

Plant picks

Curriculum focus

Year	Topic	Focus
Year 7	Science – Science understanding	<ul style="list-style-type: none"> Structures and processes involved with plant growth and reproduction.
Year 8		<ul style="list-style-type: none"> The interrelationships between organisms, energy and matter in ecosystems, and the effects of human activity on the sustainability of ecosystems.
Years 8 and 9	Geography – Geographical knowledge and understanding	<ul style="list-style-type: none"> Exploring the concepts of environment, nature and wilderness. Exploring the perception and use of environmental resources. Investigating environmental resources and human dependence on them.

Learning outcomes

Students will learn to:

- understand the relationship between local environmental characteristics and plants
- identify the suitability of plants to different environments
- identify plant characteristics which affect water requirements
- access information from a variety of sources
- analyse and interpret information to make recommendations
- explore and evaluate new ideas
- communicate conclusions and ideas.

Resources

- Fact sheet – *Microclimates*
- WaterRight Gardens WebTool - www.ap.urscorp.com/watertool/Introduction.aspx
- Sydney Water's Plant Selector Tool – sydneywater.com.au/SavingWater/InYourGarden/
- Worksheet 1
- Worksheet 2
- Worksheet 3
- Appendix 1 – Climate, rainfall and vegetation maps.

Web resources

- Australian Bureau of Meteorology - http://www.bom.gov.au/climate/environ/other/kpn_group.shtml and http://www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/annual-monthly-rainfall.cgi
- NSW Department of Environment, Climate Change and Water - <http://www.environment.nsw.gov.au/sop04/sop04ch3.htm>
- <http://www.bom.gov.au/jsp/watl/weather/frost.jsp>.
- Gardening Australia - <http://www.abc.net.au/gardening/stories/s908548.htm>
- Australian National Botanical Gardens - <http://www.anbg.gov.au/>
- Australian Plants Online - <http://asgap.org.au/apol.html>
- Weeds in Australia - <http://www.weeds.gov.au/>

Equipment

- Computer with Internet access
- Data projector
- Soil samples (sand, loam, clay)
- Stop watches or timer
- Buckets or bowls
- 3 x 2 L soft drink bottles cut in half (pre-prepared).

Technical requirements

To use the WaterRight Gardens WebTool you will need:

- Windows Internet Explorer 6.0 or above, Mozilla (Firefox) 2.0 or above
- pop-ups, cookies and Javascripts enabled
- a minimum screen resolution of 1280x1024.

Classroom organisation

- Whole class tasks
- Individual work

Learning sequence

Lesson 1

Objective: This lesson will explore the relationship between plants, soil, water and climate.

Task:

- Working as a class, students brainstorm a list of factors that affect plant growth (for example, climate, soil type, water etc).
- Using the brainstorm list, get students to discuss whether they think different types of plants could be affected by these factors. Introduce the different types of plants listed on Sydney Water's Plant Selector Tool:

annual	palm
bulb	perennial
climber	shrub
fern	tree
grass	turf
ground cover	vegetables and herb
orchid	

- Working individually, students select two of the above plant types and using a range of resources (Internet, books, scientific journals etc) complete Worksheet 1 (homework if required).

Lesson 2

Objective: To investigate the Australian climate, then the local climate and reinforce the relationships between climate, rainfall and vegetation.

Task: Put up three basic maps of Australian climate, rainfall and vegetation. These are shown in Appendix 1, and can be downloaded from the following websites:

- Climate: Australian Bureau of Meteorology
http://www.bom.gov.au/climate/environ/other/kpn_group.shtml
- Rainfall: Australian Bureau of Meteorology http://www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/annual-monthly-rainfall.cgi
- Vegetation: NSW Department of Environment, Climate Change and Water
<http://www.environment.nsw.gov.au/sop04/sop04ch3.htm>

Using the maps as a reference, students write a short outline of how the rainfall and climate of NSW may affect the type of vegetation found in this state.

Lesson 3

Objective: Investigate low water use plants.

Task:

- Students write some points about what the term 'low water use plants' means to them.
- Introduce the term 'xerophyte' as a definition of low water use plants. Using the information provided by students, write a class definition of this term.
- Students brainstorm a list of characteristics they believe to be particular to plants that are xerophytes.
- Discuss these ideas and using the list below as a reference, add any that have not been mentioned.

