SOCIAL SCIENCE

GRADE 9

PROJECT 1

CLIMATE AND ITS EFFECTS

ACKNOWLEDGEMENT

We acknowledge the contributions of all Secondary Teachers who in one way or another have helped to develop this Course.

Our profound gratitude goes to the former Principal of FODE, Mr. Demas Tongogo for leading FODE team towards this great achievement. Special thanks to the Staff of the Social Science Department of FODE who played an active role in coordinating writing workshops, outsourcing lesson writing and editing processes, involving selected teachers of Central Province and NCD.

We also acknowledge the professional guidance provided by Curriculum and Development Assessment Division throughout the processes of writing, and the services given by member of the Social Science Review and Academic Committees.

The development of this book was Co-funded by GoPNG and World Bank.

DIANA TEIT AKIS

PRINCIPAL

Published in 2017 by the Flexible, Open and Distance Education, Papua New Guinea

Printed by Flexible, Open and Distance Education.

ISBN: 978 – 9980 – 87 – 748 - 2

National Library Service of Papua New Guinea

TABLE OF CONTENTS

TOPIC 1 INTRODUCTION

Dear Student,

This is Project 1 of the Grade 9 Social Science course. In this Project, you will study Climate and its effects.

You have learnt about climate in Unit 1. This is an extension to what you have already studied. This project will enable you to examine important aspects of the climate in more detail.

Therefore you will:

- identify the differences between climate and weather
- discuss factors that influence climate
- discuss climate and its effects on the vegetation
- cyclones and their effects on Papua New Guinea

This project comprises of four topics. They include

Chapter 1 The difference between Climate and Weather

Chapter 2 What makes Climate different?

Chapter 3 Climate and its effect on Vegetation

Chapter 4 Cyclones and their effect on Papua New Guinea

Each chapter has an activity which you will do after reading through the chapter. Answers to the activities are found at the end of the Project.

We hope you will enjoy working through this project.

Your teacher

Chapter 1 Difference between Climate and Weather

Climate and Weather are very important aspects in any environment as they influence the kind of vegetation, the activities people do and the kind of material culture people poses. To begin with this Topic, you will first look at the definition of weather.

Weather is the condition of the atmosphere at a particular time.

You often hear broadcasters give weather conditions daily on television, radios and newspapers. They are simply describing the **daily average temperatures, precipitations, wind speed, wind direction and cloud cover for that day**. Obviously, they are describing the weather.
Let us now look at the definition of climate.

Climate is the condition of the atmosphere over a period of time.

If you hear someone say that it is 'hot and wet all year round' or a place has 'hot dry summers and warm mild winters', they are in fact describing the climate of a place.

Difference between Weather and Climate

The difference between weather and climate is a measure of time. Weather is the conditions of the atmosphere over a short period of time, and climate is how the atmosphere behaves relatively over a long period of time.

Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure, as in high and low pressure. In most places, weather can change from minute-to-minute, hour-to-hour, day-to-day, and season-to-season. Climate, however, is the average of weather over time and space.

Did you ever have an activity ruined by a surprise rainstorm? People often complain when the weather forecast is wrong. But in fact, weather forecasts today are much more accurate than they were just 20 years ago. Scientists who study and forecast the weather are called **meteorologists**. How do they predict the weather?

Predicting the Weather

Weather is very difficult to predict. That is because it is very complex and many factors are involved. Slight changes in even one factor can cause a big change in the weather. Still, certain "rules of thumb" generally apply. These "rules" help meteorologists forecast the weather. For example, low pressure is likely to bring stormy weather. So if a center of low pressure is moving your way, you can expect a storm.

You will find on the next page what meteorologists use in measuring and predicting weather conditions.

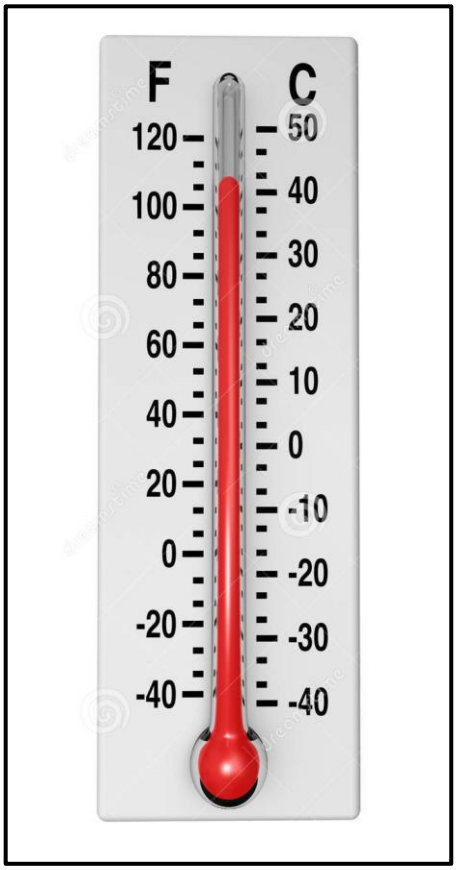
Technology and Computers

Predicting the weather requires a lot of weather data. Technology is used to gather the data and computers are used to analyze the data. Using this information gives meteorologists the best chance of predicting the weather.

Weather Instruments

Weather instruments measure weather conditions.
The photographs below show some instruments used in measuring different elements of weather.

Thermometer



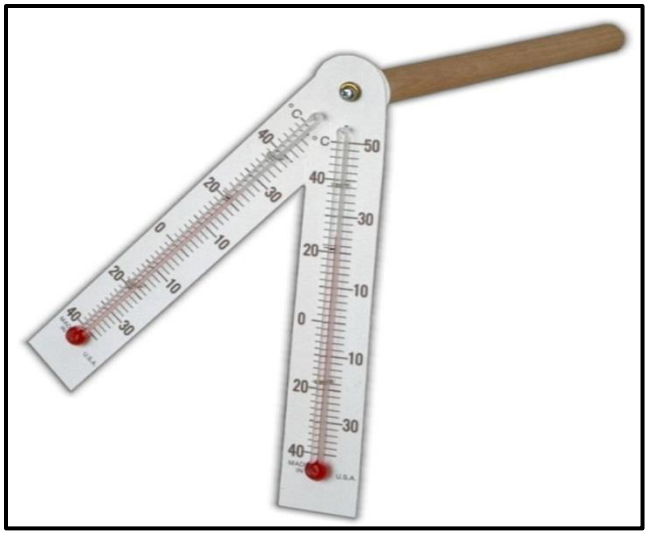
A **thermometer** measures the air temperature. Most thermometers are closed glass tubes containing liquids such as alcohol or mercury. When air around the tube heats the liquid, the liquid expands and moves up the tube. A scale then shows what the actual temperature is.

Barometer

A **barometer** measures air pressure. It tells you whether or not the pressure is rising or falling. A rising barometer means sunny and dry conditions, while a falling barometer means stormy and wet conditions. An Italian scientist named Torricelli, built the first barometer in 1643.

Sling Psycrometer

A **sling psychrometer** is also called the 'wet and dry bulb thermometer. It is a kind of hygrometer that measures the water vapour present in the air. The instrument is used by swinging the wet and dry bulb for a minute. Water evaporates from the cloth, causing the temperatures on that thermometre to be lower than other. The readings are then taken to determine the humidity of the atmosphere.



Rain Gauge

A **rain gauge** measures the amount of rain that falls over a specific time period.

Wind Vane

A wind *vane*, also called a weather vane, is a tool for measuring wind direction. To determine wind direction, a wind vane spins and points in the direction from which the wind is coming. It has two parts. One is shaped like an arrow and turns into the wind, and one end is wider so that it catches the breeze. The arrow will point to the direction the wind is blowing from so, if it is pointing to the east, it means the wind is coming from the east. Wind direction is where the wind is blowing from.

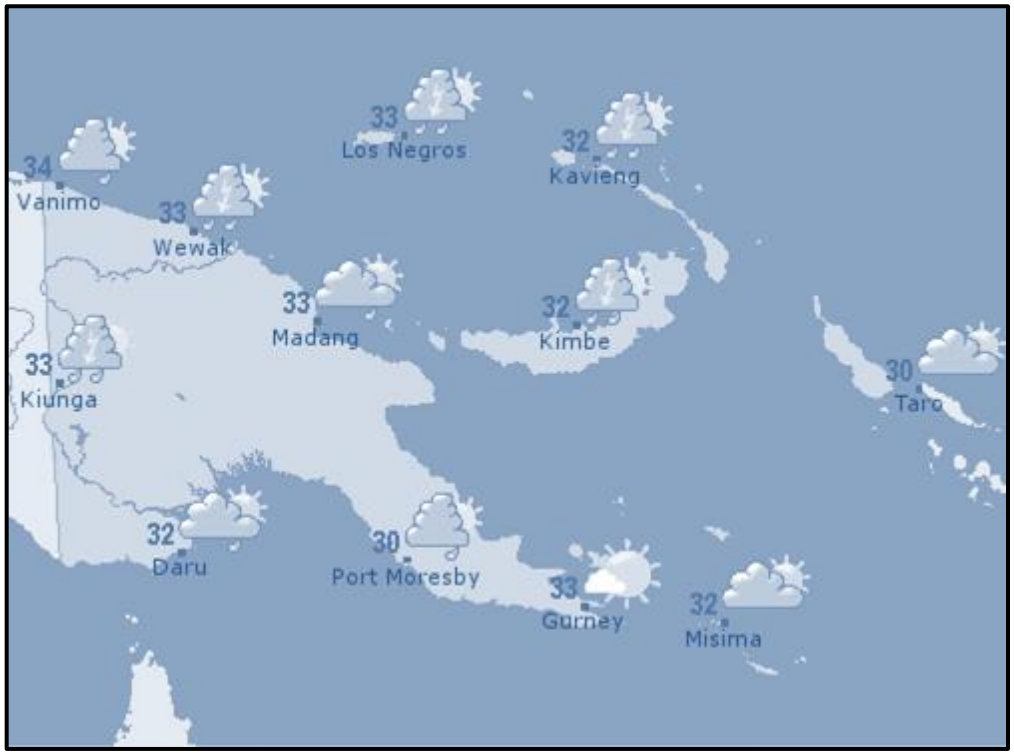
Anemometer

An **anemometer** measures wind speed. The cups catch the wind, turning a dial attached to the instrument. The dial shows the wind speed.

Hygrometer

A **hygrometer** measures the water vapour content of air or the humidity.

WEATHER MAP OF PAPUA NEW GUINEA



A **weather map** shows weather conditions for a certain area. The map may show the actual weather on a given day or it may show the predicted weather for some time in the future. Some weather maps show many weather conditions. Others show a single condition. Weather meteorologists use weather maps to forecast the weather.

Weather Balloon

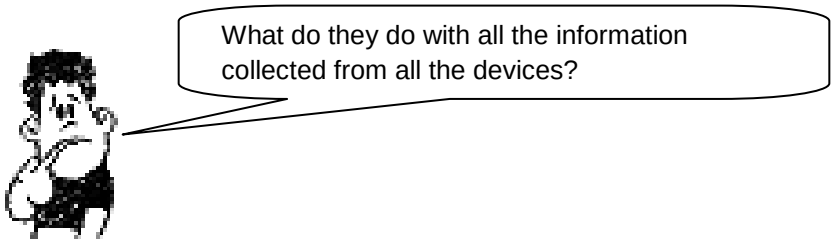
A **weather balloon** measures weather conditions higher up in the atmosphere. The **weather balloon** will rise into the atmosphere until it bursts. As it rises, it will gather weather data and sends it to the weather stations on earth.

Collecting Data

Weather instruments collect data from all over the world at different weather stations. Many are on land but some float in the oceans on buoys. There is probably at least one weather station near you.

Other weather devices are needed to collect weather data in the atmosphere. They include weather balloons, satellites, and radar. Weather stations collect data on land and sea. Weather balloons, satellites, and radar collect data in the atmosphere.

Weather stations contain many instruments for measuring weather conditions. Many **weather satellites** orbit the Earth. They constantly collect and transmit weather data from high above the surface of the earth. A radar device sends out radio waves in all directions. The waves bounce off water in the atmosphere and then return to the sender. The radar data shows where precipitation is falling.



Use of Computers

Meteorologists use information collected from the devices in weather models to predict daily weather conditions. Weather models are computer programs that analyse the collected data and then predicts the weather. Computers are used because there are so many measurements and calculations involved.

Learning about the weather is important as it is from the weather measurements that gives us an idea of our climates.

SUMMARY

- Weather is the condition of the atmosphere at a particular time.
- Climate is the condition of the atmosphere over a long period of time.
- The difference between weather and climate is a measure of time. Weather is the conditions of the atmosphere over a short period of time, and climate is how the atmosphere behaves relatively over a long period of time.
- Scientists who study and forecast the weather are called meteorologists

Now do the Activity 1 below.

