2 Climatic Regions and Climate Change

I came to Canada for higher education and staying in the province of New Brunswick, now it is the starting of cold season here. The maple trees have begun to shed their leaves, heralding the arrival of winter. But the pine trees still remain green. Winter begins here in mid-September. It peaks by the end of January and gradually cools off to an end by April. The average temperature during this period is -20˚C and can touch as low as -35˚C. The most difficult thing in winter is the cold wind. There will be heavy snowfall during this time. 40 to 50 cm of snow will accumulate. One has to wear multiple layers of clothing to survive winter conditions. Without a jacket, gloves and footwear, it is a mess. Heaters are installed in all houses and buildings. As the month of May begins, the temperature starts to rise and by August it may reach up to 30˚ C. Daytime is hot and humid during summer and sometimes it even rains. Thin clothes will suffice in winter.

Nikhil Shibu

Did you read the note?

Is the climate where Nikhil is residing, similar to ours? Analyse the writing based on the weather elements given below.

- Temperature
- Precipitation
- Wind

Did you notice that New Brunswick, where Nikhil lives, experiences severe winters and snowfall?

Is climate the same everywhere in the world? Some places experience severe cold and snowfall, whereas it will be extremely hot and arid elsewhere. There are also areas with moderate temperature and humidity. Our earth is enriched with such diverse climates. You have studied about weather elements in the previous chapter.

Based on the fluctuations in elements of weather such as temperature and precipitation, the world can be divided into different climatic regions.

What is a climatic region?

A climatic region is an extensive geographical area in which similar climate characteristics are observed.

Look at some of the major climatic regions of the world that are given below.

- Equatorial climatic region
- Monsoon climatic region
- Savanna climatic region
- Hot deserts
- Temperate grasslands
- Mediterranean climatic region
- Taiga region
- Tundra region

Each climatic region has its own unique climate, and flora and fauna developed according to it. Human life of the respective climatic region is also moulded according to the geographical features. Let's delve deep into the characteristics of the major climatic regions.

Equatorial climatic region

Fig 2.1

Look at the picture (Fig.2.1). It shows the lifestyle of the pygmy tribe living in the equatorial climatic region.

This climatic region extends up to 10° North and South of the equator. Observe the map (Fig 3.3) and identify of the areas included in this region. The equatorial climatic region is characterised by high temperatures and high rainfall throughout the year. This climatic region is hotter because sun's rays fall almost vertically throughout the year. This results in higher air convection and convectional precipitation. These areas receive rainfall every day in the afternoon. Don't you remember the previous chapter discussing convectional rainfall?

Evergreen forests are abundant in the equatorial climatic region due to high temperatures and high rainfall. Further details of the equatorial climatic region will be discussed in the following chapter.

Monsoon climatic Region

Didn't you know that the Indian subcontinent, of which our country is a part, receives rain mostly during the monsoon season?

Monsoons are the seasonal reversal of wind system.

These winds blow from sea to land in summer and get reversed from land to sea in winter.

This region is known as monsoon climatic region, because of the decisive influence of monsoon winds.

Is monsoon climate experience only in the Indian subcontinent?

Some other regions of the world also experience similar climatic conditions. Observe the map (Fig 2.2) and atlas, and list the regions experiencing monsoon climate.

