Powerful pollinators

Encouraging insect pollinators in farm landscapes

Pollinators are an essential component of agricultural production and of healthy, biodiverse landscapes. Protecting and enhancing pollinator resources on farms will help support a diverse range of pollinators. This brochure provides an introduction to encouraging insect pollinators on farms, including a guide to choosing plants that will support diverse pollinators throughout the year.

WHEEN BEE FOUNDATION

The power of pollinators

Different animals — mostly insects, but also birds and mammals — help to transfer pollen between flowering plants, allowing the formation of seeds and fruit. Pollinators do this by visiting flowers in search of food (nectar, pollen or both) and transferring pollen from one flower to another in the process.

In Australia, honey bees, native bees and other native insects like hoverflies, wasps and butterflies provide essential pollination services for native plants, pastures, crops, fruits and vegetables.

Native vegetation supports pollinators by providing food and nesting sites. Nearby crops and pastures will benefit from the increased abundance and diversity of pollinators in the landscape.

Pollinators and food security

Without insect pollinators, the quantity and diversity of food grown for humans in contemporary agricultural systems would be severely restricted. Many of the food crops we eat, as well as pasture and fodder crops, benefit from pollination by insects.

Pollinator-dependent crops include almonds, apples, blueberries and vegetables, as well as many crops grown for seed production , such as canola. The quantity and diversity of insect pollinators are key drivers of production as they influence both crop yields and quality. Under-pollination results in smaller and misshapen fruit that is commercially unsaleable.

Grazing enterprises can also suffer from a reduction in the abundance or diversity of pollinators, due to the role these insects play in the persistence of nitrogen-fixing pasture legumes such as clover.

A diverse and healthy community of pollinators generally provides more effective and stable pollination than relying on any single species.

Insect populations are in decline worldwide due to land clearing, intensive or monocultural agriculture, pesticide use, environmental pollution, colony disease and climate change. Low pollinator numbers mean not all flowers are pollinated, leading to low fruit or seed set. This in turn reduces crop and pasture yields, farm profits and ultimately food supply.

Under-pollination results in smaller, misshapen fruit such as this strawberry.

Healthy ecosystems

Pollinators are both essential to, and depend upon, healthy ecosystems. A growing human population and increasing demand for food puts pressure on ecosystems, while declining ecosystem function will in turn negatively impact food production.

Insect pollinators are a prime example of this — without healthy ecosystems and the presence of patches of native vegetation to support insect populations, pollination will decline. This will threaten both crop productivity and the persistence of native, pollinator-dependent flowering plants.

Pollinators require habitat — such as diverse, native vegetation — that contains year-round food sources and nesting sites. The presence of pollinator habitat close to food crops has been shown to improve food production in adjacent crops by enabling a greater variety and number of pollinators to persist year-round, providing pollination services to crops when required.

Turn to the centre of this brochure for a guide to planting for pollinators.

Diapause or diet? Where are the insects?

Many insect pollinators undergo a diapause during colder winter months. Diapause is a period of suspended development during unfavourable environmental conditions, and during this period insect pollinators do not need flowers. Birds and other small mammals will however continue to benefit from available pollen and nectar during this time.

If there are low numbers of insect pollinators in the landscape, it is important to determine whether this is because of diapause, or because of an inadequate availability of nectar and pollen creating a 'food desert' where insect pollinators cannot survive.

There are still many unknowns about insect pollinators in Australia. Take part in Australian Pollinator Week or in the bi-annual Wild Pollinator Count to learn more about pollinators in your area — visit **AustralianPollinatorWeek.org.au** and **WildPollinatorCount.com**

Encouraging pollinators on your property

Create pollination reservoirs

Pollination reservoirs are areas of native plant species that provide floral resources for pollinators. They can be new plantings or existing habitat, such as shelterbelts or remnant vegetation. A high diversity of plant species is essential to provide nectar, pollen and nesting sites throughout the year. Pollination reservoirs need to be close enough to crops to ensure that pollinators can fly easily to them.

Use existing habitat

Protect and improve existing habitat where possible. Roadsides, shelterbelts, dam margins, woodlands, grasslands, rocky areas and river and creek edges can all be important pollinator-attracting areas, bringing valuable pollination services to your farm.