Activity 1

1. Read the article below and answer the questions that follow.

Extreme Weather Shaping Up

People should brace for more drastic weather as two systems are developing in the north and south of the country, according to a weather forecaster. National Weather Service Director, Samuel Maiha said there was a low pressure system developing over the Coral Sea and moving very slowly westwards towards the Gulf of Carpentaria in Australia.

“This system is producing strong to gale force winds experienced over the Papuan coasts, especially from Port Moresby to Daru in the Western Province” he said. He said the system should move towards the Northern Territory by the end of the week.

Another low pressure system over the Pacific Ocean is located southeast of the Solomon Islands near Vanuatu.

“This is producing or strengthening the northwest winds over the Solomon Sea covering Milne Bay and the Bismarck Sea, including waters of Manus,” he said. “These winds are favourable for heavy rainfall over the northward side of the Nakanai ranges, and are therefore resulting in heavy rainfall over West New Britain and to an extent, the North coasts of East New Britain.”

Maiha said in the New Guinea Islands region, the sea was becoming warmer resulting in the wet weather because of the moisture it produced. “This trend will continue until May,” he said. The highlands provinces are experiencing their usual northwest monsoon season to last until May.

“For the highlands region, it is the normal wet season,” he said. He advised people to heed weather warnings until the end of May when conditions are expected to be more favourable.

Source: The National, Tuesday March 10th, 2015

1. What is the cause of the drastic weather condition?

_____

2. Where is the first low pressure system developing and in which direction is it moving?

_____

3. Which part of the country is affected by this system?

_____

4. Which parts of the country are affected by the low pressure system located south east of the Solomon Islands?

_____

Now check your answers at the end of the project.

Chapter 2: What Makes Climate Different?

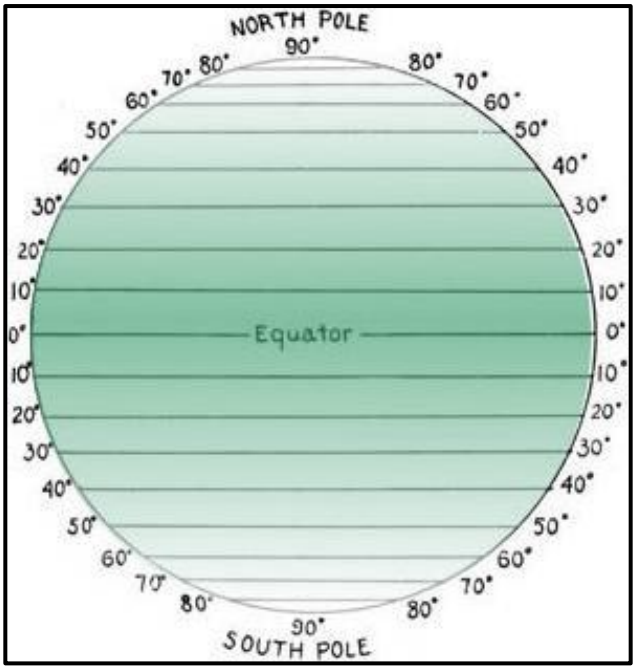
Have you ever wondered why it is cooler in some places while hot in others? Have you also wondered why some places in the world have four seasons; summer, autumn, winter and spring in a year while, others have only two like Papua New Guinea? The variations in temperatures, precipitations, winds, seasons and so on are associated with a number of factors. These are the factors that make climate different from place to place. They are;

1. **Latitude**
2. **Seasons**
3. **Altitude**
4. **Distance from the sea**
5. **Air movements**
6. **Precipitation**
7. **Aspect**

1. Latitude

You have studied latitude in Unit 9.1. Now, you can revise the meaning below.

Latitudes are the imaginary lines that run across the globe from east to west. It measures 0 degrees at the equator to 90 degrees at the poles. The lines get progressively shorter towards the poles. Latitude is a measure of the distance you are located from the equator. It is commonly shown as an imaginary horizontal line that goes across the earth on maps and is used along with longitude as a reference point to determine location. The tilt of the earth affects the seasons you experience throughout the year.



Lines of Latitude

The amount of heat received from the sun varies greatly from place to place at different latitudes. The closer a place is to the equator, the hotter it is. As you move away from the equator, the average temperature decreases.

Why are places at and near the equator, hotter than those away from the it?

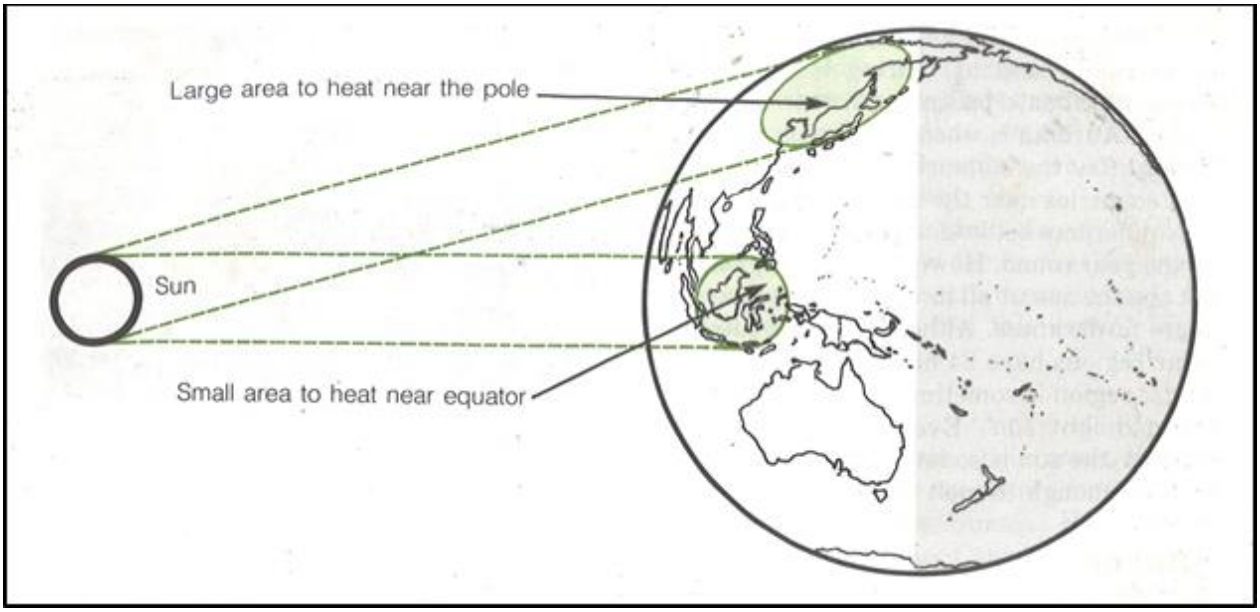
Areas that are close to the equator receive more heat because:

- The insolation (incoming solar energy) travels a shorter distance before reaching the equator. Therefore, a less amount of heat is reflected back into the atmosphere thus, reaching the equator with more intensity.

- Insolation near the poles has to pass through a greater amount of atmosphere and there is more chance of it being reflected back into the space, thus reaching the areas away from the equator with less intensity of heat.

- The sun's heat does not spread over a large area of land at the equator and therefore it is concentrated. The insolation at the poles is less because it is dispersed due to the large area of land it has to cover.

The diagram below shows the concentration of solar energy at different location on the globe.



Decreasing solar energy from the equator to the pole

Let us now look at how seasons affect climate.

2. Seasons

As the Earth circles the sun, the tilt of its axis causes changes in the angle of which the sun's rays contact the earth and, hence changes the daylight hours at different latitudes. Polar Regions experience the greatest variation, with long periods of limited or no sunlight in winter and up to 24 hours of daylight in the summer. This is because the Earth's axis is tilted with respect to the sun. In the temperate regions, this gives rise to clearly defined seasons including summer, autumn, winter and spring.

When North Pole tilts most toward the sun, Northern Hemisphere experiences summer. This occurs when the Earth is farthest away from the sun, and begins around June 21-22. Astronomers refer to the arrival of this event as the Summer Solstice in the Northern Hemisphere. This is the time when Earth reaches its closest orbital distance to the sun.

As the Earth continues along its path around the sun, its angle constantly shifts the North Pole away from the sun and the South Pole toward the sun. The sun's energy is more concentrated on the Northern Hemisphere where its rays hit the Earth more directly and are thus more intense. At the same time, however, the Southern Hemisphere tilts away from the sun, causing the sun's rays to hit the region more at an

angle and with less intensity. This brings about winter in the Southern Hemisphere, called the Winter Solstice.

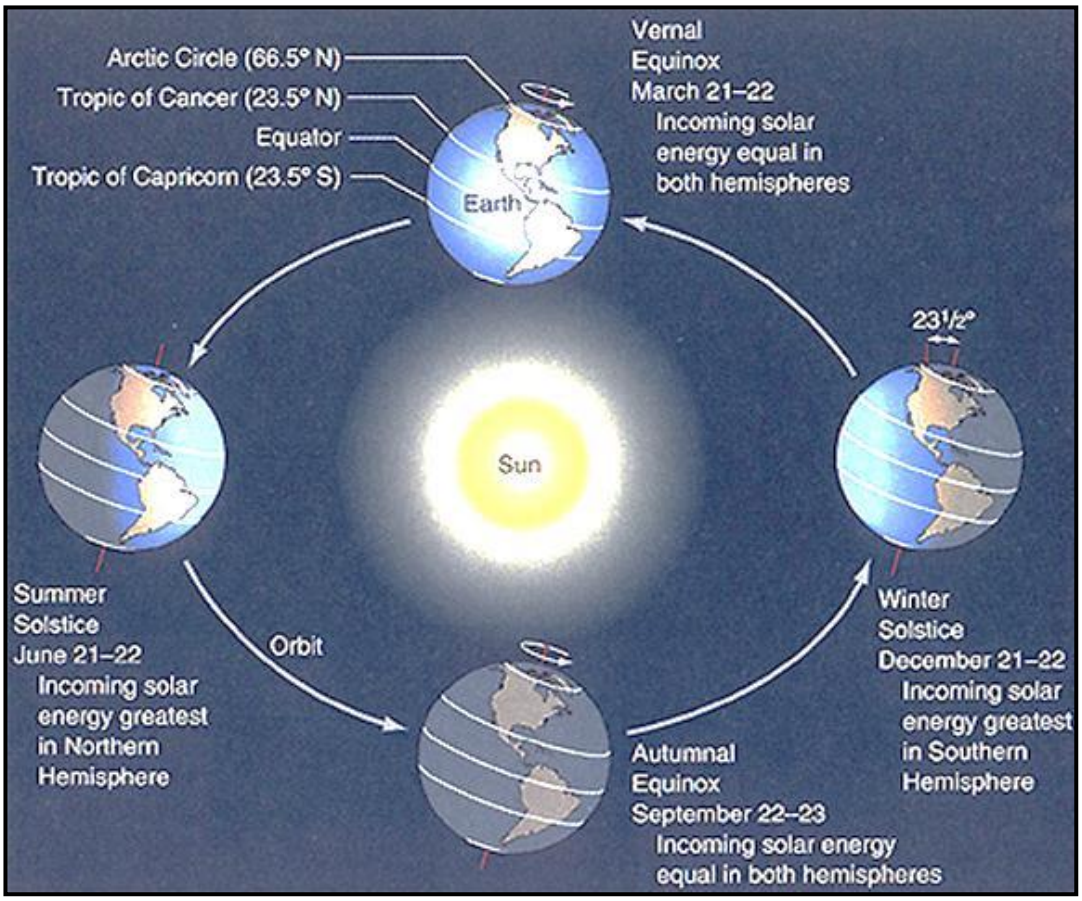
The Equinoxes

What is an Equinox?

An equinox is a period in the orbit of a planet in which the planet's orbit and position cause the Sun to pass directly over the equator or the two orbital positions of the earth where places experiencing the equinox have equal length of day and night which is 12 hours each.

Spring and Fall (or Autumn) occur midway on the Earth's journey from winter to summer and from summer to winter. These times occur when the sun appears to be directly over the Earth's equator, and the length of days and nights are equal over most of the planet. On March 20 or 21 of each year, the Earth reaches the vernal equinox, which marks the arrival of spring in the north and autumn in the south. The autumnal equinox occurs on September 22-23 and marks the arrival of autumn in the north and spring in the south.

