

# Community In Bloom

SCHOOLS

Gardening Engagement Activities For Students

Primary

**Name of Teacher:**

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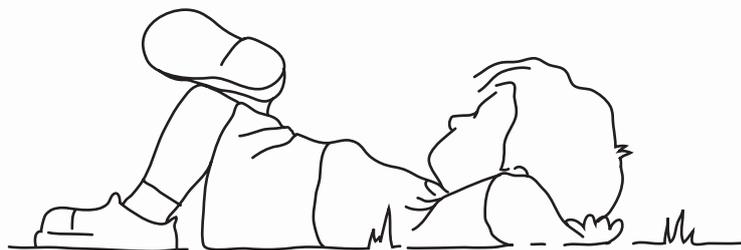
# A Word from NParks

The Community In Bloom Schools Programme aims to promote gardening among schools and helps them develop innovative school gardens that beautify and teach.

To assist schools in this gardening programme, we have developed two teachers' resource books for Primary and Secondary levels. These books contain gardening engaging activities that capture your pupils' attention and interests, value-add to the curricula and encourage self-directed learning. They are specially designed to turn gardening activities (like weeding and pruning) into mini projects, and your school garden into an outdoor classroom, where pupils develop skills like science process skills, project management skills and teamwork.

We hope that you will find these activities useful in awakening your pupils' interests in the life sciences, our local heritage (local fruits, medicinal plants, Asian cuisines) and the environment. We also hope that through these engaging gardening activities, your pupils will grow a love for gardening and be more involved in the school garden.

Wishing you and your pupils many hours of joy and learning as you garden your school!



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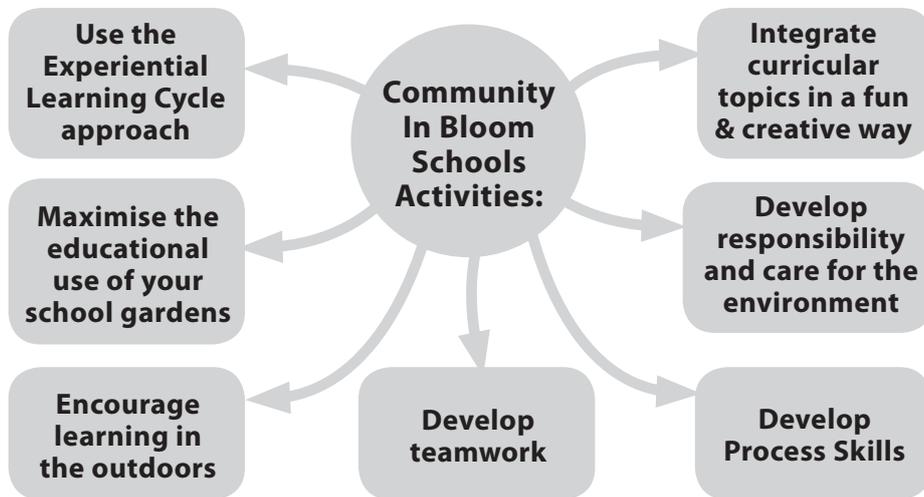
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# The 'Community In Bloom Schools' Programme

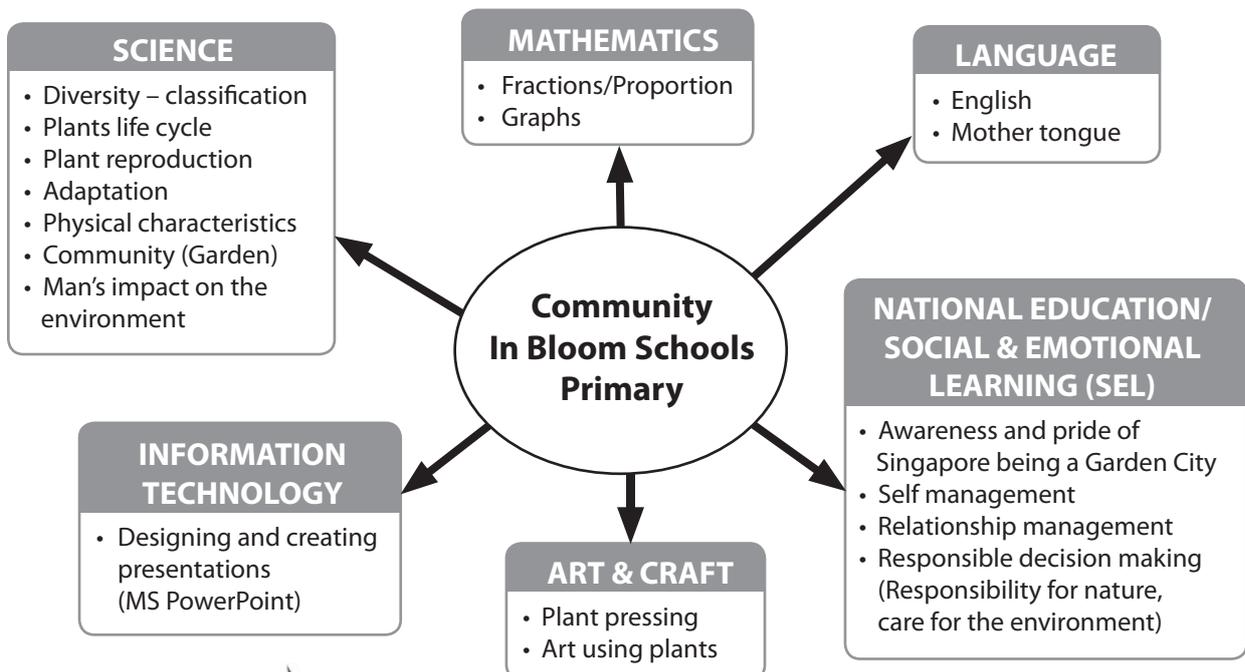
## Aims

1. To help pupils discover science and the natural environment through fun nature, engaging and hands-on gardening activities.
2. To raise awareness of local ornamental plants, fruit trees, medicinal plants, as well as garden animals (insects and pests).
3. To turn the usual gardening activities into mini-projects where pupils can develop their process skills, entrepreneurial skills and creativity.
4. To encourage greater pupil involvement in the school gardens.
5. To provide a direct and relevant means of introducing the 'global dimension' into teaching and learning local and international partnership element within 'Community In Bloom' Programme.

## Highlights

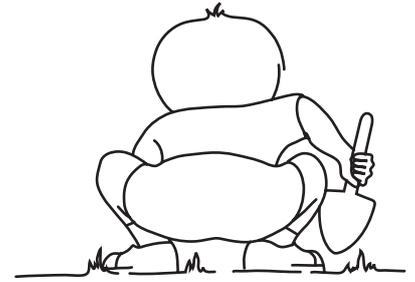


## Subject Links



ABOUT CIB

# How to Start?



1. **Choose activities** that suit your learning objectives and schedule. Use the summary pages on page 6 to 9.
2. **Plan the Scheme of Work** using the Planning Sheet (on page 56).
3. **Read the lesson plan**, make preparations and get the materials.
4. **Rece** (conduct a reconnaissance) the school grounds and decide where is the best place/garden in the school to conduct each activity. Do not select an area too near a road or car park as this is unsafe. The garden should not be too near a classroom as the pupils carrying out the activity might be noisy and affect the pupils in the nearby classroom.
5. **Facilitate/Conduct** the activity. Tips on conducting outdoor lessons can be found on page 4 and 5.
6. **Help pupils Reflect** on their experiences.

# Tips on Conducting Activities



1. **Be aware of safety issues**
  - Have a first-aid kit on hand.
  - Be alert in case pupils get cut, injured, bitten, have asthmatic attacks or allergic reactions from touching plant sap.
  - Weather
    - a. Check the weather forecast before the activity at the NEA website: [www.weather.gov.sg](http://www.weather.gov.sg)
    - b. Postpone or delay the outdoor component of the activity if there is lightning (school siren sounds). If at a park, phone the Lightning Advisory number at 62826821 to check if there is a Category 1 lightning risk in the area.
    - c. If there is haze and it reaches an “unhealthy” level, postpone the activity.
  - Brief pupils about safety. The briefing points are given below.
2. **Conduct a briefing** before the activity, preferably in the classroom where there are fewer distractions and where it is easier for pupils to hear you. Here are 3 areas to brief pupils about:

| Activity  | Expectations  | Safety  |
|---|---|---|
| <ul style="list-style-type: none"> <li>• Introduce the activity - its objectives and outcomes.</li> <li>• Distribute the handout if there are any.</li> <li>• Run through what they have to do and clarify if they do not understand. Go through the questions, if any.</li> <li>• Show pupils how to use the equipment and remind them to take care of these.</li> </ul> | Inform pupils that they are expected: <ul style="list-style-type: none"> <li>• Not to damage plants or hurt animals.</li> <li>• Not to damage school property.</li> <li>• To carry out the activities within the set time and place.</li> <li>• To make as little noise as possible, so as not to disturb classes nearby.</li> <li>• To be responsible for all equipment and clean up the area after the activity.</li> </ul> | Inform pupils that: <ul style="list-style-type: none"> <li>• All outdoor activities will be stopped if the lightning siren sounds (Lightning Category 1).</li> <li>• They should wash their hands thoroughly after every activity.</li> <li>• They need to be careful of potentially “dangerous” animals like fire ants, bees, wasps, centipedes and keep away from them.</li> <li>• They need to tell the teacher immediately if they have been injured, cut, bitten, have rashes on the skin or have any other medical condition.</li> <li>• Be careful of plants with thorns or white sap (may cause irritation to the skin).</li> </ul> |

3. **Decide if you would like pupils to work individually or as a team**

We have made recommendations for each activity whether individual work or team work is more suitable. If pupils are working in teams, you can have 3 -5 members in each team and assign a leader and assistant leader.

4. **Create a photo journal**

Have a digital camera with you, or ask a photographer to join the group, to photograph pupils carrying out the activities, their projects, your school garden, interesting plants and animals etc. Make a slideshow to showcase these photos to the school.

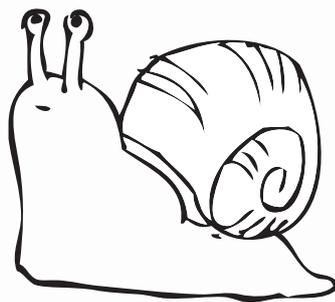
5. **Debrief to drive home learning**

The debrief is important in ensuring that the learning objectives/outcomes take place. Set aside at least 20 min at the end of each activity or the next day for debrief:

- Go through the answers for given questions.
- Ask more questions to spur them to think further.
- Commend pupils for their effort in being creative and completing their projects.
- Ask pupils to share their experiences, opinions and feelings.
- Explain more concepts about the topics covered. For older or more advanced pupils, you could ask them to "teach" the class about they had researched on or found out.
- Discuss the teamwork of their group and how they can improve this further.

6. **Have a conclusion and an extension activity**

Conclude each activity by summarising the main points learnt by pupils (content, SEL etc.). Decide on whether you would like to have an extension activity to continue with the topic/ theme of the current activity. We have included suggested extension activities in the summary table and lesson plans.



# Summary of CIB Schools Activities

| NO  | ACTIVITY TITLE / DURATION                   | RECOMMENDED FOR:   | THE ACTIVITY  | SUBJECT LINKS / PROCESS SKILLS   | SUGGESTED EXTENSION ACTIVITY   |
|---|---|--|---|--|--|
| <p><b>Getting to Know My Garden</b></p> <p><i>Pupils may visit the school garden occasionally or walk past landscaped areas of the school every day, yet not take notice of the plants in school or the animals they support! These activities help "open" pupils' eyes to the variety of life in the gardens and the natural elements in nature, like soil, rocks etc. Mapping the garden helps pupils become familiar with your school garden/s and even grow attached to them!</i></p> |   |  |   |  |  |
| 1   | <b>What's Alive in my Garden?</b><br>1 hour | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Teamwork</li> </ul>                    | Pupils identify the living and non-living components of a garden.   | Science, SEL<br>Observing, classifying                                 | <ul style="list-style-type: none"> <li>Activity 2 Plant Galore.</li> <li>Activity 3 Who Lives Here?</li> </ul>   |
| 2   | <b>Plant Galore</b><br>1 hour               | <ul style="list-style-type: none"> <li>Upper &amp; Lower Primary</li> <li>Individual work</li> </ul> | Pupils go on a plant scavenger hunt and become aware of the large variety of plants (shapes, colours and sizes) in Singapore. | Science, Language<br>Observing, comparing                              | <ul style="list-style-type: none"> <li>Art – splatter leaf print.</li> <li>Activity 5 Plant Life Cycle.</li> <li>Activity 6 Grow Some Plants.</li> <li>Activity 9 Nature Bookmarks.</li> </ul> |
| 3   | <b>Who Lives Here?</b><br>1 hour            | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work/ teamwork</li> </ul>   | Pupils spot garden animals in the school and classify them in various ways.   | Science, SEL<br>Observing, classifying                                 | <ul style="list-style-type: none"> <li>Activity 8 Pest Potion.</li> <li>Activity 13 Butterfly Haven.</li> </ul>  |
| 4   | <b>My Garden Map</b><br>1-2 hours           | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Teamwork</li> </ul>                    | Pupils measure and draw a scaled map of a garden in the school.   | Maths, Science, Art<br>Observing, measuring, communicating, generating | <ul style="list-style-type: none"> <li>Art and craft – model of a garden.</li> <li>Pupils digitise their map.</li> </ul>   |

| NO  | ACTIVITY TITLE / DURATION   | RECOMMENDED FOR:   | THE ACTIVITY  | SUBJECT LINKS / PROCESS SKILLS                                | SUGGESTED EXTENSION ACTIVITY   |
|---|---|--|---|---|--|
| <p><b>Fun With Plants</b></p> <p><i>Plants are fascinating! Yet many people are not aware of these natural secrets! These activities help pupils practise their process skills and take notice of plants in a new way. They also lend creativity to the way some Science curriculum topics (e.g. life cycle) can be learnt. Some creative plant-care activities (like weeding and pest removal) have also been included, for pupils to become more responsible for plants around them and become more involved in the school gardens.</i></p> |   |  |   |   |  |
| 5   | <p><b>Plant Life-cycle Hunt</b><br/>1-1.5 hours</p>                               | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Individual work/ teamwork</li> </ul> | <p>Pupils spot the different stages of flowering plants in the school garden and make a plant life cycle poster</p>   | <p>Science<br/>Observing</p>                                  | <ul style="list-style-type: none"> <li>Have pupils act out the life cycle of a plant.</li> <li>Activity 6 Grow Some Plants.</li> </ul>   |
| 6   | <p><b>Grow Some Plants</b><br/>2 sessions (3 weeks apart);<br/>1-2 hours each</p> | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Individual work</li> </ul>           | <p>Pupils plant seeds and stem-cutting to learn more about plant reproduction. Pupils monitor the growth of these new plants to understand what plants need for a healthy growth.</p> | <p>Science<br/>Observing, comparing, measuring, analysing</p> | <ul style="list-style-type: none"> <li>Continue to Care for Plants.</li> </ul>   |
| 7   | <p><b>Wildflower or Weeds?</b><br/>1 hour</p>                                     | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Individual work</li> </ul>           | <p>Pupils help maintain the school garden by weeding and in the process learn about wildflowers (weed plants).</p>  | <p>Science<br/>Observing, comparing</p>                       | <ul style="list-style-type: none"> <li>Pupils compost weeds.</li> <li>Activity 9 Nature Bookmarks.</li> </ul>                            |
| 8   | <p><b>Pest Potion</b><br/>1-2 hours</p>   | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work/ teamwork</li> </ul> | <p>Pupils search for garden pests in the school garden and help to remove them through environmentally-friendly methods.</p>  | <p>Science<br/>Observing, classifying</p>                     | <ul style="list-style-type: none"> <li>Evaluate the effectiveness of the pupil's spray and do research to improve the recipe.</li> </ul> |

