

# Evolution of Australian Biota Study Day

2013

**The Australian Botanic Garden, Mount Annan** session  
*Evolution and adaptation of Australian natives*

## Student Activities

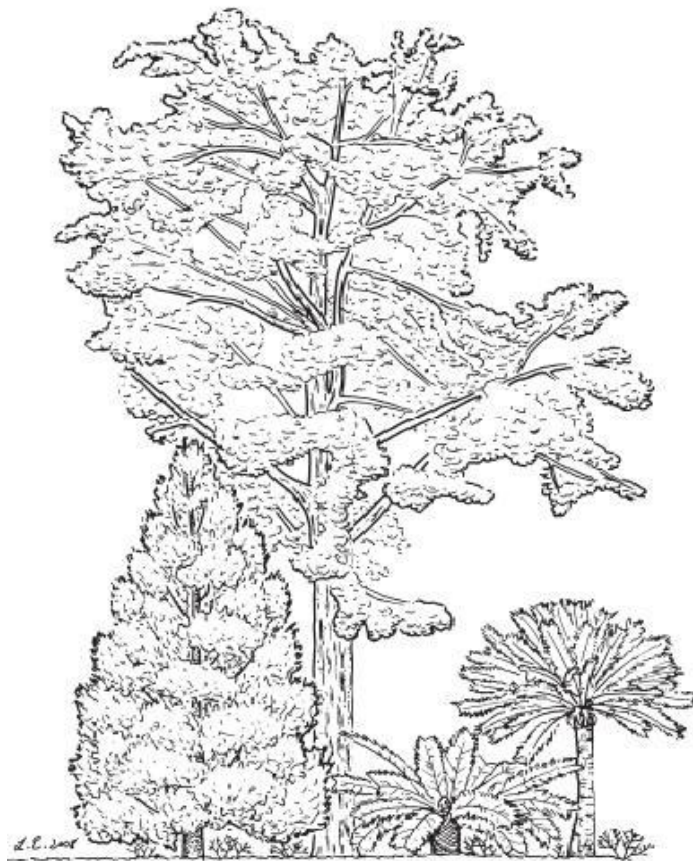


Illustration: Southern conifer forests,  
Royal Botanic Gardens & Domain Trust.

# Evolution of Australian Biota

## List of plants

Wollemi Pine	<i>Wollemi nobilis</i>
Podocarp (Mt Spurgeon Black Pine)	<i>Prumnopitys ladei</i>
Kauri Pine	<i>Agathis robusta</i>
Bunya Pine	<i>Araucaria bidwillii</i>
Hoop pine	<i>Araucaria cunninghamii</i>
Cycads	<i>Cycas revolta</i> , <i>Zamia integrifolia</i>
Ginkgo	<i>Ginkgo biloba</i>
Tree fern	<i>Dicksonia antarctica</i>
Skeleton Forked-Fern	<i>Psilotum nudum</i>
Ferns, Mosses, Liverworts, Algae	various
Wait-a-while Palm	<i>Calamus muelleri</i>
Tree waratah	<i>Alloxylon flammeum</i>
Rose silky oak	<i>Darlingia ferruginea</i>
Sandpaper Fig	<i>Ficus coronata</i>
Macadamia	<i>Macadamia integrifolia</i>
Magnolia	<i>Magnolia grandiflora</i>
Ribbonwood	<i>Idiospermum australiense</i>
Bolwarra	<i>Eupomatia laurina</i>
Grevillea	<i>Grevillea spp.</i>
Coastal Banksia	<i>Banksia integrifolia</i>
Kangaroo grass	<i>Themeda australis</i>

# Living fossils – Australian native plants past and present

This exercise requires you to measure and record your observations of the following parts of Australian conifers to compare the extinct *Agathis jurassica* with its modern relatives.

Fill in the table using the words below.

plant part	Ancient Kauri Pine <i>Agathis jurassica</i>	Modern Kauri Pine <i>Agathis robusta</i>	Wollemi Pine <i>Wollemia nobilis</i>
leaves			
cone			
other features of interest			
habitat:			
distribution:			

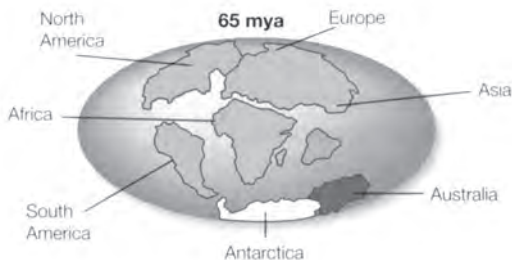
long and narrow	not evident	40 m tall
sedimentary rock	Gondwana	fossil fish
"chocolate crackle" bark	male and female	widespread
warm – cool temperate	rainforest	shallow lake
parallel veins	warm and wet	100 trees
smooth bark	protected environment	coppicing