Native mallee stands provide habitat for pollinators. If you have them on your property, protect and enhance the areas where they grow.

Plant new trees, shrubs and groundcovers

Use a combination of direct seed sowing and planting tube stock to establish new vegetation. Initial watering and protection from grazing will improve the success rate of young plants. Forbs and native pea species are excellent pollinator attractors but more difficult to establish.

Plant according to habitat type and prepare for change

When establishing pollinator habitat, consider including species that are indigenous to your area but can tolerate increasingly drier and warmer conditions, to create resilient habitat for the future under climate change. Rehabilitate weedy areas into managed pollination reservoirs by introducing higher native plant diversity. Be careful not to plant invasive or listed weeds.

Amplify the flower signal

Plants have evolved large flowers or clusters of smaller flowers because they attract more pollinator visits. Large, colourful and diverse plantings attract more pollinators. Ideally, plant in groups that use all the vegetation layers possible — combine a species-rich mixture of forbs, ground covers, shrubs and trees.

Utilise ecotones

Ecotones are the margins between two different habitats. Ecotones often contain a more diverse mixture of species because they are used by species from both habitats. Protect and utilise ecotones such as the transition zones between woodland and grassland, or heath and shrubland, to create highly diverse floral and insect communities.

Get to know your local bush

Each farm and region will have distinct populations of insects, based on the plants and climate. Identifying and understanding the insects in your area will help you develop better plantings. The plants growing in nearby bush will be well suited to the climate and soils in your region. Local community groups and specialist native nurseries can provide useful information and usually produce local plant species.

Double the crop value

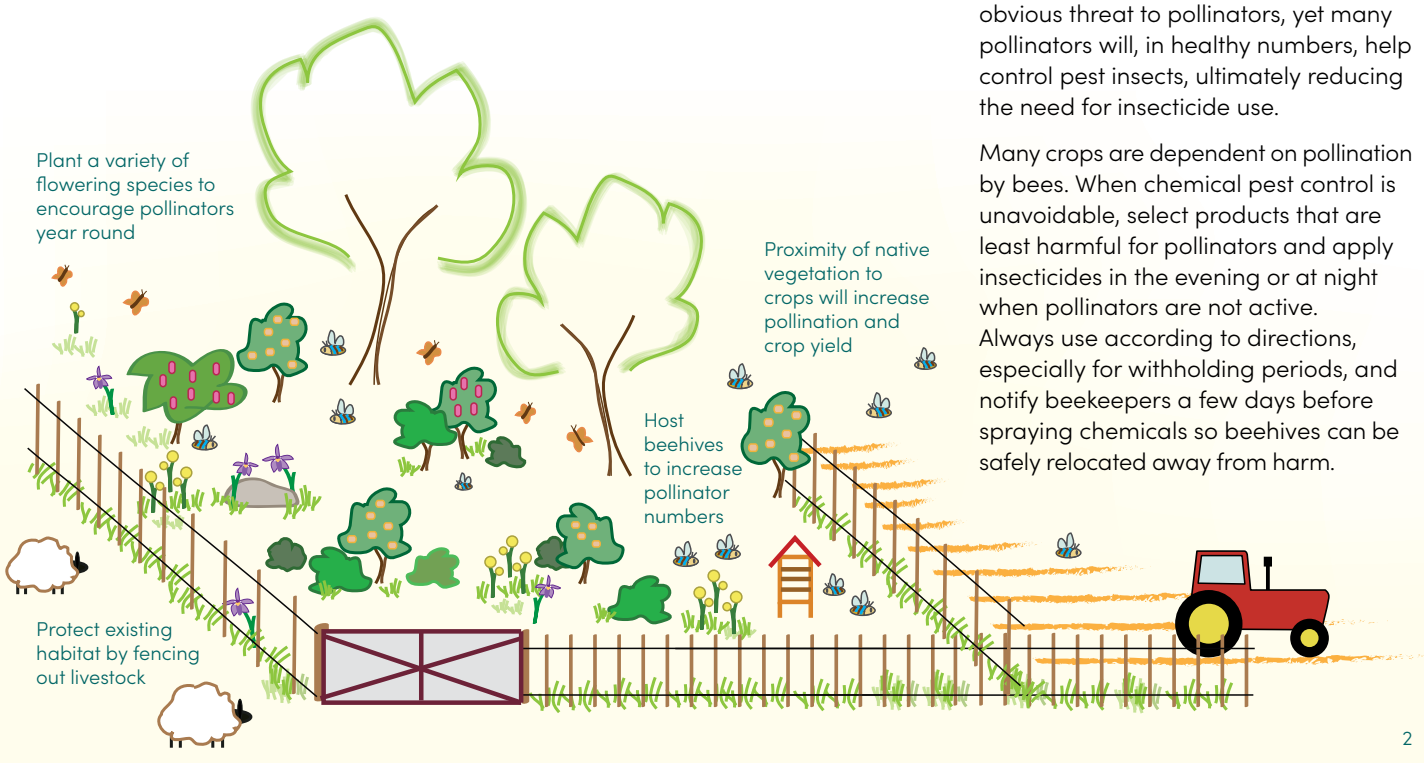
Plants that are pollinator-attracting are sometimes crop species in their own right and can be used to diversify farm production. Bush foods such as desert limes, bush tomato, yam daisy and many more are in high demand for use in fresh and manufactured products. Native plant seed is needed for revegetation projects.