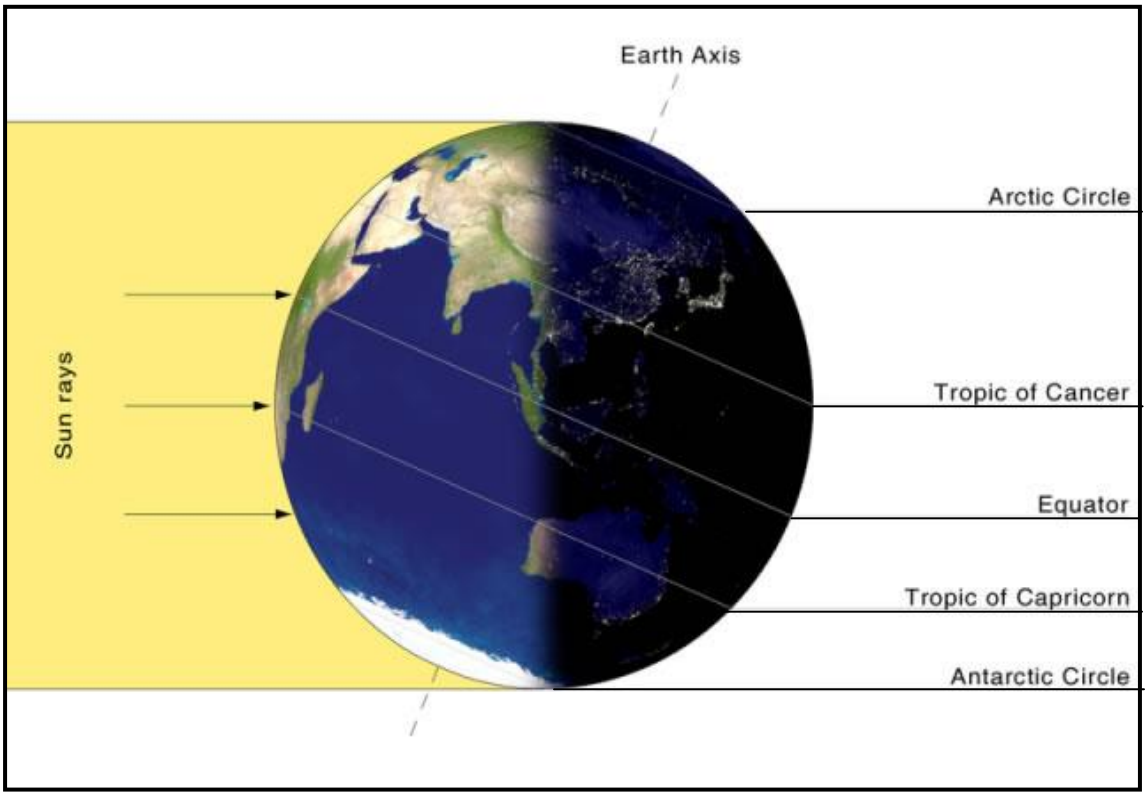
The diagram below shows the earth and its position in relation to the sun which then results in the four seasons in a year.



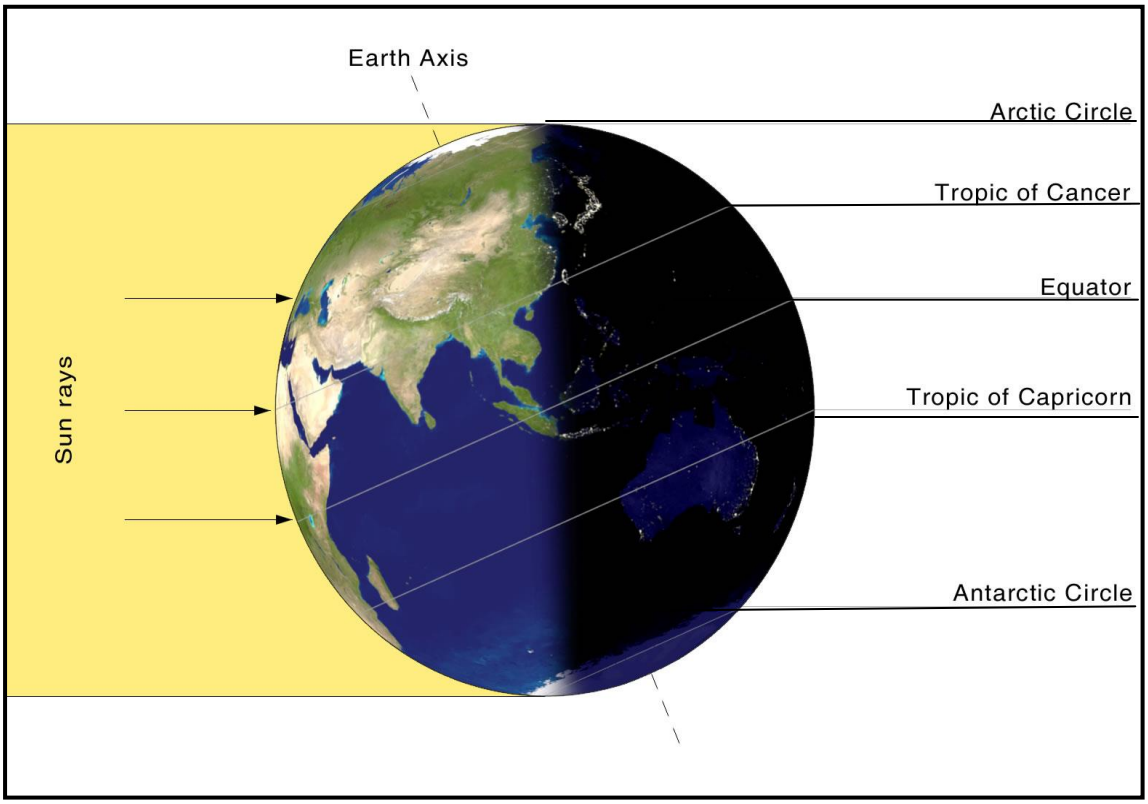
The Earth and its position in relation to the sun

The two diagrams below show how the earth is tilted at different time of the year in relation to the sun.

NORTHERN HEMISPHERE WINTER/SOUTHERN HEMISPHERE SUMMER



NORTHERN HEMISPHERE SUMMER/SOUTHERN HEMISPHERE WINTER



We will now find out how altitude affects climate.

3. Elevation or Altitude

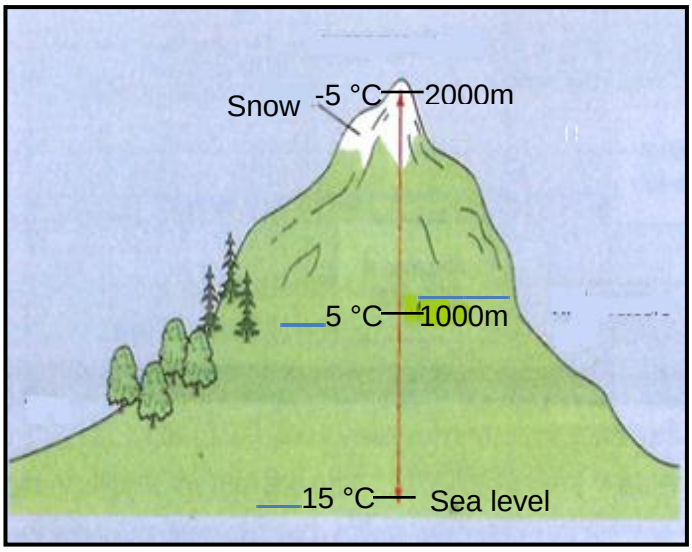
Temperature decreases with altitude and so the higher you go up the mountains, the cooler it becomes. On average temperature drops about 1°C for every 100 metres or 10°C over 1000 metres, because air at higher altitudes is thinner and less dense.

Altitude is height above sea level.

Why is the air at higher altitudes thinner or less dense?

As the height of the mountain decreases, the amount of land surface to be heated by the sun also decreases. This results in small amount of heat given off from the land surface. Furthermore, as the density or pressure of the air decreases, so does its ability to hold heat. This is because the molecules in the air which receive and retain heat becomes fewer and more widely spaced as height increases. Study the diagram below. It shows the effect of altitude on temperature.

You will notice that from 15°C, the temperature dropped by 10°C as the altitude increased by 1000 metres. Therefore, 15 minus 10 gives us 5. This means that the temperature at the first 1000 metres is 5°C. At the altitude of 2000 metres, which is the summit, the temperature as shown in the diagram is -5°C. We have minus another 10 °C to give us a negative 5 degrees at the summit of the mountain. So the higher up you go, the cooler it becomes.



Effect of altitude on temperature

Mt Wilhelm is the highest mountain in PNG. It is located in the Simbu Province and is about 4509 metres (14,793ft) above sea level. If the average daily temperature along the coast is about 27°C, then the temperature at the summit would approximately be -18 degrees. It is very cold at the summit.

When the temperatures get cool, then humid air is not able to hold the moisture so the moisture condenses and clouds form and it rains. Very often one side of a mountain receives rainfall so the vegetation grows well. The air traveling over the mountain is now dry so a desert or semi-desert condition exists.

Mt Wilhelm in Simbu Province, Papua New Guinea

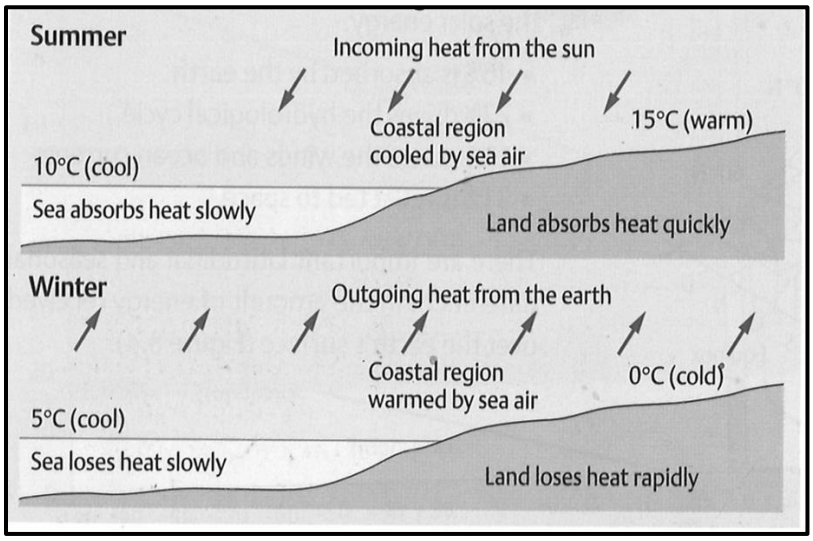
Um! Now I know. The higher you go, the cooler it becomes.

4. Distance from the Sea

Oceans heat up and cool down slowly than land, because it takes more energy to heat up water than it does to heat the land. This means that coastal locations tend to be cooler in summer and warmer in winter than places inland.

When the land is already cold in winter, the seas are still warm because it takes time for the sea to cool down. The winds that blow over the sea are warm, thus increasing the temperatures during winters in coastal areas while, places inland would be very cold.

On the other hand, summers are cooler in temperate coastal countries and hotter in temperate continental countries (countries away from the sea) because the sea would still be cool, while the land will already be hot in summers. The air blowing across the sea is cool thus reducing the temperatures in temperate maritime places while the inland areas are hot. The diagram on the right shows how temperatures are affected by distance from the sea.



Effects of Distance from the Sea on coastal areas

We will now look at the next factor that influences climate.

5. Air movements (Wind)

Before you look at how air movements make climate different, you must first remember these basic facts about air movements.

1. Hot air is light (not heavy) and so it rises. The weight of the air pressing on the surface of the earth is less heavy (light) causing a low pressure zone.

2. Cold air is heavy and so it sinks. The weight of the air pressing on the surface of the earth is great causing a high pressure zone.

3. When cold air sinks from high pressure zone and moves horizontally to a low pressure zone, it creates the wind. Wind is actually the moving air.

Now you know that hot air rises forming low pressure zones and cold air sinks forming high pressure zones.

How Does Air Movements/Wind Affect Climate

The direction from which the wind comes has a large effect on the type of climate a place has. The wind picks up moisture when it crosses the sea. If the wind blows across the sea towards the land, the land will have a lot of rain. However, if the wind blows mainly from the land towards the sea, the land will be very dry. The wind also alters the temperature depending on the direction from which it is blowing. The sinking air that blows from high pressure zone to low pressure zone tends to lower the temperatures of places that are directly facing the wind.

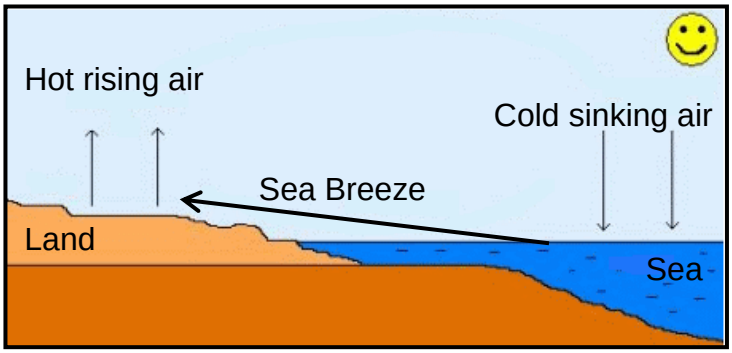
There are two main types of wind that blows across the earth.

