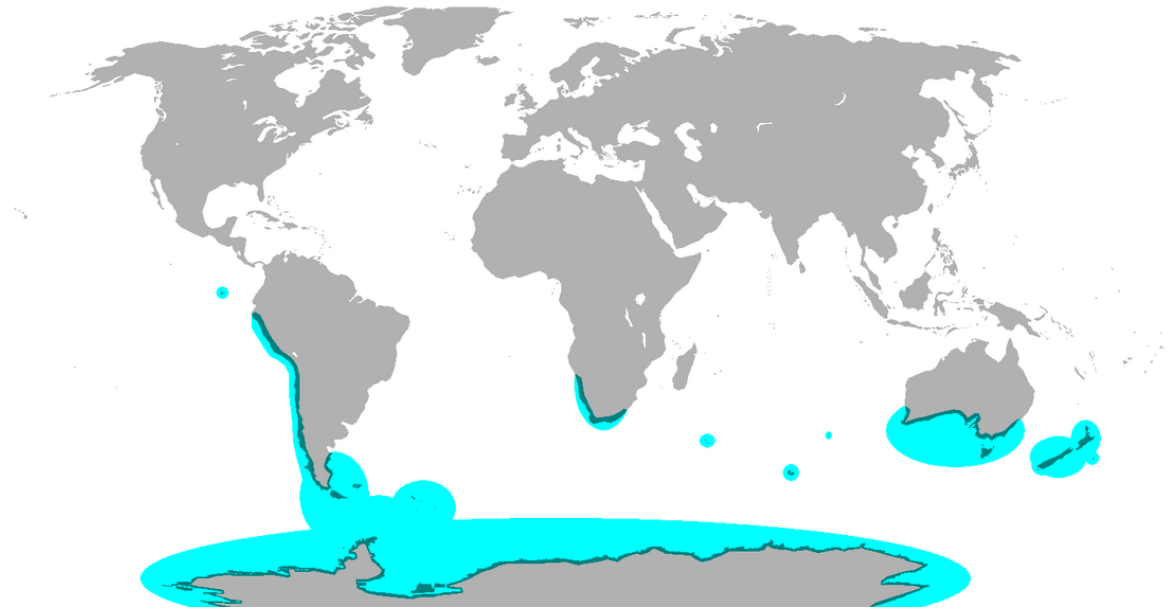
## 5. ANTARCTIC TUNDRA

The Antarctica is centered around the South Pole. It includes parts of the Southern ocean, surrounding seas, ice shelves, continental glaciers, plateaus and mountain ranges.

The Antarctic covers more than 14,000,000 km<sup>2</sup>, making it as the fifth-largest continent, in the world.

About 98% of Antarctica is covered by only ice sheet, averaging at least 1.6 km in thickness.

The continent has about 90% of the world's total ice. It contains about 70% of the world's fresh water resource.



The icecap is up to 4,800 metres thick.  
At its highest points, over mountain ranges, the icecap rises as high as 4,100 metres above sea level.

Today, this Antarctic icecap forms the largest body of fresh water or ice in the world.  
Its volume of 30 million cubic kilometres represents the world's 70 per cent of fresh water resources.

Mountains, valleys, and glaciers mark the coast of East Antarctica.

The Ross Ice Shelf is the largest one, measures about 700 metres thick at the inner edge and about 200 metres thick at the outermost edge.

In summer, the outer edges of the ice shelves break away and form immense, flat icebergs.

Scientists have measured the Antarctic icebergs cover an area as huge as 13,000 square kilometres.

Each winter, the surface of the Antarctic Ocean freezes into a sheet of ice.

In summer, this sheet breaks into pieces called ice floes.

The Antarctica's climate varies from extremely cold, dry conditions on the inland plateau to milder, moister conditions along the coasts.

Many people call this plateau as a "polar desert."

It has only about 5 centimetres of snowfall each year.

The average annual precipitation (rain and snow) on coastal areas is about 60 centimetres.