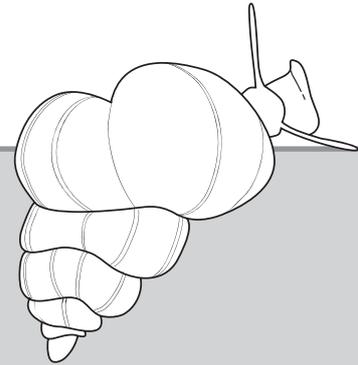
| NO  | ACTIVITY TITLE / DURATION   | RECOMMENDED FOR:   | THE ACTIVITY   | SUBJECT LINKS / PROCESS SKILLS  | SUGGESTED EXTENSION ACTIVITY  |
|---|---|--|--|---|---|
| <p><b>From the Garden</b></p> <p><i>Through these activities, pupils quickly see how plants provide people with many products – beautiful designs which can be made into craft, food, materials, spices for our food and even fragrances!</i></p> |   |  |  |   |   |
| 9   | <p><b>Nature Bookmarks</b><br/>2 sessions (1-2 weeks apart);<br/>1-2 hours each</p> | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work</li> </ul>           | <p>Pupils learn to appreciate the designs in plants and create plant bookmarks.</p>  | <p>Science, Art and Craft<br/>Observing</p>                                       | <ul style="list-style-type: none"> <li>Bookmarks can be given as gifts or used to raise funds for a needy cause.</li> </ul> |
| 10  | <p><b>Useful Plants</b><br/>1-1.5 hours</p>   | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work/ teamwork</li> </ul> | <p>Pupils identify plants in the school garden which are useful to people. They become more aware of which parts of the plants are used and how they are used.</p>   | <p>Science, Social studies, IT<br/>Observing, classifying, generating</p>         | <ul style="list-style-type: none"> <li>Make plant signs for useful plants in school.</li> </ul>                             |
| 11  | <p><b>Spice Up My Food</b><br/>1 hour</p>   | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Individual work/ teamwork</li> </ul> | <p>Pupils identify specific herbs and spices that are important as ingredients in some Asian cuisine. They then select a herb or spice in the garden and write a story about a chef using these food plants.</p> | <p>English, Social Studies, Science<br/>Observing, classifying, communicating</p> | <ul style="list-style-type: none"> <li>Pupils make a spice and herb poster.</li> </ul>                                      |
| 12  | <p><b>Fragrant Plants</b><br/>1-2 hours</p>   | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work</li> </ul>           | <p>Pupils learn about fragrant plants (in school) and discuss the benefits of this adaptation in plants. Pupils then make a potpourri.</p>   | <p>Social Studies, Science<br/>Observing, generating</p>                          | <ul style="list-style-type: none"> <li>Pupils make labels for their potpourri.</li> </ul>                                   |

| NO   | ACTIVITY TITLE / DURATION                     | RECOMMENDED FOR:   | THE ACTIVITY  | SUBJECT LINKS / PROCESS SKILLS                           | SUGGESTED EXTENSION ACTIVITY   |
|--|---|--|---|--|--|
| <p><b>Special Gardens</b></p> <p><i>Many schools have garden plots which attract butterflies, showcase local fruits and/or simulate a desert habitat. Here are some suggested activities to be carried out in these gardens if your school has these garden plots.</i></p> |   |  |   |  |  |
| 13   | <p><b>Butterfly Haven</b><br/>3 hours</p>     | <ul style="list-style-type: none"> <li>Lower Primary</li> <li>Individual work</li> </ul>           | <p>Pupils go on a fieldtrip to HortPark to identify and observe local butterflies and the stages of their life cycles.</p>  | <p>Science, IT<br/>Observing, classifying, comparing</p> | <ul style="list-style-type: none"> <li>Pupils study the butterflies in the school grounds.</li> </ul>  |
| 14   | <p><b>My School Orchard</b><br/>1-2 hours</p> | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work</li> </ul>           | <p>Pupils observe and identify different types of local fruit trees. They dissect some fruits to learn more about these.</p>  | <p>Science<br/>Observing</p>                             | <ul style="list-style-type: none"> <li>Pupils create educational signs for the fruit trees in school.</li> <li>Pupils plant more fruit trees in school.</li> </ul>   |
| 15   | <p><b>Desert Life</b><br/>1-1.5 hours</p>     | <ul style="list-style-type: none"> <li>Upper Primary</li> <li>Individual work/ teamwork</li> </ul> | <p>Pupils observe cacti and succulent plants in a "desert" plot to note their common characteristics. They measure the physical conditions of the "desert plot" to learn what is suitable for these plants.</p> | <p>Science<br/>Observing, measuring analysing</p>        | <ul style="list-style-type: none"> <li>Field trip: Bring pupils to visit parks with desert gardens e.g. Singapore Botanic Garden (Sun Garden, Evolution Garden), Jacob Ballas Garden etc.</li> <li>Care for the school's "Desert Garden".</li> </ul> |

# 1. WHAT'S ALIVE IN MY GARDEN?

## Outcome

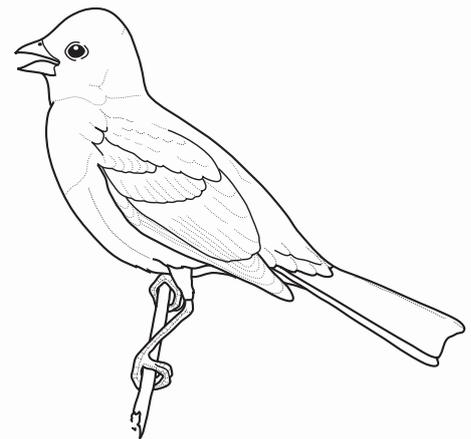
Pupils identify the living and non-living components of a garden.



|                                 |  |
|---------------------------------|--|
| <b>Duration</b>                 | 1 hour   |
| <b>Recommended for</b>          | Lower Primary; teamwork  |
| <b>Subject Links</b>            | Science, SEL   |
| <b>Process Skills</b>           | Observing, classifying   |
| <b>Equipment/<br/>Materials</b> | Optional: Singapore Science Centre Guide Book: A Guide to Common Garden Animals, A Guide to Common Butterflies of Singapore. |
| <b>Preparation</b>              | Photocopy Handout 1 (one per team)   |

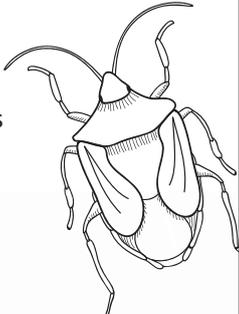
## How to Conduct?

1. Assign pupils into teams.
2. Explain that any environment, e.g. a garden, has both living and non-living components.
3. Explain the activity: Pupils will go to the school garden to
  - Identify living things. They can refer to these guide books to identify the animals - A Guide to Common Garden Animals , A Guide to Common Butterflies of Singapore (Singapore Science Centre Guide Book).
  - Identify non-living things (garden structures, soil etc.).
4. Distribute the handout and bring the class to the garden/school grounds.
5. After the activity, return to class to debrief.



## Debrief

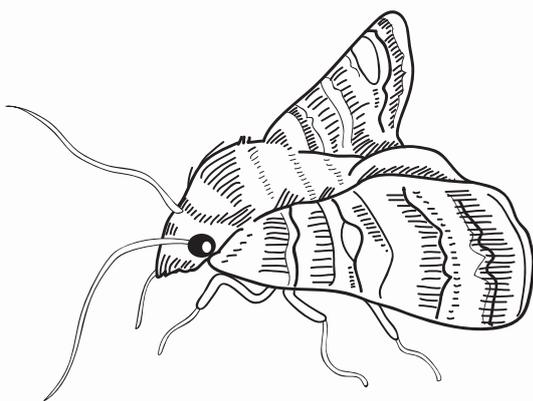
- List the living things found in a school garden on the whiteboard. You could refer to A Guide to Common Butterflies of Singapore, A Guide to Common Garden Animals (Singapore Science Centre Guide Book). Here are possible answers:

| Living Things  | Non-living Things  |
|--|--|
| <p><b>Plants</b><br/>Including trees, weeds, cacti, Introduce the common plants to the pupils e.g. Bougainvillea, mango tree, etc.</p> <p><b>Animals</b><br/>Bees, butterflies, ants, wasps, dragonflies, grasshoppers, crickets, beetles, spiders, millipedes, centipedes, woodlice, cockroach, beetles, moths, snail, slugs, earthworm, garden lizards, changeable lizard, blind snake (non-venomous garden snake), Mynahs, Peaceful Doves, Eurasian Sparrow, Crows, Black-naped Oriole, Bulbuls, etc.</p> | <ul style="list-style-type: none"> <li>• Slabs for paths</li> <li>• Flower beds</li> <li>• Garden furniture</li> <li>• Bridges</li> <li>• Water features like ponds</li> <li>• Signs</li> <li>• Fence</li> <li>• Green house</li> <li>• Hydroponics enclosure</li> </ul>  |

- Ask pupils to describe what the animals were doing.** E.g. bees and butterflies visiting flowers to collect nectar; insects are often found under leaves, taking shelter from the sun and hiding from predators like birds, birds hunting for food, etc.
- Ask pupils why everyone should care for nature. (Nature takes care for us, gives us food, water and air. All the plants and animals are somehow connected to us. If we harm them, it will affect our environment and somehow affect our food, water and air. We should not damage, hurt or kill living things.)

## Suggested Extension Activities

- Activity 2 Plant Galore
- Activity 3 Who Lives Here?



# Pupil's Handout

1

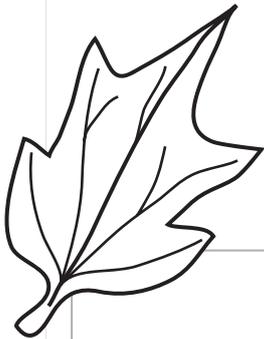
Name :

Members of your team :

## WHAT'S ALIVE IN MY GARDEN?

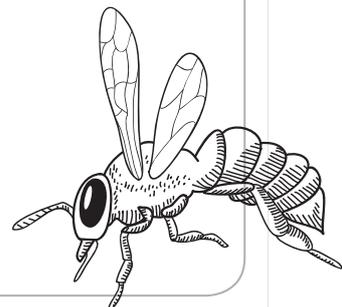
What are the **living things** and **non-living things** in your school garden? Write them in the boxes below:

### THINGS IN THE SCHOOL GARDEN



Living Things

Non Living Things



HANDOUT 1

## 2. PLANTS GALORE

### Outcome

Pupils go on a plant scavenger hunt and become aware of the large variety of plants (shapes, colours and sizes) in Singapore.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1 hour  |
| <b>Recommended for</b>          | Upper & Lower Primary; individual work                              |
| <b>Subject Links</b>            | Science, Language   |
| <b>Process Skills</b>           | Observing, comparing  |
| <b>Equipment/<br/>Materials</b> | None  |
| <b>Preparation</b>              | Photocopy Handout 2a (Lower Primary) and Handout 2b (Upper Primary) |



### How to Conduct?

1. Explain that there is a large variety of plants in Singapore and other tropical lands. Ask pupils if they can name a few (answer depends on what you have in school).
2. How do plants differ? (Plants differ in their sizes, shapes, colours of leaves, barks, flowers, fruits etc.)
3. Lower primary: Distribute Handout 2a and explain that you will bring pupils to different parts of the school garden and they are to look for and record flowers and leaves of the given colours. They also have to spot plants which are described on the handout.
4. Upper primary: Distribute Handout 2b:
  - Explain that you will bring pupils to different parts of the school garden and they are to spot as many colours of plants as they can and record the parts which are coloured. E.g. they see a red flower and record the colour 'red' under the second column and 'flower' under the third column.
  - As they walk with you around the garden, they also have to spot plants which are described on their handout.
  - Explain the differences between a tree and a bush/shrub. A tree is tall – usually more than 3m; and has one or two main stems. A bush/shrub does not grow taller than 2m and often has many branches.
  - Run through the types of plants they have to find.
5. Bring pupils to the school garden/planted area and start the activity.
6. After the activity, get pupils to wash their hands and then return to class for a debrief.

### Debrief

#### For Lower Block Primary 1-3 Colour Hunt

1. Summarise which coloured flowers and leaves were found (and not found) by the teams.

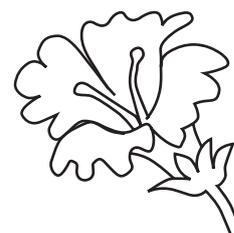


## 2. Suggested questions:

What colours are common in nature? (Green, brown, red, orange, pink, purple, white, yellow)

Which colours are rare? (Blue, purple)

3. Ask a few pupils to draw and describe leaves they had observed e.g. on the whiteboard. Summarise that leaves come in all shapes and sizes. Each plant has a particular shape of leaves and this is one of the ways we can identify plants.

