STAGE 3 SCIENCE

Waterwise Garden

FOCUS AREA - Digital Technologies

Outcomes explored

A student:

- Plans and uses materials, tools and equipment to develop solutions for a need or opportunity ST3-2DP-T

Skills Focus

- Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships
- Employ appropriate technologies to represent data
- Compare data with predictions
- Present data as evidence in developing explanations

Content:

- Using and Interpreting Data

Content focus

Students:

- Develop knowledge and understanding of project management
- Learn abstraction and the relationship between models and real-world systems they represent

Australian Syllabus Links:

- ACTDIK015

STAGE 3 MATHS

Waterwise Garden

FOCUS AREA - Whole Numbers 2

Outcomes explored

A student:

- Selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations MA3-2WM
- Gives a valid reason for supporting one possible solution over another MA3-3WM

Content focus

Students:

- Interpret integers in everyday contexts, eg temperature

Australian Syllabus Links:

- ACMNA124

Waterwise Garden

FOCUS AREA - Data 1

Outcomes explored

A student:

- Gives a valid reason for supporting one possible solution over another MA3-3WM
- uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables MA3-18SP

Content focus

Students:

- Pose questions and collect categorical or numerical data by observation or survey
- Constructs displays, including column graphs, dot plots and tables, appropriate for data type with and without the use of digital technologies
- Describe and interpret different data sets in context

Australian Syllabus Links:

- ACMSP118
- ACMSP119
- ACMSP120

HOW SMART IS YOUR GARDEN?

Water is an important resource on the Central Coast due to the increasing demand on our water supply system. One way schools can contribute is being water conscious and having a Waterwise garden at school. Gardens at schools provide habitat for local animals, holds soil to ground during windy days and also beautifies the area.

The Central Coast has very hot summers and drought is always looming due to changes in climate. The amount of water required to keep the gardens lush and green depends on a variety of components. The type of plants, soil, shaded areas and ground cover all play a factor in water efficiency of a garden. Waterwise gardens focus on having plants species that can survive with very little water which are adaptations for dry environments. Water being a resource that is vital to everyone in the Central Coast it's important to properly plan out gardens to ensure water efficiency rather than water wasting. Today's experiment will survey a garden at your school to determine if your school's garden is Waterwise or water wasting.

The key areas of focus will be:

- Leaves
- Location
- Soil/ground cover
- Watering method

Equipment needed:

- Clipboard
- Thermometer

HOW SMART IS YOUR GARDEN?

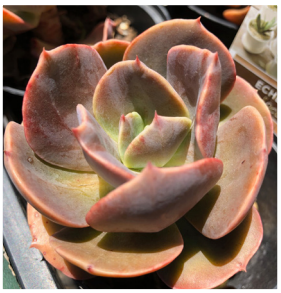
Leaves

Plants absorb water through their roots but they also lose water through their leaves. This process is called transpiration which is the flow of water from the leaves to the dryer atmosphere. This happens when the sun heats the leaves and turns the water inside the leaf into water vapour which can escape the plant. Plants have physical adaptations to limit this water loss such as:

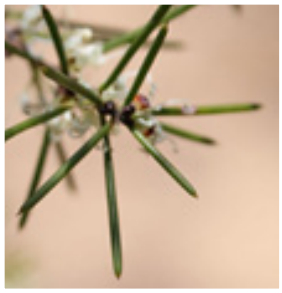
- Thick waxy leaves that limit the water loss and allows storage of water in the tissue of the leaves.
- Needle-like leaves to cut down on the surface area so they don't get as hot during the summer and reduce lose water.
- Hair like fibres that create insulation around the leaves to keep the dry wind from blowing away the humid air around the leaf.
- Leaves that are folded or curled can conserve water by not being fully exposed to the sunlight and wind thus limiting water loss.
- Leaves that are grey and silver reflect more sunlight which helps to minimize heating of leaves and water loss.

In table one below inventory all the plants in the garden based on the leaf categories. The inventory will be an important piece of data to determine if this garden is Waterwise.

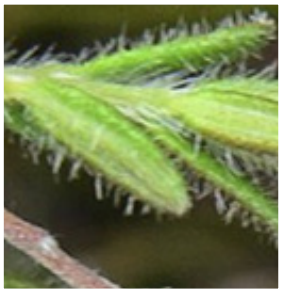
Grey and Silver leaves



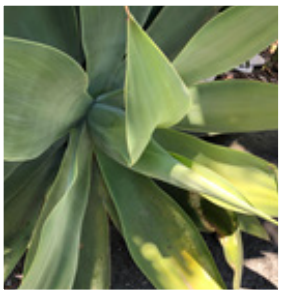
Thick waxy leaves



Needle-like leaves



Hairy leaves



Folded or curled leaves

Leaf types	Thick waxy leaves	Needle like leaves	Hairy leaves	Folded or curled leaves	Grey and sliver leaves	No leaf adaptations
Tally (individual plants						
Grand Total						

Place a tick mark in the box based on your findings from this experiment

Waterwise	Water wasting

HOW SMART IS YOUR GARDEN?

Shaded garden

Location

The amount of direct sunlight your garden receives impacts the water loss from the plants and soil. As temperatures increase moisture in the ground evaporates leaving less water in the soil for the plants to use. Leaves will also lose water from direct sunlight due to water turning into water vapour and escaping from the plant's leaves. Shaded areas limit direct sunlight and lessen the amount of water lost into the atmosphere. Wind can also play a significant role in water loss in gardens. When hot summer winds occur, they can pull moisture away from plants much like a hairdryer to wet hair. If gardens are fully exposed to wind and sun this can increase the amount of water loss. Having partially protected gardens will minimize the water loss due to wind and sun.