Characteristics of xerophytes	
Roots <ul style="list-style-type: none"> • deep taproots • wide spreading roots near the soil surface 	Leaves <ul style="list-style-type: none"> • thick, waxy cuticle – reflective and reduces evaporation • white and shiny – reflective and reduces evaporation • small surface area • fewer leaves • densely packed • rolled – to reduce leaf area exposure • covered in hairs/thorns – act as a wind break, produce small shadows on the surface of the plant which cools it, trap humid air and are a light reflecting surface
Stems <ul style="list-style-type: none"> • more fleshy and spongy to help store water 	Stomata <ul style="list-style-type: none"> • on underside of leaf to limit exposure to heat • fewer to reduce transpiration • closed during the day

- Students use a selection of the characteristics above to draw a low water using plant of their own.

Lesson 4

Objective: Investigate soil structure

What is soil? Soil is more than just 'dirt'. It is the food source and water holding area, for plants. It is also the home to worms, microbes, fungus and bacteria. The soil is its own living world.

Soil texture describes the relative content (more plain English term?) of soil particles, which consist of three main types: sand, loam and clay (or a combination of these).

Sand: A soil consisting of particles between 0.02 and 2.00 millimetres in diameter. Particles feel gritty and crumbly. Sandy soil is light coloured and low in nutrients, and water drains away easily. It can dry out quickly in hot weather.

Loam: Soil forms a ball but will crumble if too much pressure is applied. It is ideal for most plants and has good nutrient levels. It holds and drains water well. Loam includes all soil types in between sandy and clay soils.

Clay: A soil that has fine, dense particles that stops water soaking in easily, and that becomes hard and even more water-resistant in hot weather. Clay soil is smoother and more nutrient rich than a sandy soil and forms a ball easily when rolled in the hand.

Soil structure is the arrangement of the soil particles and pore spaces between them. Individual particles cluster into aggregates or crumbs held together by humus or decomposed organic matter. The pore spaces are required to let plant roots penetrate the ground, and to store water for the plant to use.

Soil depth is the distance you can easily dig down before you hit an impenetrable layer such as hard clay or rock. Soil is a medium. The more soil there is, the more food and water can be held for the plants and animals. The soil medium is measured by depth. Two hundred millimetres of soil has the potential to hold double the food and water than 100 mm of the same soil. Remember that texture can also impact on the amount of water held in the soil.

Task:

- Students design and perform an experiment to see which soil type holds the most water. You could also get students to conduct the following simple experiment. This experiment requires three clear 2 L soft drink bottles. Cut the bottles in half, and make three or four punctures in the bottom. Note: the teacher should prepare these bottles before class.
 1. Fill the three bottle halves with equal amounts of sand, loam and clay (one soil type in each half).
 2. Using the same amount of water for each, tip the water over the soil while holding over a bowl or bucket. Time how long it takes for the water to stop flowing through.
 3. Measure the amount of water that has passed through each soil type.
- Using the results of their experiment, students discuss which soil holds the most water. Refer to soil texture to describe which soil you think would be suitable to most garden plants.

It is important to reinforce that whilst clay holds the most water, it does not drain easily, often resulting in waterlogging. Loam is the best choice for garden plants.

- Students write a short report that outlines their experiment and the results.

Lesson 5

Objective: Explore indigenous plants

There are many different words used to describe plants that are local to a particular area. The terms 'native plant,' 'indigenous plant' and 'endemic plant' are commonly used.

Task:

- Have students work individually to create a definition of the term 'indigenous plant.'
- As a class, discuss how you think indigenous plants may differ in characteristics to non-indigenous plants. Create a chart that lists the characteristics of both indigenous and non-indigenous plants.

Note: refer to the characteristics of xerophytes in Lesson 3.

- Working in small groups or pairs, students use a variety of sources to research one indigenous and one non-indigenous plant to Australia. Take note of the physical differences and environmental requirements between indigenous and non-indigenous plants.