- Indian sub continent
-

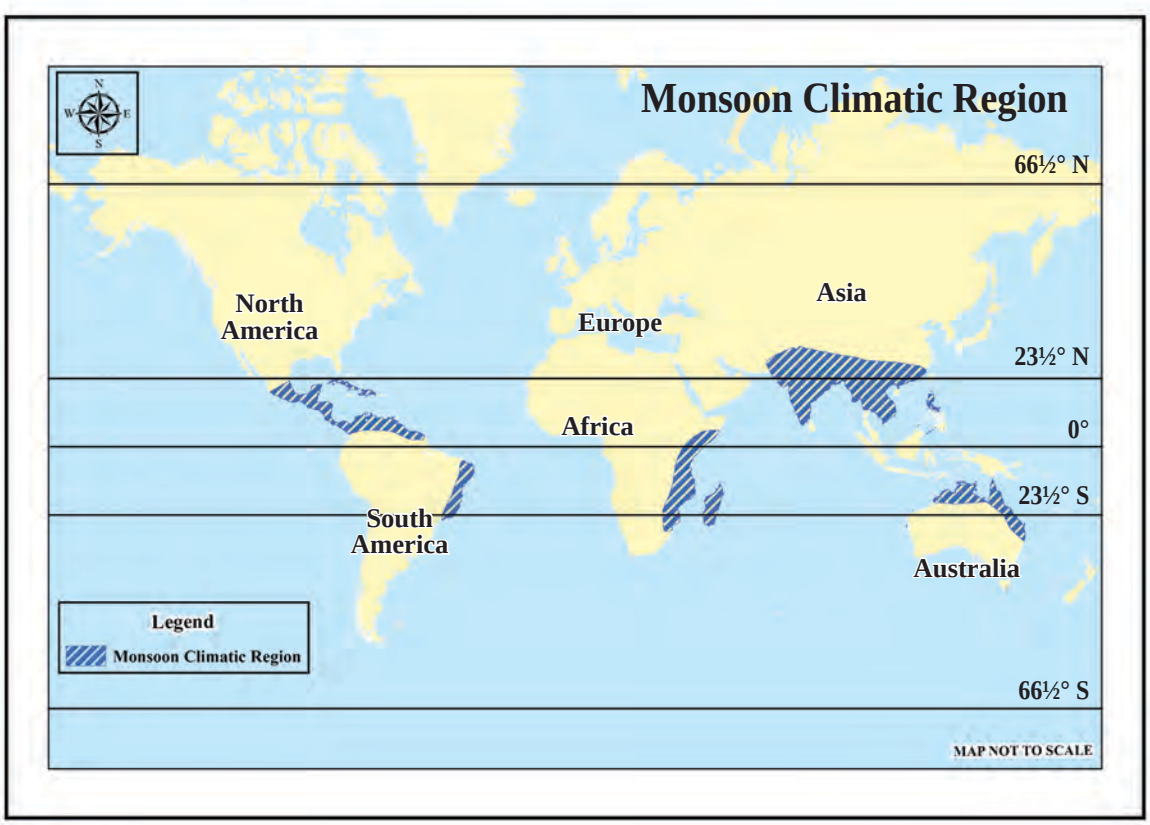

Fig 2.2

Monsoon climate is characterised by long and humid summer and short dry winter. In monsoon climatic regions, diurnal range of temperature is very low in coastal areas and very high in the interiors.

Why does this difference in diurnal range of temperature occur?

Depending on the factors like physiography, direction of wind, and distance from the coast, rainfall distribution also varies in the monsoon regions. Regions with as little as 50 cm of rainfall to areas receiving over 1000 cm of annual rainfall can be found in this region.

Don't you remember different types of rainfall discussed in the previous chapter?

Does convectional rainfall occur in the monsoon climatic region?

Luxuriant growth of vegetation due to the high temperature and rainfall helps forests in this region to become dense. Evergreen and deciduous trees are generally found here. However deciduous trees are more common. Monsoon forests also known as tropical deciduous forests have a mixture of different types of trees depending on the amount of rainfall received.

Monsoon Forests
Fig 2.3

With the help of ICT, collect images of plants and animals found in monsoon forests and create a digital album of the same. Caption them.

Monsoon region is one of the most densely populated areas in the world. High rainfall and availability of labour keeps monsoon climatic region an important agricultural region. Tropical crops like rice, sugarcane, jute, cotton, tea and coffee. are cultivated here. Why are these crops called tropical crops?

Intensive subsistence agriculture, is prevailing in this region. In rare areas, shifting cultivation, a primitive subsistence agriculture also exists.

Shifting cultivation has different names in different countries of the monsoon region. Find these names.

With the variations in the availability of rainfall, the type, height and diversity of flora also vary. Diversity is evident in fauna also.

Savanna Climatic Region

Savannas are tropical grasslands found between 10° and 30° latitudes in both the hemispheres. These grasslands are known by different names in different regions. It is known as Savanna in Africa, Campos in Southern Brazil and Llanos in Venezuela.