The Antarctic winter lasts from May until August.

The Antarctic summer lasts from December until February.

The July temperatures range from  $-40^{\circ}\text{C}$  to  $-70^{\circ}\text{C}$  inland, and from  $-15^{\circ}\text{C}$  to  $-30^{\circ}\text{C}$  on the peninsula's coast.

The January temperatures range from -15 °C to -35 °C inland and reach 0 °C on the coast.

The northern islands may have summer temperatures of up to 10 °C. The icy winds make the Antarctic air feel even colder.

The winds that sweep downward from the plateau can average upto 70 kilometres per hour.

The wind gusts often reach the coast at 190 kilometres per hour.  
The Antarctic has a unique set of biodiversity and natural resources.

Only a few plants can grow in the Antarctica because of the ice-covered land and typical climate.

Mosses are the most common plants.

Only two flowering plants grow in Antarctica. They grow over the northern part of the Antarctic Peninsula.

Simpler organisms like algae grow on the snow, in lakes, and on ice surrounding the continent

Black, white, and green lichens have been found to be attached to the rocks. These lichens survive by bunching together to conserve water.

The Animal life of the Antarctic are very wonderful to see.

Only a few insects and other tiny animals are found to spend their entire lives on the Antarctic mainland.

The continent's largest land animal is a wingless midge, a type of fly no more than 12 millimetres long.

Most land animals live at the edges of the continent.

Very small lice, mites, and ticks live by attaching themselves with the mosses, under the fur of seals, or on the feathers of birds.

The Antarctic Ocean has abundant wildlife.

Krill, a small, shrimplike creature that feeds on tiny floating organisms is the most common animal of the ocean.

Many other Antarctic animals depend on the krills for food. It is protein-rich food for the people also.

There are squids, which are eaten by many other Antarctic animals.

About 100 kinds of fish are found to be existing in the oceanic waters of Antarctic.  
These includes Antarctic cod, icefish, and plunderfish.

Whales are the visitors of the Antarctic. Several kinds of whales migrate to Antarctica during the summer seasons.

The notable varieties are blue whales, fin whales, humpback whales, minke whales, right whales, and sei whales.

The blue whale is the largest animal that has ever lived with its length growing upto 30 metres.

Antarctic whales that eat fish and squid include killer whales, southern bottlenose whales, southern fourtooth whales, and sperm whales.

It has been observed that the Killer whales are found to be hunting the seals, penguins, and smaller whales, in the Antarctic.

It is also seen from exploration reports that various kinds of seals also live in the Antarctica.

They spend most of their lives in the Antarctic waters, by swimming, diving, and catching food. Most of them nest on the beautiful coasts.

The largest seal in the world is the southern elephant seal, which feeds on the squids.

Whenever we talk about the Antarctic, we remember the Penguins. Penguins are the beautiful, loveable ones most often associated with the Antarctica.

These are birds. They cannot fly. But they waddle awkwardly on land. But they are the most skilful swimmers, in oceanic waters. They fly through the oceanic waters for diving for fish and other food.

There are six kinds of penguins, which are native breeds of this continent.

Playful Adelie penguins are the the most common kindof penguins. They build their nests on the pebbles of the coasts.

The tall and quiet penguins are called as the emperor penguins. They are the most spectacular birds on the globe. They grow to about 1.2 metres.

The other varieties are Chinstrap penguins, gentoo penguins, king penguins, and macaroni penguins. All of them nest on the Antarctic Peninsula and on various islands.

Rockhopper penguins are one variety which nest only on the islands north of Antarctica.

It is reported that more than 40 kinds of flying birds spend their summer seasons in the Antarctica.

These birds include albatrosses, prions, and a large group of sea birds known as petrels.

### **Conclusion:**

The tundra biome is characterized by extremely cold temperatures and treeless, frozen landscapes. The ecology of the tundra is controlled by the extreme cold climate and the high northern latitude. The unique climate, soil structure, permafrost conditions, life forms and inhospitable situation dominate the biology of Tundra.