Examples of plants that could be selected	
Indigenous plants	Non-indigenous plants
<ul style="list-style-type: none"> Bacon and Egg Plant – (<i>Oxylobium capitatum</i>) Dianella (<i>Dianella caerulea</i>) Kangaroo Paw (<i>Anigozantus spp.</i>) Rough Daisybush (<i>Olearia rudis</i>) Snakebush (<i>Hemiandra pungens</i>) Snowy Daisy-bush (<i>Olearia lirata</i>) Spiked Featherflower (<i>Verticordia spicata</i>) 	<ul style="list-style-type: none"> Agapanthus (<i>Agapanthus africanus</i>) Arum Lily (<i>Zantedeschia aethiopica</i>) Diosma (<i>Coleonema pulchrum</i>) Lantana (<i>Lantana camara</i>) Leichhardt's Thornapple (<i>Datura leichharstii</i>) Rhododendron (<i>Rhododendron sp.</i>) Rose (<i>Rose sp.</i>) Prickly pear – (<i>Opuntia sp.</i>)

- Complete Worksheet 2.

Lesson 6

Objective: Investigate the suitability of plants for the local area.

Task:

As a class, discuss why some plants are more suitable than others to a particular area. What factors might influence the suitability of a plant to a certain area? For example, you may like to consider factors such as soil type and climate. Brainstorm:

- What are some of the common plants that only grow in Australia?
- Can you think of any that only grow in NSW?

Discuss the benefits of planting plants that are suitable to your local area.

- Using a variety of sources (including the Internet, scientific journals, books etc) ask students to complete Worksheet 3. The first half of the worksheet can be filled out using Sydney Water's Plant Selector Tool - sydneywater.com.au/SavingWater/InYourGarden/PlantSelector/.

Note: Water ratings used in the Plant Selector Tool are provided diagrammatically. One droplet indicates low water use, two drops indicated medium water use and three drops indicate high water use. Further information can be found on the Sydney Water website at sydneywater.com.au/SavingWater/InYourGarden/PlantSelector/WaterRatings.cfm

- Referring to the *Microclimates* fact sheet, discuss the effect of shade and wind on plants and water use.
- Outline what frost tolerance is. Frost tolerance can be described as the tenderness or hardiness of a plant and its susceptibility to succumbing to frost.

The Bureau of Meteorology provides some information about frost.
<http://www.bom.gov.au/jsp/watl/weather/frost.jsp>.

The Gardening Australia website (<http://www.abc.net.au/gardening/stories/s908548.htm>) provides a fact sheet on frost tolerance and provides some useful information on how frost can affect plants.

- Select one or two students to describe their selected plant and as a class discuss the suitability of each plant to the local area, using information relating to rainfall, soil type and frost.

Lesson 7

Objective: Investigate the similarities and differences between indigenous and non-indigenous plants.

Task:

- Select one indigenous plant and one non-indigenous plant from Lesson 5.
- Discuss the similarities and differences between the plants. Do you think there are any particular features of the indigenous plant that identify it as uniquely Australian?
- Ask students to vote for the plant they think will have the lowest water requirements.
- Work through the Water Right Gardens WebTool using each plant as the primary plant for one garden. Keep all information the same with the exception of the plants in each garden.
- Use the following information to complete the form. (Suggestion: Use a data projector to allow all students to have input into the web tool)

www.ap.urscorp.com/watertool/Introduction.aspx

Garden details

- Size: 3m²
- The garden is watered by drip irrigation and about 50% of soil is wet
- Your chosen plant is the only plant in this garden (note: if your chosen plants are not included on the list you will need to include it in the section under the plant list – based on its water use rating)
- Soil texture: sandy loam
- Soil structure: average
- Soil depth: 150 mm
- Moderate shade
- Some wind protection.
- As a class, discuss the results
 - Which plant has the lowest water requirement?
 - Why do you think this is?
- In pairs, ask students to describe how and why they think the results would change, if each of the following characteristics were changed in the hypothetical garden.
 - Clay soil
 - No shade
 - High wind exposure.
- Ask a representative from one or two pairs to tell the class about their discussion. Communicate these assumptions with the class.
- If time permits, work through the WaterRight Gardens WebTool keeping all information the same with the exception of soil type, shade and wind exposure. Discuss how accurate the assumptions were.

Lesson 8

Objectives: Investigate the difference in water requirements between indigenous and non-indigenous plants.