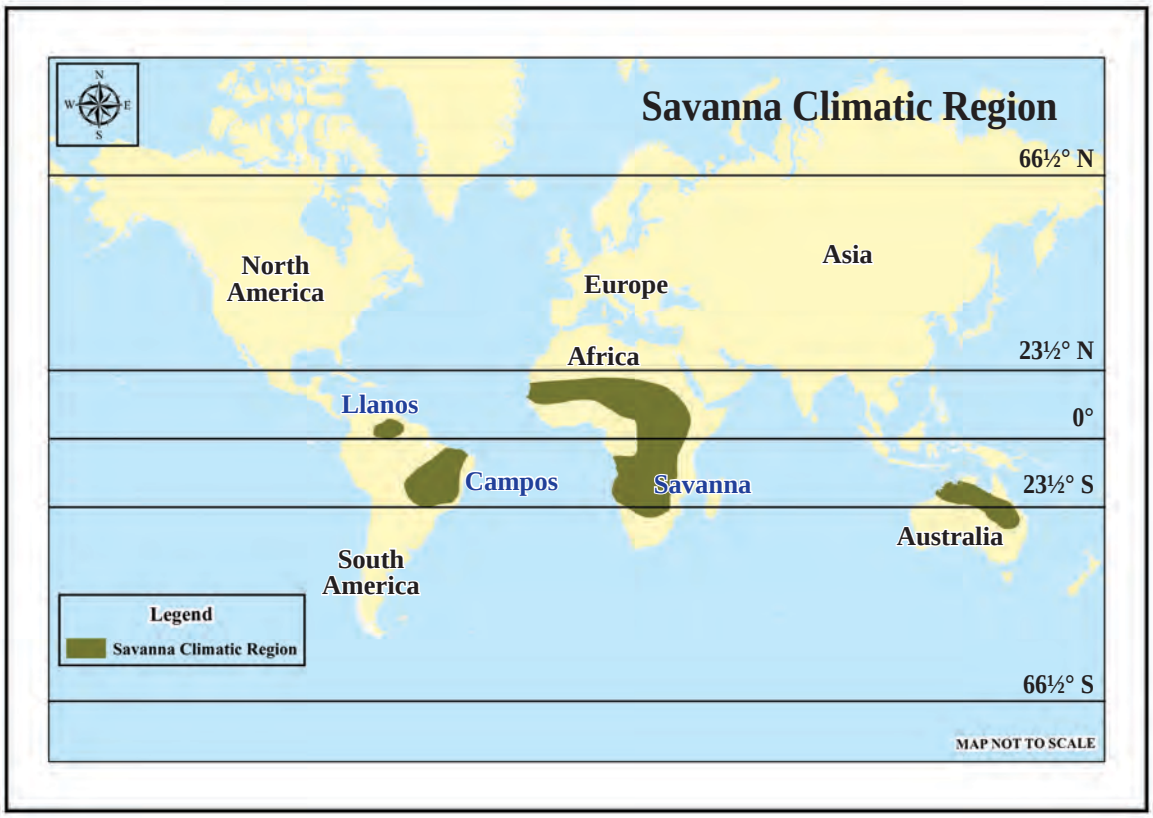

Fig 2.4

With the help of map (Fig 2.4) and atlas, identify the countries in which tropical grasslands are found.

Tropical grasslands have hot and humid summers, and cool and dry winters. The annual average temperature here is between 21° C and 32° C and also receives annual rainfall of 25 cm to 125 cm.

Deciduous trees and tall grasses are the dominant vegetation of this region. As we move closer to the deserts, short bushes and thorny forests are seen. The forests and grasslands here provide a favourable habitat for wild animals. Herbivorous animals like giraffes and zebras abound in these grasslands. Carnivorous animals like lion and tiger are also found here.

Although soil found here is relatively fertile, due to low rainfall, 'dry farming' that requires less amount of water is adopted. Animal husbandry and agriculture are the means of livelihood of the people. Population density is generally low in the savanna region. Maasai, an indigenous tribe of the African savanna, leads a pastoral life. Cash crops are cultivated extensively in the savanna areas of former European colonies. Cotton cultivation in Sudan and coffee cultivation in Brazil are examples.

When we approach the western margins of tropical grasslands, height of the trees gradually decreases with the decrease in rainfall. This is followed by desert vegetation.

Maasai Tribal Village
Fig 2.5

Hot deserts

We have discussed the characteristics of tropical grasslands and monsoon climatic regions. Though located at the same latitudes, hot deserts are regions with very little rainfall.

Observe the map (Fig 2.6) and atlas, identify the continents where hot deserts are located.

Locate hot deserts in the outline map and include in 'My Own Atlas'.