**For Upper Block Primary 4-6**

1. Summarise what was found (and not found) by teams. Here are suggested answers:

| No. | Colour | Which part of the plant has this colour?  |
|-----|--------|---|
| 1   | Green  | Mostly leaves<br>Whole plant - mosses, ferns etc.<br>Only a few plants have green stems |
| 2   | Red    | Flowers e.g. Canna, Hibiscus, Bougainvillea<br>Leaves e.g. <i>Cordyline</i>             |
| 3   | Orange | Flowers e.g. Honey Suckle, Bougainvillea<br>Fallen leaves                               |
| 4   | White  | Flowers e.g. Spider Lily  |
| 5   | Pink   | Flowers e.g. Balsam, Star Fruit, Bougainvillea  |
| 6   | Yellow | Flowers e.g. Allamanda<br>Fallen leaves<br>Pollen of many flowers                       |
| 7   | Blue   | Flowers e.g. Butterfly Pea  |
| 8   | Purple | Flowers e.g. Bougainvillea  |

2. Summarise which colours are commonly found in nature - green, brown, red, orange, pink, white, yellow. Some colours are rare in nature (blue and purple).

## 3. Suggested questions:

- What causes the red colouration in leaves or flowers? (Red pigments in the leaves)
- Do red leaves have chlorophyll? (Yes, but these are usually below or masked by the red pigments, so we cannot see the green. Red pigments cannot carry out the full process of photosynthesis, but assist chlorophyll to carry out photosynthesis.)
- Ask pupils/teams to tell the class which plants they found interesting.

For both levels, conclude that:

- There is a large variety of plants in Singapore.
- Leaves and flowers can be found in many shapes and colours and these help us to identify them.

**Suggested Extension Activities**

- Activity 5 Plant Life Cycle
- Activity 6 Grow Some Plants
- Activity 9 Nature Bookmarks





**2a**

Name :

Members of your team :

**PLANTS GALORE**

**Colour Hunt**

Look for the coloured leaves and flowers in your school garden.

| Leaves or flowers which are: | Tick those that you have observed: |
|------------------------------|------------------------------------|
| Green                        |                                    |
| Orange                       |                                    |
| Pink                         |                                    |
| Red                          |                                    |
| White                        |                                    |
| Yellow                       |                                    |
| Purple                       |                                    |
| Blue                         |                                    |
| Any other colour: _____      |                                    |

**The Shapes of Leaves**

Look for different leaves on the ground (do not pluck from a plant or a tree).



**HANDOUT 2a**



Name :

**2b**

Members of your team :

**PLANTS GALORE**

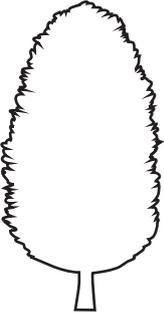
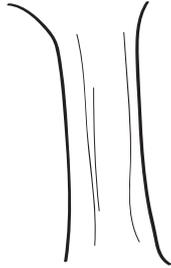
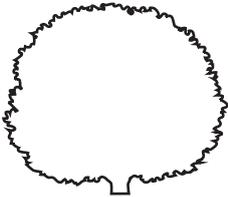
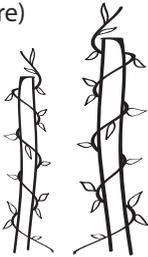
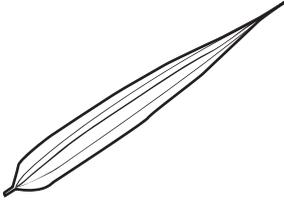
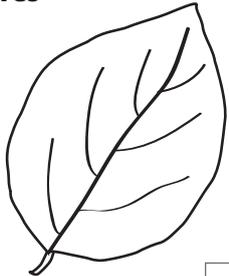
**Colour Hunt**

Find these colours among the plants. (e.g. red is found, the flowers are coloured red.)

| No. | Colour | Which part of the plant has this colour? |
|-----|--------|--|
| 1   |        |  |
| 2   |        |  |
| 3   |        |  |
| 4   |        |  |
| 5   |        |  |
| 6   |        |  |
| 7   |        |  |
| 8   |        |  |

**Plant Hunt**

Look for different types of plants and tick the boxes below:

|   |   |   |  |
|---|---|---|--|
| <p><b>A Tree with this shape</b></p>  <input type="checkbox"/>   | <p><b>A Tree with smooth bark</b></p>  <input type="checkbox"/>  | <p><b>A Palm</b><br/>(A woody, unbranched, trunk with feather or fan-shaped leaves growing in a bunch at the top)</p>  <input type="checkbox"/> | <p><b>A fern</b><br/>(A flowerless, seedless plant which reproduce by spores)</p>  <input type="checkbox"/> |
| <p><b>A shrub/bush</b><br/>(Hint: It never grows as tall as a tree - less than 3m and has many branches)</p>  <input type="checkbox"/> | <p><b>A climber</b><br/>(Hint: It has weak stems and climbs on a fence or structure)</p>  <input type="checkbox"/> | <p><b>A plant with linear leaves</b></p>  <input type="checkbox"/>  | <p><b>A plant with oval leaves</b></p>  <input type="checkbox"/>  |

HANDOUT 2b

## 3. WHO LIVES HERE?

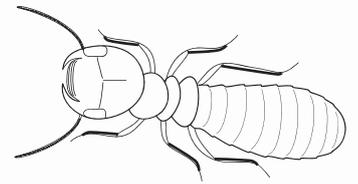
### Outcome

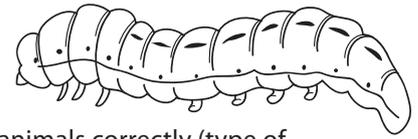
Pupils spot garden animals in the school and classify them in various ways.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1 hour  |
| <b>Recommended for</b>          | Upper & Lower Primary; individual work/teamwork   |
| <b>Subject Links</b>            | Science, SEL  |
| <b>Process Skills</b>           | Observing, classifying  |
| <b>Equipment/<br/>Materials</b> | A few pairs of magnifying glass.<br>Optional: A Guide to Common Garden Animals (Singapore Science Centre Guide Book), digital camera. |
| <b>Preparation</b>              | Photocopy Handout 3. Plan a route which you will take your pupils through.  |

### How to Conduct?

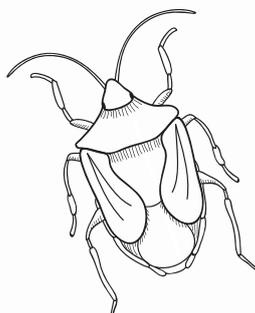
- Assign pupils into teams if you prefer this to be a team activity.
- Explain how the garden is a habitat, with its community of living things that interact with one another and the physical environment (soil, water and air).
- Explain that some animals are beneficial to plants, while others harm and damage plants.
  - Explain how some animals are beneficial to the garden:
    - Eat pest/insects e.g. spiders, lizards and birds
    - Pollinate flowers e.g. bees, sunbirds and butterflies
    - Help disperse seeds e.g. birds and bats
    - Help loosen soil and improve soil quality and drainage e.g. earthworms
    - Help breakdown dead plant material e.g. woodlice, termites
  - Explain what garden pests do. Pests harm the plants:
    - By eating the leaves of plants e.g. grasshoppers, caterpillars, bagworms, garden snails etc.
    - By sucking plant sap, e.g. leaf hopper, mealy bugs, scale insects.
- Distribute Handout 3 and explain what they have to do, as stated on the handout:
  - Spot garden animals in your school.
  - Record the name and type of animal.
  - Decide if they are beneficial or harmful to garden plants and tick the box (Optional: take a photo of the animals).
- Bring the class to the school grounds. Lead them through a few gardens/locations in school and let them record animals on the way.
- Return to class to debrief the activity after your class has completed the route.





## Debrief

- List all the animals that pupils spotted. Check that they have classified the animals correctly (type of animal or whether they are beneficial or harmful to plants).
- The suggested answers are given here:

| Beneficial Animals  | Harmful animals (Garden pests)  |
|---|---|
| <p><b>Animals that eat dead or decaying animals/ cleans up the garden:</b><br/>                     Garden cockroach (insect)<br/>                     Ant (insect)</p> <p><b>Animals which pollinate flowers:</b><br/>                     Bee (insect)<br/>                     Sun bird (bird)<br/>                     Butterfly or moth (insect)*</p> <p><b>Animals that eat pests</b><br/>                     Wasp (insect)<br/>                     Dragonfly (insect)<br/>                     Spider (arthropod)<br/>                     Centipede (arthropod)<br/>                     Asian toad (amphibian)<br/>                     Banded bullfrog (amphibian)<br/>                     Changeable lizard (reptile)<br/>                     Garden lizard (reptile)<br/>                     Mynah (bird)<br/>                     Sparrow (bird)</p> <p><b>Animals that improve soil</b><br/>                     Earthworm<br/>                     Woodlice</p> <p><b>Animals that help break down decaying wood:</b><br/>                     Termite (insect)<br/>                     Woodlice</p> | <p><b>Animals that suck sap:</b><br/>                     Aphids (insect)<br/>                     Scale insects (insect)<br/>                     Mealy bugs (insect)<br/>                     Leaf hoppers (insect)</p> <p><b>Animals that eat leaves:</b><br/>                     Grasshoppers (insect)<br/>                     Bagworms (insect)<br/>                     Land snails (mollusc)<br/>                     Slugs (mollusc)<br/>                     Caterpillars of butterflies (insect)*</p>  |
| <p><i>*Note that Butterflies, moths and their caterpillars are both beneficial and harmful.</i></p>   |   |

- Suggested Question: Are there many animals that live in their school? If there are, then we say that "biodiversity is high".

## Suggested Extension Activities

- Activity 8 Pest Potion
- Activity 13 Butterfly Haven





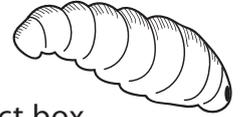
**3**

Members of your team :

Name :

**WHO LIVES HERE?**

1. Spot garden animals in your school.
2. Record the name and type of animal.
3. Decide if they are beneficial or harmful to garden plants and tick the correct box.



| No. | Animal I Spotted | Type of animal<br><i>(e.g. insect, mollusk, amphibian, reptile, bird, fish, etc.)</i> | Tick below:          |                   |
|-----|------------------|---|----------------------|-------------------|
|     |                  |   | Beneficial To Plants | Harmful To Plants |
| 1.  | e.g. Earthworm   | worm  | ✓                    |                   |
| 2.  |                  |   |                      |                   |
| 3.  |                  |   |                      |                   |
| 4.  |                  |   |                      |                   |
| 5.  |                  |   |                      |                   |
| 6.  |                  |   |                      |                   |
| 7.  |                  |   |                      |                   |
| 8.  |                  |   |                      |                   |
| 9.  |                  |   |                      |                   |
| 10. |                  |   |                      |                   |
| 11. |                  |   |                      |                   |
| 12. |                  |   |                      |                   |
| 13. |                  |   |                      |                   |

**HANDOUT 3**

## 4. MY GARDEN MAP

### Outcome

Pupils measure and draw a scaled map of a garden in the school.

|                             |   |
|-----------------------------|---|
| <b>Duration</b>             | 1-2 hours   |
| <b>Recommended for</b>      | Upper Primary; teamwork   |
| <b>Subject Links</b>        | Maths, Science, Art   |
| <b>Process Skills</b>       | Observing, measuring, communicating, generating   |
| <b>Equipment/ Materials</b> | Measuring tapes, at least one compass, paper/drawing block, pencils, rulers   |
| <b>Preparation</b>          | Conduct a reconnaissance in school and select a school garden or section of it suitable for this activity and your pupils' ability. |

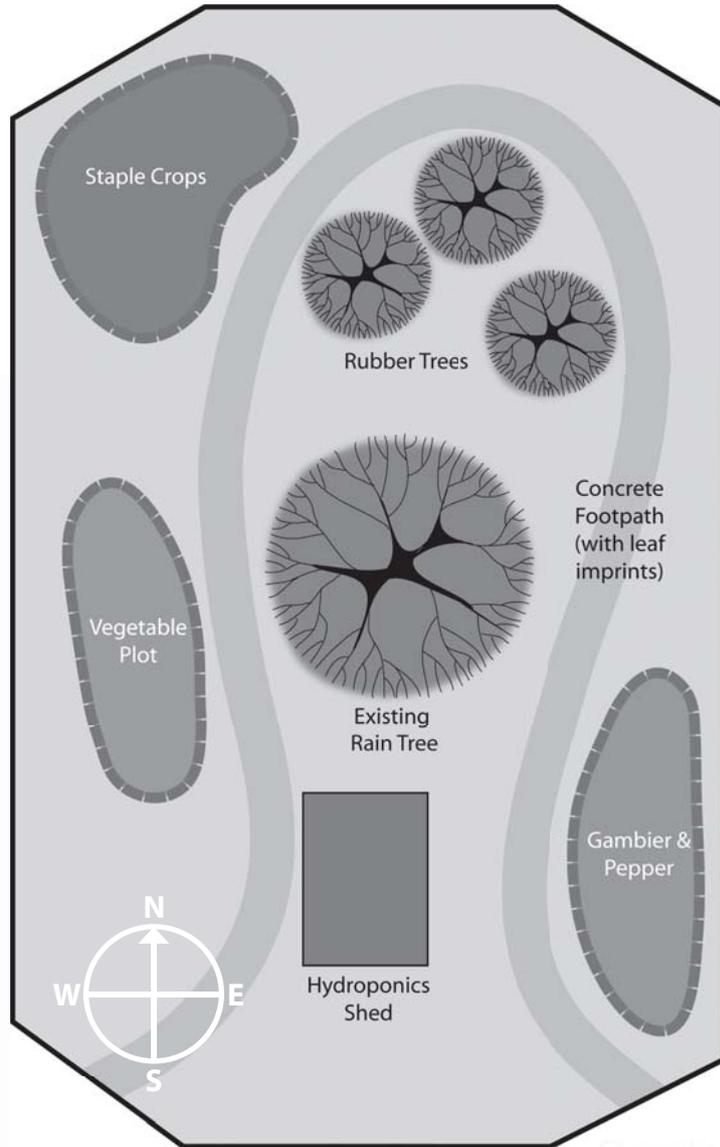
### How to Conduct?