Task:

- Using information collected from Lesson 6 and 7, students work in groups to discuss whether they think there is a difference between the water required by indigenous and non-indigenous plants and why. Brainstorm ideas to support the reasoning.
- Invite a representative from each group to present their findings to the class.
- Discuss any differences with the class.
- Based on the discussion, ask students to work individually to write up a short report recommending a plant (or plants) that could be planted in one of the school gardens. Reports could include the following information:
 - Plant name(s)
 - Detailed description (using both words and labelled diagrams)
 - Environmental requirements (ie water requirements, preferred soil type, sun, shade etc).
 - Reasons why the plant is being recommended.
- Students should be encouraged to investigate the relationships between plants and their environment (ie soil type, wind and sun exposure, climate).

Follow up

It is recommended that this activity be followed by the lessons on microclimates.

Worksheet 1 - Prime picks

Plant type 1: _____

General characteristics (eg garden size, watering system, soil structure/texture/depth, shade and wind):

Explain how some of these characteristics influence the amount of water this type of plant requires to survive.

Plant type 2: _____

General characteristics:

Explain how some of these characteristics influence the amount of water this type of plant requires to survive.

Worksheet 2 - Prime picks

Indigenous plant

Common plant name: _____

Botanical plant name: _____

Description of the plant characteristic: _____

Plant type: _____

Sun/shade tolerance: _____

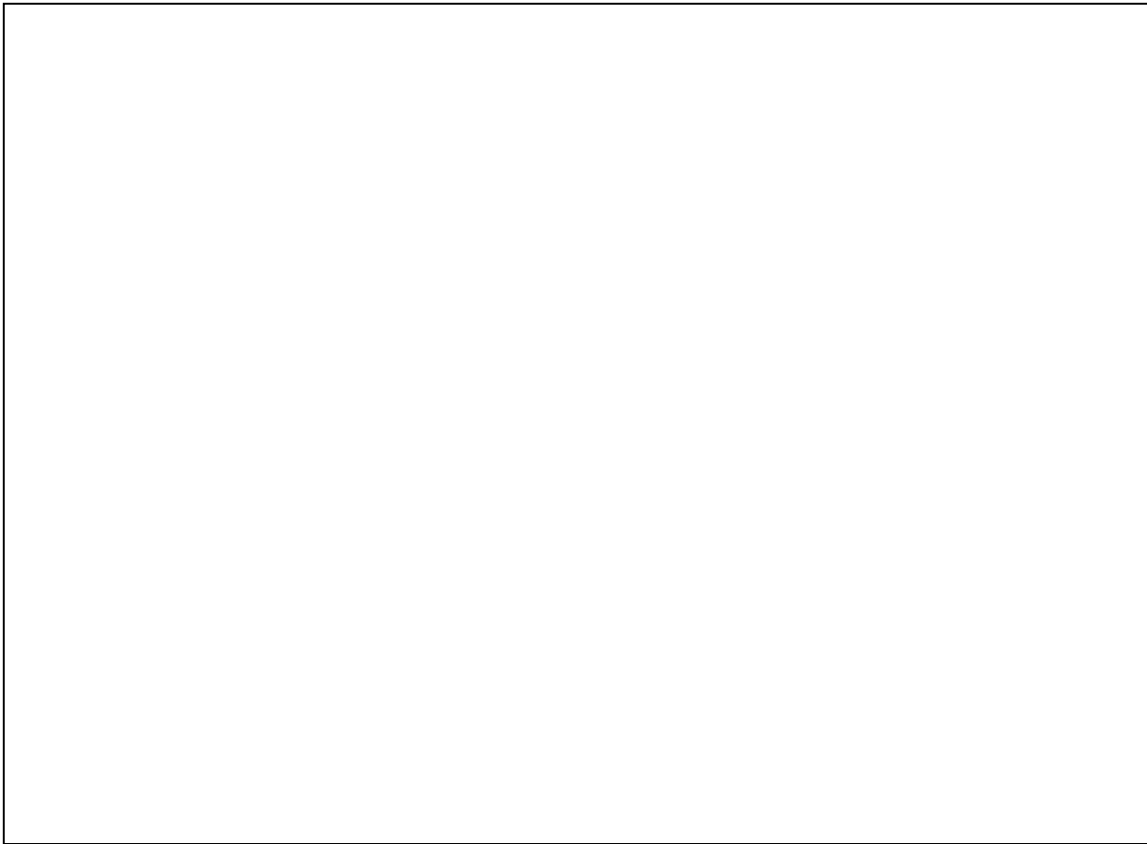
Frost tolerance: _____

Preferred soil type: _____

Water rating: _____

List some of the physical characteristics of this plant that may contribute to the amount of water it requires.