Supporting beekeepers by hosting beehives is an opportunity to increase pollinator numbers on the farm.

Reduce chemical use where possible

Insecticides, fungicides and herbicides all affect bee, colony and wild pollinator health. Herbicides can impact pollinators by reducing the availability and diversity of flora and removing vegetation that helps support insect life. Some herbicides can also harm the beneficial bacteria in the insect gut. Insecticides are an obvious threat to pollinators, yet many pollinators will, in healthy numbers, help control pest insects, ultimately reducing the need for insecticide use.

Many crops are dependent on pollination by bees. When chemical pest control is unavoidable, select products that are least harmful for pollinators and apply insecticides in the evening or at night when pollinators are not active. Always use according to directions, especially for withholding periods, and notify beekeepers a few days before spraying chemicals so beehives can be safely relocated away from harm.



A guide to planting for pollinators for the Mallee, Victoria and SE South Australia

Healthy populations of insect pollinators are important for crop yields, orchard production and thriving native vegetation.

This planting guide will help you choose plant species to attract and keep pollinators on your property throughout the year.

All the plants listed have been selected for their resilience and capacity to supply rewards to pollinators. There is an emphasis on species that can withstand dry periods and irregular rainfall but some of the forbs, especially the lilies, will require moist habitats.

The eucalypt species in the chart have been selected as high quality honey production species. Most eucalypt species do not flower every year, so choosing diverse species will help create continuously flowering habitat.

How to use the calendar

To create pollinator-attracting plantings, use the guide to choose a selection of plants with a variety of floral colours, growth habits and flowering seasons.

For each species, the planting guide lists:

- plant growth habit (forb, shrub or tree) and height
- the habitat in which they naturally occur
- flower colour and flowering season
- the plant's growth requirements (sun or shade, moist or dry)
- the insect groups that use each plant and the type of reward the pollinator receives (pollen and/or nectar).

The coloured bars show the flowering months for each species. Heavier shading indicates peak flowering period. Because flowering dates will differ between regions and seasons, non-peak flowering months are shown in a paler tone. Take particular note of these non-peak times if your region is consistently warmer or cooler than average and experiences early or late flowering times.

Sourcing plants

Most of the plant species listed are easy to establish from tubestock or seeds and all are available from retail or wholesale nurseries. If you can't source these plants at your local nursery, ask them to contact the local wholesale nursery suppliers and plant growers listed online — see the reverse of this guide for details.

