Growing Up
Sharing and Activity Sheet for Students

Gardens by the Bay Avatar:

- Engineer

Level/ Subject(s):

- Lower Secondary/ Geography

Learning Objectives:

- Understand the concept of vertical gardening
- Appreciate the benefits of vertical gardening in land-scarce Singapore

Hello students! My name is Eric, and I have been working as an engineer at Gardens by the Bay for the last 5 years. Part of my job involves conceptualising and drawing up plans for buildings, systems and structures in the Gardens. Today's sharing will draw inspiration from our iconic structures. These are my favorite ones at the Gardens - the Conservatories and the Supertrees! Let's begin!

What comes to mind when you are asked to describe a garden? Do you think of a garden that is flat on the ground? Have you heard of the term "vertical gardening"?

Did You Know?

Vertical gardening is when plants in a garden are grown on a vertical surface, like a wall, instead of traditional horizontal ground surfaces. Traditional gardeners have done similar things with climbing plants like pumpkins and beans for centuries by building fences.

Vertical gardening takes it one step further by giving non-climbing plants a space on the wall. This type of gardening or farming is particularly valuable in land-scarce Singapore as we need to be creative in the way we use available land spaces. Besides optimising land use in Singapore, vertical farming can operate on minimal manpower.

The idea of vertical gardening is not new, nor was it "invented" by Man. We will now "visit" one of the conservatories, Cloud Forest, to see how vertical gardens can happen in "nature".

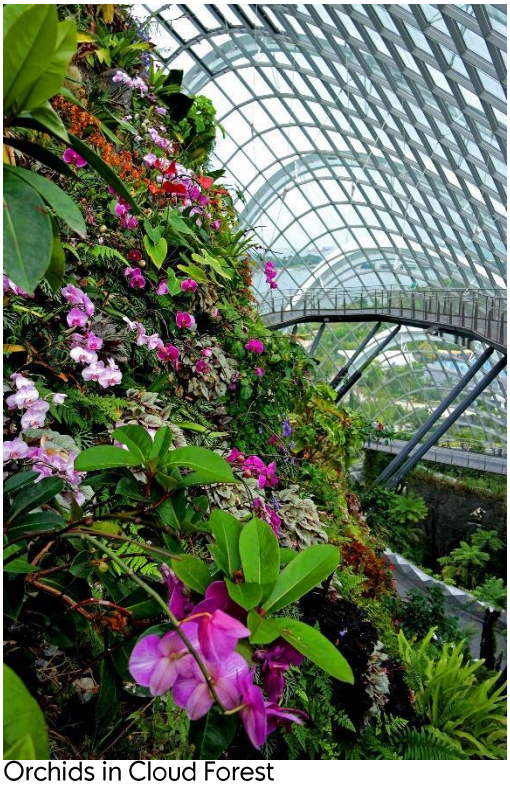
Nature-inspired Vertical Gardens

In nature, cloud forests are evergreen mountain forests that are almost permanently shrouded in clouds. They can be found in tropical and subtropical mountainous areas in Southeast Asia, Tropical America and Africa and they are important for at least two reasons - water and biodiversity.

First is water - Plants of cloud forests capture moisture from the mist and fog and release the water into streams, rivers and waterfalls. The waterfall that you see in this conservatory is about 35 metres high. Cloud forests capture water that would not have fallen to the ground as rain. This additional freshwater makes up about one-fifth of ordinary rainfall.

Second is biodiversity - Biodiversity means that there are many varieties of living things, and many varieties within each species of plants and animals. For example, the orchid is one type of plant but there are also many varieties of orchids. There are many unique and rare species of plants and other creatures living in cloud forests which cannot be found anywhere else in the world. This makes scientists interested as many species have yet to be discovered and studied.

Sadly, global warming might "dry out" cloud forests. This conservatory will help more people know about these important natural resources and also present and preserve a small slice of the variety of plants from cloud forests.



Orchids in Cloud Forest

Refer to the picture of the orchids in Cloud Forest. Orchids are epiphytes - plants that grow on other plants purely for physical support (they are non-parasitic) and often tap on nutrients and moisture from the air around them. As they do not have any ground attachment, they are generally able to grow without soil.

As you can see, plants are able to grow on vertical, and not just horizontal surfaces in nature. We can grow plants in vertical gardens if we can provide the right growing conditions on these surfaces.

It's time for our first activity to find out more about a fascinating fern that grows in Cloud Forest!

Activity 1: Growing Up in Nature

Decode the puzzle to decipher the mystery words within the boxes by completing the passage below. (Hint: Each letter is represented by a corresponding number.)

The Tasmanian _____ (1-3-16-16 15-16-3-7) grows in moist environments and can be occasionally found in cloud forests. It is the most _____ (20-19-26-7-17-20-7-1) tree fern in south-eastern Australia.

Due to overcollection from the _____ (24-12-9-17), the natural _____ (13-20-19-12-1-20-1) of other species of flora and fauna that _____ (18-6-16-23-12-2-1) with this fern has been affected. These include epiphytic ferns and _____ (8-6-2-2-16-2) which use the tree fern for shelter or _____ (7-16-2-1-12-7-14).

1	2	3	4	5	6	7	8	9	10	11	12	13
		R										
14	15	16	17	18	19	20	21	22	23	24	25	26
										W		

Did you manage to solve the puzzle above? Great job!