Draw a diagram of your plant, including labels to show some of the characteristics listed above.



List the reasons why you would or wouldn't recommend this plant for inclusion in your school garden.

Non-indigenous plant

Common plant name: _____

Botanical plant name: _____

Description: _____

Plant type: _____

Sun/shade tolerance: _____

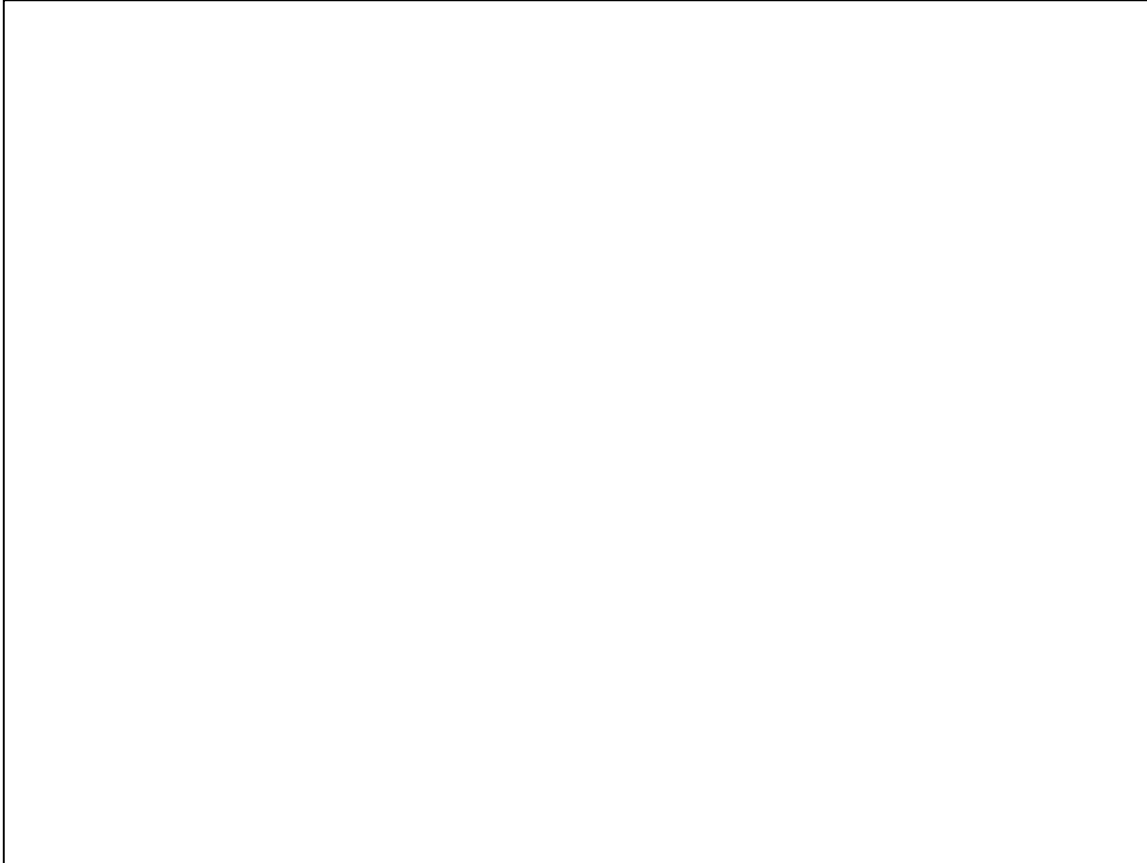
Frost tolerance: _____

Preferred soil type: _____

Water rating: _____

List some of the physical characteristics of this plant that may contribute to the amount of water it requires.

Draw a diagram of your plant, including labels to show some of the characteristics listed above.