(i) Local Winds

These are winds that blow because of local weather conditions. They are created when air moves from small high pressure zones to small low pressure zones. They blow in a particular location over a short distance. There are two main local winds.

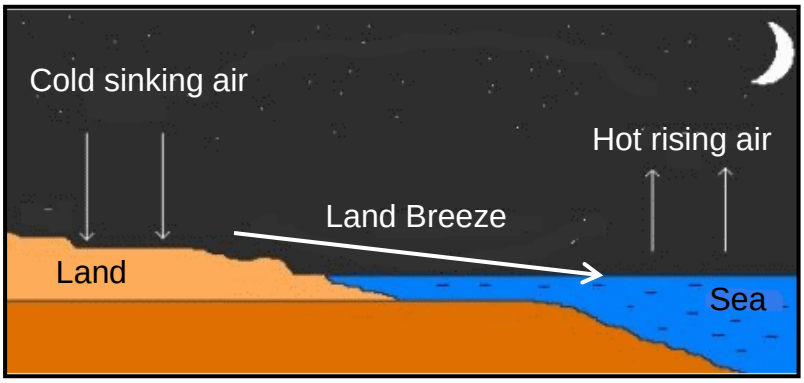
a) Land and Sea Breeze

The idea of land and sea breeze is similar to what has been explained in the notes on Distance from the Sea on page 17. In tropical regions this is experienced during the day and night. During the day, the winds blow from the sea to the land and during the night, the winds blow from the land to the sea. The diagram on the right shows the sea breeze blowing from the sea to the land during the day.



Sea Breeze

The diagram on the left shows the land breeze blowing from the land to the sea during the night. If you leave along the coast or on an island, you will notice that that the sea is warmer in the night than on the land. This is because the sea cools down slower than the land.

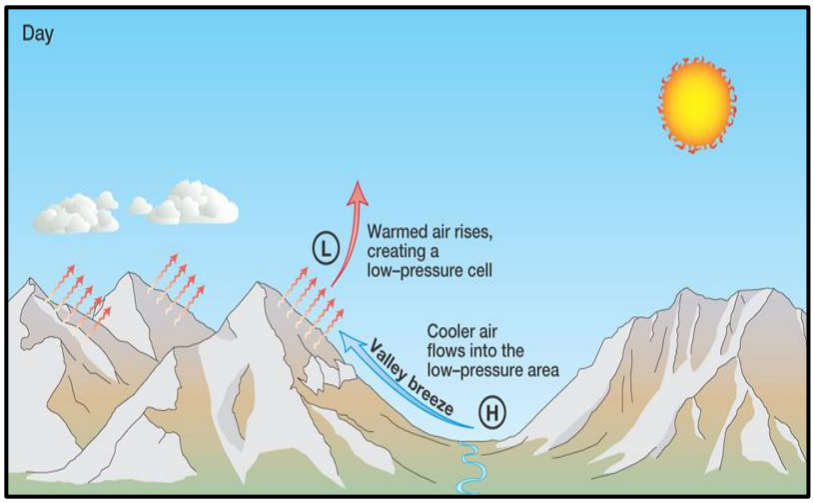


Land Breeze

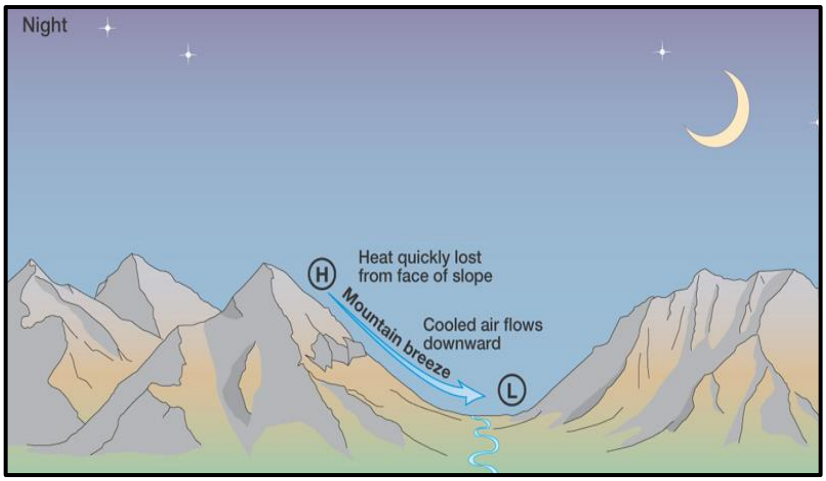
b) Mountain and Valley Breezes

The temperature difference between the mountains and valleys create mountain and valley breezes.

During the day, air on mountain slopes is heated more than that in the valley. As the day progresses, warm air on the slopes rises off causing the cool air in the valley to rise up the slopes. The cool air that is rising up the mountain slope is the valley breeze. The diagram below illustrates the flow of a valley breeze.



During the night, air from the mountain slopes cools down faster and so causes a high pressure zone, while the valley air is still hot. The hot air from the valley rises, causing the cold air from the mountain slopes to sink to the valley. The sinking air is the mountain breeze.



2. **The Global Winds**

These Global Winds are the dominant prevailing wind patterns that blow in a fairly constant, steady direction across our earth. These are large air masses that are created mainly as a result of the earth's rotation, the shape of the earth and the sun's heating power. Global winds are comprised of three prevailing or dorminant winds.

i. Tradewinds
ii. Westerlies and
iii. Polar Easterlies

The equator receives the Sun's direct rays. Here, air is heated and rises, leaving low pressure areas behind. Moving to about thirty degrees north and south of the equator, the warm air from the equator begins to cool and sink. Between thirty degrees latitude and the equator, most of the cooling sinking air moves back to the equator. The rest of the air flows toward the poles.

i. Tradewinds

The trade winds are just air movements toward the equator. They are warm, steady breezes that blow almost continuously. The Coriolis Effect makes the trade winds appear to be curving to the west, whether they are traveling to the equator from the south or north.

ii. Westerlies

Between thirty and sixty degrees latitude, the winds that move toward the poles appear to curve to the east. Because winds are named from the direction in which they originate, these winds are called prevailing westerlies.

iii. Polar Easterlies

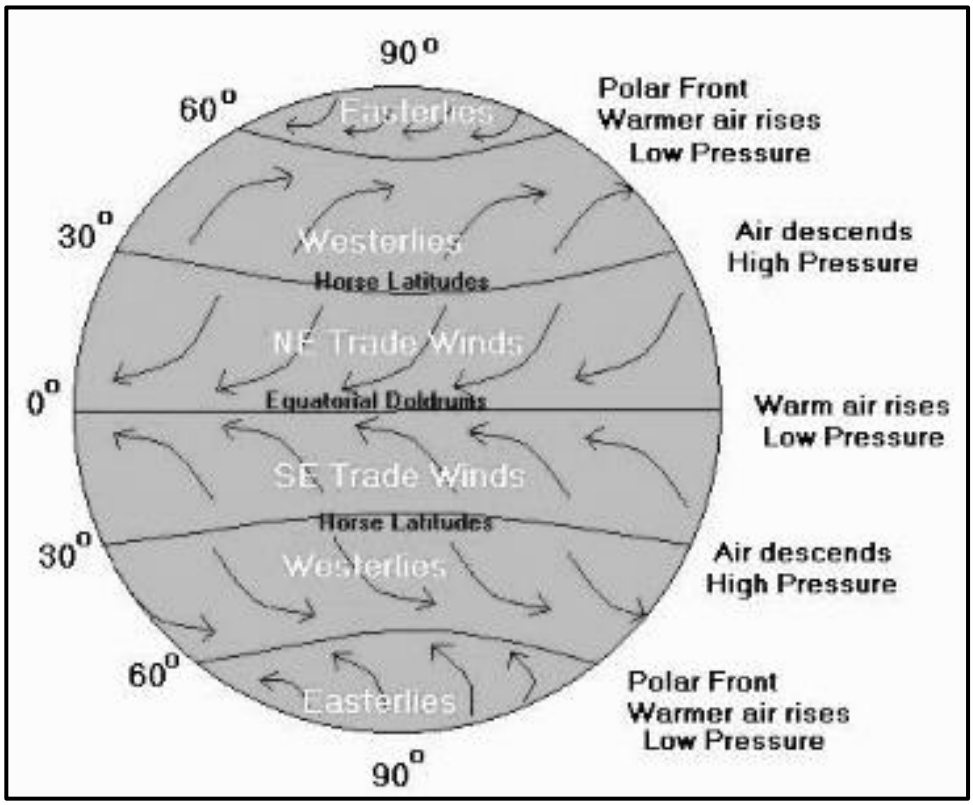
At about sixty degrees latitude in both hemispheres, the prevailing westerlies join with the polar easterlies to reduce upward motion. The polar easterlies form when the atmosphere over the poles cools. This cool air then sinks and spreads over the surface. As the air flows away from the poles, it is turned to the west by the Coriolis Effect. Again, because these winds begin in the east, they are called easterlies.

How does global winds affect climate?

Global winds help to distribute heat and water vapor around the Earth, which influences temperature and precipitation patterns around the entire globe.

The diagram on the next page shows the global wind system.

THE GLOBAL WIND SYSTEM



6. Precipitation

Precipitation refers to the different forms of moisture that reaches the surface of the earth.

Moisture reaches the surface of the earth in different forms, such as rain, hail, snow, fog, mist and frost. Rainfall is the form you are familiar with in Papua New Guinea. Snow is familiar to those in the temperate Regions.
How does precipitation affect climate?

Precipitation affects climate in the following ways.

1. **It helps regulate air and land temperature**
2. **It determines plant life in the area that contributes to the climate, and**
3. **It contributes to the formation of wind.**

Water heats up and cools down more slowly than land as explained on page 17. On hot days, water cools the land and on cold days it warms the land. This creates a moderating effect, so that areas with high precipitation and locations near bodies of water do not experience the temperature extremes that drier climates do.

You might think that climate determines plant life, but plant life also has an effect on climate, and plant life depends on precipitation. Precipitation encourages a varied and heavy plant population, which traps water in the land. This causes the land to heat and

cool more slowly and reducing very high temperatures. Plants also serve as a windbreak, slowing the evaporation of water and helping to reduce storms.

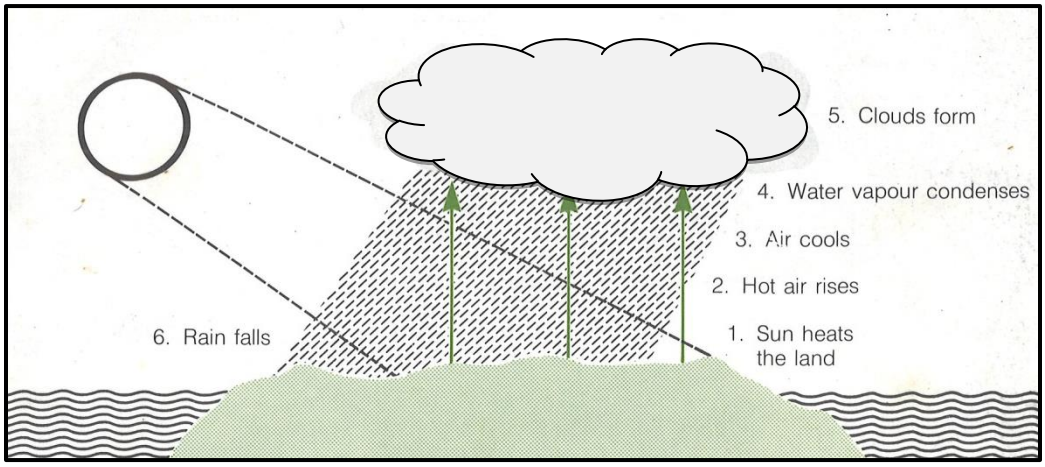
Finally, precipitation is related to the formation of wind. When water evaporates, the resultant warm, moist air rises and cools to form clouds and creates a pocket of low pressure. More air rushes into this pocket, creating wind. The water in the clouds falls as precipitation.

Rainfalls are named according to the different ways they are formed.

a. Convectional Rainfall

Convectional rainfall occurs when the energy of the sun (or insulation) heats the earth's surface and causes water to evaporate changing to water vapor. This warm, moist air then rises and as it rises, it cools. When the droplets are heavy enough they fall to the earth as convectional rain. Convectional rain is often accompanied by thunder and lightning. It is most common in the afternoons in the tropics and on summer days in temperate regions.

