

Window to the Tropics Sharing and Activity Sheet for Students

Gardens by the Bay Avatar:

- Horticulturist

Level/ Subject(s):

- Upper Secondary/ Science, Geography

Learning Objectives:

- Describe and explain the characteristics of a tropical rainforest.
- State how plants adapt to their environment



Hello students! My name is Hidayah. I am a horticulturist and I have been working at Gardens by the Bay for two years. I will be sharing with you the characteristics of a tropical rainforest and how plants adapt to such an environment in today's sharing. Let's begin!

Found on every continent except Antarctica, rainforests are ecosystems filled with mostly evergreen trees that typically receive high amounts of rainfall.

Did You Know?

A tropical rainforest is an ecosystem that occurs approximately within latitudes 28 degrees north and south of the equator (in the equatorial zone between the Tropic of Cancer and Tropic of Capricorn). This ecosystem experiences high average temperatures and a significant amount of rainfall.

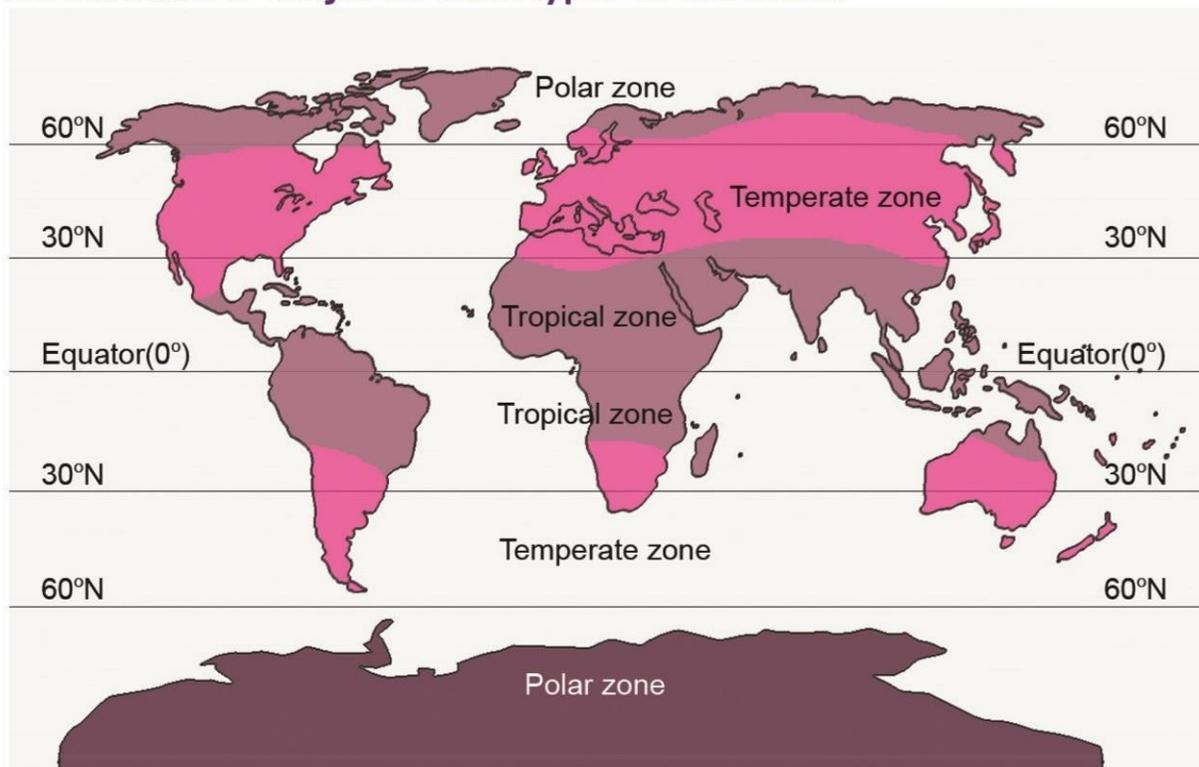


Tree Top Walk at MacRitchie Reservoir. Credit: NParks

Activity 1: Where Are We?

First things first, let's see if you can locate Singapore on the map! Mark an "X" on the map below to show where Singapore is.

Distribution of major climate types in the world



Distribution of major climate types in the world. Credit: Kahihi Science Dictionary

1a) According to the map, which climatic zone is Singapore located?