List the reasons why you would or wouldn't recommend this plant for inclusion in your school garden.

Worksheet 3 - Prime picks

Any other plants of your choice (eg one particular plant found on the school playground)

Common plant name: _____

Botanical plant name: _____

Description: _____

Plant type: _____

Sun/shade tolerance: _____

Frost tolerance: _____

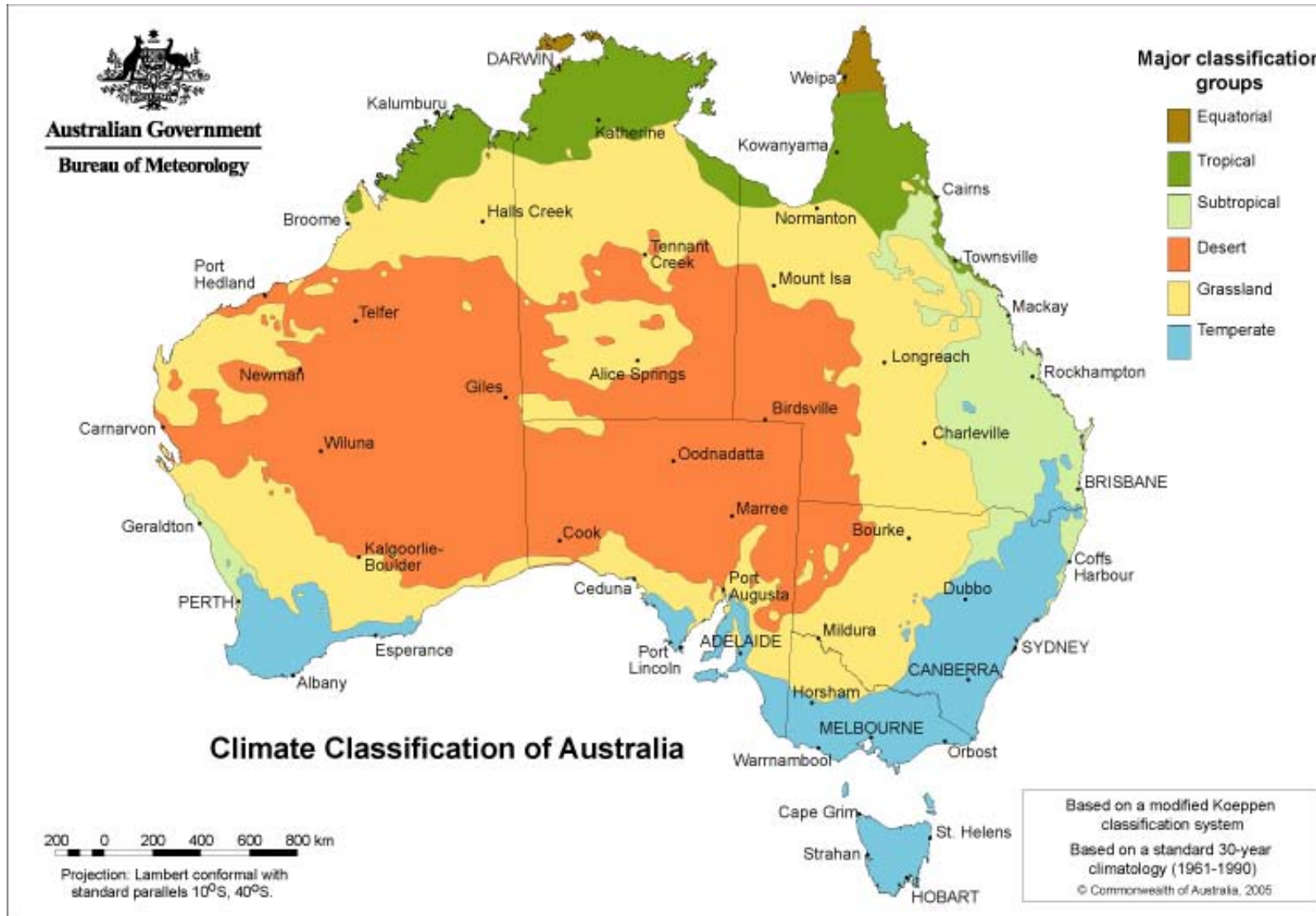
Preferred soil type: _____

Plant origin (indigenous/non-indigenous): _____

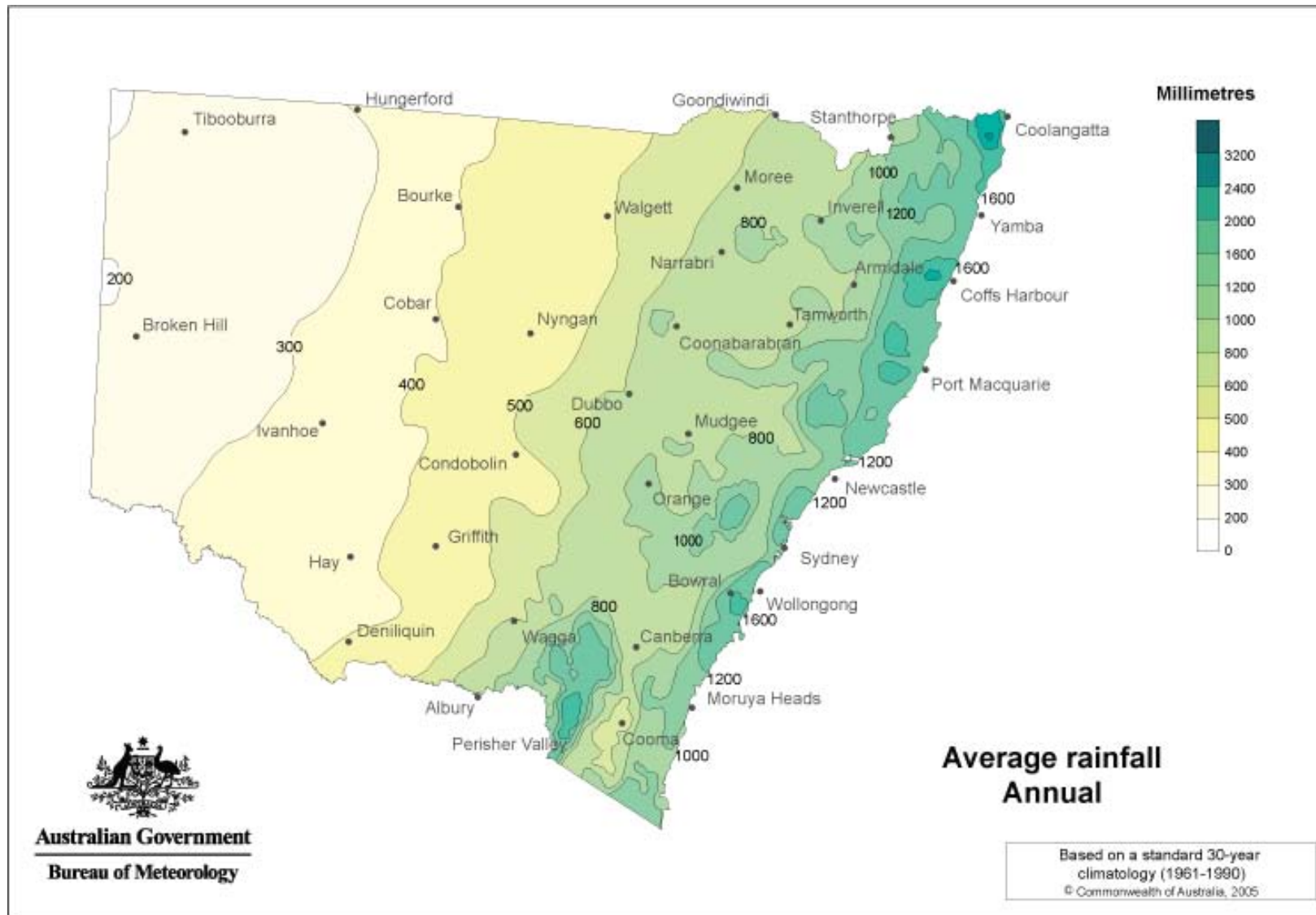
Water rating: _____

List the reasons why you would or wouldn't recommend this plant for inclusion in your school garden:

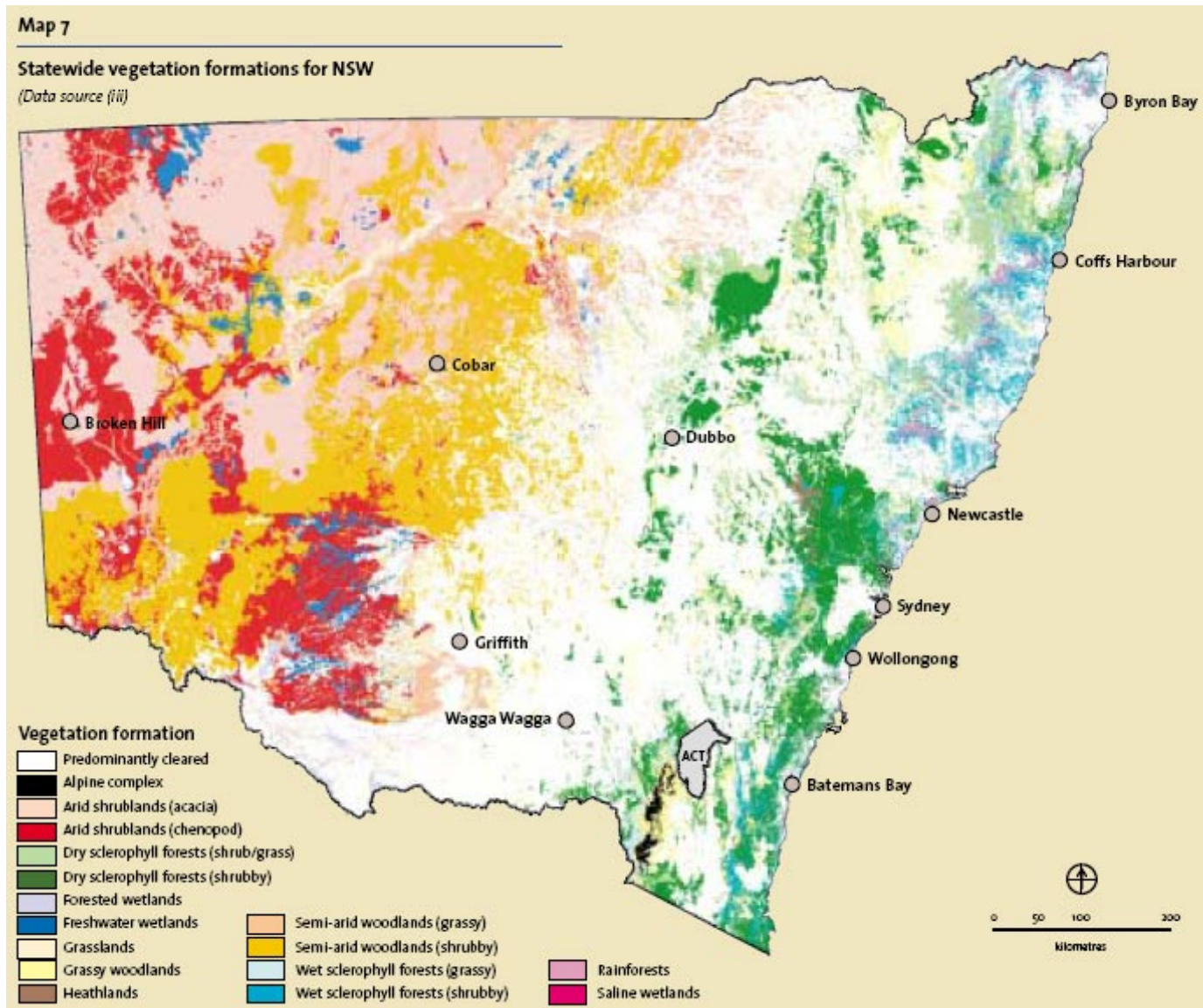
Appendix 1



Source: Australian Bureau of Meteorology website: http://www.bom.gov.au/climate/enviro/other/kpn_group.shtml



Source: Australian Bureau of Meteorology: http://www.bom.gov.au/cgi-bin/climate/cgi_bin_scripts/annual-monthly-rainfall.cgi



Source: NSW Department of Environment, Climate Change and Water: <http://www.environment.nsw.gov.au/sop04/sop04ch3.htm> page 7