Convectional Rainfall

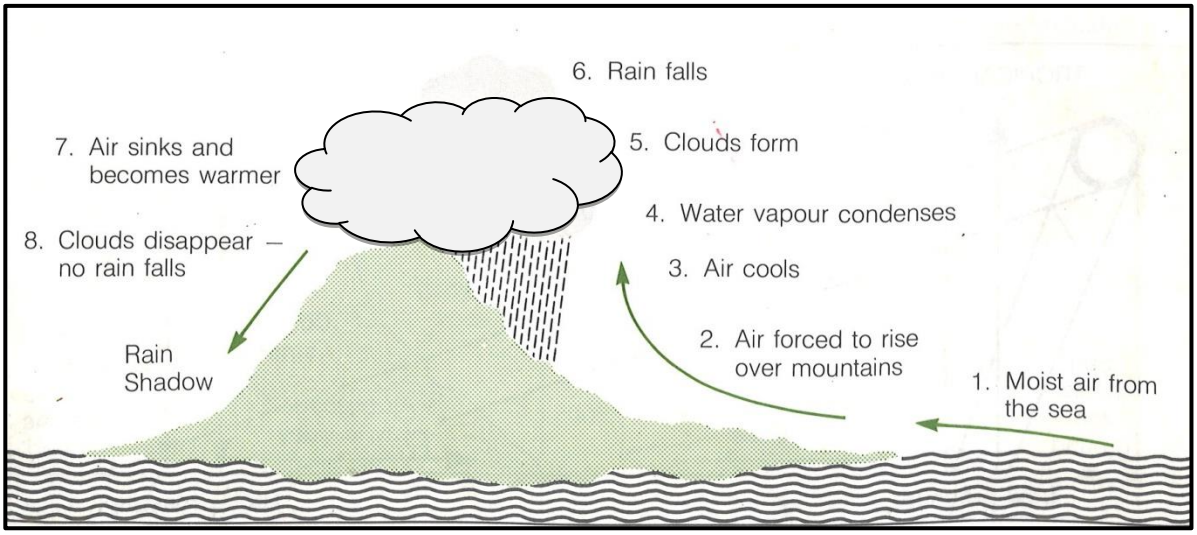


b. Relief or Orographic Rainfall

Orographic rainfall is produced when warm moist air is lifted as it moves over a mountain range. As the air rises and cools, rain clouds form and serve as the source of the rainfall. Most of the rain falls on the slope facing the wind (windward slope). Some also fall a short distance downslope of the ridge On the leeward slope of the mountain, rainfall is usually low, and the area is said to be in a rain shadow. Very heavy precipitation typically occurs on the windward slope of the mountain, that is faced by the prevailing wind from a warm ocean.

This information is shown in the diagram on the next page.

Relief or Orographic Rainfall

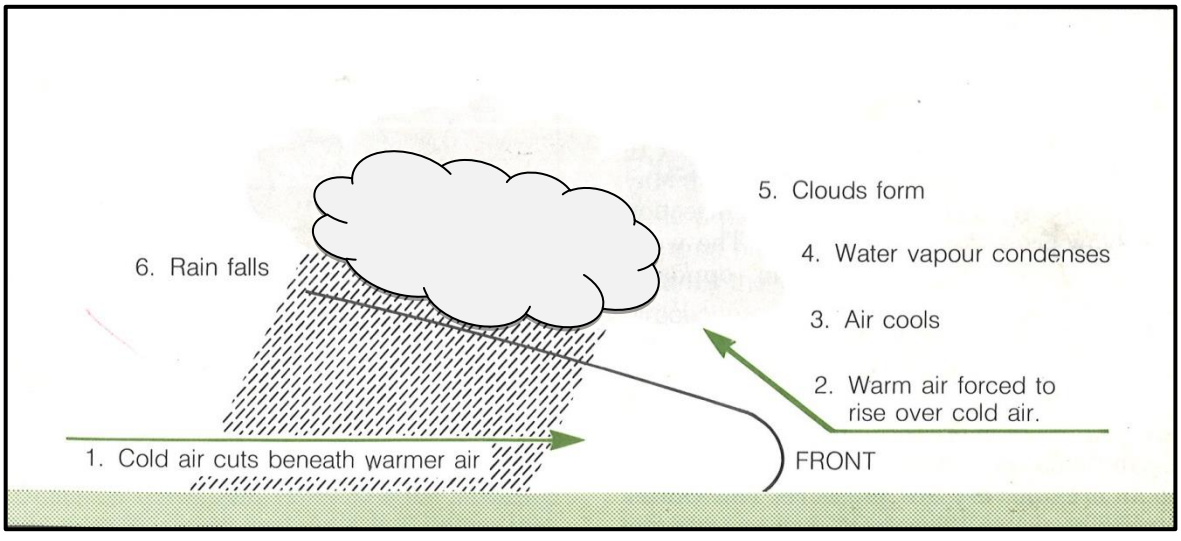


c. Frontal or Cyclonic Rainfall

Frontal (or cyclonic) Rain is caused by cyclonic activity and it occurs along the fronts of the cyclone. It is formed when two air masses of different temperature, humidity and density meet. The layer separating them is called the front. This front has two parts, the warm front and the cold front. At the warm front, the warm lighter air rises gently over the heavier cold air. The air which is heavy stays close to the ground. As the warm air rises, it cools, and the moisture present in it condenses to form altostratus clouds. This rain falls steadily for a few hours to a few days.

The diagram below shows how the frontal rain is form.

Frontal or Cyclonic Rain



Rainfall like other forms of precipitation also affects climate by regulating temperatures on land and air.

7. Aspect

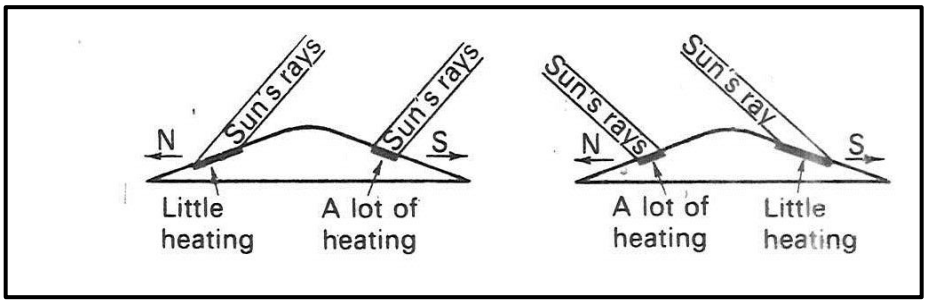
Aspect in geography refers to the compass direction that a slope faces. So if the slope is facing towards the equator, then the temperature will be warmer than facing away.

In the northern hemisphere, south-facing slopes are usually warmer than north-facing slopes, while in the Southern Hemisphere north-facing slopes are warmer than south facing slopes.

Sunrays arrive at more direct angles, so they are more concentrated and give more heat at slopes facing the equator. They get longer periods of daily sunshine and are sheltered from the cold northerly and southerly winds respectively.

Slopes facing the opposite direction to the equator get shorter periods of daily sunshine, and are sometimes in the shade. They are cooler than the slopes facing the equator. Generally in microclimates, (A microclimate is a small but distinctly different climate within a larger area) any slope facing the sun tends to be warmer than slopes facing the opposite direction.

The information above is shown in the diagram below.



Effect of aspect on temperature

A microclimate is a small but distinctly different climate within a larger area.

You have come to the end of the Chapter. On the next page are the main points of the chapter.

SUMMARY

- Latitude is the imaginary lines that run across the globe from east to west. It measures 0 degrees at the equator to 90 degrees at the poles. The lines get progressively shorter towards the poles.

- The factors that make climate different from place to place are, Latitude, Seasons, Altitude, Distance from the sea, Air movements, Precipitation, Wind patterns and Aspect.

- Areas that are close to the equator receive more heat because:

  1. The insolation *(incoming solar energy)* travels a smaller amount of atmosphere before reaching the equator. Less amount of heat is reflected back into the atmosphere, thus reaching the equator with more intensity.

  2. Insolation near the poles has to pass through a greater amount of atmosphere and there is more chance of it being reflected back into the space thus, reaching the areas away from the equator with less intensity of heat.

  3. The sun's heat does not disperse (heats up a smaller area of land) at the equator and therefore it is concentrated. The insolation at the poles is less because it is dispersed due to the large area of land it has to cover.

- As the Earth circles the sun, the tilt of its axis causes changes in the angle of which sun's rays contact the earth and hence changes the daylight hours at different latitudes. Polar Regions experience the greatest variation, with long periods of limited or no sunlight in winter and up to 24 hours of daylight in the summer. This is because the Earth's axis is tilted with respect to the sun. In the temperate regions this gives rise to clearly defined seasons including summer, autumn, winter and spring

- An equinox is a period in the orbit of a planet in which the planet's orbit and position cause the Sun to pass directly over the equator.

- Temperature decreases with altitude (*height above sea level*) and so the higher you go up the mountains, the cooler it becomes. On average temperature drops about 1°C for every 100 metres or 10°C over 1000 metres, because air at higher altitudes is thinner and less dense

- Coastal locations are cooler in summer and warmer in winter than places inland at the same latitude.

- Wind is created by the unequal heating of the atmosphere. Cold air is said to be heavy and thus exert high pressure. Warm or hot air is said to be light and thus exert low pressure. Air moves toward the area with the lowest pressure. The prevailing wind of an area can greatly influence local climate.

- Over time, prevailing wind and weather patterns greatly alter the climate of a region. There are four main types of air masses. They are Polar maritime, Polar continental air, Tropical maritime air and Tropical continental air. The masses are named and categorized based on their topographical location, which also dictates, the temperature and effect the air will have on a surrounding area if it moves.

- Precipitation refers to the different forms of moisture that reaches the surface of the earth.

- Precipitation affects climate in the following ways.

  1 It helps regulate air and land temperature
  2 it determines plant life in the area that contributes to the climate, and
  3 it contributes to the formation of wind.

- Winds affect the amount of precipitation received in an area. In contrast to the temporary effects of daily wind shifts, prevailing trade winds have a direct effect on a region's climate.

- Because the sun is more intense at the equator, global wind patterns called prevailing winds form. Hotter air at the equator rises and spreads toward the poles. This hotter air is deflected by the rotation of the Earth in a pattern known as the **Coriolis Effect.** Winds are deflected to the right in the northern hemisphere and to the left in the southern hemisphere. Prevailing winds either bring moisture to the land or take it away, depending upon the orientation of the land to the prevailing wind direction.

- Aspect in geography refers to the compass direction that a slope faces. So if the slope is facing towards the equator, then the temperature will be warmer than facing away. In the northern hemisphere, south-facing slopes are usually warmer than north-facing slopes while, in the Southern Hemisphere, north-facing slope are warmer than south facing slope.

Now, do the activity on the next page before you move on to the next topic.

Activity 2

1. Why are places near and at the equator hotter than those away from the equator?

   _____

2. What does the term insolation refer to?

   _____

3. By how many metres high above sea level does the temperature decrease by 1 °C?

   _____

4. Distance from the sea is a factor that also influences climate. Which regions in the world is the effect obvious?

   _____

5. State the three ways in which precipitation can affect climate.

   a. _____

   b. _____

   c. _____

6. Explain how wind is created.

   _____

7. Explain in your own words what Coriolis effect is?

   _____

   _____

8. Explain the term aspect in geography.

   _____

   _____

Now check your answers at the end of the project

Chapter 3 Climate and its effect on Vegetation

Climate of a place plays an important role in determining the vegetation and the type of activities people are engaged in.

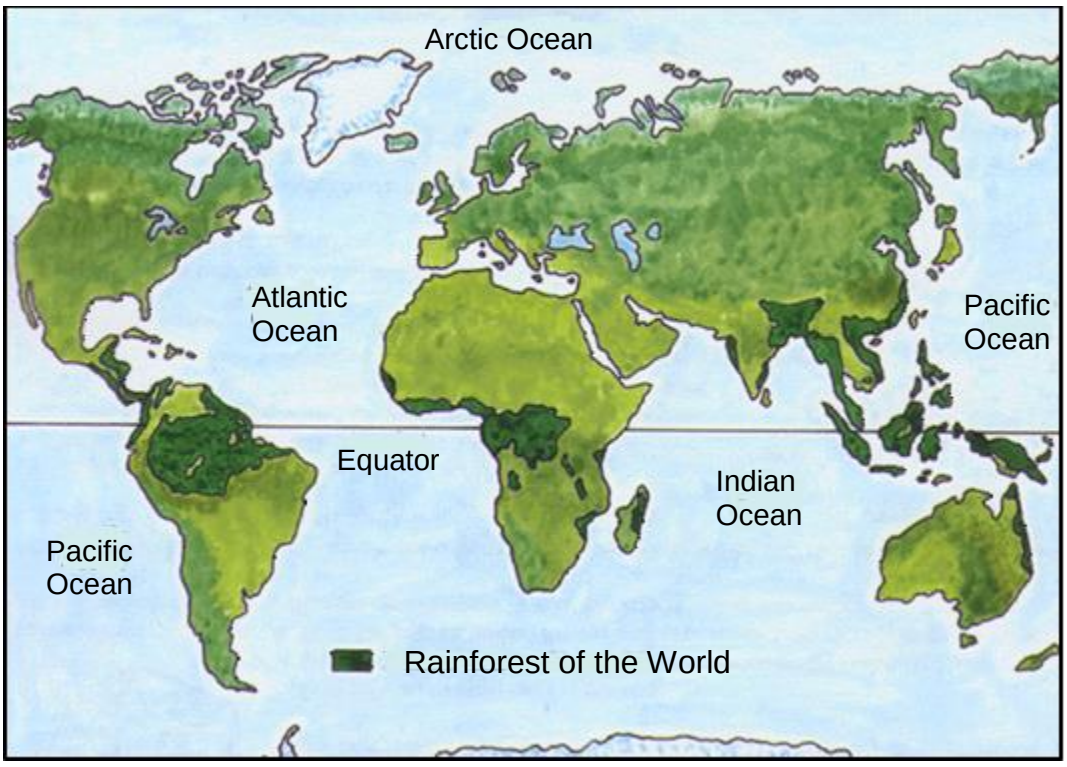
In this Topic you will specifically look at climate and its effect on vegetation.