Next, we shall shift our focus to Supertree Grove to find out more about the Supertrees! Of the 18 Supertrees in Gardens by the Bay, 12 of them can be found here at Supertree Grove, with the tallest one measuring up to 16 storeys in height.

11 Supertrees have canopies embedded with environmentally sustainable functions such as photovoltaic cells to harness energy from the sun for lighting up the Supertrees. Others are integrated with the Cooled Conservatories and serve as air exhaust receptacles.

While these Supertrees are not real trees, each one consists of a trunk core made of reinforced concrete wrapped with a steel frame. Planting panels are installed on the trunks with materials that depict the natural conditions of the epiphytic plants in their natural habitat.

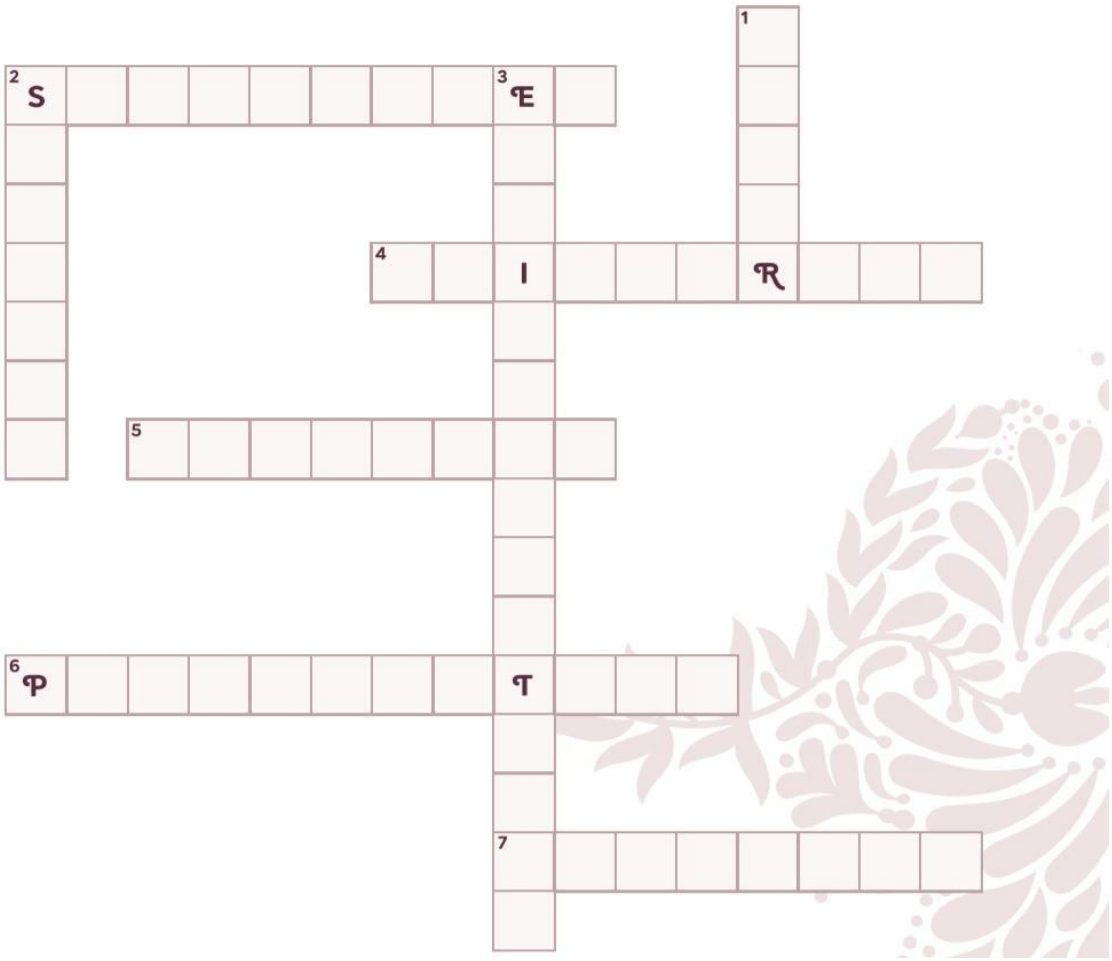
This is done by using tree bark and other organic material like coconut coir as growth media for the plants. Let's look at the next activity to find out how much you know about the Supertrees!

Planting panels on the Supertrees

Activity 2: "Growing Up" at Gardens by the Bay

Complete the crossword puzzle below to find out more about the Supertrees.

The _____ (2, across) are inspired by the _____ (5, across) trees of the _____ (4, across). At Gardens by the Bay, the trees are between 25 and 50 metres tall, which is 9 to 16 _____ (2, down) high! There are_____ (6, across) cells at the crown of selected Supertrees to harness _____ (1, down) energy for _____ (7, across) the Supertrees. This makes them _____ (3, down) sustainable.



Did you know that vertical gardening with a similar set-up to the Supertrees can be placed on the external walls of buildings, or even in homes? When the conditions in nature for vertical plant growth are replicated, we are theoretically able to grow plants on man-made vertical surfaces as well.

That's right! Vertical gardens are particularly useful for greening land-scarce places like Singapore! We have come to the end of today's sharing. Till our next adventure! See you soon!