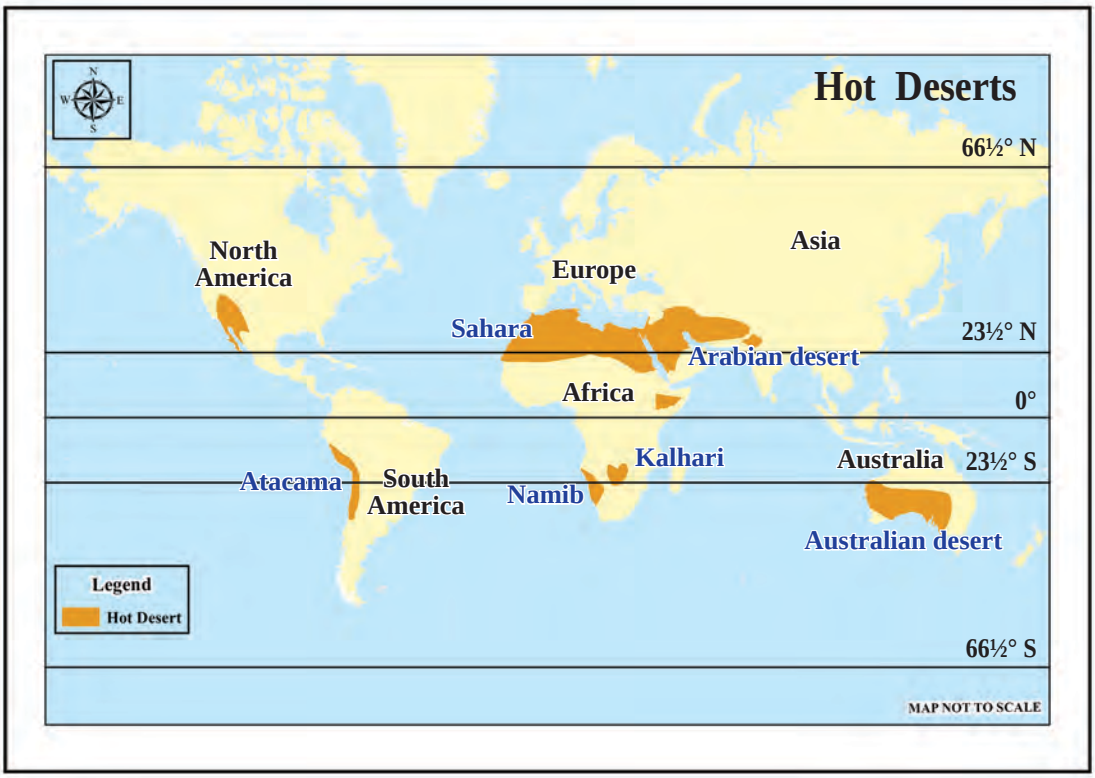

Fig 2.6

Tropical deserts are the hottest regions on earth with an average annual temperature of 30° C. The highest recorded temperature in Al Aziziya in the Sahara desert is 58° C. High diurnal range of temperature makes desert climate very difficult. Annual rainfall in desert areas is generally less than 25 cm and in some places it may not rain for several years. In the tropical region, hot deserts are located mostly on the western margins of continents. As the trade winds travel across the continents and reach the western margins, the wind loss its moisture and become dry. Therefore the western margins of continents remain dry throughout the year. This is the main reason for the formation of deserts on the western margins of continents.

Plants adapted to low rainfall climate such as cactus, shrubs and palms are mostly found here. Oases are formed in places where water sources are found. What are oases?

Identify and list the animals found in hot deserts. Collect their pictures with the help of ICT and prepare a digital album.

These areas are sparsely populated due to the unfavourable climate and other factors. However there are indigenous tribal communities, who have adapted to the adverse conditions in most of the desert regions. The Bushmen of Kalahari Desert are an example for this.

An oasis in Sahara
Fig 2.7

Agriculture and animal husbandry are the main means of livelihood in deserts.

Another factor that promotes human life in desert is the presence of economically valuable minerals. Gold mining in Australia and

Riyadh City in Saudi Arabia
Fig 2.8

copper in Atacama Desert are examples for this. Discovery of petroleum deposits and the starting of oil mining in the Sahara and Arabian deserts, have changed the very face of these regions.

We have discussed three different climatic regions in the tropical region. Now let's get familiarise with the characteristic features of the climatic regions in the temperate zone.

Mediterranean Climatic Region

Have you seen the location of the Mediterranean Sea on the map, Fig 2.9? The areas around this sea are the Mediterranean region.

It is a region that experiences dry summers and humid winters. Temperature of around 20-25° C is experienced in summer. Highest temperature during winter is 10° C to 16° C. Winter rainfall of 30 to 75 cm distinguishes this region from other climatic regions. Rains during the winter are beneficial to the winter crops.

Apart from the coasts of Mediterranean Sea, some other regions lying between 30° and 45° latitudes also experience the same climate. All these regions are collectively known as the Mediterranean climatic regions.

Observe the map (Fig 2.9) and atlas, identify the areas included in the Mediterranean climatic region. Depict them on the world map and add to My Own Atlas.