The plant community in an area is the most sensitive indicator of climate. The vegetation, climate and weather are all related. Each is entirely dependent on the other. The relationship also works in reverse, with plants contributing to the type of climate. Plants absorb water and release energy that helps determine the type of climate a particular region experiences. The moisture released into the atmosphere by plants contributes to the climate. While the moisture level in the climate in turn regulates the climate and the growth of vegetation. You will now look at different types of vegetation that is associated with the various climate types in the world.

Areas with moderate to high temperatures and abundant rainfall throughout the year are heavily forested The forests are of three main types and are confined to their respective climatic region.

1. Tropical Rainforests

MAP SHOWING LOCATION OF TROPICAL RAIN FOREST IN THE WORLD



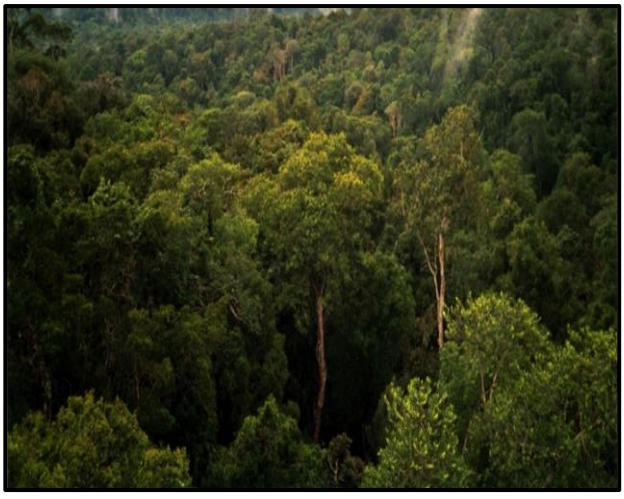
Places with tropical rainforest are those that are located in the tropical regions with generally hot and wet climate throughout the year. Rainforests cover only a small part of the earth's surface - about 6%, yet they are home to over half the species of plants and animals in the world.

From the map on page 27 you will notice that tropical rainforests are found in the north of South America, west central Africa, South East Asia, Papua New Guinea and North eastern Australia.

The photographs below show rainforests in different parts of the world.

Saposa Island, Bougainville PNG

Rain forest along the Mpivie River in Gabon, Africa

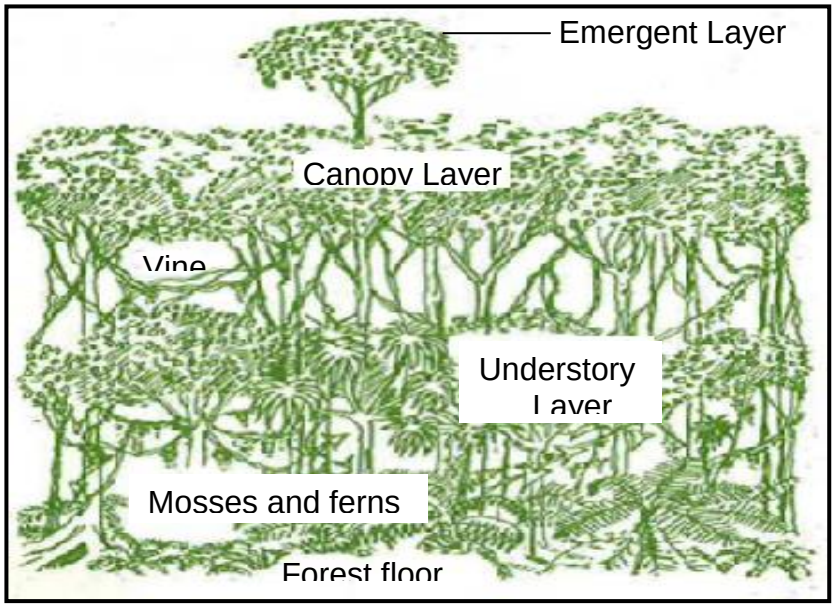


Amazon rainforest near Manaus, Brazil

Rainforest in Indonesia

Turn to the next page to read about the layers of rainforest.

Rain forests have several layers and form a dense cover that allows very little light sunlight reaches the forest floor. The first layer is called the emergent. These are the tallest trees in the forest. The second layer is known as the canopy. This is made up of trees that form a dense roof over the forest. Below the canopy are the understory and finally the forest floor. Amongst these layers are vines, mosses and ferns



The diagram on the right shows the layers of the rainforests.

2. Deciduous Forests

Deciduous forests are confined to warm temperate regions. These regions lie between latitudes 25 and 55 degrees north and south of the equator. Climate in this region comprises of four clearly defined seasons, summer, autumn, winter and spring. Summers are warm and winters cool with year-round rain or snow.

Here the trees have to cope with differences in temperature between summer and winter. Deciduous trees lose their leaves in autumn to prepare for winter because their leaves could not withstand the extreme cold weather in winter. The leaves grow again in spring to prepare for summer.

The word deciduous means to lose leaves in one season. The leaves that fall off the trees in winter rot slowly in temperate climates. They form a rich, dark layer of humus which is like compost and is very fertile

Below are photographs showing deciduous trees in the four seasons.

Autumn

Winter

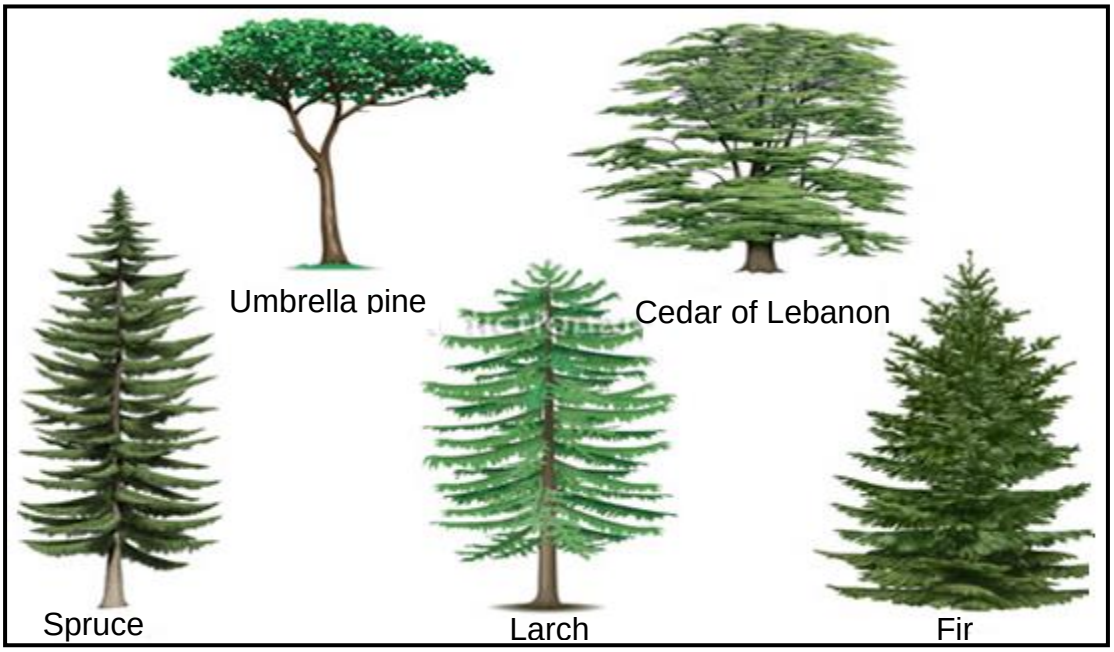
Spring

Summe

3. Coniferous Forests

Coniferous forests are found in cold temperate regions. These regions lie between latitudes 55 degrees to 65 degrees north and south of the equator. Coniferous forests comprise, of trees with tall straight trunks and needle-like leaves and are well adapted to long, cold and often snowy winters. The trees are sometimes called **evergreen** because they have leaves all year round. Old leaves that fall are replaced with new leaves. These needle-like leaves are tough to withstand cold winters. Coniferous forests grow right across northern Europe, Asia and North America. Coniferous leaves do not rot easily so nothing is able to grow on the forest floor.

Below are pictures of different coniferous trees.



Below are images of conifer cone seeds and the coniferous forests.

Dried conifer cone seeds

Green conifer's cone seeds

Coniferous forest

Coniferous forest covered in snow in winter

You have looked at the main types of forests. You will now proceed to looking at other types of vegetation.

Grassland

Grasslands are, as their name suggests, flat and open areas where grasses are the dominant type of vegetation. Grasslands can be found on every continent except Antarctica.

Different types of grassland

a. Temperate Grassland

Climate plays a role in the type of grassland you get. In cool, mild climates, like northwest Europe, grasslands are dominated by tough vegetation, such as oats, that grows all year. Some of these grasses are so tough, that they are considered weeds. The photograph on the right shows wild oats. This vegetation is common in Europe and North West of Africa.

Wild oats in Eramosa, Canada

b. Prairies

Prairie is a large area with grassland and few trees.. The term was originally used to describe the prairies of North America. Temperate grasslands exist where there are seasonal variations in temperature over the course of the year, hot summers, low rainfall and cold winters. Different grasses grow in different temperatures. Similar areas also exist in South Africa and is known as the **'veld'**, in South America, the '**pampas**' and Russia the **'steppes'**.

Coastal prairies in California, USA

c. Savanna Grassland

Tropical grasslands are called savannas. They grow well in warm and dry climate. They are rolling grassland and scattered with shrubs and isolated tree. They can be found between a tropical rainforest and desert biome.

What is a **biome?**

Biomes **are very large ecological areas on the earth's surface, with fauna and flora (animals and plants) adapting to their environment.** ***Biomes*** **are often defined by abiotic (non-living) factors such as climate, relief, geology, soils and vegetation. A** ***biome*** **is NOT an ecosystem, although in a way, it can look like a massive ecosystem.**

Not enough rain falls on a savanna to support forests. Savannas are also known as tropical grasslands. They are found in a wide band on either side of the equator on the edges of tropical rainforests.

Savanna grassland in Tanzania, Africa

Savanna grassland in Port Moresby

Tundra

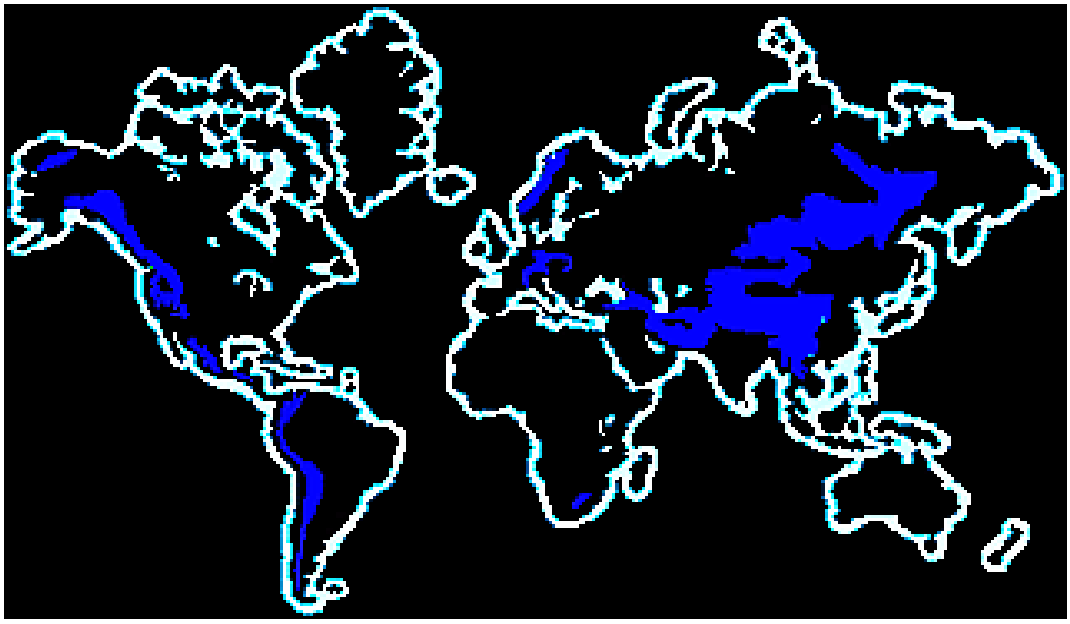
Tundra is an area where tree growth is difficult because of cold temperatures and short seasons. Tundra vegetation is limited to a few shrubs, grasses, and mosses. The ground is often too cold for plants to set down roots, and without plants, few animal species survive.

