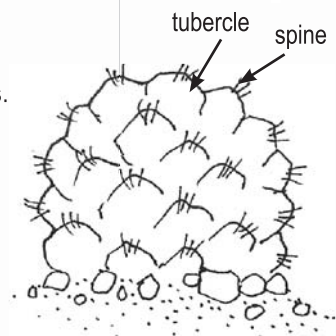
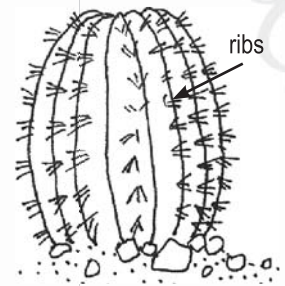


# 15. Living in a 'Desert'

<b>Aim</b>	Students identify characteristics of cacti and other drought-resistant plants which enable them to survive in a hot and dry desert habitat. They also observe the plot for the cacti and drought-resistant plants in the school and evaluate (how well these conditions simulate a desert/dry habitat). They then propagate a cacti or drought-resistant plant from the garden.
<b>Recommended for</b>	Sec 1-3
<b>Subject Links</b>	Science: adaptations and plant reproduction; IT
<b>Horticultural Skills</b>	Cacti and succulents
<b>Process Skills</b>	Observing, measuring and evaluating
<b>Equipment/Materials</b>	Data loggers from school (with temperature and light sensors), pots, soil, gardening tools. Optional: digital camera
<b>Duration</b>	1-3 gardening sessions (1-3 hours)
<b>Preparation</b>	Photocopy the handouts, obtain the materials and book the computer room.
<b>Safety</b>	Remind students to be careful of spines found on the plants.



## Procedure

1. Distribute the handout, explain the activity and briefly run through the main points on the handout.
2. Let students use the computer to do their research.
3. Guide them on propagation methods for cacti and drought-resistant plants – ask expert gardeners for advice etc. Advanced students may even try reproducing the grafted cacti (green succulent cacti with a red cacti at the top)
4. Teams can post pictures of their new cacti on your school blog or the NParks Gardening blog 'Young Gardeners' ([http://www.nparks.gov.sg/blogs/young\\_gardeners/](http://www.nparks.gov.sg/blogs/young_gardeners/)).
5. Extension: encourage students to make suggestions for new cacti and drought-resistant plants to be planted in the school garden. Get them involved in planting and caring for these.
6. Extension: they can sell their new cacti/drought-resistant plants as part of Activity 2 – Home Grown Business.

## Debrief

### § Characteristics common to cacti and drought-tolerant plants (Adaptations for living in a desert):

1. **Swollen green stems** – Their stems have taken over the function of leaves and are the main photosynthetic parts of the plants. Inside the swollen stems are special water storage cells. During the rainy season, the stems swell as water is stored while during the dry months, stems slowly contract as water is used up.
2. **Few or no leaves, presence of spines** - In many cacti, leaves are reduced to spines! This helps the plant to save water by lowering the rate of evaporation (which is highest through leaves). Cacti with spines have an extra protection against plant-eaters (herbivores).

3. **Waxy surface of stems and leaves** – There is a waxy cuticle coating on the upper-most layer of cells. This helps reduce water loss through evaporation.
4. **Ribs or tubercles (areoles)** – Some cacti stems have ‘lumps’ of cacti tissue called tubercles where the spines grow from. Other cacti have ribs. These features allow the stem section to swell or shrink without damaging the tissue on the surface.

§ **Features which may not be apparent:**

5. **Shallow, extensive roots** – these quickly soak up water after a shower of rain. Some cacti have additional deep penetrating roots to reach ground water.
6. **Sunken stomata** – if you cut a cross section of a cactus stem, you can see that the stomata are found in small ‘pits’. These are called ‘sunken stomata’ and they help reduce further loss of water.

§ **Are the conditions at the plot suitable for the cacti and drought-resistant plants in your school garden?**

• **Amount of light measured at your cacti plot**

A cacti plot should be located in an area where it receives maximum sunlight (e.g. not shaded by a building or tree). Hence the light levels you should be recording on a sunny day should be at least 1000 lux and above.

• **Substrate**

Soil should be sandy or rocky (not loamy or clay-based), which drains water off. Well-drained soil prevents cacti from rotting. A raised cacti bed also increases drainage.

• **Temperature**

Temperature is linked to the amount of sunlight the plot receives. This reading is usually 1-2°C higher than that in a shaded area.

• **Water**

Cacti need very little watering.

§ Commend the teams with well-researched and designed guides to cacti and drought-resistant plants.