1. Assign pupils into teams.
2. Ask pupils what a map is for (to show the main features of a place, or help a person find his/her way).
3. Explain the activity – pupils work in teams to draw a map of an existing school's garden or a section of a garden.
  - Their maps should include all the features in the garden, trees and planted areas (e.g. shape of flower beds.) and a compass rose to show where the North direction is.
  - Their maps should be to scale. They will need to take measurements of the garden and its features, then draw the parts in proportion (e.g. 1 cm on the map represents 1 m of the garden).
4. Bring pupils to the selected garden. Explain (and if needed, demonstrate) how pupils can carry out their map drawing:
  - Identify the shape of the garden – ensure the drawing has the same shape.
  - Identify all the main features in the garden and draw them into the map. You can include a legend as well.
  - Use a compass to find the North direction.
  - Show upper primary pupils how to draw in scale (measure the feature and calculate its distance on a map).
5. Debrief the activity.

### Debrief

1. Suggested questions for discussion
  - What else can the garden maps be used for? (To redesign the garden.)
  - Why is it important to include a compass rose in the map? (To show where the North direction is. This allows the garden map to be compared to maps of the area/ town. It also tells us the angle of the sun and the amount of sunlight falling on different parts of the garden. Knowing this can help us to better select plants suitable for the conditions in different parts of the garden.)

2. Ask pupils what they have learnt through this activity. Alternatively, you could ask them to fill in the reflection sheet in Annex 3 and discuss their reflections.



## Suggested Extension Activities

- An Art and Craft activity where pupils make a model of the garden.
- Pupils digitise their map - After drawing a map on paper, pupils may use a computer programme (e.g. MS Word) to draw a digital one.

## 5. PLANT LIFE-CYCLE HUNT

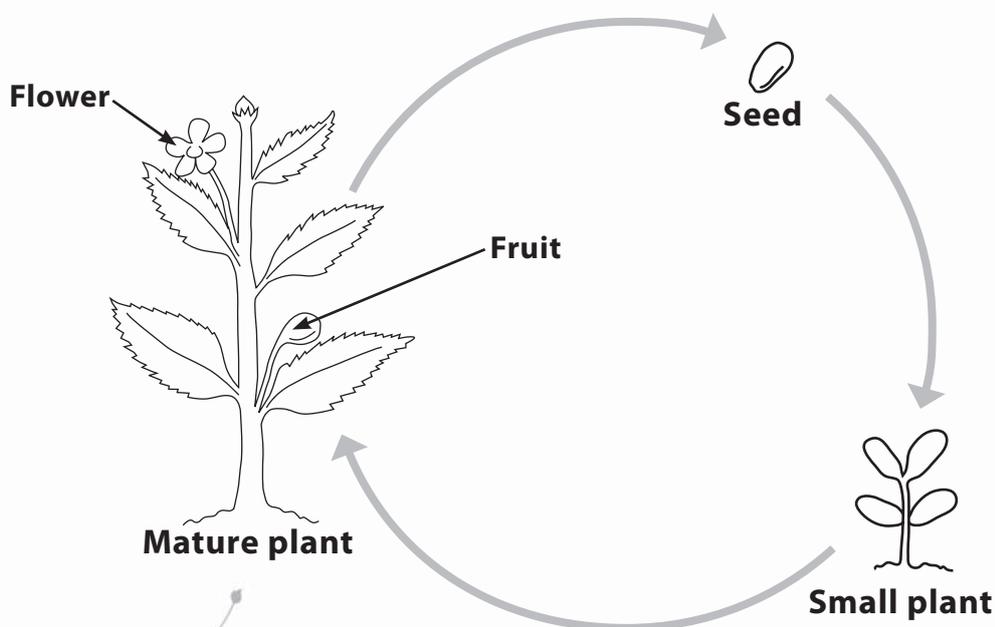
### Outcome

Pupils spot the different stages of flowering plants in the school garden and make a plant life cycle poster.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1-1.5 hours   |
| <b>Recommended for</b>          | Lower Primary; individual work/teamwork   |
| <b>Subject Links</b>            | Science   |
| <b>Process Skills</b>           | Observing, generating   |
| <b>Equipment/<br/>Materials</b> | Drawing block paper, markers/colouring pencil.<br>Optional: digital cameras, blue-tack.   |
| <b>Preparation</b>              | Conduct a simple reconnaissance in the school garden to see if the plants are flowering and fruiting, to ensure that pupils can find all the main stages at the time you are conducting this activity. Some plants flower and fruit all year round, whereas larger plants and trees tend to fruit about 1-2 times each year. Plan a route you take your pupils through. |

### How to Conduct?

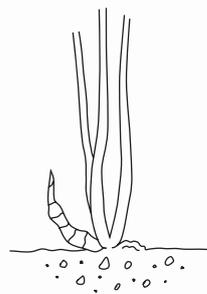
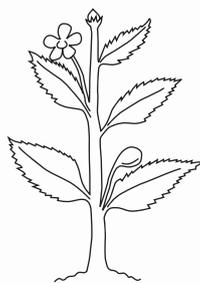
1. Introduce or recap the main stages of the life cycle of a flowering plant: (You could get pupils to role-play – ask pupils to be seeds, growing into small plants and then into adult plants. They can hold props which represent the flowers, which are exchanged for fruits!)



2. Explain the activity
  - You will bring pupils to the school garden to observe the common plants and the variety of seeds, flowers and fruits (sizes, shapes and colours).
  - They observe different stages of the life cycle of plants – flower, fruit with seeds, small plant (not necessarily on the same plant). Optional: Pupils take photos of the different stages.
  - When they return to class, each pupil is to draw a plant life cycle poster.
3. Bring the class to the garden and lead them on the route you have planned. If present, pupils may collect the fruit/seeds of selected plants.
4. On returning to class, ask pupils to take out their art materials (drawing block and markers/coloured pencils). They are to draw a poster with the life cycle of a plant found in your school.
5. Debrief after they have completed the poster.

## Debrief

1. Ask pupils to show the class their posters (with the plant life cycle). Optional: Pin all life cycle posters in class for a week.
2. Praise pupils who have put in much effort.
3. Explain more about the life cycles of flowering plants:
  - The lifecycles of plants are very much the same for most flowering plants. However, they differ in the length of time between the stages.
  - Some plants have flowers all year round e.g. Lime plant, while some plants, especially trees, flower only once or twice a year.
4. Discuss reproduction in plants. Suggested points:
  - Like all living things, plants make new plants.
  - There are 2 main ways of reproduction
    - o Sexual reproduction of plants – where seedlings have characteristics different from both parent plants.
    - o Asexual reproduction – where new plantlets are clones of another plant.



5. Suggested Question: How is a plant's lifecycle similar or different from an animal's life cycle? (Similarities – there are male and female parts which have to be transferred; the process of fertilisation must take place and a new embryo is formed. Differences – parts of plants and animals are different, plants have agents of pollinators for transfer of pollen)

## Suggested Extension Activities

- Have pupils act out the life cycle of a plant. Provide props like flowers, fruits or pictures.
- Activity 6 Grow Some Plants.

## 6. GROW SOME PLANTS

### Outcome

Pupils plant seeds and try stem-cutting to learn more about plant reproduction. Pupils monitor the growth of these new plants to understand what plants need for healthy growth.

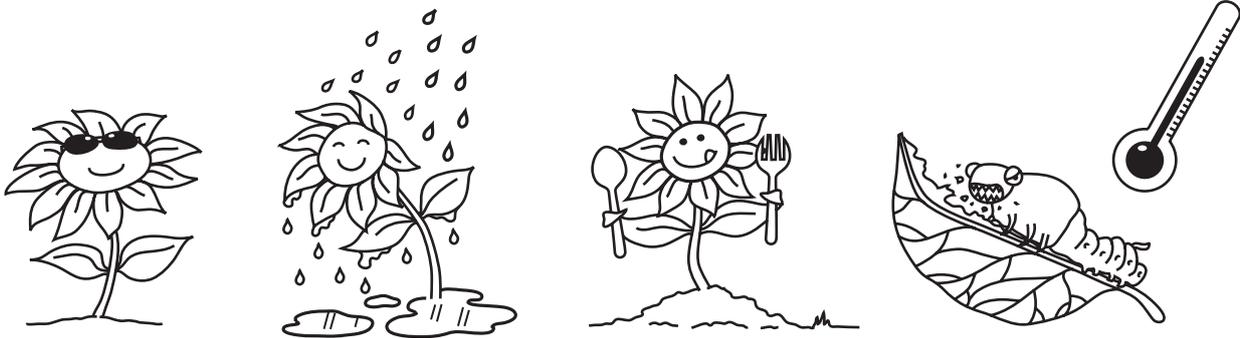
|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 2 sessions 3 weeks apart; 1-2 hours each  |
| <b>Recommended for</b>          | Lower Primary; individual work  |
| <b>Subject Links</b>            | Science   |
| <b>Process Skills</b>           | Observing, comparing, measuring, analysing  |
| <b>Equipment/<br/>Materials</b> | <p><b>For planting into existing school garden plots:</b> soil/potting mix, seeds (suggested species include Balsam, Plume Celosia, green vegetables like Chai Sim, Kai Lan or Amaranth or seeds from existing plants in the school garden), stem cuttings (e.g. Sweet Potato, Dill), small spades, watering can.</p> <p><b>For container planting:</b> Pots or containers (reuse Styrofoam boxes), permanent markers for labelling.</p> <p>Optional: Data logger with light and temperature sensors, gardening book: Community In Bloom, A Concise Guide to Tropical Gardening</p>       |
| <b>Preparation</b>              | <ul style="list-style-type: none"> <li>• Conduct a reconnaissance of the school and decide where you would your pupils will do their planting – in an existing school garden plot or in containers. For the latter, select a sunny area to place the containers. Be aware of the safety of this area (near traffic, roof top etc.). Seek permission to use the plot if you have to.</li> <li>• Arrange for school staff to water the pupils' plants during weekend.</li> <li>• Photocopy Handout 6a; Handout 6b is optional.</li> <li>• Read the instructions on seed packets.</li> </ul> |

### How to Conduct?

#### Session 1 (1-2 hours)

1. Explain what new plants need for healthy growth.
  - The main factors which affect growth (what plants need to survive) are sunlight, water, good soil and nutrients and the right temperature to grow well.
  - Sunlight – Different plants need different amounts and intensities of sunlight. Give sun-loving plants as much sunlight as possible during the day. Balsam, sunflower etc are all sun-loving plants. Pupils can measure the amount of light using their data loggers.
  - Water – Give the optimum amount of water (too much causes root rot; too little water limits growth).
  - Good soil - Promote healthy root growth by ensuring that the soil is not water-logged. Mix clay-based soil with compost (organic matter) and sand to increase drainage.

- Nutrients – Plants need some fertilisers for healthy growth. There is no need to fertilise plants for this 3 week project. However, fertilise plants after they have been transplanted to the school garden.
- Temperature – The climate in Singapore is a tropical one. Pupils can measure the temperature using the data logger. The range of approximately 24 – 34 °C.



2. Bring pupils to a shaded area near the garden to start the planting.
3. Explain that pupils are going to plant seeds and stems. Explain that planting seeds is a form of sexual reproduction and planting stems is a form of asexual reproduction or cloning.
4. Demonstrate how to plant to pupils. Optional: Distribute Handout 6b.
  - For planting into plots: prepare the planting bed by adding new soil/potting mix
  - For containers: label the container – name of the team members, class. Make holes in the container if there are no holes (if there are no holes water will collect and cause the plants to rot. Mosquitoes may breed in them too). Fill the container with soil – potting mix
  - On one side of the container or bed, plant the seeds at intervals of a few cm apart (read the label on the seed packet for the optimum distance). You need to make a very shallow hole in the soil, place the seed inside and cover the seed slightly.
  - On the other side of the container or bed, plant an onion. Explain that an onion has a stem inside. Make a shallow hole in the soil and place the onion in it, with half of it sticking out of the soil.
  - Next show pupils how to plant a stem cutting (e.g. sweet potato stem or dill), use a scissors to cut off the leaves and stick the stem into the soil).
  - Place a pinch of fertiliser between the 2 sections of seeds and stems – explain that this will give the new plants nutrients. Only a little fertiliser should be used.
  - Water all seeds, onions or stem cuttings with a watering can.
5. Distribute the materials and get pupils to plant and water their plants.
6. When teams have completed their planting, check each container to see if the plants are planted right.
7. Get teams to place the containers in the sunny area of the school which you have chosen. Optional: Take the temperature and light levels at this place using a data logger.
8. Return to class. Distribute one copy of Handout 6a to each team and run through the schedule and what they have to do:
  - Schedule – their project will be conducted over 3 weeks. Ask them to write the start date on Handout 6a.
  - Over this time, teams are responsible to water the plants every day. Explain that during weekend, the school staff will help pupils water their plants for them.
  - Once a week, members have to count the number of leaves and check for pests and remove them (Optional: You may want to get them to measure the physical conditions using the data logger). They record their findings on Handout 6a.
9. For the next 2 weeks, check on pupils' plants to see how they are growing. Should the plants die, get the pupils to start planting again.

## Debrief

### Session 2 (1 hour)

1. At the end of the 3 weeks, get pupils to examine their plants and also observe the plants of different teams.
2. Help pupils analyse how their plants grew using handout 6a, tracking their length of the plant, etc.
3. Analyse why plants grew well or not e.g. whether their plants received sufficient light, nutrients, were eaten by pests, affected by diseases, etc.
4. Reiterate the needs of plants (see notes for Session 1).
5. Encourage pupils to continue trying their hand at gardening. Like most skills, it needs much practice.

## Suggested Extension Activities

- Transplant those plants in containers into a school garden plot.
- Pupils could plot the growth of their plants (length of plant or number of leaves) using MS Excel.
- Pupils carry out an experiment/investigation – place plants under different conditions (e.g. different amount of light).