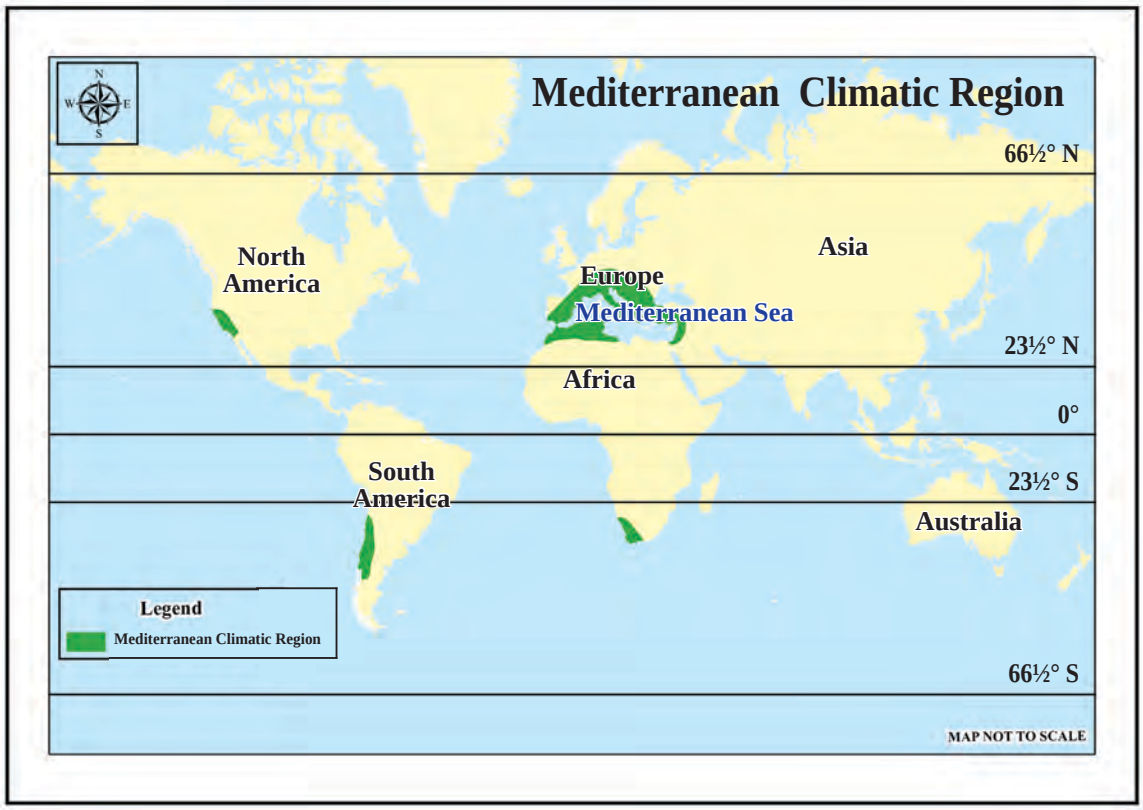

Fig 2.9

Westerlies are responsible for winter rainfall in the Mediterranean region. Dense forests are not found due to low rainfall. Tall evergreen trees such as oak and sequoia, evergreen conifers such as pine and fir, and shrubs are found here. Fruits and vegetables are the major produces of this region. Cereals and pulses are also cultivated wherever possible.

A Vine Yard in Mediterranean region
Fig 2.10

Agricultural practices developed according to the climate conditions and related activities make the Mediterranean region an area of great economic importance. The Mediterranean countries are the world's leading producers of wine. About 70 precent of citrus fruit export comes from the Mediterranean countries.

As in the tropics, in the interior of the subtropical zone, the maritime influence is minimal and treeless grasslands are found. These are the temperate grasslands.

Temperate Grasslands

These grasslands are located in both the hemispheres at a latitudes between 40° and 50° and are known by different names in different regions.

Observe the map given below Find out the continents where grasslands are located and complete the table below.