There are two types of tundra:

1. Alpine Tundra

Alpine tundra is separated from a forest vegetation region by the tree line. Beyond the tree line, the conditions are too harsh or cold for tree growth. The weather in alpine tundra is cold, snowy, and windy. Most of the Tibetan Plateau located in Tibet, China, and India, west of North and South America is alpine tundra. Animals like mountain goats live in this vegetation region.

MAP SHOWING LOCATION OF ALPINE TUNDRA



Alpine tundra in summer, Colorado USA

2. Arctic Tundra

Arctic tundra is confined to the Northern Hemisphere, fringing the Arctic Ocean and North America. It has a bare landscape and is frozen for much of the year. Here, the soil is permanently frozen. Russia and Canada have huge areas of arctic tundra. During the summer, the permafrost thaws(melts) just a bit, allowing some plants to grow in the wet, marshy ground. You will not find many mammals in the arctic tundra, but thousands of insects and birds show up every year and enjoy the marshes before they freeze.

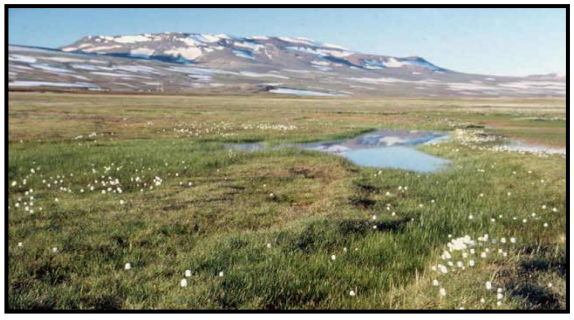
MAP SHOWING LOCATION OF ARCTIC TUNDRA

Below are photographs of Arctic tundra

Arctic tundra in autumn

Arctic tundra in summer

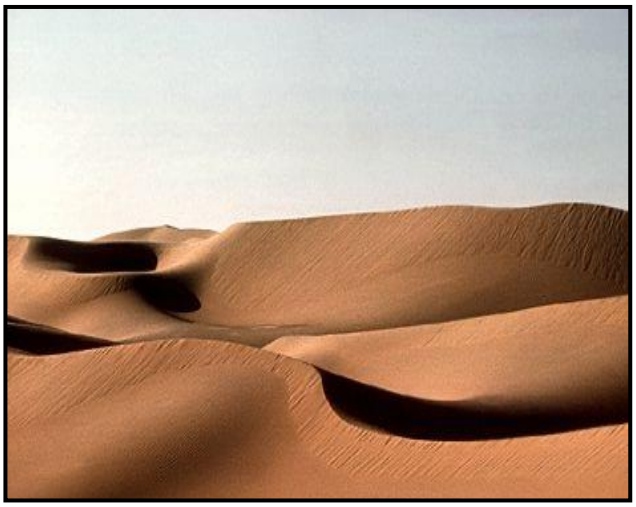
Arctic tundra in winter



Arctic tundra in spring

Desert

Deserts have almost no precipitation, or rainfall. In fact, deserts are specifically defined as areas with an average annual precipitation of less than 254 mm per year. Deserts usually have high daytime temperatures, low nighttime temperatures, and very low humidity. Desert soil is sandy and rocky where it is semi-arid.



Sand dune in Sahara

Algerian portion of the Sahara Desert

The photographs above show some common features in a desert. Plant life is highly specialized to adapt to these coarse, dry conditions. One plant that has adapted to these harsh conditions is the Cactus. With its long roots and small leaves, it stores water in its stem. Also its prickly spines discourage animals from touching or eating it. Cactuses are native to deserts in North and South America. Despite the barren look, deserts are full of animal life. Most desert animals, such as lizards or snakes, are nocturnal, meaning they are active at night. Nocturnal animals take advantage of the cooler nighttime temperatures of the hot desert to move around.

The photographs below show pictures of desert plants.

Jumping cholla and Saguaro cactus in California USA

Deserts that tend to have more vegetation are known as semi-arid deserts. These areas receive a little more rain with vegetation that is sparse and often made of short grass and mosses.

You have basically looked at the type of vegetation that grows in different climatic conditions across the globe. From what you have studies earlier, climate is one of the important elements that determine the type of vegetation in an area.

Below are the main points to the summary

SUMMARY

- The plant community in an area is the most sensitive indicator of climate.
- Places with tropical rainforest are found in the tropical regions with generally hot and wet climate throughout the year.
- Temperate grasslands exist where there are seasonal variations in temperature over the course of the year: hot summers, low rainfall and cold winters.
- Tropical grasslands are called savannas. They do well in weather that is warm and dry all year-round. Consisting of rolling grassland, shrubs and scattered trees, savannah vegetation is found between a tropical rainforest and desert biome.
- Biomes are very large ecological areas on the earth's surface, with flora and fauna (animals and plants) adapting to their environment. Biomes are often defined by abiotic (non-living) factors such as climate, relief, geology, soils and vegetation. A biome is NOT an ecosystem, although in a way, it can look like a massive ecosystem.
- Tundra is an area where tree growth is difficult because of cold temperatures and short seasons. Vegetation in tundra is limited to a few shrubs, grasses, and mosses. The ground is often too cold for plants to set down roots, and without plants, few animal species can survive.
- Deserts have almost no precipitation, or rainfall. They have an average annual precipitation of less than 254 mm per year. Deserts have high daytime temperatures, low nighttime temperatures, and very low humidity.

Now do Activity 3 on the next page.

Activity 3

1. Briefly explain the relationship between climate and vegetation.

   _____

   _____

2. Name the kind of forests found in the following climatic regions?
   a. tropical _____
   b. warm temperate _____
   c. cold temperate _____

3. Tropical grassland is known as _____.

4. Prairies in North America is also known as
   a. _____ in South Africa,
   b. _____ in South America and
   c. _____ in Russia.

5. Name the two types of Tundra.
   a. _____
   b. _____

6. Describe a desert climate.

   _____

   _____

   _____

Now check your answers at the end of the project.

Chapter 4: Cyclones and Their Effects in Papua New Guinea

The term cyclone may not be new to you, as you had learnt it in Grade 7 and 8. Also you may have read in newspapers, or seen on Televisions or heard on radios about cyclones and its effects in Papua New Guinea.

Why do we have cyclones in Papua New Guinea?

Papua New Guinea experiences cyclones, simply because it lies just outside the main tropical belt within Southwest Pacific region. Tropical cyclone hit the country at the rate of about one cyclone per year. Tropical cyclones affect southern Papua New Guinea between November and April. Between 1969 and 2012, twenty three cyclones have passed within 400 km of Port Moresby.

Now let us begin with the basic facts about cyclone.

Definition of cyclone

Cyclone refers to any spinning storm that rotates around a low-pressure center.

The low-pressure center is also referred to as the 'eye' of the storm. The eye is well known for being eerily calm compared with the areas under the spinning 'arms' of the storm.

Types of Cyclones

Tropical cyclones are what most people are familiar with because they occur in tropical ocean regions. It is important to know where the storm is occurring, because its location determines the name of the storm. For example, if the storm occurs in the Atlantic Ocean and Northeast Pacific, it is called a **hurricane**. If the storm occurs in the Northwest Pacific, it is called a **typhoon**. Similarly, if the storm occurs in the South Pacific and Indian Oceans, it is known as a **tropical cyclone.**

The strength of a tropical cyclone is described based on its wind speed. They are called category 1, 2, 3, 4 or 5, increasing with intensity and speed as the number increases. A category 1 cyclone is the weakest, with wind speeds of 74-95 miles per hour (mph). A category 5 cyclone, on the other hand, is extremely dangerous and has the potential for major damage. Category 5 cyclones have wind speeds of 155 mph and above. The image on the next page is a category 4 tropical cyclone.

Formation of a Cyclone

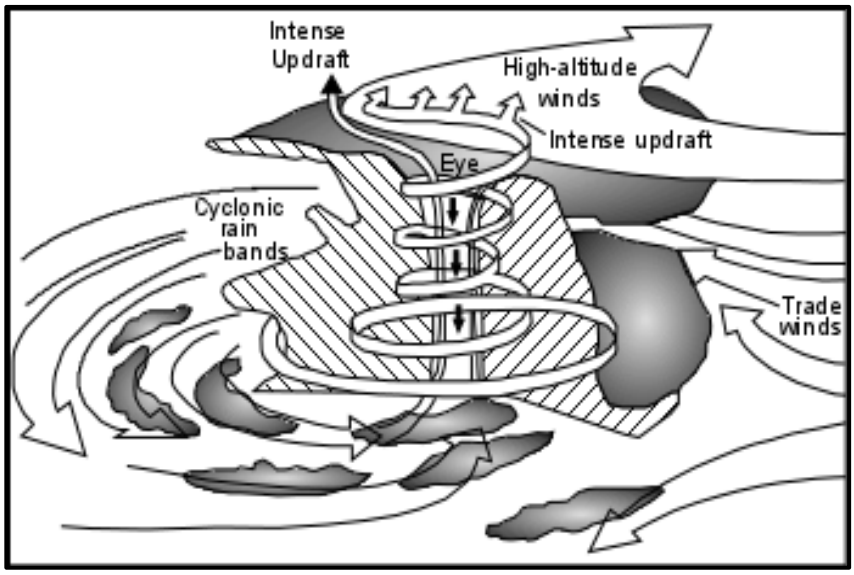
Even though they form over different areas, cyclones tend to come about in the same way and revolve around that low-pressure eye. Warm air likes to rise, and as it rises, it cools. Cool air cannot hold as much moisture as warm air, so that water gets squeezed out of the condensing air and a cloud begins to form. If the warm air rises very quickly, this creates an **updraft** (vertical upward movement of low pressure air).

Likewise, if the water in the cloud builds up enough moisture, it may fall back to the ground as rain, and draw cool air down with it as a **downdraft** (vertical downward movement of high pressure air). When they come together, the warm updraft and cool downdraft create a **storm cell**. As this process continues, the cloud grows and you eventually get a large thunderstorm cloud.

This thunderstorm cloud is now ready to diversify into other storms like tropical cyclones and tornadoes. But this cannot happen, unless the air in the cloud starts spinning horizontally. If this occurs over the tropical ocean, this is called a **tropical depression**. It is a baby tropical cyclone, with wind speeds of less than 39 mph.

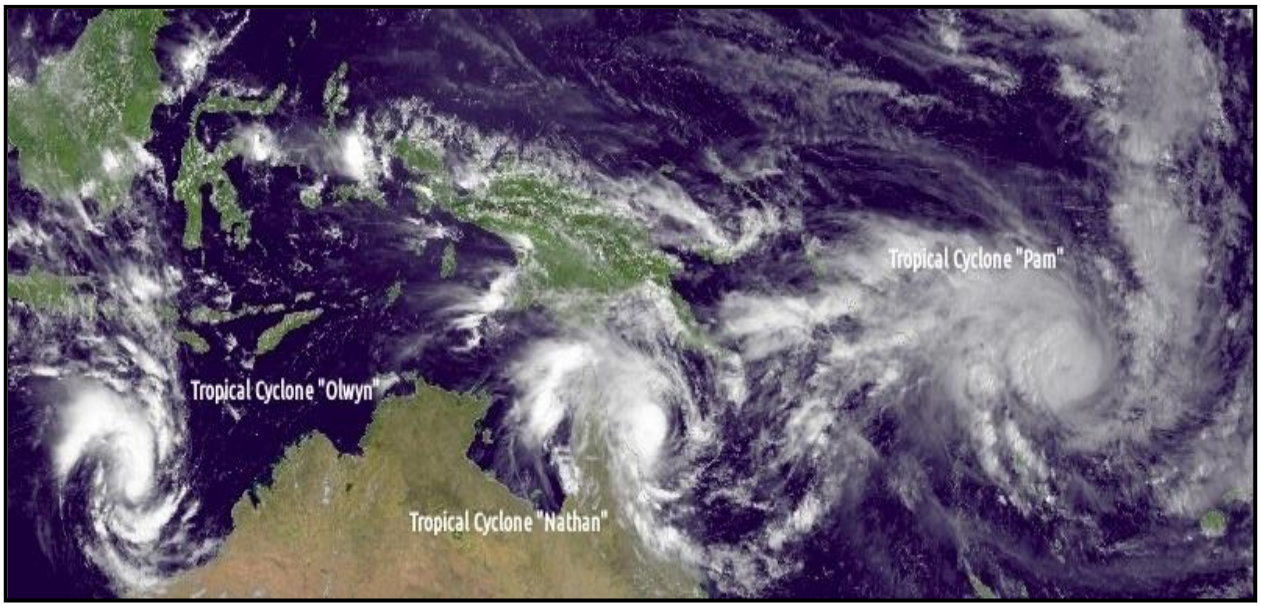
If it starts spinning even faster and has wind speeds between 40-73 mph, you have a **tropical storm**. If the storm grows even larger over the tropical ocean and has wind speeds above 74 mph, you have a full-grown cyclone, typhoon or hurricane, depending on where the storm is found.