Name :

Members of your team :

**GROW SOME PLANTS**

**Plant Growth Chart**

Date when seeds were planted:

|   | Week 1                     | Week 2                     | Week 3                     |
|---|----------------------------|----------------------------|----------------------------|
| <b>Date checked:</b>  |                            |                            |                            |
| <b>Checked by:</b><br>(name of team member)   |                            |                            |                            |
| PLANT GROWTH  |                            |                            |                            |
| <b>No. of leaves</b><br>Count the number of leaves on the plant.  |                            |                            |                            |
| <b>Length</b><br>Measure the length of the plant using a measuring tape.  |                            |                            |                            |
| <b>Pests</b><br>Record any pests on the plant and remove them.  |                            |                            |                            |
| <b>Other Observations</b>   |                            |                            |                            |
| PHYSICAL CONDITIONS (OPTIONAL)  |                            |                            |                            |
| <b>Temperature</b><br>Measure the temperature around the plant.   |                            |                            |                            |
| <b>Light</b><br>Measure the light level around the plant. Record the weather conditions at the time of measuring. | Light reading:<br>Weather: | Light reading:<br>Weather: | Light reading:<br>Weather: |
| <b>Water</b><br>Record how often and how much water the plant is given each day                                   | (ml)                       | (ml)                       | (ml)                       |

HANDOUT 6a

# Pupils' Handout

**6b**

Name : \_\_\_\_\_

Members of your team : \_\_\_\_\_

## GROW SOME PLANTS

### Gardening Tips

- Place the netting into an empty pot.
- Cut the bottom part of the bag (with the potting mix) and pour the potting mix into the pot.
- Use your finger to make 5 shallow holes (less than 1cm deep) into the potting mix.
- \*Cut open the section of the bag with the seeds. Sprinkle a few seeds into each hole. Cover the holes with potting mix.
- Water your seeds with a fine spray of water (from a sprayer or watering can).
- Place the pot where your new plants can get sunlight.



Don't plant your seeds too close to each other! Give them space to grow!

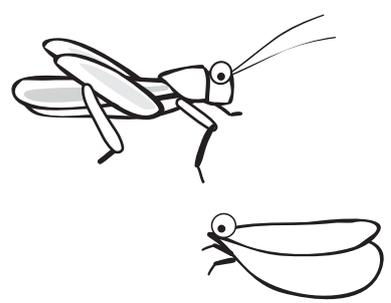


Wash your hands thoroughly with soap after gardening!

### Plant Care Tips!

#### Check your plants every day –

- Water them so they do not dry out (keep the soil damp, but do not over-water!)
- Check how they are growing
- Remove any weeds
- Look out for pests and remove them:



|                           |  |
|---------------------------|--|
| <b>Leaf eaters:</b>       | Beetles, grasshopper, caterpillars, snails |
| <b>Plant sap suckers:</b> | Leaf hoppers, mealy bugs, aphids           |

HANDOUT 6b

## 7. WILDFLOWERS OR WEEDS?

### Outcome

Pupils help maintain the school garden by weeding and in the process learn about wildflowers (weed plants).

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1 hour  |
| <b>Recommended for</b>          | Lower Primary; individual work  |
| <b>Subject Links</b>            | Science   |
| <b>Process Skills</b>           | Observing, comparing  |
| <b>Equipment/<br/>Materials</b> | Gloves, plastic bags.<br>Optional: A Guide to the Wildflowers of Singapore (Singapore Science Centre Guide Book). |
| <b>Preparation</b>              | Conduct a reconnaissance of your school grounds to identify where you would like to conduct this activity.        |



### How to Conduct?

- Ask pupils some questions about wildflowers:
  - What are wildflowers? (Plants that grow on their own, not planted by the gardener)
  - What are so special about them? (They are well adapted plants, able to survive harsh conditions other plants normally cannot – high temperatures, poor soil, little water etc.; they reproduce so fast and found in most places, some are medicinal, others can improve the soil, grown to prevent erosion, they can be very beautiful and ornamental)
  - Why do gardeners refer to wildflowers as weeds? (Weeds are unwanted by the gardener. They compete with our garden plants for nutrients, water, space and light. They make the garden look untidy and may even spread diseases to our plants)
- Explain what pupils will be doing:
  - Pupils will look for wildflowers in the garden areas you will bring them to. They are to photograph each type, identify it (using the guide book) and pull all of them out (weed the garden) and place them in a plastic bag.
  - After some time of weeding, collect all the weeds.
  - All will wash their hands, return to the classroom to debrief the activity
- Bring pupils to the garden and distribute the gloves and bags.
- Brief pupils on the safety issues (see page 4) and the time to stop weeding. Start the activity.
- When they have finished weeding, ask pupils to bring all their weeds together for disposal.
- Get pupils to return the gloves, wash their hands thoroughly and return to class.

## Debrief

### Discuss the Adaptations of weeds:

- They have fast growth rates and short reproductive cycles.
- They are hardy plants, adapted to grow in places with minimal soil. These plants can tolerate high temperatures and low water conditions.
- They produce large numbers of seeds.
- They have very efficient methods of seed dispersal and their seeds are adapted for the agent of dispersal - e.g. the seeds of the Common Vernonia (*Vernonia* sp.) are very small and have parachute structures which are dispersed by wind. Others have hooked seeds for dispersal by animals e.g. Love Grass (*Chrysopogon aciculatus*).



### Additional Information

- Some wildflowers have medicinal value e.g. Lesser Clover-leaved Desmodium (*Desmodium triflorum*) has been used to treat rheumatism and relieve fever. The Hairy Spurge (*Euphorbia hirta*) has been used to treat conjunctivitis, bronchitis and asthma.
- Wildflowers from the legume family e.g. Clover-leaved Desmodium (*Desmodium* species) are able to fix nitrogen in the soil in their root nodules. They are sometimes grown as ground cover to help prevent erosion.

## Suggested Extension Activities

- Compost the weeds:
  - Look for a place in school where you can compost the weeds.
  - Explain to pupils what to do. Cut the weeds into shorter pieces if clippings are long. Use a spade or changkol to scatter soil from the garden (which contain soil bacteria) around the clippings and mix it up.
  - Discuss how composting the garden trimmings (cut plant parts from pruning and weeding etc.) can help in solid waste management:
  - In Singapore, the amount of waste generated per day is very high – about 0.8 kg per day per person. This is excluding the industrial and ‘agricultural’ waste. Taking biodegradable material like plant clippings out from the main load of garbage saves space in our landfill, prolonging the landfill’s life. Moreover, these clippings can be composted to produce high-organic based compost, which is important for soil improvement. In a small scale, schools can also do their part in waste reduction by composting garden clippings.
  - Harvest your compost - Check on the compost pile regularly. If possible, have someone mix the soil and plant parts regularly to improve aeration and hasten the composting process. Use the compost to improve soil after 2 months
- Activity 9 Nature Bookmarks

## 8. PEST POTION

### Outcome

Pupils search for garden pests in the school garden and help to remove them through environmentally-friendly methods.

|                                 |  |
|---------------------------------|--|
| <b>Duration</b>                 | 1-2 hours  |
| <b>Recommended for</b>          | Upper Primary; individual work/teamwork  |
| <b>Subject Links</b>            | Science  |
| <b>Process Skills</b>           | Observing, classifying   |
| <b>Equipment/<br/>Materials</b> | 4-6 spray bottles (one for each team), blender, chilli, garlic, dish washing liquid and cooking oil. Optional: Community In Bloom, A Concise Guide to Tropical Gardening.                              |
| <b>Preparation</b>              | Conduct a reconnaissance of your school grounds to identify where garden pests can be found. Select an area to prepare the pest spray (with a nearby power socket) e.g. canteen or science laboratory. |

### How to Conduct?

1. Assign pupils into teams if you prefer this to be a team activity.
2. It is recommended that pupils carry out Activity 3 "Who Lives Here?" Before this activity.
3. Explain (or recap) the problems of garden pests:
  - Some pests eat or damage the leaves of plants e.g. grasshoppers, caterpillars, bagworms, garden snails etc.
  - Some pests suck plant sap e.g. leaf hopper, mealy bugs, scale insects.
4. Explain the activity: pupils will spot garden pests in the school garden, identify them and make an environmentally friendly pest spray to spray on the pest.
5. Bring pupils to different gardens and planted areas in school to observe garden pests. They can use the book "A Concise Guide to Tropical Gardening" to identify the pests.
6. After the walkabout, bring pupils indoor to prepare the pest spray.
7. Discuss the problem/s when using commercial pesticides on our plants:
  - Spraying pesticides is the most common method of removing pests. However, they are essentially poisons and pollute the environment.
  - They may adversely affect other living things they come into contact with, including human beings (e.g. increasing the incidence of cancers).
  - They also affect the beneficial animals in the garden (e.g. birds and lizards which feed on pests).
8. Distribute Handout 8 to each team and run through the steps for preparing the pest spray.

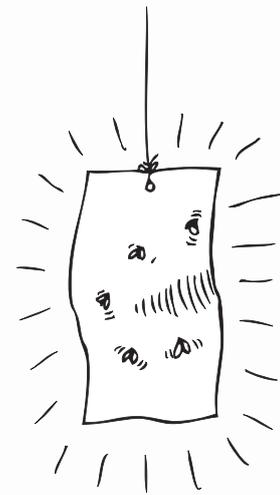
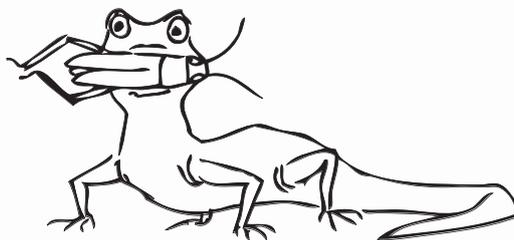
9. Distribute the materials and let pupils make the pest spray. After they have finished, fill the spray bottles and let pupils spray the pests in the school garden.
10. Ask pupils to discard all excess pest spray into the toilet bowl and wash out the spray bottle and other equipment. Debrief the activity.

## Debrief

1. Explain these points:
  - Making a non-pesticide spray is environmentally friendly.
  - Organic gardening employs environmentally-friendly products and practices to manage pests. One example is the use of natural plant-based pest and weed sprays.
  - Other common environmentally-friendly methods of pest control:
    - o Keeping plants healthy to better resist attack by pests.
    - o Attracting the natural predators of the pest-insects (e.g. lizards, birds by providing a lush habitat for them to live in).
    - o Removing pests by hand.
    - o Using barrier nets to prevent flying pests from reaching plants.
    - o Using sticky tape or surfaces to attract and trap flying adult pests.
2. Ask pupils to share what they have learnt.

## Suggested Extension Activities

Track the conditions of the plants which have been sprayed by the pupils' environmentally-friendly pest spray. Guide pupils to evaluate its effectiveness. Do some research to obtain a more effective formula/ recipe.



Name : 

8

Members  
of your team : **PEST POTION****Recipe for Pest Potion:****Ingredients**

Half a chilli (red or green)

1 clove of garlic

1 teaspoon of cooking oil

3 drops of dish washing liquid

1 l water

Spray bottle

Blender or grinder

Container for mixing

A Sieve

**What to do?**

1. Blend or pound the chilli and garlic in a blender or grinder.
2. Transfer the paste into a larger container and add water, cooking oil and washing liquid.
3. Mix well.
4. Sieve the liquid and pour the sieved liquid into spray bottles.
5. Spray the garden pest with the pest-potion generously once a day for a week.
6. Check on the garden pest a week later to see if they are still around/alive.

## 9. NATURE BOOKMARKS

### Outcome

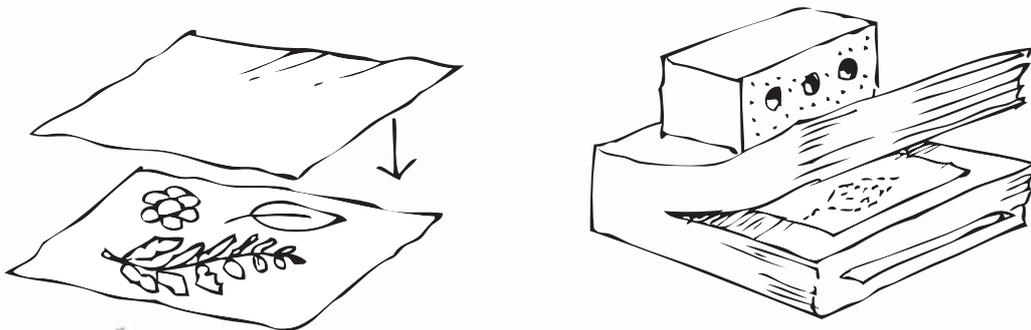
Pupils learn to appreciate the designs in plants and create plant bookmarks.

|                             |  |
|-----------------------------|--|
| <b>Duration</b>             | 2 sessions (1-2 weeks apart); 1-2 hours each   |
| <b>Recommended for</b>      | Upper Primary; individual work   |
| <b>Subject Links</b>        | Science, Art and Craft   |
| <b>Process Skills</b>       | Observing  |
| <b>Equipment/ Materials</b> | White paper (reuse if you can), old newspaper, large books or heavy weight (bricks), coloured paper, laminator, laminating film, markers, hole puncher, yarn or craft string, scissors.              |
| <b>Preparation</b>          | Cut or buy some plant parts (leaves, ferns, flowers). Do not get those with thick, woody or bulky parts. Examples of suitable flowers are Baby's breath, Jasmine, Blue Butterfly Pea, Bougainvillea. |

### How to Conduct?

#### Session 1 Press the plants:

- 1 Explain how to make a plant pressing: When making a plant pressing, the basic idea is to sandwich plant parts between layers of absorbent material so they will dry quickly, and press them (under heavy weight) into shape.
- 2 Pupils select plant parts (flowers and leaves) and arrange them on a piece of white paper.
- 3 Cover them with another piece of white paper and place both pieces of paper (with the plant parts within) on some newspaper. Place another newspaper above this.
- 4 Place heavy books or bricks on the paper containing the plant parts to press them. Change the paper once in 5-7 days.



## Session 2 Making the bookmarks (1-2 weeks later)

- 5 After 1-2 weeks, ask pupils to check on the pressings. Discard any plant pressing with fungal growth. Select the best plant pressings and proceed with the lamination.
- 6 Cut out coloured paper and place selected pressings on them, forming a design. Use markers to add drawings or text.
- 7 Place the decorated coloured paper with the plant pressing, inside a laminating film. Feed this into a laminator (warmed up) and let the laminated pieces cool.
- 8 Once cooled, cut the individual bookmarks out with a margin of at least 1 cm all round the paper. Use a hole puncher to make a hole in the plastic. String some yarn/craft string through the hole.