The table below has three categories where data will need to be collected and entered. Once the garden has been selected, circle the answers that best match the shade and wind options. Randomly select three different locations in your garden and record the temperature, shade and amount of protection from the wind at each location. Finally, calculate the average for your garden.

	Location 1	Location 2	Location 3	Average
Temperature (°C)				
Shade	No Shade Some shade Mostly shade	No Shade Some shade Mostly shade	No Shade Some shade Mostly shade	
Wind Protection	No protection Some protection Mostly protected	No protection Some protection Mostly protected	No protection Some protection Mostly protected	

Place a tick mark in the box based on your findings from this experiment

Waterwise	**Water wasting**

HOW SMART IS YOUR GARDEN?

Soil and Ground Cover

When water is applied to gardens the goal is to keep the soil wet for an extended amount of time so that the plants can absorb the water through their roots. The soil in gardens plays an important role in this process for retaining water. Certain types of soil can either hold the water like a sponge, let it pass through like a colander for spaghetti or some soil doesn't allow water to pass through and acts as a barrier. Having the proper type of soil in the garden beds helps to maximize the water being held for the plants to use. When trying to maximize water savings in gardens, ground cover is a vital component in achieving this. Ground cover is often added to the gardens to keep moisture in the soil by using woodchips, mulch and bark. This layer acts like a blanket that keeps the soil under it cooler which then limits how much water is lost by evaporation. Let's look to see if the soil and ground cover are doing their job.

Mulch

Use the table below to circle which soil type and ground covering exist in the garden. Complete this table and tick the box if you believe the soil and ground cover are Waterwise.

Soil	Mostly sand (water drains fast)	Mixture of sand, clay and other organic material (holds water for plants well	Clay (water doesn't absorb well)
Ground Cover	No groundcover. Exposed soil (hot soil, water loss to evaporation	Some wood chips, mulch and bark. Not completely coverered. (cooler soil under twood chips, holds some moisture	Woodchip, mulch and bark covering all the soil (cooler soild holds the moisture in soil

Place a tick mark in the box based on your findings from this experiment

Waterwise	**Water wasting**

HOW SMART IS YOUR GARDEN?

Watering Method

Effective components of a waterwise garden thus far include; water-efficient plants, soil that holds moisture, ground covering, and location. The final part of a waterwise garden is the watering method implemented. Watering the garden every day is not necessary if you have the correct plants, soil and ground covering. A good long soaking of the soil early in the morning or at night is the best. Taking away the suns ability to heat the soil and evaporate the water before the plants can absorb it is crucial. The way a garden is watered is very important since this is the direct use of water. Having a sprinkler system spraying water everywhere is inefficient if the sprinkler is not focused on the garden. Automated irrigation systems are very effective by having water directly applied to the soil allowing the plants to slowly absorb water with less water used and lost. A hose with a nozzle or a watering can be very effective since you can water specific areas while minimizing the waste of water in areas that do not need water. Lastly, where does the water used for gardens come from? Check to see if the school is using rainwater tanks to harvest water for gardens. Collected rainwater is best since it has no chemicals added and the water is not being taken from the potable water supply. Drought conditions are always looming which means when available try to use rainwater not town water for outdoor use.

Use the table below to circle which watering method, water source and watering time is being used. Complete this table and tick the box if you believe the soil and ground cover are waterwise.

Watering Can

Watering Method	Sprinklers (lots of water used everywhere)	Automated Irrigation (watering on a timer with various slow methods of water application)	Hose with nozzle or Watering Can (water can be placed where its need)
Water Source	Town Water (drinkable water)	Rain Water (collected in rain tanks, not treated)	Grey Water (re-used wastewater)
Watering Time	Early Morning (cool time of the day)	Mid-day (warmest time of the day)	Evening (cool time of the day)

Place a tick mark in the box based on your findings from this experiment

Waterwise	Water wasting

HOW SMART IS YOUR GARDEN?

Experiments Results		
	Results	**Waterwise or Water wasting**
Leaf (plant tally)		
Shade		
Temperature	C°	
Wind Protection		
Soil		
Ground Cover		
Water Source		
Watering Time		

Table. Smart Garden Results

HOW SMART IS YOUR GARDEN?

Teacher Debrief Q&A Ideas

1. **A waterwise garden has various components to ensure water is used to its maximum potential. After completing the experiment what do you conclude about the garden examined?**
   Students will look at their results and decide if the garden they inspected is waterwise or water wasting. Students may find it to be not conclusive if the results have a mixture of both waterwise and water wasting components.
2. **What are some ways to make the garden more water efficient?**
   Analysing the results, students can select which areas need changes and provide ways to achieve a more water conscious garden.
3. **What aspects of the garden are well designed?**
   Students discuss which areas of the garden were well designed and how that impacted the garden. Also, students can compare other aspects of the garden that did not meet the standard of a waterwise garden.
4. **Why is it important to have waterwise gardens at school?**
   Schools water usage varies depending on the size of the school, but generally one of the biggest uses of water at schools is water gardens, lawns and ovals. Minimizing water loss with proper planning of ovals, gardens and lawns can save significant amounts of water annually.
5. **How can you extend this knowledge beyond school?**
   Using the same experiment at home students can explore their own gardens. Students can then provide results from the experiment to family and friends.

Experiments Results		
	Results	**Waterwise or Water wasting**
Leaf (plant tally)		
Shade		
Temperature	C°	
Wind Protection		
Soil		
Ground Cover		
Water Source		
Watering Time		