WHEEN BEE FOUNDATION

WheenBeeFoundation.org.au

Lifeform	Common name	Scientific name	Family	Vegetation type	Height	Flower colour	Flowering												Aspect	Soil moisture	Pollinator reward		Visitation by pollinator							
							Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			Pollen	Nectar	Native bees	Honey bees	Hoverflies	Wasps	Butterflies	Moths	Beetles	Flies
Crop plants																														
Lily	Onion seed	*Allium cepa*	Amaryllidaceae	Field	0.4–0.8 m	White											■	■	Sun	Moist to dry	●	●	●	●	●	●	●	●	●	●
Tree	Orange	*Citrus × sinensis*	Rutaceae	Orchard	2–4 m	White									■	■	■		Sun	Moist to dry	●	●	●	●	●					
Tree	Olive	*Olea europaea*	Oleaceae	Orchard	2–4 m	Cream-white									■	■	■		Sun	Moist to dry	●	●	●	●	●					
Tree	Almond	*Prunus dulcis*	Rosaceae	Orchard	2–4 m	White to Pink								■	■	■			Sun	Moist to dry	●	●	●	●	●	●				
Native plants																														
Daisy	Variable Daisy	*Brachyscome ciliaris*	Asteraceae	Grassy & floodplain woodlands	0.2–0.4 m	Mauve							■	■	■	■	■		Sun to semi-shade	Moist to dry	●	●	●	●	●		●	●	●	●
Daisy	Common Everlasting	*Chrysocephalum apiculatum*	Asteraceae	Woodland	0.1–0.35 m	Yellow	■	■	■	■	■				■	■	■		Sun	Moist to dry	●	●	●	●	●	●	●		●	●
Daisy	Clustered Everlasting	*Chrysocephalum semipapposum*	Asteraceae	Woodland	0.2–0.8 m	Yellow	■	■	■							■	■		Sun	Moist to dry	●	●	●	●	●	●	●		●	●
Daisy	Satin Everlasting	*Helichrysum leucopsideum*	Asteraceae	Woodland, shrublands	0.15–0.5 m	White and Yellow	■	■						■	■	■	■		Sun	Moist to dry	●	●	●	●	●		●		●	●
Daisy	Minnie Daisy	*Minuria leptophylla*	Asteraceae	Woodland	0.15–0.2 m	White and Yellow					■	■	■	■	■				Sun	Dry	●	●	●	●	●		●		●	●
Daisy	Fringed Daisy-bush	*Olearia ciliata*	Asteraceae	Heath, sand dunes	0.2–0.3 m	Mauve and Yellow								■	■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Daisy	Club-moss Daisy-bush	*Olearia lepidophylla*	Asteraceae	Woodland	0.5–1.3 m	Mauve and White			■	■	■	■							Sun	Dry	●	●	●	●	●		●	●	●	●
Daisy	Mueller Daisy-bush	*Olearia muelleri*	Asteraceae	Woodland	1–1.5 m	White							■	■	■	■			Sun to semi-shade	Moist to dry	●	●	●	●	●		●	●	●	●
Daisy	Pimelea Daisy-bush	*Olearia pimeleoides*	Asteraceae	Woodland	0.6–1 m	White and Yellow							■	■	■	■			Sun	Dry	●	●	●	●	●		●	●	●	●
Daisy	Variable Groundsel (Mallee form)	*Senecio spanomerus*	Asteraceae	Woodland	0.7–1 m	Yellow							■	■	■	■	■		Sun	Moist to dry	●	●	●	●	●		●		●	●
Forb	Australian Bugle	*Ajuga australis*	Lamiaceae	Woodland	0.05–0.3 m	Blue to Purple								■	■	■	■		Sun to semi-shade	Moist	●	●	●	●	●		●	●	●	●
Forb	Golden Pennants	*Glischrocaryon behrii*	Haloragaceae	Woodland	0.3–0.5 m	Yellow									■	■	■		Sun to semi-shade	Moist to dry	●	●		●	●		●	●	●	●
Forb	Cut-leaf Goodenia	*Goodenia pinnatifida*	Goodeniaceae	Woodland	0.2–0.4 m	Yellow										■	■	■	Sun	Moist to dry	●	●	●	●	●					
Forb	Sticky Goodenia	*Goodenia varia*	Goodeniaceae	Woodland	0.2–0.4 m	Yellow										■	■	■	Sun	Moist to dry	●	●	●	●	●					
Forb	Grey Germander	*Teucrium racemosum*	Lamiaceae	Woodland, floodplain woodland	0.15–0.4 m	White	■	■	■	■	■	■			■	■	■	■	Sun	Periodic inundation	●	●	●	●	●		●		●	●