## Debrief

Here are some points for debrief:

- Plants have beautiful designs! These can be seen on the patterns of the leaves and forms of the flowers. Plant designs are often used as themes for art and sculptures.
- Look around you to observe them!

## Suggested Extension Activities

These nature bookmarks can be given as gifts or used to raise funds for a needy cause.



# 10. USEFUL PLANTS

## Outcome

Pupils identify plants in the school garden which are useful to people. They become more aware of which parts of the plants are used and how they are used.

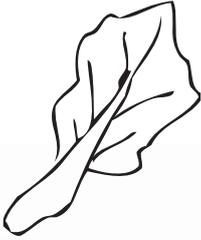
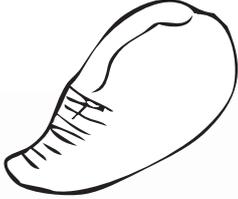
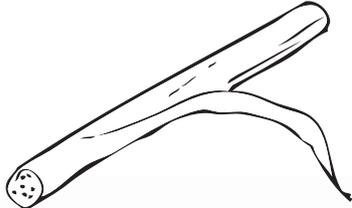
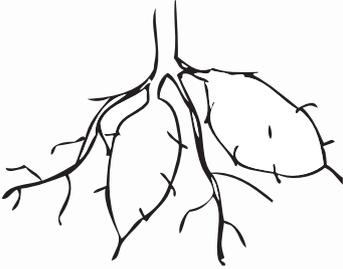
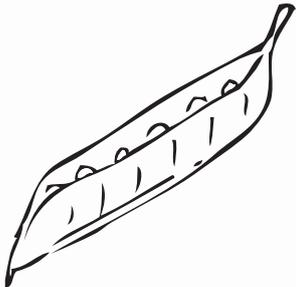
|                                 |  |
|---------------------------------|--|
| <b>Duration</b>                 | 1 – 1.5 hours  |
| <b>Recommended for</b>          | Upper Primary; individual work/teamwork  |
| <b>Subject Links</b>            | Science, Social Studies, IT  |
| <b>Process Skills</b>           | Observing, generating  |
| <b>Equipment/<br/>Materials</b> | Digital camera, cord for downloading photographs. Optional: A Guide to Herbs and Spices (Singapore Science Centre Guide Book). |
| <b>Preparation</b>              | Photocopy Handout 10. Conduct a reconnaissance of your school grounds to identify useful plants and where they are located.    |

## How to Conduct?

1. Assign pupils into teams if you prefer this to be a team activity.
2. Introduce the activity: There are many local herbs, spices and food plants which are important for our Asian food. Plants give people wood, dyes and other materials too.
3. Briefly recap the main parts of a plant and their functions.
4. Bring the pupils to the garden. Distribute Handout 10 and run through what they have to do:
  - Look for useful plants in the school garden.
  - Identify which part/s of the plants is/are useful and then write the name of the plant in the table below.
  - Take a photo of the plant.
  - After the walkabout, download your photographs and do research on these plants.
5. After 30-35 min in the school garden, bring pupils to download their photos and carry out research on the internet.

## Debrief

1. Run through list of plants identified by the pupils. Here are some suggested answers. The uses are in brackets:

|  |   |   |
|--|---|---|
| <p><b>Plants with useful leaves</b><br/>Sweet Potatoes (food), chives (spice), Curry leaf (spice), basil (spice), Mint (spice), Banana (plate, wrapping food), Lime (flavouring)</p>  | <p><b>Plants with useful fruits</b><br/>Banana, Starfruit, Mangosteen, Pomelo, Pineapple, Papaya, Guava (as fruits), Lime (flavouring, drink), Chilli (spice), Noni (health drink), Corn (food), Bitter Gourd (food, drinks), Brinjal (food), Long Beans (food)</p>  | <p><b>Plants with useful stems</b><br/>Sugar Cane (source of sugar, drink), Ginger (flavouring/spice), Lemon Grass</p>                         |
| <p><b>Plants with useful roots</b><br/>Yam, Tapioca, Sweet Potato (food); Lotus root (flavouring for soup), Lemon Grass (spice)</p>    | <p><b>Plants with useful seeds</b><br/>Peanut, Cashew nut (food), Cocoa (to make chocolate), Lotus (food)</p>   | <p><b>Plants with useful sap</b><br/>Aloe Vera (for healing, soothing effect, skin products), Rubber (to make rubber items, chewing gum)</p>  |

2. Get pupils to download their pictures, identify each significant plant and do some research on each plant. The guidebook *A Guide to Herbs and Spices* (Singapore Science Centre Guide Book) is useful. Pupils then make a presentation of useful plants in the school.

## Suggested Extension Activities

Ask pupils to write and design plant labels for useful plants in the school. They could use their photographs and information they had gathered.





**10**

Name :

Members of your team :

**USEFUL PLANTS**

1. Look for useful plants in your school garden
2. Identify which part/s of the plants is/are useful and then write the name of the plant in the table below.
3. Take a photo of the plant.
4. After the walkabout, download your photographs and do research on these plants.

|                                  |                                  |
|----------------------------------|----------------------------------|
| <b>Plants with useful leaves</b> | <b>Plants with useful fruits</b> |
| <b>Plants with useful stems</b>  | <b>Plants with useful roots</b>  |
| <b>Plants with useful seeds</b>  | <b>Plants with useful sap</b>    |

**HANDOUT 10**

# 11. SPICE UP MY FOOD

## Outcome

Pupils identify specific herbs and spices that are important as ingredients in some Asian cuisine. They then select a herb or spice in the garden and write a story about a chef using these food plants.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1 hour  |
| <b>Recommended for</b>          | Lower Primary; individual work/teamwork   |
| <b>Subject Links</b>            | English, Social Studies, Science  |
| <b>Process Skills</b>           | Observing, classifying, communicating   |
| <b>Equipment/<br/>Materials</b> | Scissors. Optional: A Guide to Herbs and Spices (Singapore Science Centre Guide Book).  |
| <b>Preparation</b>              | Photocopy Handout 11. Conduct a reconnaissance of your school grounds to identify herb and spice plants and where they are located. If your school does not have many of such plants, you could buy new plants from the nursery or buy herbs and spice from the market for this activity e.g. pandan, chilli, curry, laksa leaves, cloves, cinnamon bark etc. |

## How to Conduct?

1. Assign pupils into teams if you prefer this to be a team activity.
2. Introduce the activity by stating that there are many local herbs, spices and food plants which are important for our Asian food.
3. Distribute Handout 11 and explain the activity. Pupils read the story of the 2 chefs, find the plants that they need and make observations about these plants. They then select a third plant each (herb, spice or food plant) found in the garden and write a similar story about a chef using these food plants.
4. Bring pupils to the school garden and start the activity.
5. When they have completed the first 2 plants, bring pupils to the plants and go through the answers. Cut a section of Pandan leaf (with a scissors) for them to see the 'w' shape and smell the Pandan. Crush a curry leaf for pupils to smell.
6. Guide them around the garden to choose plants for them to write their own story about a chef. Ask pupils to share their new stories with the class. Debrief the activity.



## Debrief

1. Run through the answers for Handout 11.

### The Pandan Plant

- The leaf of the Pandan is a long-like grass. It is from the Pandanus family, a monocotyledonous plant ('grass' family). If you look from the side (cross-section view) the leaf blade is folded to form a 'W' shape. Cut a cross-section to show your pupils this.
- The pandan leaf gives off a distinct fragrance which is a very important flavouring in many local dishes, especially desserts and rice dishes. This fragrance comes from piperidine-like alkaloids present in the leaves.

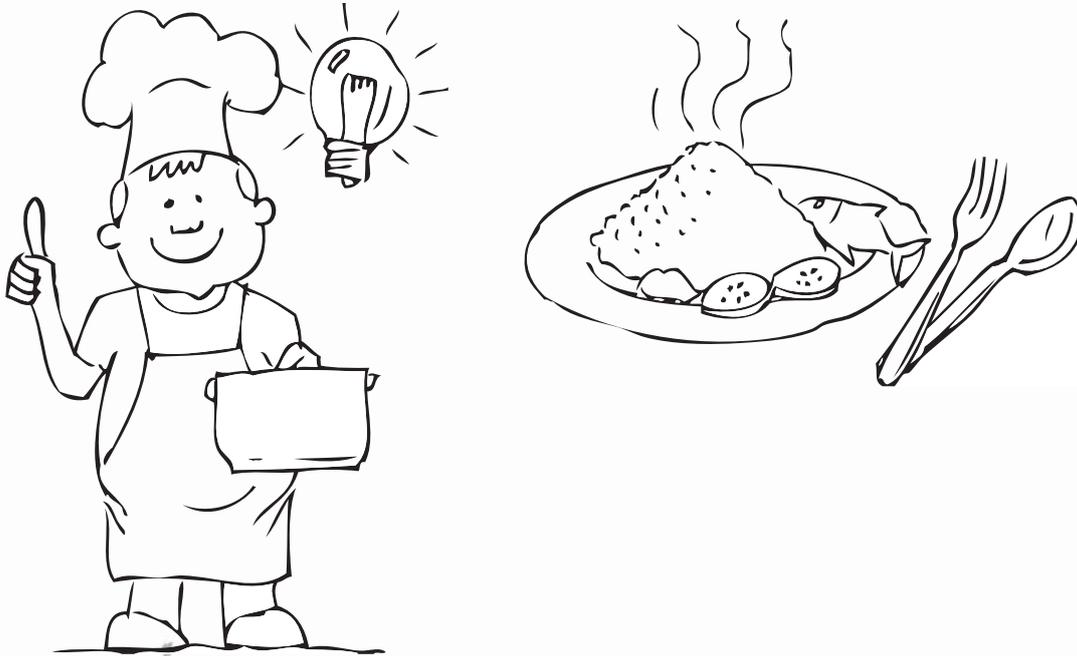
### The Curry Leaf Tree

- A curry leaf is a compound leaf, with many leaflets. Each leaflet is rhombus-shaped (or diamond-shaped for younger pupils).
- The curry leaf gives off a distinct fragrance and is used in the making of Indian and Sri Lankan curries. The plant originated in India, but has now spread to all parts of South East Asia. The fruits of a curry plant are black-coloured berries.

2. Ask a few pupils to share with the class their stories about a chosen herb or spice.

## Suggested Extension Activities

Ask pupils to do research on a few herbs, spices or food plants found in your school garden and make an Asian spice and herb poster.





11a

Members  
of your team :

Name :

## SPICE UP MY FOOD

### Aunty Minah and Her Pandan Leaves

**Aunty Minah is going to cook some Nasi Lemak. She needs some pandan leaves to cook her coconut rice.**

Find the Pandan plant/s in your school garden. Draw a pandan leaf here:

**Your teacher will cut a small section of the leaf for you to smell and observe.**

What does it smell like?

What is the shape like?

What other foods are Pandan leaves used in?

### Aunty Shanti and Her Curry Leaves

**Aunty Shanti is going to cook a special curry for Deepavali. She needs some curry leaves for her recipe.**

Find a Curry plant in your school garden. Draw a curry leaf here:

**Your teacher will pluck a leaflet for you to smell.**

What does it smell like?

How many leaflets are there on the leaf?

What other foods are Curry leaves used in?



Name : \_\_\_\_\_

Members of your team : \_\_\_\_\_

### SPICE UP MY FOOD

1. Choose a herb or spice →

\_\_\_\_\_ and His/Her\*

2. Choose a few dishes you can cook with this. →

\_\_\_\_\_ (Plant Name)

\_\_\_\_\_ (Name) is going to

cook \_\_\_\_\_ (dish).

He/She\* needs some \_\_\_\_\_

\_\_\_\_\_ (plant part) to cook it.

3. Write a parallel story like the previous ones. →

Which culture does this dish come from? (e.g. Malay, Chinese, European, Thai, etc.)

4. Observe the herb or spice, and draw it. →

Draw the herb/spice that he/she needs here:

5. Answer the questions about your chosen herb or spice. →

What does your chosen herb or spice smell like?

6. Share your story with your classmates! →

What other foods is/are the spice/spices used in?

\*Delete one

HANDOUT 11b

## 12. FRAGRANT PLANTS

### Outcome

Pupils learn about fragrant plants (in school) and discuss the benefits of this adaptation in plants. Pupils then make a potpourri.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1-2 hours   |
| <b>Recommended for</b>          | Upper Primary; individual work  |
| <b>Subject Links</b>            | Social Studies, Science   |
| <b>Process Skills</b>           | Observing, generating   |
| <b>Equipment/<br/>Materials</b> | Scissors (for harvesting plants), containers for potpourri<br>Optional: a fragrant flower or a bottle of perfume, A Guide to Herbs and Spices (Singapore Science Centre Guide Book), 1001 Garden Plant in Singapore, (2nd Edition) National Parks Board                 |
| <b>Preparation</b>              | Photocopy Handout 12. Conduct a reconnaissance of your school grounds to identify fragrant plants and where they are located. If your school does not have many of such plants, you could buy fragrant cut flowers (Jasmine) or plants (e.g. Pandan) for this activity. |

### How to Conduct?

1. Pass a fragrant flower or perfume around the class. Explain fragrance is a very powerful trigger in our human brains. They can affect your feelings and even bring back memories.
2. Distribute the handout and explain the activity. Pupils will look for fragrant plants in the school, identify them and record which part of the plant is fragrant. They collect the fragrant parts of these plants e.g. flowers. Pupils will then make a potpourri (a container of fragrant flowers and spice, used for scent).
3. Pupils can refer to this book to identify the plants: A Guide to Herbs and Spices (Singapore Science Centre Guide Book) or 1001 Garden Plants in Singapore, (2nd Edition) National Parks Board.
4. Explain that some plants have fragrant flowers which give off fragrance freely into the air, while in other plants, the fragrance becomes apparent only when the leaves are "damaged" e.g. Pandan.
5. Bring pupils to the garden and start the activity.
6. After the walkabout, bring pupils indoors to make their potpourri. They can use the fragrant plant parts they collected or the flowers and plants you have purchased.
7. Debrief the activity using Handout 12.