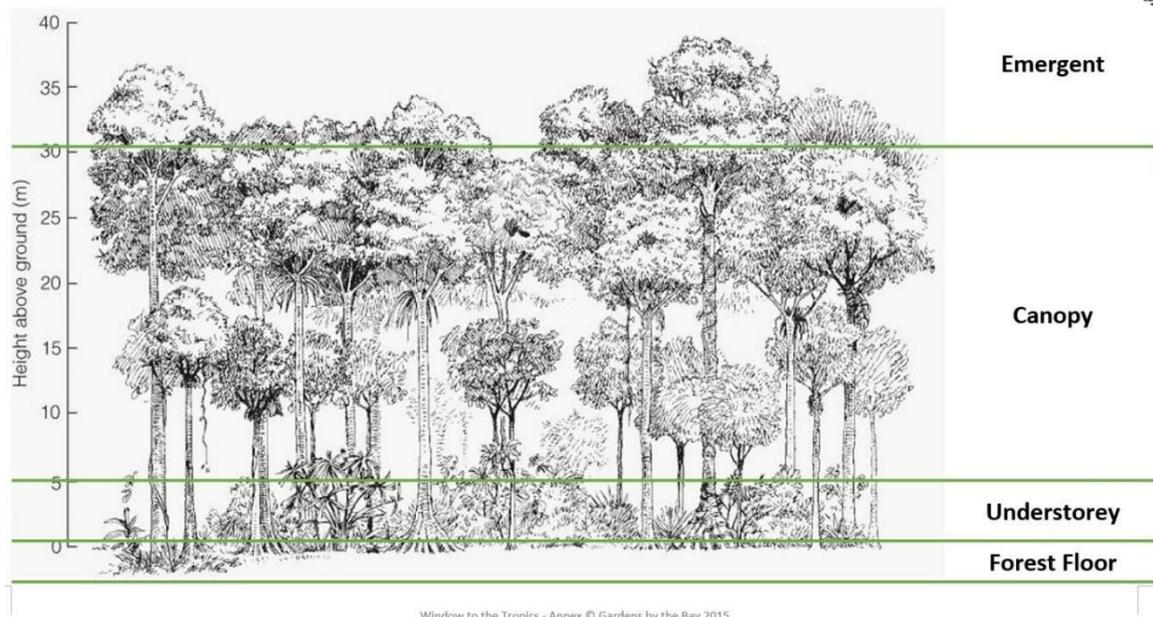
(b) In the box below, list the characteristics of this climatic zone.

Look at the greenery around you! Yes, tropical rainforests are found near the equator in a climate similar to Singapore's.



Greenery in Singapore. Credit: 99.co

Now, let's look at the various layers within a rainforest. There are 4 layers in a tropical rainforest. Let's find out more about them!



Layers of a tropical rainforest

Four Layers of Tropical Rainforests

The top layer is the **emergent layer**. This is where the leaves and branches of the tallest trees in the rainforest are.

The second layer is the **canopy**. In this layer, the leaves and branches form a continuous cover with the leaves forming a 'shelter' over the entire rainforest.

The third layer is the **understorey**. As this layer is below the canopy, it receives very little sunlight since much of it has been blocked out. There are many insects here and smaller trees and shrubs can be found at this layer.

The fourth and last layer is the **forest floor**. With hardly any sunlight reaching the forest floor, there are almost no plants found here. This layer is damp and warm, so decomposition takes place very quickly. The decomposers e.g. fungi are all found here.

Let's find out more about what goes on at the forest floor and understorey. Are you able to identify the factors affecting the rate of decomposition?

Characteristics of Plants at the Various Levels



Rainforest in Singapore. Credit: Straits Times

The following are factors that affect the rate of decomposition at the forest floor.

Temperature - Higher temperatures speed up the rate of decomposition since enzymes function more effectively at these temperatures. However, denaturation of enzymes will happen if it gets too hot. Around 40°C is the optimum temperature. (Denaturation happens when the molecular structure of a protein is modified by heat, acid, alkali, or UV radiation, such that some of its original properties are destroyed.)

Moisture/ Humidity - Moisture in the soil or air speeds up the rate of decomposition. Microbes need water to grow, so water is essential.

Oxygen - Decomposition is an aerobic (takes in oxygen) process that is highly dependent on oxygen.

Below the canopy, the understory receives very little sunlight since the canopy has blocked out much of it. There are many insects here and smaller trees and shrubs can be found at this layer. Let's look at how plants adapt to survive under shade at the understory.

What Colour Do You See?

The chlorophyll needed for photosynthesis is hidden within the leaf colour. Plant leaves have three primary types of pigments - chlorophyll, carotenoids and anthocyanins. Chlorophyll absorbs red and blue light from the sun and reflects green light, which explains why leaves appear green. Green light is used least by chlorophyll. When the leaf has a high concentration of chlorophyll relative to other pigments, it appears green to our eyes.

Carotenoids absorb the blue-green and blue light from the sun and reflect yellow or orange light. Carotenoids help chlorophyll in the process of photosynthesis. They are also responsible for giving carrots their colour.

Anthocyanins absorb blue, blue-green and green light. When leaves have high concentrations of anthocyanins compared to other pigments, the leaves appear red or purple to our eyes. Anthocyanins give red apples their colour.

Purple leaves usually have high anthocyanin concentration relative to chlorophyll. Since anthocyanin absorbs green light and reflects red and purple light, the leaves appear purple to our eyes. Chlorophyll is present but masked by the higher concentration of anthocyanins.



Diplazium cordifolium, a plant with leaves of different colours. Credit: Patrick Blanc

We have learnt about the characteristics of plants at the understory and forest floor, as well as the conditions there. Read the instructions given in Activity 2 and work on your answers to test your understanding!

Activity 2 - Stories in the Understorey

Refer to the picture of the Chinese Croton provided below.



Chinese Croton. Credit: Dave's Garden

2a) Observe the Chinese Croton (*Excoecaria cochinchinensis* 'firestorm'). It usually grows under shade. Explain how it adapts to grow under shade by first describing the colour of its leaves and then discussing its adaptation. Pen your ideas in the box provided.



Garden Croton. Credit: Public Domain Pictures

Refer to the picture of the Garden Croton provided above.

(b) Variegated leaves have green and non-green parts due to cell mutation. This results in the lack of chlorophyll in the non-green parts of the leaf. The Garden Croton (*Codiaeum variegatum*) is an example of a plant with variegated leaves. Do you think these parts are able to carry out photosynthesis? Why or why not?



You have now learnt a little more about tropical rainforests. While each rainforest is unique, there are features common in all of them. I look forward to another adventure with you soon. Goodbye!