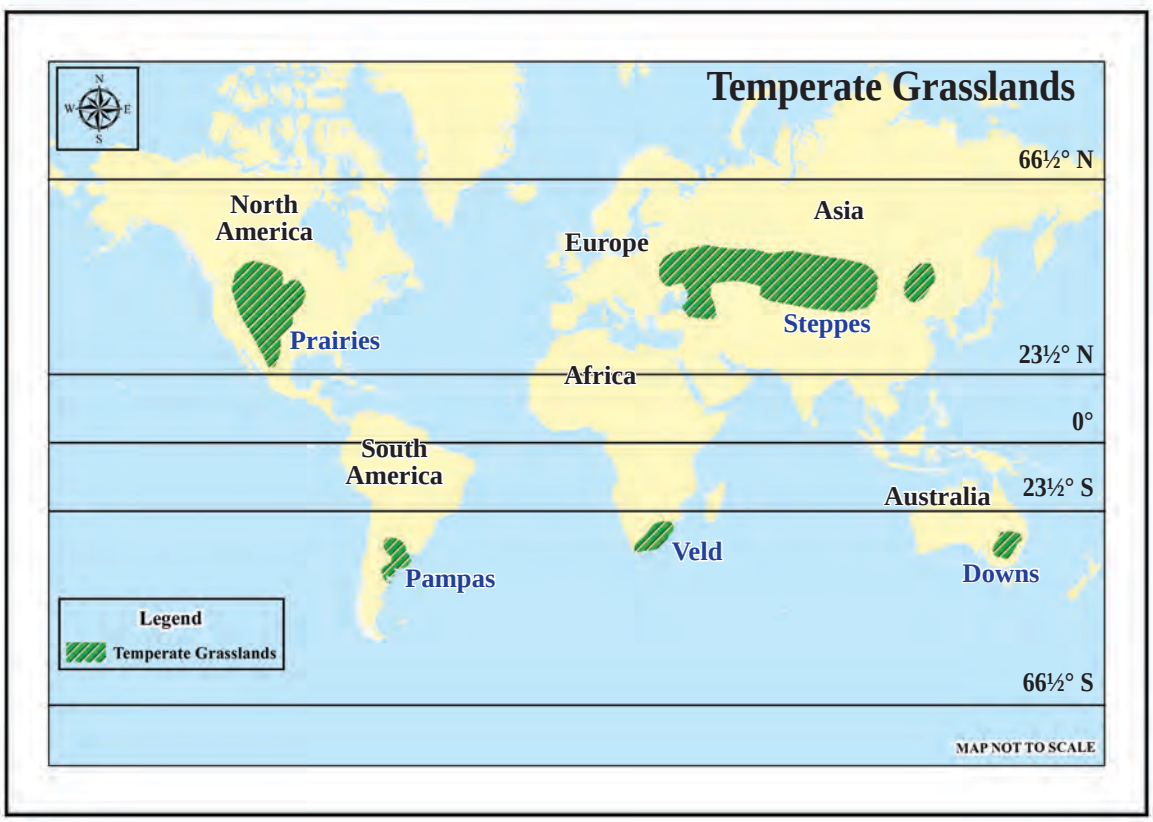

Fig 2.11

Temperate Grasslands	
Continent	Name of the Grassland

Though temperate grasslands are found in different parts of the world, their climate characteristics are almost the same. Short summers and long winters are the characteristics of the temperate grasslands. These regions experience high temperature in summer as they are located at the interior of the continents. Average winter temperature ranges from 2° to 13° C.

Rainfall here ranges from 25 cm to 60 cm Fluctuations in the rainfall availability is reflected in vegetation also. Due to less rain, trees are also few. Varieties of grass are generally found. Since temperate grasslands are natural grazing lands, most of the inhabitants are shepherds.

Nowadays grasslands are widely converted into agricultural lands. Commercial mechanised grain farming and animal husbandry are increasing day by day in this region.

Prairie – The Granary of the World

The Prairie, the temperate grasslands of North America, are often referred to as the world's granary. Nearly two million acres of this vast grasslands, spread across the United States and Canada, are under commercial grain cultivation today. Wheat is the main crop. Moderate temperature, rainfall availability and fertile soil make this region highly suitable for wheat cultivation. The large scale production of wheat earned the prairies the title of the world's granary.

The flora and fauna and the life of the people of each region are formed according to the climate characteristics. However as part of the technological progress achieved over time, humans are changing the natural features of many areas.

Don't you see that the temperate grasslands, which were once natural grazing lands, have been now converted into areas of agriculture and animal husbandry, practiced widely on industrial basis?

Efforts to utilize all possible areas of the world will continue as long as there is ever- increasing population and human needs.

Let's examine the geographical features and life of the people in the climatically difficult cold region.

Taiga Region

It is a cold region located between latitudes of 55° and 70° in the Northern Hemisphere. Short summers and long winters are experienced there. Summer temperature is from 15° C to 20° C while winter temperature drops up to -13° C to -25 ° C. This region receives an annual rainfall of 50 cm to 70 cm. In winter, precipitation is in the form of snowfall.

Taiga climatic region is absent in high latitudes of Southern Hemisphere because the extent of landmass is generally less.

This region is dominated by sub-Arctic coniferous evergreen trees. Taiga is the Russian word for 'coniferous trees'. This region is named as Taiga because of the abundance of such coniferous trees. Coniferous trees such as pine, fir and spruce are the main vegetation types.

Observe the map (Fig 2.12) to identify the continents where Taiga region is located, and include it in My Own Atlas.

Most of the crops cannot be grown in sub-Arctic climates, hence the cultivation is very less in this region.

Lumbering and wool industry are the main economic activities. Lumbering industry is very popular in Canadian Taiga region.

Lumbering is more industrialized in the Taiga region than in the equatorial region. Why?