## Debrief

- List the fragrant plants in school. Here are some common examples:

| <b>Plants and trees with fragrant flowers</b>  | <b>Plants which have fragrant parts</b><br>(they need to be crushed for us to smell it)  |
|--|--|
| <p>Tembusu (<i>Fragrea fragrans</i>),<br/>           Frangipani (<i>Plumeria rubra cultivar</i>)<br/>           Cape Jasmine (<i>Gardenia jasminoides</i>)<br/>           Angelonia (<i>Angelonia salicariaefoli</i>)<br/>           Ylang Ylang (<i>Cananga odorata</i>)<br/>           Rose<br/>           Marigold (<i>Tagetes erecta</i>)<br/>           Water Jasmine (<i>Wrightia religiosa</i>)<br/>           Hoya sp.<br/>           Yesterday-Today-and-Tomorrow (<i>Brunfelsia calycin</i>)</p> | <p>Mosquito plant (<i>Citronella</i>)<br/>           Lemon grass (<i>Cymbopogon citratus</i>)<br/>           Basil (<i>Ocimum basilicum</i>)<br/>           Pandan (<i>Pandanus amaryllifolius</i>)<br/>           Curry leaf plant (<i>Murraya koenigii</i>)<br/>           Mint (<i>Mentha</i> spp.)<br/>           Lime (<i>Citrus aurantifolia</i>)<br/>           Ginger (<i>Zingiber officinale</i>)</p> |
| <b>Plants with fruits that give off a smell</b>  |   |
| <p>Durian (<i>Durio sp</i>)<br/>           Champedak, (<i>Artocarpus integer</i>)<br/>           Jackfruit (<i>Artocarpus heterophyllus</i>)</p>   |  |

- Discuss the questions in the handout:

**a) Having fragrance parts is an adaptation in plants. What are the benefits of this?**

- Fragrant flowers help attract pollinators (e.g. bees, moths).
- Fragrant leaves and other plant parts help to protect the plant from leaf-eating animals, especially insects. Certain chemicals in the plant parts act as toxins or poisons which the animals will avoid.

**b) How have people used the fragrance in plants?**

- In making fragrant products like perfumes, essential oils, insect repellents, soaps, etc.
- To flavour food (e.g. fragrant herbs and spices)
- In aromatherapy (the use of extracts from plants to promote health and well-being, alternative medicine).

- Ask pupils what they have learnt through this activity.

## Suggested Extension Activities

Let pupils do research on fragrances in plants, write and design a fun label for their potpourri - to explain what plants they had chosen and the significance of the fragrance.





**12**

Name :

Members of your team :

**FRAGRANT PLANTS**

What are some plants in your school garden that have a fragrance?

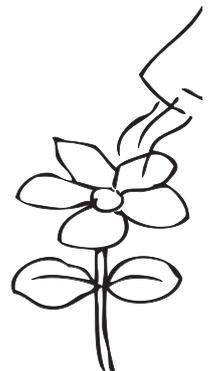
Which part of the plant (e.g. leaves, flower etc) is fragrant? Record these in the table below:

| No. | Name of plant/Description | Which part is fragrant? |
|-----|---------------------------|-------------------------|
| 1.  |                           |                         |
| 2.  |                           |                         |
| 3.  |                           |                         |
| 4.  |                           |                         |
| 5.  |                           |                         |
| 6.  |                           |                         |

**Try these questions:**

a) Having fragrant parts is an adaptation in plants. What are their benefits?

b) How have people used the fragrance in plants?

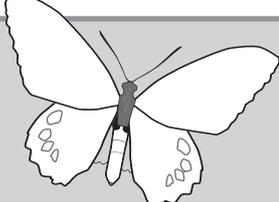


**HANDOUT 12**

## 13. BUTTERFLY HAVEN

### Outcome

Pupils go on a field trip to HortPark to identify and observe local butterflies and the stages of their life cycles.

|                             |  |   |
|-----------------------------|--|---|
| <b>Duration</b>             | 3 hours  |  |
| <b>Recommended for</b>      | Lower Primary; individual work   |   |
| <b>Subject Links</b>        | Science, IT  |   |
| <b>Process Skills</b>       | Observing, classifying, comparing  |   |
| <b>Equipment/ Materials</b> | Magnifying glass. Optional: Digital camera. A Guide to Common Butterflies of Singapore (Singapore Science Centre Guide Book)   |   |
| <b>Preparation</b>          | Photocopy Handout 13. Plan a fieldtrip to HortPark. Inform HortPark staff of your field trip. Here are the contacts: Tel: 64715601 or email: NPARKS_HortPark@nparks.gov.sg |   |

### How to Conduct?

1. Bring pupils to HortPark.
2. Distribute Handout 13 and explain what they have to do.
  - Bring them to both the butterfly enclosure and butterfly plots.
  - At the butterfly plot/s, pupils are to spot butterflies, describe and identify them. Optional: Take photographs of the butterflies.
  - At the Butterfly enclosure, pupils try to spot the main stages of butterflies (egg, caterpillar, pupa and adult) and draw/photograph each of them. They identify the butterfly using the butterfly guide at the enclosure.
3. After observing butterflies at both locations, gather pupils to debrief the activity.



## Debrief

1. Ask pupils to describe some butterflies that they have observed and recorded.
2. Some suggested questions:
  - How many types of butterflies are there in Singapore. (About 280 species.)
  - How do we tell 2 butterflies apart? (By looking at their size, shape of the 4 wings, patterns and colours.)
  - How long does a butterfly live (1-3 weeks. Different species live for a different length of time.)

| Here is a list of Common Butterflies |                                     |
|--------------------------------------|-------------------------------------|
| Common name                          | Scientific name                     |
| <b>Lime butterfly</b>                | <i>Papilio demoleus malayanus</i>   |
| <b>Lemon Emigrant</b>                | <i>Catopsilia pomona pomona</i>     |
| <b>Common Palmfly</b>                | <i>Elymnias hypermnestra agina</i>  |
| <b>Common Mormon</b>                 | <i>Papilio polytes romulus</i>      |
| <b>Common Grass Yellow</b>           | <i>Eurema hecabe contubernalis</i>  |
| <b>Cycad Blue</b>                    | <i>Chilades pandava pandava</i>     |
| <b>Lesser Grass Blue</b>             | <i>Zizina otis lampa</i>            |
| <b>Chocolate Pansy</b>               | <i>Junonia hedonia ida</i>          |
| <b>Leopard</b>                       | <i>Phalanta phalantha phalantha</i> |
| <b>Plain Tiger</b>                   | <i>Danaus chrysippus chrysippus</i> |

## Suggested Extension Activities

- Show pupils some good websites on local butterflies:
  - <http://butterflycircle.org>
  - <http://butterfly.nss.org.sg/>
- Pupils study the butterflies in the school grounds.





Name :

Members of your team :

### BUTTERFLY HAVEN

Butterflies I have observed at HortPark (Butterfly Plots and within the Butterfly Enclosure).

| Common Name of butterfly | Description<br>(approximate size, colours and patterns of wings etc.) | Do you have a photograph of the butterfly?<br>(Yes/No) |
|--------------------------|---|--|
|                          |   |  |
|                          |   |  |
|                          |   |  |
|                          |   |  |
|                          |   |  |
|                          |   |  |

My drawings of the 4 stages of a butterfly's life cycle observed in the Butterfly Enclosure.

| Egg | Caterpillar (Larva) | Pupa | Adult |
|-----|---------------------|------|-------|
|     |                     |      |       |

# 14. MY SCHOOL ORCHARD

## Outcome

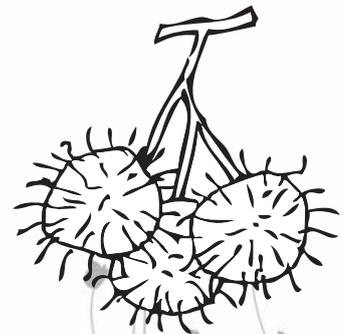
Pupils observe and identify different types of local fruit trees. They dissect some fruits to learn more about these.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1-2 hours   |
| <b>Recommended for</b>          | Upper Primary; individual work  |
| <b>Subject Links</b>            | Science   |
| <b>Process Skills</b>           | Observing   |
| <b>Equipment/<br/>Materials</b> | 1-2 local fruits*, knife. Optional: A Guide to Fruits and Seeds (Singapore Science Centre Guide Book) |
| <b>Preparation</b>              | Photocopy Handout 14.   |

\*If possible, pick these fruits from the fruits trees in the school garden. If the trees in school are not fruiting, buy some local fruits.

## How to Conduct?

1. Introduce the activity by talking about fruits:
  - A 'fruit' in botanical term, is a fertilised and ripened ovary of a flowering plant; hence not only mangos and apples are fruits, but also tomatoes, brinjal and chilli.
  - Fruits are healthy food. They are rich in vitamins (especially vitamins C, A, E, B series B6) and minerals like potassium and fibre.
  - Ask pupils if they have heard about fruits like the Duku, Chempadak etc. Explain that this activity is on local, tropical fruits (those that can grow in a hot and wet climate, like that in Singapore).
2. Bring pupils to the garden. Distribute Handout 14 and explain the activity. Pupils go the school garden and identify the local fruit trees in school. They then choose 2 trees and study them in detail (take measurements etc.). Divide pupils in their teams and start the activity.
3. After they have completed the activity, bring pupils to 2-3 trees and get them to describe the characteristics of the tree - leaf, trunk, flowers and fruits. Compare the characteristics of these trees.
4. Ask pupils to return to the classroom to examine some local fruits. Ask them to describe and draw the external features. Then cut the fruit with a knife for them and let them draw the internal parts. Let pupils taste the fruit and describe the taste.
5. Check on all their drawings on their handout. Debrief the activity.



## Debrief

1. Run through the list of fruit trees planted in your school garden.

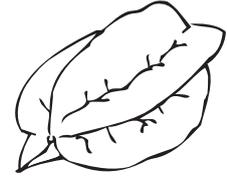
Here are some common local fruits in the region:

### Common fruit trees

- Mango
- Starfruit
- Kedondong
- Jambu Air
- Rambutan
- Belimbing
- Jackfruit
- Chiku
- Banana
- Papaya
- Guava

### Rarer Fruit trees

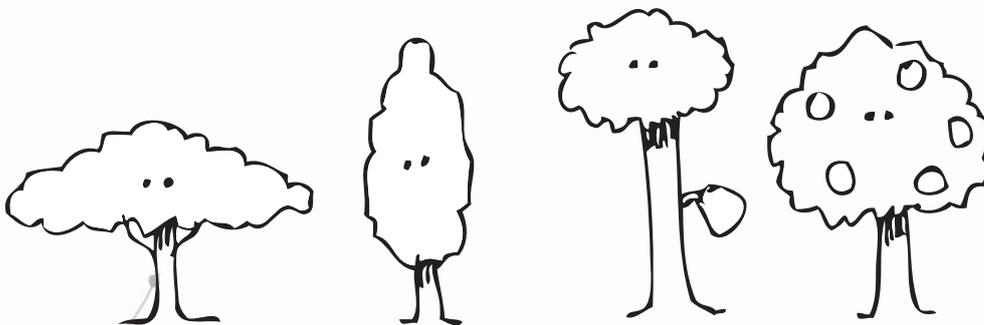
- Cashew nut
- Mangosteen
- Buah (indian) Cherry
- Dwarf guava
- Buah salak (snakefruit)
- Chempedak
- Sweet tamarind
- Duku
- Pulasan
- Green orange (mandarin)
- Quini (a mango strain)
- Durian
- Breadfruit
- Soursop
- Custard apple
- Nam nam



2. Ask pupils what kinds of fruits they usually eat. Discuss the popularity of local fruits and imported fruits like apples, pears and oranges.
3. Ask pupils what they have learnt through this activity. Alternatively, you could ask them to fill in the reflection sheet in Annex 3 and discuss their reflections.

## Suggested Extension Activities

- Pupils can do research on the fruit trees in the school garden and create educational signs for them.
- Involve pupils in planting more fruit trees in school. They can make suggestions on the species and care for these new fruit trees to be planted in the school garden.





**14**

Name : \_\_\_\_\_

Members of your team : \_\_\_\_\_

**MY SCHOOL ORCHARD**

|   | Fruit Tree 1 | Fruit Tree 2 |
|---|--------------|--------------|
| <b>Common Name &amp; Scientific Name of tree</b>  |              |              |
| <b>Leaf of the tree</b><br><ul style="list-style-type: none"> <li>• What shape is it? Draw the shape.</li> <li>• Is it a simple or compound leaf?</li> <li>• What is the leaf texture like?</li> <li>• What is the length of each leaf?</li> </ul>  |              |              |
| <b>Trunk of the tree</b><br><ul style="list-style-type: none"> <li>• What is the colour of the trunk?</li> <li>• What is the texture of the trunk?</li> </ul>   |              |              |
| <b>Flowers and fruits</b><br><ul style="list-style-type: none"> <li>• What are the flowers of the trees like? Draw one.</li> <li>• Where do the flowers or fruits develop? (tick one)</li> <li><input type="checkbox"/> at the end of branches</li> <li><input type="checkbox"/> main branch or tree trunk</li> </ul> |              |              |

**A local fruit**

Observe the external (outside) and internal (inside) features of the fruit shown to you. Describe it in your own words or draw it.

Name of fruit: \_\_\_\_\_

| What is the Outside like? | What is the Inside like? |
|---------------------------|--------------------------|
|                           |                          |

**HANDOUT 14**

# 15. DESERT LIFE

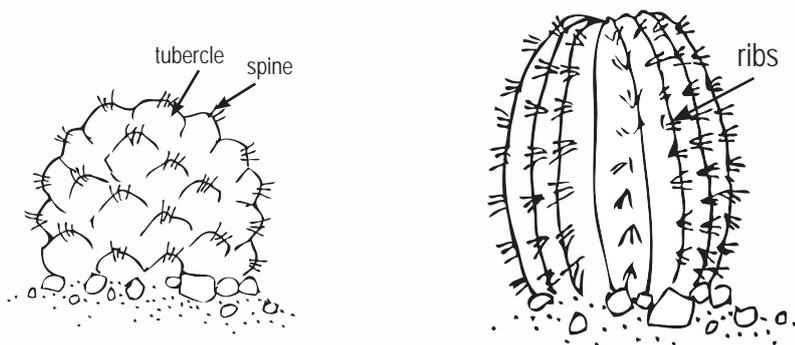
## Outcome

Pupils observe cacti and succulent plants in a “desert plot” to note their common characteristics. They measure the physical conditions of the “desert plot” to learn what is suitable for these plants.

|                                 |   |
|---------------------------------|---|
| <b>Duration</b>                 | 1-1.5 hours                                       |
| <b>Recommended for</b>          | Upper Primary; individual work /teamwork          |
| <b>Subject Links</b>            | Science   |
| <b>Process Skills</b>           | Observing, measuring and analysing                |
| <b>Equipment/<br/>Materials</b> | Data loggers (with temperature and light sensors) |
| <b>Preparation</b>              | Photocopy Handout 15.                             |

## How to Conduct?

1. Assign pupils into teams if you prefer this to be a team activity.
2. Introduce cacti and other “desert” plants:
  - They are also known as ‘succulents’ or “drought tolerant” plants.
  - They are adapted to living and reproducing in deserts with little rainfall, scorching sunlight and high temperatures. They can even survive long periods of drought.
3. Distribute the handout and explain the activity. Pupils go to the cactus plot in the school garden to identify characteristics of common cacti and drought-tolerant plants. They then measure the physical conditions of a “desert habitat”.
4. Get pupils to present their findings to you and the class, after they have completed the activity.