# Landscapes of Gondwana

180 mya Gondwana and Laurasia begin breaking up



65 mya



Present



## Jurassic Period 165mya

- Great southern continent of Gondwana formed as it separates from the north
- Climate warm and wet
- Even climate across Gondwana with no dramatic seasonal changes
- Vegetation lush. Dominant plant groups included conifers, cycads, ferns, ginkgos, ferns and mosses
- Age of dinosaurs

## Cretaceous Period 110mya

- Gondwana breaking into pieces. Australia stays attached to Antarctica near Sth Pole.
- Climate changing, becoming colder then warming again
- Conifers, cycads and ferns still dominate, but with climate changes, new species are adapting and evolving.
- Flowering plants make an appearance, coevolving with insects.
- Dinosaurs still abundant.

## Tertiary Period 50mya

- Australia breaks away from Antarctica
- Polar currents cut Antarctica off from warmed water spreading from Equator
- Australia moving north on its own and starts to become drier.
- Flowering plants abundant. Evolved with pollinators and seed dispersers. In great variety of forms such as climbers, shrubs and epiphytes.
- Dinosaurs gone. Marsupials and birds become dominant in Australia.

## Quaternary Period Modern Australia

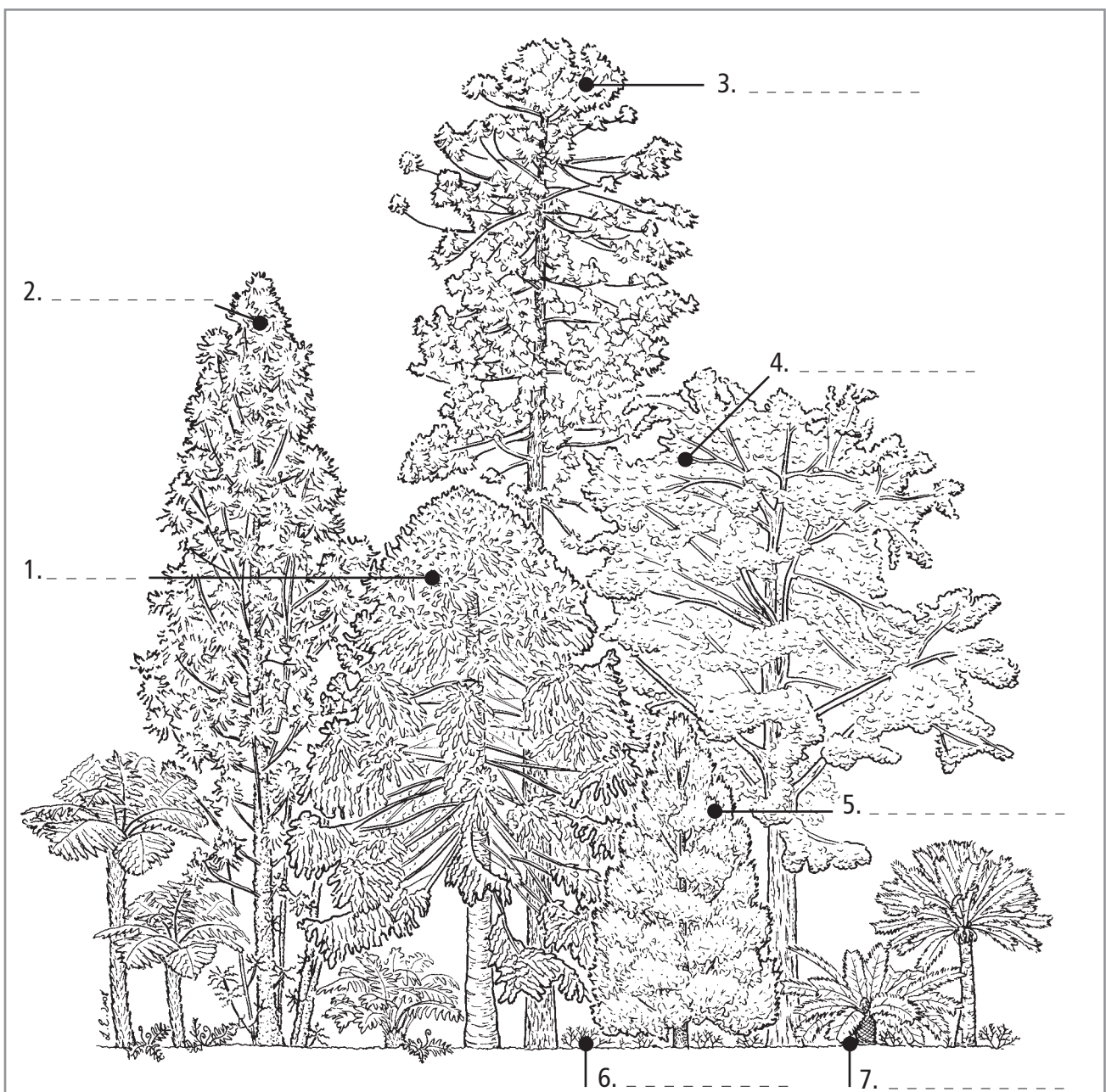
- Increasing aridity and frequency to fire. Dominated by Eucalyptus and Acacia plants and humans.
- Pockets of remaining rainforest still resemble ancient Gondwanan forests of Cretaceous.