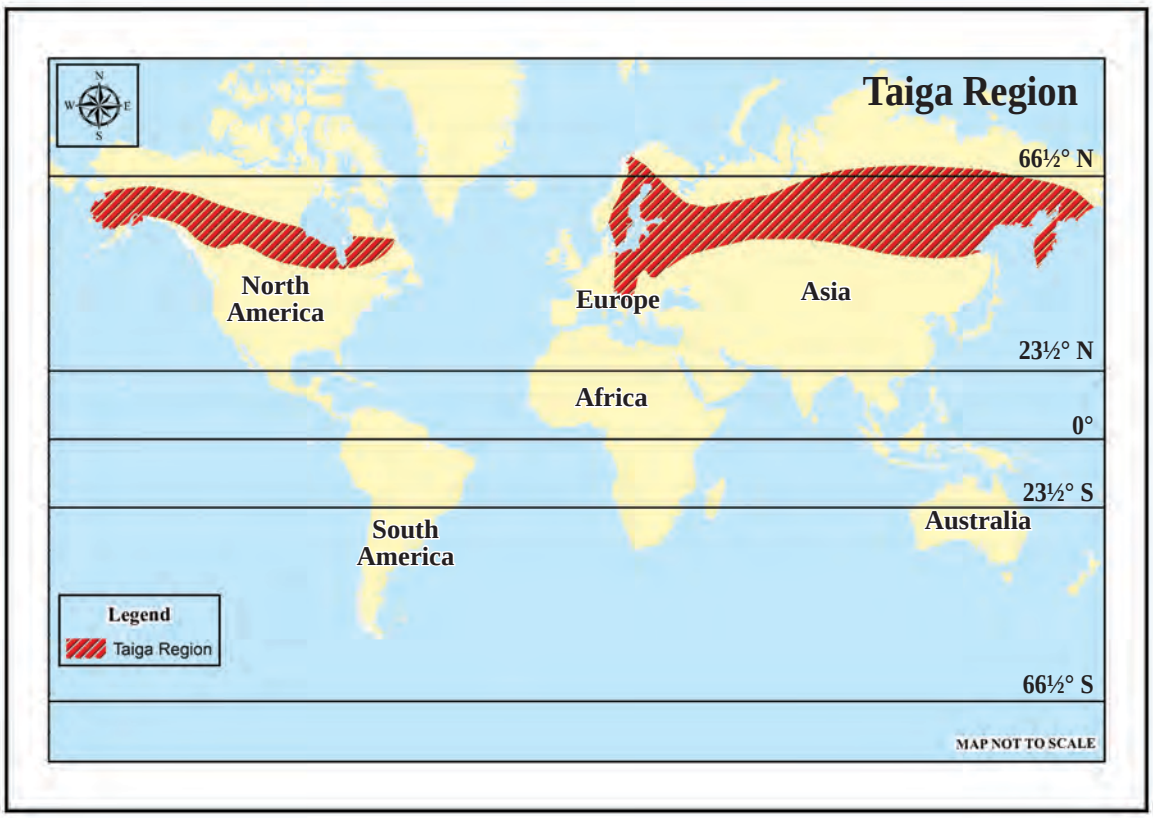

Fig 2.12

As we move from the Taiga region to the polar region, the height of vegetation decreases and becomes sparse and less in number. Only frigid vegetation such as shrubs and mosses can be found in regions close to the Poles.

Tundra region

Tundra region is the extreme cold zone extending from north of the Arctic Circle in Alaska, Canada, Greenland, and the Arctic coasts of Europe and Asia. Here winter temperature ranges from -25°C to -40°C and the summer temperature rises up to 10°C . Precipitation is mainly in the form of snowfall.

Only a few plants can survive in the harsh climatic conditions of the Tundra region. Plants grow only in summer. Due to the very short growing season available, short shrubs and mosses are the main plants found here. The native people of this region such as Eskimo, and Lappas lead a semi nomadic life. Arctics

are the regions with relatively little human intervention. Scientists and explorers are continuing their studies in this region in search of future possibilities for mankind. Further details about this climatic region will be discussed in the next chapter.

Haven't you understood the different climatic regions of the world and their characteristics? Complete the table given below, based on their characteristics.

Climatic Region	Location	Climate	Vegetation	Human Activities
Equatorial Climatic Region	0° to 10° North and South latitudes			

Climate change

Didn't you understand that each climate zone has a unique climate, flora and fauna, and human living conditions? Studies indicate that uncontrolled exploitation of resources and unscientific developmental activities affect the unique climatic characteristics of each region.

UN defines 'climate change' as a long-term shift in weather patterns and temperatures that is caused by human activity or natural variability. The timescale of climate change may range from a few years to millions of years. It affects ecosystems severely.

Fig 2.13

Picture of two differently-held cabinet meetings are given (Fig 2.13). The first picture shows a cabinet meeting held at Mt. Everest, by Nepal, a country belongs to the Himalayas, which is the highest point of the world. The second picture is of a cabinet meeting held under water by Maldives, an island nation with an average elevation of just one and a half metres above the mean sea level.

These cabinet meetings were organized in a different manner to draw attention of the world nations to the problems of climate change. The mountain country of Nepal and the island nation of Maldives are among the countries most affected by the global climate change. It is estimated that the Himalayan glaciers are melting at a rate of 12 to 20 metres per year as a result of global climate change. The increase in global temperature is causing rapid melting of glaciers and undesirable changes in ecosystem.

If the sea level rises by two and a half metres, the Maldives will be completely submerged in the sea. Global sea level is estimated to rise by 0.42 cm per year as a result of climate change.

Haven't you understood that climate change is the long term shift in elements of climate?

Which are these elements? Atmospheric temperature, pressure,

winds, precipitation and humidity are the elements of climate. Climate change results from the shift in quantity, distribution pattern, and seasonal pattern of these elements. It may affect a specific region or the whole world.