## Debrief

- Go through the questions on Handout 15.

| <b>What are some characteristics of desert plants? (Adaptations for living in a desert):</b> |   |
|--|---|
| 1.   | Their stems are green – for photosynthesis. Stems are the main photosynthetic parts of cacti and other desert plants  |
| 2.   | Stems are thick – are special water storage cells which store water during the rainy season. Stems slowly contract as water is used up during the dry season.                                       |
| 3.   | There are few or no leaves – to minimise water loss through evaporation   |
| 4.   | Leaves are modified/reduced to thorns <ul style="list-style-type: none"> <li>To minimise water loss through evaporation</li> <li>Additional protection for the plant against herbivores</li> </ul>  |
| 5.   | The surfaces of stems and leaves are waxy – to minimise water loss through transpiration; water evaporating through small leaf spaces)  |
| <b>Other adaptations of desert plants which are not very obvious:</b>                        |   |
| 6.   | Shallow, extensive roots – to quickly soak up water after a shower of rain. Some cacti have additional deep penetrating roots to reach ground water.  |
| 7.   | 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. |

- What are the physical conditions of a desert plot like?

| <b>Physical Characteristics</b>   | <b>Reading/Observation</b>   |
|---|--|
| <b>Substrate</b><br>Describe the type of soil in the plot   | Soil should be sandy or rocky (not loamy or clay-based), so that water can drain away easily. Otherwise the roots could rot.                           |
| <b>Temperature</b> <ul style="list-style-type: none"> <li>Record the temperature and</li> <li>Time of day:</li> </ul> | The range could be 28-34 °C<br>Temperature is high. Cacti plants can tolerate high temperature.  |
| <b>Light levels</b><br>Record the Light level and weather condition (e.g. sunny, cloudy etc.)                         | <b>Weather:</b><br><b>Reading</b> (in lux):<br>Light levels should be high for a sunny day - at least 1500 lux and more.                               |
| <b>Watering</b><br>Feel the soil. Is it wet?  | Often the soil is dry (unless it has just been watered). Cacti can withstand many weeks/months of drought! In a plot, Cacti need very little watering. |

## Suggested Extension Activities

- Bring pupils on a field trip to visit parks with a collection of succulent plants e.g. Singapore Botanic Garden Sun Garden, Evolution Garden) and Jacob Ballas Children's Garden etc.
- Care for the school's "Desert Garden" by weeding, fertilising etc.



**15**

Members of your team :

Name :

**DESERT LIFE**

1. Observe the cacti or succulent plants in the desert plot. What are some characteristics of desert plants? (Adaptations for living in a desert):

|    |  |
|----|--|
| 1. |  |
| 2. |  |
| 3. |  |
| 4. |  |
| 5. |  |
| 6. |  |
| 7. |  |

2. What are the physical conditions of a desert plot like? Observe, measure and record the following physical characteristics.

| Physical Characteristics  | Reading/Observation                             |
|---|---|
| <b>Substrate</b><br>Describe the type of soil in the plot.                                    |   |
| <b>Temperature</b><br>• Record the temperature and<br>• Time of day:                          |   |
| <b>Light levels</b><br>Record the Light level and weather condition (e.g. sunny, cloudy etc.) | <b>Weather:</b><br><br><b>Reading</b> (in lux): |
| <b>Watering</b><br>Feel the soil. Is it wet?  |   |

3. Are the conditions in your school plot/s suitable for cacti and drought resistant plants?

Why?



# Annex 1 Resources

## WEB RESOURCES

### NParks Websites

Community In Bloom, NParks Website  
[http://www.nparks.gov.sg/cib\\_intro.asp](http://www.nparks.gov.sg/cib_intro.asp)

NParks Website  
<http://www.nparks.gov.sg>

Plant Reference  
<http://www.floraweb.nparks.gov.sg>

NParks Gardening Blog – Garden Voices  
[http://www.nparks.gov.sg/blogs/garden\\_voices](http://www.nparks.gov.sg/blogs/garden_voices)

### Other Websites

Green Culture Singapore – Website and Discussion Forum  
<http://www.greenculturesg.com/>

Singapore Gardening Society – <http://www.gardeningsingapore.org/>

Local Butterflies – <http://butterflycircle.org>  
<http://butterfly.nss.org.sg/>

## BOOKS

### NParks Publications

- Boo Chih Min, Kartini Omar-Hor, Ou-Yang Chow Lin. 1001 Garden Plants in Singapore, (2nd Edition) National Parks Board, Singapore 2006. ISBN 981-04-9268-5
- Grace S.Y. Lim-Leng. Community In Bloom – A Concise Guide to Tropical Gardening. National Parks Board, Singapore 2007. ISBN 981-05-6796-0
- Trees of Our Garden City (2nd Edition)

### Other Publications

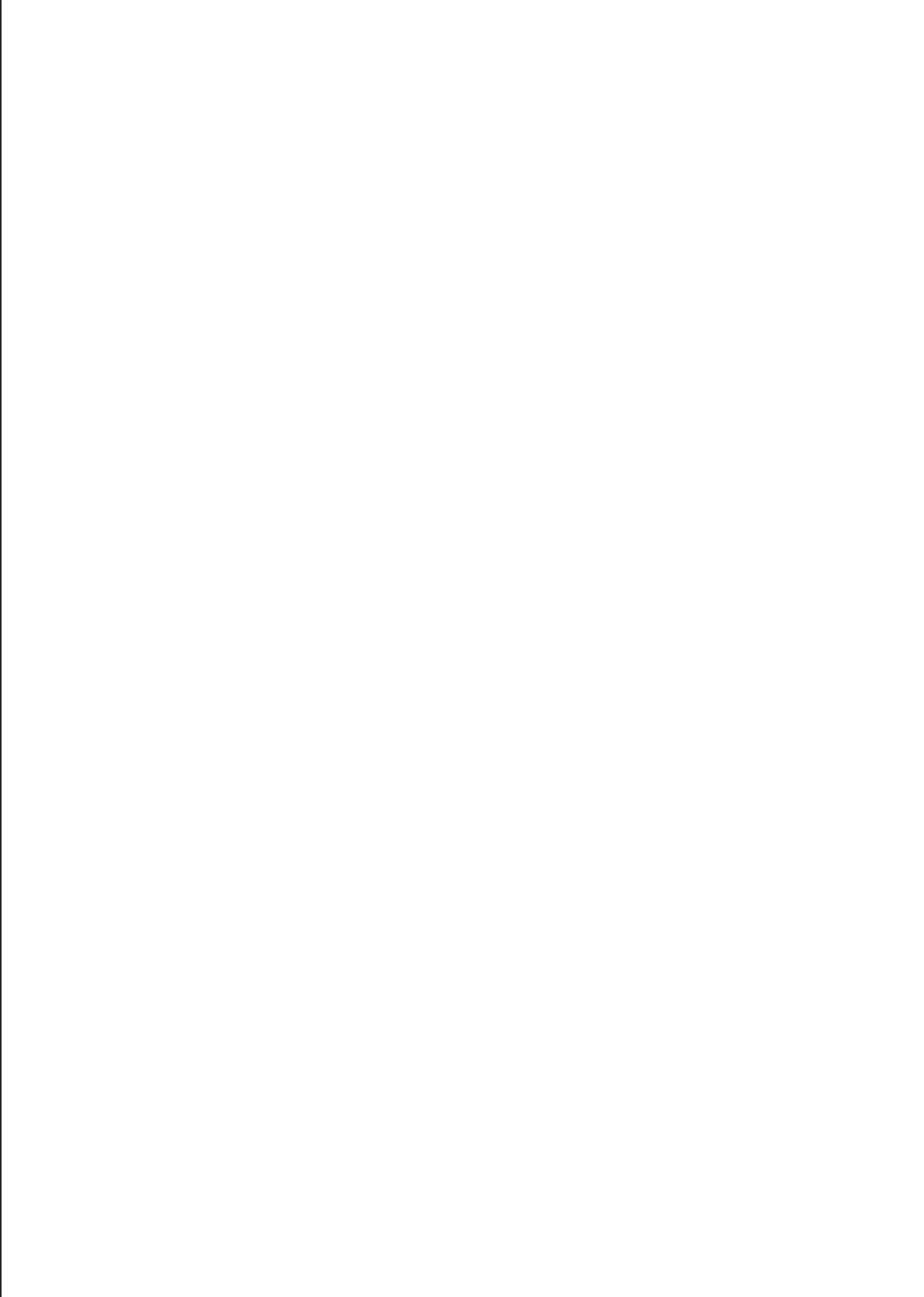
Singapore Science Centre Guide Books:  
 A Guide to the Wildflowers of Singapore,  
 A Guide to Herbs and Spices  
 A Guide to Common Horticultural Shrubs  
 A Guide to Common Butterflies of Singapore  
 A Guide to Medicinal Plants  
 A Guide to Common Garden Animals  
 A Guide to Fruits and Seeds

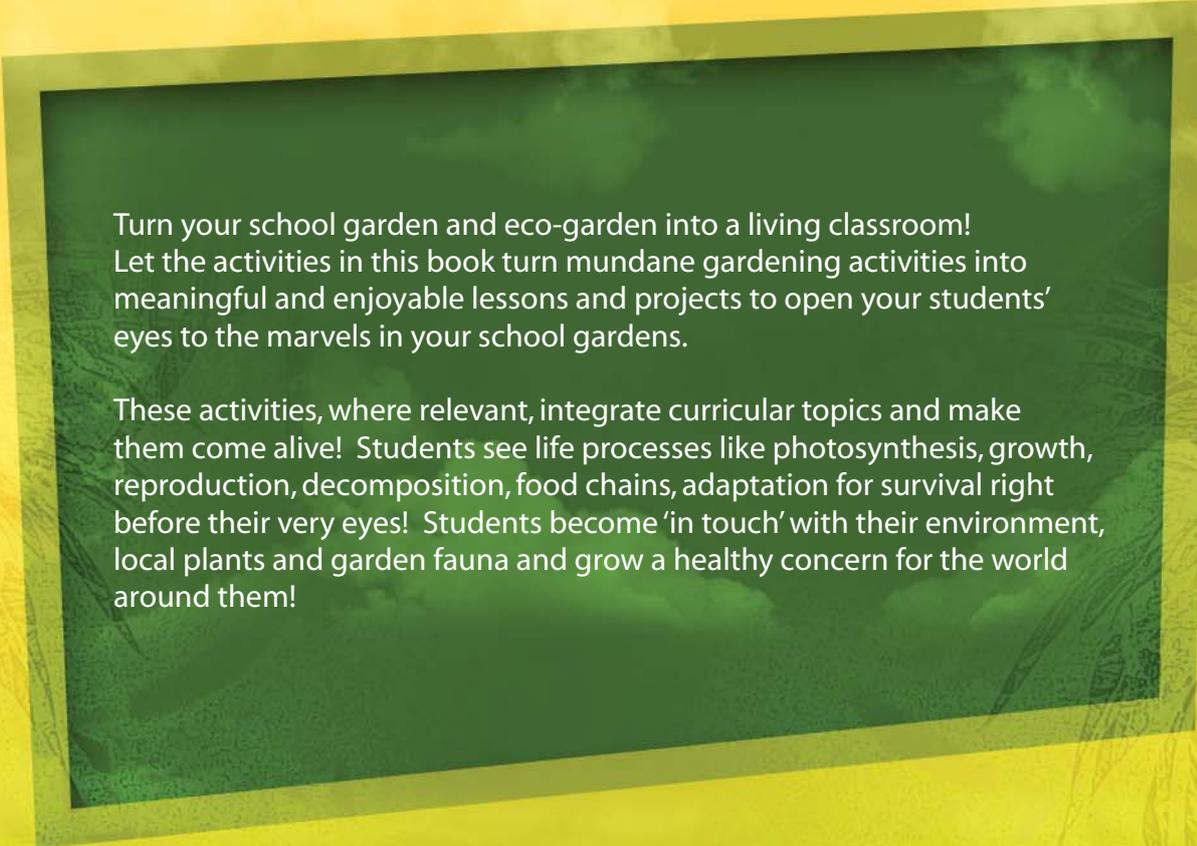
# Annex 2 Teacher's Planning Sheet For Community In Bloom Schools Activities

Students from:

| Session | Term <input type="text"/> | Activity | Equipment/<br>Materials | Preparation |
|---------|---------------------------|----------|-------------------------|-------------|
|         | Week <input type="text"/> |          |                         |             |
| 1.      |                           |          |                         |             |
| 2.      |                           |          |                         |             |
| 3.      |                           |          |                         |             |
| 4.      |                           |          |                         |             |
| 5.      |                           |          |                         |             |
| 6.      |                           |          |                         |             |
| 7.      |                           |          |                         |             |
| 8.      |                           |          |                         |             |
| 9.      |                           |          |                         |             |
| 10.     |                           |          |                         |             |

ANNEX 2





Turn your school garden and eco-garden into a living classroom!  
Let the activities in this book turn mundane gardening activities into meaningful and enjoyable lessons and projects to open your students' eyes to the marvels in your school gardens.

These activities, where relevant, integrate curricular topics and make them come alive! Students see life processes like photosynthesis, growth, reproduction, decomposition, food chains, adaptation for survival right before their very eyes! Students become 'in touch' with their environment, local plants and garden fauna and grow a healthy concern for the world around them!