# The forests of Gondwana

## Southern conifer forests

Southern conifer forests were a characteristic environmental feature across South Africa, South America, Antarctica, Australia, New Zealand and New Guinea — the lands of Gondwana — up until the rise of flowering plants in the middle to late Cretaceous (approximately 130 million years ago).

Label the modern day relatives of these ancient conifer forests.



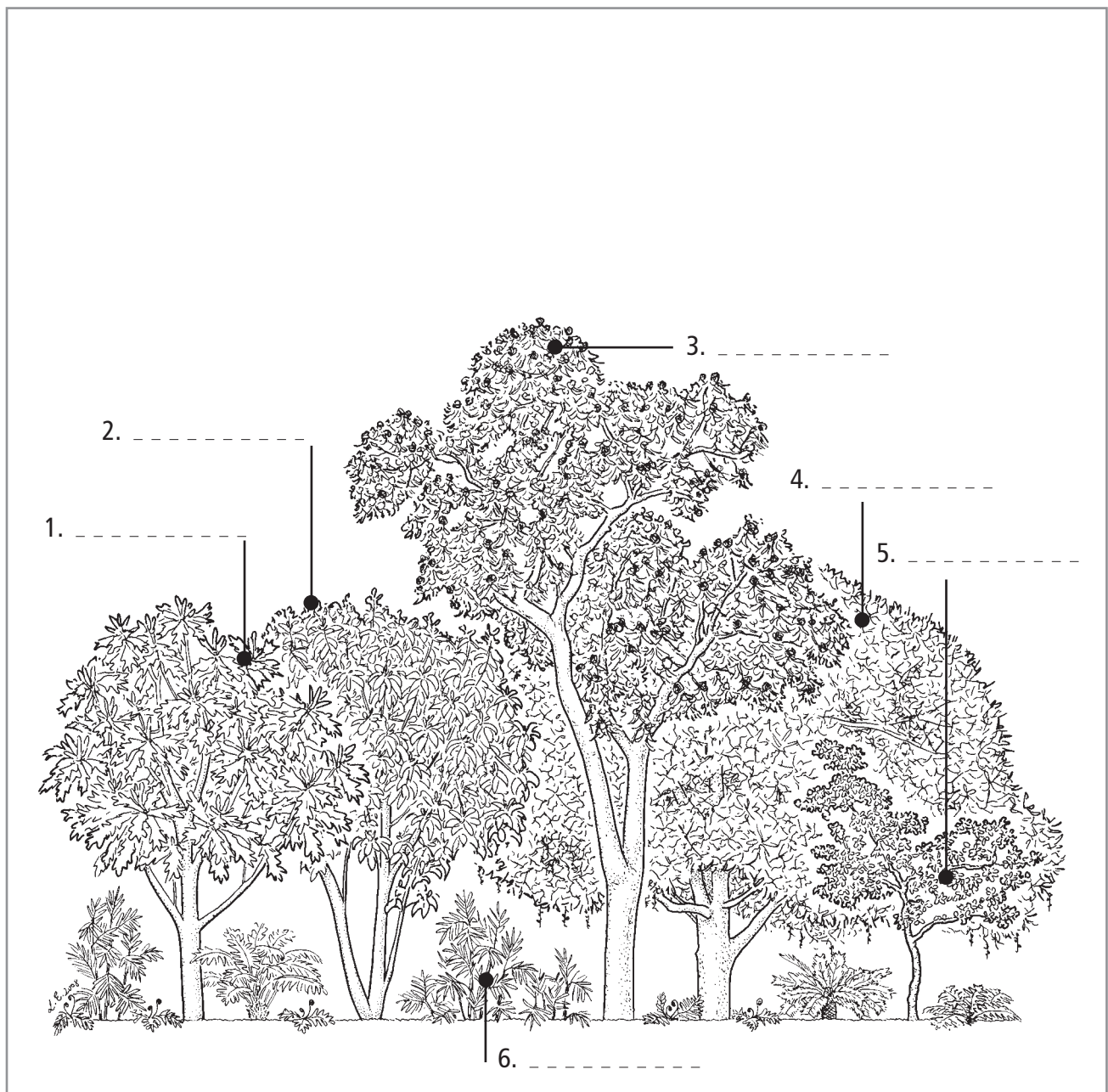


# The Forests of Gondwana

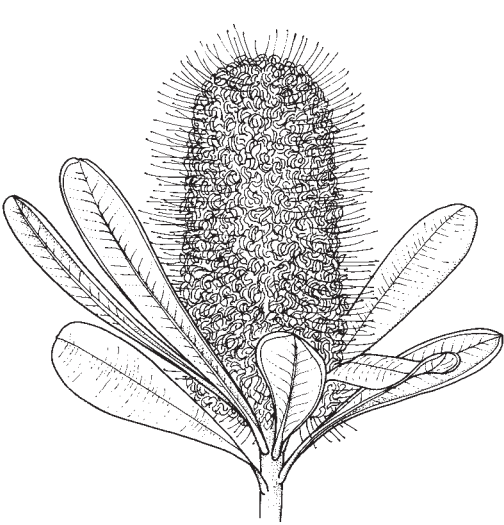
## Broad-leaved rainforests of Gondwana

At the time of Australia's rifting from Antarctica during the early Tertiary period (approximately 55–50 million years ago) broad-leaved rainforest covered