Earth's climate has not always been the same; climate has undergone cyclic changes throughout the Earth's history. Ice ages and inter glacial periods are examples of Earth's natural climate change. Along with the natural climate changes, human intervention also causes changes in the world climate. Therefore, climate change can be classified into two categories as natural and anthropogenic.

Below are some of the activities that cause climate change. Find more of them and classify them as natural and anthropogenic causes.

- Deforestation
- Oil mining
- Industrialization
- Volcanic eruption
- Ocean currents
-

Natural climate change resulting from endogenic earth processes cannot be controlled by human efforts. Climate change affects nature and human life in various ways. Human interventions often aggravate climate change. Climate change does not affect just one region alone but it creates multi-faceted implication globally.

How does climate change affect human life?

Information from study reports conducted by international agencies on the effect of climate change are given below. Based on these, gather more information and organize a discussion on the challenges of climate change.

1. Average sea level rise over 10 to 20 mm per year

   IPCC Sealevel Rise Report 2023

2. The polar ice caps which had an area of 7.5 million square kilometres in 1978 has shrunk to 3.74 million square kilometres by 2019.

   NASA Global Climate Change Report 2020

3. About 135 million people are at risk of being displaced by desertification.

   UN Convention to Combat Desertification

4. Global surface temperature in 2011-2020 showed a rise of 1.1° C compared to that in 1850-1900.

   IPCC Climate Change 2023 Report

5. The studies during 1985-2019 reveals that the nature of monsoon rain has been shifted from the rains lasted for a few months to torrential rain lasting for a few days.

   IPCC Sixth Assesment Report

Greenhouse Effect and Global Warming

Certain gases in the atmosphere are capable of trapping the solar energy (insolation) in the atmosphere. Such gases like carbon dioxide and nitrous oxide are known as Greenhouse Gases.

Greenhouse gases allow sunlight to pass into the earth's surface and keep the atmosphere warm by intercepting terrestrial radiation returning from the Earth's surface. This process is known as Greenhouse Effect of the Atmosphere.

Some human activities results in excess production of greenhouse gases. Due to this, greenhouse effect of the atmosphere becomes stronger and the temperature increases. This increase in atmospheric temperature is called Global warming.

Burning of fossil fuels such as coal and petroleum, industrial effluents and solid waste are the sources of excess greenhouse gases in the atmosphere. Global warming accelerates climate change.

Changes resulting from global climate change can be seen in the different climate zones of the world and their unique climatic characteristics. If this continues, it will destabilize the climate zones and adversely affect the ecological balance.

Identity how climate change affects climatic regions, and prepare a note.

Activities such as industrialization, land use change, and urbanization are some of the human interventions that lead to climate change. International initiatives to protect climate and environment have begun ever since it is noted that there activation may harmfully affect the climate and environment. Let us see such initiatives.

International initiatives	Year	Place	Interventions
Establishment of World Meteorological Organisation	1950	Geneva	Organises world climate conferences
Stockholm Conference	1972	Stockholm	Environmental conservation and development
Earth Summit	1992	Rio de Janeiro	Prepared UN Agenda 21 to promote environment friendly development
Kyoto Protocol	1997	Kyoto	Reduce the amount of Green House gases in the atmosphere
Montreal Protocol	1987	Montreal	Reduce the production and consumption of ozone depleting substances
Paris Agreement	2015	Paris	Reduce Global warming, helping world nations to cope up with the harmful effects of climate change
G 20 Summit	2023	New Delhi	One earth, one family, one future. Green development, climate finance, overall development

Climate change cannot be completely prevented. But human intervention that induces climate change can be controlled. Organise a discussion in the class on the changes to be brought about in industrial and other developmental activities enabling sustainable resource utilisation.

Discussion points

- Promotion of energy efficiency
- Protection of forests
- Change in technology
- Encouragement of the use of non-conventional energy such as wind and solar energy.

Millions of people of the world's ever-increasing population depends on the climate for their livelihoods. Even a small change in climate can affect lives of people adversely. Therefore it is essential to control activities that cause climate change. Since climate change is not a problem that affects only one region or country, it is essential for all the nations to work together for the sustainable existence of human life.

Climate Refugees

Many people are being forcibly displaced by the impacts of climate change-induced disasters such as droughts, floods, desertification, sea-level rise, and sea inundation. They are forced to migrate to other regions or countries. Such migrations are called climate migration. UN figures indicate that around 50 million people have been displaced due to climate-related events. Those who have to leave their homes and livelihood due to climate-related phenomena are called climate refugees.

Extended Activities

1. Compare the climate and life of people in different climatic regions and prepare a note. For this, information about climate and life of people in different regions of world can be collected with the help of IT.
2. Collect indigenous climate knowledge by interviewing senior citizens in different areas. Prepare a questionnaire for this. Find out, changes that have taken place in the current climate.