The diagram below shows the structure of cyclones as explained above.



The structure of tropical cyclone

Below is an image showing the tropical cyclones that devastated the south west Pacific region including Vanuatu, Solomon Islands, Fiji, Papua New Guinea and Northern Australia in March 2015.



Tropical cyclones Olwyn, Pam and Nathan 11/03/2015

Now that you have gone through the basic facts about cyclone, you will begin with the effects of cyclone.

Effects of Cyclone

The impact of a tropical cyclone on the environment depends on the strength of the cyclone and its wind speed. The faster its wind speed, the stronger and more destructive it will be. Category 1 and 2 cyclones may not do a lot of damage as compared to category 3, 4 and 5 cyclones because its wind speeds are not that fast. Categories of cyclone have already been discussed on page 31.

Principal dangers from cyclones are very strong winds, torrential rain, and storm surge.

.

(i) Very strong Wind

Strong winds associated with cyclones can cause extensive property damage and turn flying debris into potentially lethal weapons. Tree can fall, buildings flattened and roads washed by torrential rain, and other infrastructure such as sign posts, telecommunication and power lines can be blown down by the strong winds.

The amount of damage caused by cyclone wind depends on,

1. the maximum speed of the wind gusts,
2. how long these destructive winds lasts and
3. the variation in the direction of the wind.

The topography of the land can also play a part in the destructiveness of the wind. Hills and mountain can provide shelter from the wind on the leeward side and sometimes the

terrain can increase the wind speed, such as when the wind moves over the crest of the hills.

The photographs below show damages caused by cyclone winds in Papua New Guinea.

Rising tides crash against Takuu atoll in AROB

Damages by cyclone in Milne Bay province

(ii) Torrential Rainfall

Cyclones come with heavy rain that can cause extensive flooding, particularly in low land areas. Heavy rainfall can also cause landslides on elevated areas. This can lead to further damage to buildings, roads, bridges and even loss of lives.

The amount of damage caused by the rain depends on how heavy it is, and its duration. The heavier it is and the longer it lasts, the greater the damage it will do to the environment.

The pictures below show some example of damages caused by torrential rain in Papua New Guinea.

Floods and damages in Oro province after cyclone Guba

Floods in Oro Province

(iii) Storm Surge

A storm surge is a sudden upward or forward movement of water that is usually two to five metres higher than the normal tide. It is caused by a combination of strong winds pushing the water towards the shore, and the low pressure in the area in which a cyclone forms.

Storm surge vary in size due to the

i. speed of the wind
ii. topography of the land
iii. presence of coral reefs
iv. size and speed of the cyclone and
v. tidal flow

Potentially dangerous surges occur along low-lying coastlines, and across inland waterways such as rivers, lakes and estuaries. Estuaries are areas of a river mouth which are affected by the sea tides. These areas can suffer from severe flooding. The storm surge and the constant pounding nature of the waves can cause serious damage to the coast structures such as jetties, rock walls, marinas and coastal buildings. Natural coastline features can also be destroyed and altered or changed as a result of storm surges.

Storm surge in Meni area in Wewak, East Sepik

Storm surge in Kali Island in Manus

Effects of Cyclones in Papua New Guinea

Papua New Guinea is located in the main tropical belt of the South West Pacific and so experiences tropical cyclones at least once a year. Places in Papua New Guinea affected by cyclones are mainly southern coastal areas such as in Milne Bay, Oro, Port Moresby, NCD, Central, Gulf and Western provinces. Other coastal also feel the effects of cyclones in Papua New Guinea but to lesser degree.

Major effects caused by cyclones in Papua New Guinea include;

i. Loss of food gardens
ii. Loss of properties
iii. Destruction of homes and buildings
iv. Destruction of structures such as bridges, roads, jetties, rock walls and so on
v. Landslides
vi. Loss of lives
vii. Interruptions in business activities
viii. Destruction and changes or alterations in shape and size of natural features of coast lines

Like any other disasters, the government has always taken responsibility to restore normalcy in cyclone affected areas. Apart from the government, other non-government organisations such as the Red Cross, Adventist Development and Relief Agency (ADRA), European Union and others assist people who have been affected by cyclones to restore normalcy in their environment.

The article below shows an example of what the government did for the cyclone stricken areas in 2014.

Relief Funding For Milne Bay

On 15 April, Papua New Guinea Prime Minister Peter O'Neill and Speaker of Parliament Theo Zurenuoc provided PGK300,000 (US$113,700) in funds to Milne Bay Province. The Papua New Guinea Defence Force was dispatched to deliver relief supplies to the region. Damage surveys were conducted simultaneously using the Defense Force's helicopters to determine the areas in need of the most immediate aid. Ten relief teams were dispatched on 16 April to assist with cleanup efforts. The nation's health office also *warned of the dangers of post-storm diseases due to damaged sewer systems. Communications with the outermost islands of the province remained difficult and limited to short-distance radio. By 17 April, a barge with 57 bales of rice was sent to Wari Island where thousands of residents were in need of food*.

Source: Wikipedia

Cyclone Preparedness in Papua New Guinea

The country does not have a disaster preparedness plan in place as yet. Having the preparedness plan in place will allow people to be prepared to face the disaster with minimal loss of property and lives. The expenses in rebuilding or restoring normalcy in the affected communities will also be minimal. Unpreparedness can result in massive loss of properties and lives because people are not prepared and are taken by surprise.

Making people aware of cyclones is the role of the National Weather Service. It is also important for people to take heed of warnings and be prepared to minimize destructions that may occur. It is also necessary that accurate and updated information on disasters is conveyed to people in advance, for them to prepare themselves for the coming disaster.

Here are the main points in this chapter.

SUMMARY

- Cyclone refers to any spinning storm that rotates around a low-pressure center.
- Cyclones occur in different places, and some occur over land while others occur over water. What they all have in common is that they are spinning storms rotating around that low-pressure center.
- The strength of tropical cyclones is described based on their wind speeds. They are called category 1, 2, 3, 4 or 5, increasing with intensity and wind speed as the number increases.
- Principal dangers from cyclones are very **strong winds**, **torrential rain**, and **storm surge.**
- Places in Papua New Guinea affected by cyclones are mainly southern coastal areas such Milne Bay, Oro, Port Moresby, NCD, Central, Gulf and Western.

You have now come to the end of chapter 4. Turn to the next page to do the Topic activity.

Activity 4

Answer the questions below by writing your answers in the space provided.

1. Define the terms below.

   (i) Cyclone

   _____

   _____

   (ii) Storm surge

   _____

   _____

2. What are the 3 principle signs of a cyclone?

   (i) _____

   (ii) _____

   (iii) _____

3. List 3 effects of cyclones seen in Papua New Guinea.

   (i) _____

   (ii) _____

   (iii) _____

4. Refer to the article on page 44 to answer the questions below.

   (i) Which province was affected by the cyclone?

   _____

   (ii) What was the health warning issued by the health office?

   _____

5. Explain in one paragraph how a cyclone is formed.

_____

_____

_____

_____

Now check your answers at the end of the project

.

ANSWERS TO ACTIVITIES

Activity 1

1, The drastic weather condition is caused by the two low pressure systems developing north and south of the country.

2. It is developing over the Coral Sea and moving very slowly westward towards the Gulf of Carpentaria in Australia.

3. Papuan Coastline, especially Port Moresby to Daru in Western Province.

4. Milne Bay, Bismarck sea and the waters of Manus.

5. The highlands region.

Activity 2

1. Areas that are close to the equator receive more heat because the insolation *(incoming solar energy)* travels a smaller amount of atmosphere before reaching the equator. Less amount of heat is reflected back into the atmosphere, thus reaching the equator with more intensity. Insolation near the poles has to pass through a greater amount of atmosphere and there is more chance of it being reflected back into the space, thus reaching the areas away from the equator with less heat intensity. The sun's heat does not disperse (heats up a smaller area of land) at the equator and therefore it is concentrated. The insolation at the poles is less because it is spread out over a large area of land.

2. Insolation refers to the incoming solar energy.

3. 100 metres above sea level

4. Temperate regions

5. Precipitation affects climate in the following ways.

   (i) It helps regulate air and land temperature
   (ii) It determines plant life in the area that contributes to the climate, and
   (iii) It contributes to the formation of wind

6. The wind is created by the unequal heating of the atmosphere.

7. Coriolis effect is the pattern in the movement of the wind caused by the deflection of hotter air in relation to the rotation of the earth.

8. Aspect in geography refers to the compass direction that a slope faces. So if the slope is facing towards the equator, then the temperature will be warmer than the slope facing away.

Activity 3

1. The plant community in an area is the most sensitive indicator of climate. The relationship between vegetation and climate and weather is absolute. Each is entirely dependent on the other. The relationship also works in reverse, with plants contributing to the type of climate. Plants absorb water and release energy that helps determine the type of climate a particular region experiences. The moisture released into the atmosphere by plants contributes to the climate, while the moisture level in the climate in turn contributes back to the Earth's ability to foster the growth of vegetation.

2. a) tropical rainforest b) Deciduous Forest c) Coniferous Forest

3. Savanna

4. a) Veld in South Africa

   b) Pampas in South America

   c) Steppe in Russia

5. a) Alpine Tundra b) Arctic Tundra

6. Deserts have almost no precipitation, or rainfall. In fact, deserts are specifically defined as areas with an average annual precipitation of less than 10 inches (254 mm) per year. Deserts usually have really high daytime temperatures, low nighttime temperatures, and very low humidity.

Answers 4

1. (i) Cyclone refers to any spinning storm that rotates around a low-pressure center**.**

   (ii) A storm surge is a sudden upward or forward movement of water that is usually two to five metres higher than the normal tide.

2. (i) strong winds (ii) torrential rain (iii) storm surge.

3. Any three of the effects below.

   Loss of food gardens
   Loss of properties
   Destruction of homes and buildings
   Destruction of structures such as bridges, roads, jetties, rock walls so on.
   Landslides
   Loss of lives
   Interruptions in business activities
   Destruction and changes or alterations in shape and size of natural features of coast lines

4. i. Milne Bay Province

ii. The nation's health office also warned of the dangers of post-storm diseases due to damaged sewer systems.

5. Cyclones develop from thunderstorms. This happens when clouds in thunderstorms spin horizontally over Tropical Ocean at the speed of 74 miles per hour (mph) resulting in strong winds, storm surge, rain and floods.

YOU HAVE COME TO THE END OF GRADE 9 PROJECT 1. NOW TURN TO YOUR ASSIGNMENT BOOK AND COMPLETE ALL THE QUESTIONS IN EACH TOPIC TEST. SEND THE COMPLETED MARKING BOOK TO YOUR PROVINCIAL COORDINATOR FOR MARKING.

References

http://www.weatheronline.co.uk/PapuaNewGuinea.htm

http://www.weatherwizkids.com/weather-instruments.htm

/2011/09/10/tilting-earth-shaping-seasons/

http://www.britannica.com/EBchecked/topic/433062/orographic-precipitation

http://www.ask.com/science/effects-wind-climate

eschooltoday.com/ecosystems/what-is-a-biome.html

http://en.wikipedia.org/wiki/Tundra

http://alpinetundrakmtc.blogspot.com/

http://www.dreamstime.com/stock-image-big-set-cones-various-coniferous-trees-ima

http://depositphotos.com/2051257/stock-photo-winter-coniferous-trees.html

ge26665351

http://www.windows2universe.org/kids_space/desert.html

http://study.com/academy/lesson/what-are-cyclones-types-causes-effects.html

http://thewatchers.adorraeli.com/2015/03/11/tropical-cyclones-olwyn-and-nathan-threatening-australia/

http://news.pngfacts.com/2015/03/tropical-cyclone-nathan-update-in-png.html

http://www.wjla.com/blogs/weather/2011/10/weather-models-how-important-are-they-in-forecasting--13365.html#ixzz3gTufuWrV

https://nsidc.org/cryosphere/arctic meteorology/factors_affecting_climate_weather.html

http://www.eschooltoday.com/winds/types-of-winds.html

http://www.gardeningknowhow.com/garden-how-to/info/using-rain-gauges.htm

http://www.weatherwizkids.com/weather-wind.htm