much of the continent. Conifers shared the forests with flowering plants and the fossil pollen record shows early members of the Proteaceae (banksia family), Myrtaceae (eucalypt family), Casuarinaceae (she oak family) and many others.

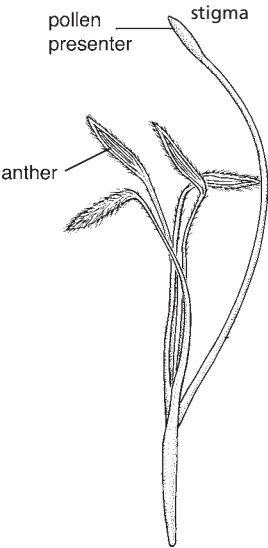
Label the modern day relatives seen in the Botanic Gardens of the broad leaved rainforests of Gondwana.



*Banksia integrifolia*  
Banksia



inflorescence



flower

Flowers \_\_\_\_\_

Colour \_\_\_\_\_

Position \_\_\_\_\_

Size \_\_\_\_\_

Pollen ☐ Yes ☐ No

Odour ☐ Yes ☐ No

Nectar ☐ Yes ☐ No

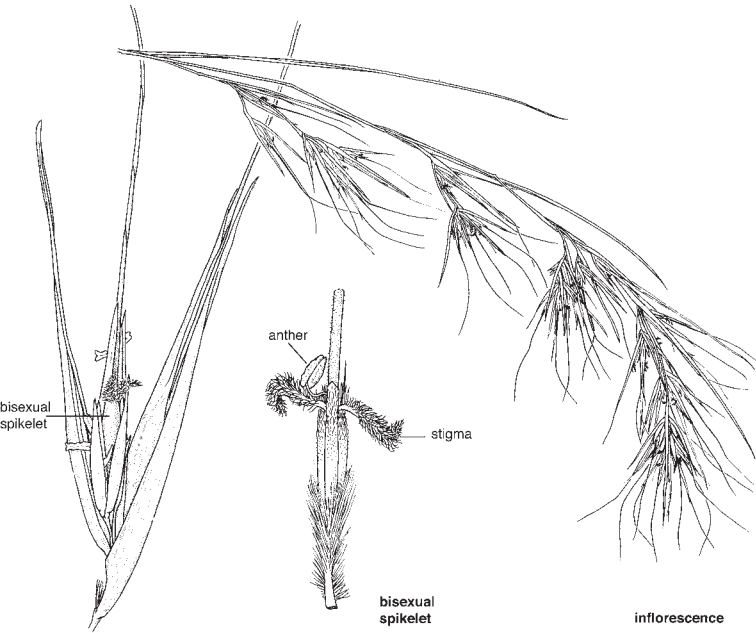
Pollinator \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*Themeda australis*  
Kangaroo Grass