§ Ask the students to share with the class what they have learnt from this activity. Alternatively, you could ask them to fill in the reflection sheet in Annex 3 and discuss their reflections.



Activity 15

Name : Members of your team : 

## 15. Living in a 'Desert'

### Project Objectives

#### Your Team has to:

- Identify characteristics common to cacti and other drought-resistant plants, which enable them to survive in a hot and dry desert habitat
- Observe soil conditions and take measurements of physical parameters in the plot to evaluate if these plants are receiving suitable conditions for healthy growth
- Select a cacti or drought-resistant plant and propagate (reproduce) it

### Duration of activity

1-3 gardening session/s (1-3 hours)

### Suggested Steps

1. Go to the computer room to do some research on the physical conditions cacti and drought-resistant plants normally live in.
2. Go to the plot for cacti and other drought-resistant plants in your school. Observe the soil conditions and take measurements of the physical parameters at the cacti plot. (page 2 of this handout)
3. Observe the cacti and drought resistant plants and note down key external features which are common to both. Optional: take photographs.
4. From your readings of the physical parameters, evaluate how well your school's plot simulates desert conditions. If there are conditions which are unsuitable, make suggestions to your teacher to change these conditions (e.g. unsuitable soil can be replaced).
5. In your next gardening session, go to the cacti plot and identify the cacti and drought-resistant plants in your school and do research about them (e.g. country of origin, how to propagate them).
6. From your research select a cacti or drought-resistant plant in your plot, and begin propagating your plants.
7. You can post your pictures of your new cacti or drought-resistant plants on your school blog or the NParks Gardening blog 'Young Gardeners' ([http://www.nparks.gov.sg/blogs/young\\_gardeners/](http://www.nparks.gov.sg/blogs/young_gardeners/)).

### Tips!

- Consult your 'gardener' friends or the school gardener for advice on reproducing cacti!
- Visit other cacti gardens (in other parks etc.) to see what physical conditions the cacti and drought resistant plants are given.

### Extension

- Make suggestions to add new cacti or drought-resistant plants to your school garden. Do your part in planting and caring for them.
- Your team can sell your new cacti plants as part of Activity 2 – Home Grown Business.

*Imagine a place where rain does not fall for months! The ground is dry and sandy and the temperatures during the day reach 40°C or more! Not many plants are able to survive in such a habitat! Yet there are some specialists!*

Cacti and drought-tolerant plants are mainly from the plant family *Euphorbiaceae*. These plants are adapted to living and reproducing in arid places! In this activity, we identify their characteristics which enable them to withstand such harsh conditions, as well as evaluate whether those in your school gardens are given suitable physical conditions.

Watch out for the spines on cacti!

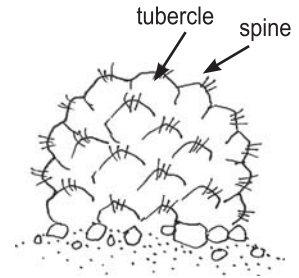
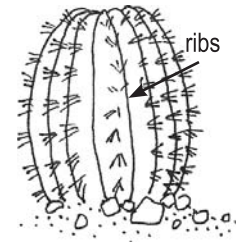
#### Equipment/Materials

- Data loggers from school (with temperature and light sensors)
- Pots
- Soil
- Gardening tools
- Optional: digital camera



Characteristics common to cacti and drought-tolerant plants (Adaptations for living in a desert):

1	
2	
3	
4	
5	



Observe and Record the following Physical Characteristics.

Location of Your Cacti Plot:

Physical Characteristics	Reading/Observation
<p><b>Substrate</b></p> <ul style="list-style-type: none"> <li>Describe the type of soil in the plot</li> </ul>	
<p><b>Temperature</b></p> <ul style="list-style-type: none"> <li>Record the temperature</li> <li>Time of day:</li> <li>Is this temperature reflective of a tropical climate or the conditions in a desert?</li> </ul>	
<p><b>Light levels</b></p> <ul style="list-style-type: none"> <li>Record the light level and weather condition (e.g. sunny, cloudy etc.)</li> <li>Is this amount of light reflective of the conditions in a desert?</li> </ul>	
<p><b>Watering</b></p> <ul style="list-style-type: none"> <li>How much water do cacti and drought-resistant plants need?</li> <li>Are they being over-watered?</li> </ul>	

Conclusions

- From your research and measurement of the physical parameters at your cacti plot, how do the conditions compare with that of a desert?
- Are the conditions at the plot suitable for the cacti and drought-resistant plants in your school garden?
- What recommendations would you suggest to provide optimal conditions.