Flowers \_\_\_\_\_

Colour \_\_\_\_\_

Position \_\_\_\_\_

Size \_\_\_\_\_

Pollen ☐ Yes ☐ No

Odour ☐ Yes ☐ No

Nectar ☐ Yes ☐ No

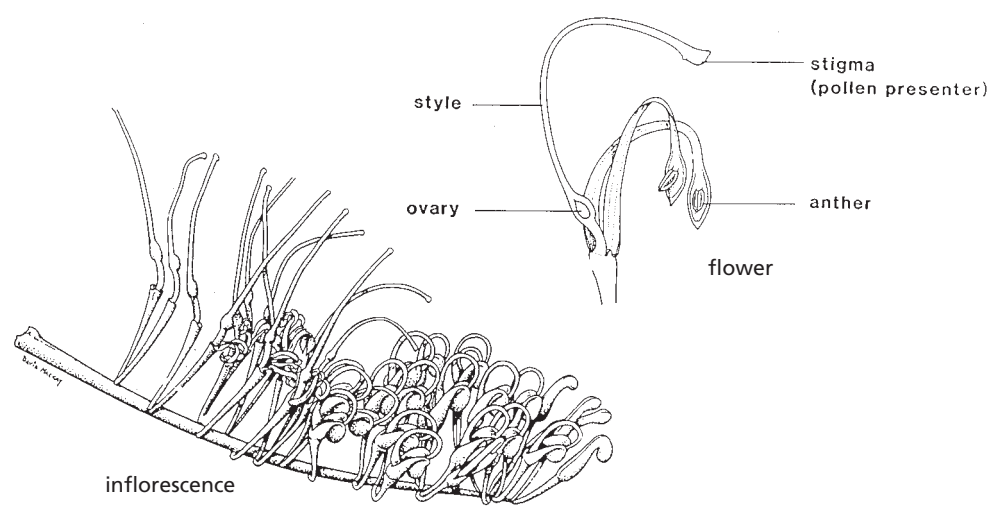
Pollinator \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*Grevillea* spp.  
Grevillea



Flowers \_\_\_\_\_

Colour \_\_\_\_\_

Position \_\_\_\_\_

Size \_\_\_\_\_

Pollen ☐ Yes ☐ No

Odour ☐ Yes ☐ No

Nectar ☐ Yes ☐ No

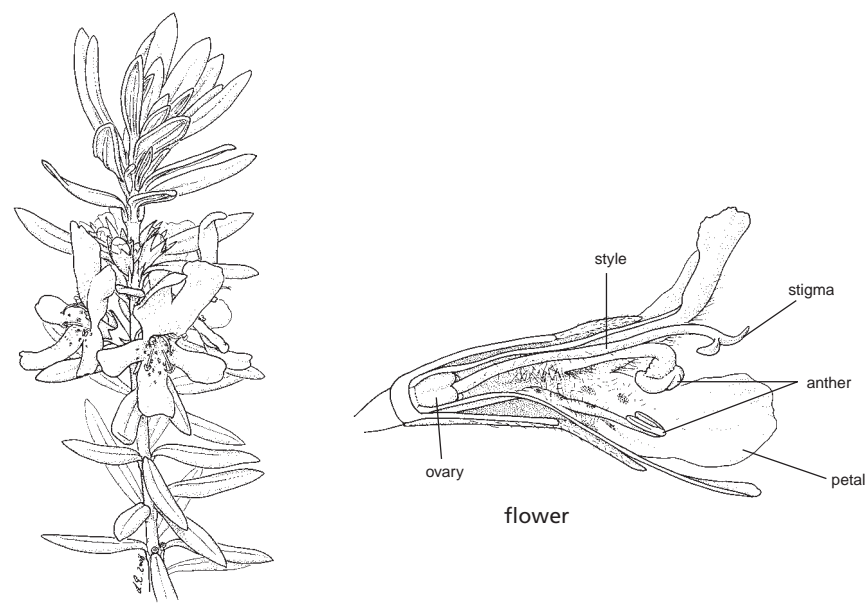
Pollinator \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*Westringia fruticosa*  
Coastal Rosemary



Flowers \_\_\_\_\_

Colour \_\_\_\_\_

Position \_\_\_\_\_

Size \_\_\_\_\_

Pollen ☐ Yes ☐ No

Odour ☐ Yes ☐ No

Nectar ☐ Yes ☐ No

Pollinator \_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_