Forb	Tufted Bluebell	*Wahlenbergia capillaris*	Campanulaceae	Woodland	0.15–0.5 m	Blue	■	■	■							■	■	■	Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	●
Lily	Leek Lily	*Bulbine semibarbata*	Asphodelaceae	Woodland	0.2–0.3 m	Yelllow										■	■	■	Sun	Dry	●	●	●	●	●				●	
Lily	Spreading Flax Lily	*Dianella revoluta*	Hemerocallidaceae	Woodland	0.4–0.7 m	Blue										■	■	■	Sun to semi-shade	Moist to dry	●*		●							
Pea	Sreading Eutaxia	*Eutaxia microphylla*	Fabaceae	Woodland	1–1.5 m	Yellow and Red									■	■	■		Sun	Dry	●	●	●							
Pea	Silver Cassia	*Senna artemisioides*	Fabaceae	Woodland	2–4 m	Yellow								■	■	■	■		Sun	Dry	●*		●							
Prostrate shrub	Muntries	*Kunzea pomifera*	Myrtaceae	Woodland	0.2–0.3 m	White										■	■	■	Sun	Dry	●	●	●	●	●		●	●	●	●
Prostrate shrub	Creeping Myoporum	*Myoporum parvifolium*	Scrophulariaceae	Woodland	0.05–0.1 m	White	■	■	■							■	■	■	Sun	Moist to dry	●	●	●	●	●		●	●	●	●
Shrub	Common Correa (Mallee variety)	*Correa reflexa var. scabridula*	Rutaceae	Heath	0.3–0.5 m	Green and Red				■	■	■	■	■	■				Sun to semi-shade	Moist to dry	●	●	●	●	●				●	
Shrub	Desert Grevillea	*Grevillea pteropserma*	Proteaceae	Shrublands	2–4 m	Cream-white		■			■	■	■	■	■	■	■		Sun	Dry	●	●	●	●	●	●	●		●	●
Shrub	Desert Baeckea	*Baeckea crassifolia*	Myrtaceae	Woodland	0.5–0.7 m	Pink									■	■	■		Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Desert Banksia	*Banksia ornata*	Proteaceae	Heath	2–3 m	Yellow					■	■	■	■					Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Mallee Boronia	*Boronia coerulescens*	Rutaceae	Woodland, heath, sand dunes	0.3–0.6 m	White to Pink-blue								■	■	■			Sun	Dry	●	●	●	●	●		●	●	●	●
Shrub	Common Fringe-myrtle	*Calytrix tetragona*	Myrtaceae	Woodland, floodplain woodland	0.5–3 m	White to Pink									■	■	■		Sun	Moist to dry	●	●	●	●	●	●	●	●	●	●
Shrub	Tangled Lignum	*Duma florulenta*	Polygonaceae	Floodplain woodland	1–2 m	Pale Yellow							■	■	■				Sun to semi-shade	Dry	●	●	●	●	●		●	●	●	●
Shrub	Berrigan, Emu Bush	*Eremophila longifolia*	Scrophulariaceae	Woodland	4–8 m	Red									■	■			Sun to semi-shade	Dry	●	●	●	●	●		●			
Shrub	Comb Grevillea	*Grevillea huegelii*	Proteaceae	Woodland, shrublands	3–4 m	Red													Sun	Moist to dry	●	●	●	●	●	●	●		●	●
Shrub	Holly-leaf Grevillea	*Grevillea ilicifolia*	Proteaceae	Woodland, shrublands, heath	0.25–2 m	Green and Red								■	■	■	■		Sun to semi-shade	Dry	●	●	●	●	●		●		●	●
Shrub	Desert Hakea	*Hakea mitchellii*	Proteaceae	Woodland, shrublands, heath	1–4 m	Cream-white										■	■	■	Sun	Dry	●	●	●	●	●	●	●		●	●
Shrub	Shrub Violet	*Hybanthus floribundus*	Violaceae	Woodland	1–1.5 m	Blue to Purple							■	■	■	■			Sun	Dry	●	●	●	●	●		●	●	●	●
Shrub	Broom Baeckea	*Hysterobaeckea behrii*	Myrtaceae	Woodland	1–2.5 m	White									■	■	■	■	Sun	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Mallee Tea-tree	*Leptospermum coriaceum*	Myrtaceae	Heath, sand dunes	3–4 m	White									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Mallee Honey-myrtle	*Melaleuca acuminata*	Myrtaceae	Woodland, heath	1–2 m	Cream-white									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Fringed Heath-myrtle	*Micromyrtus ciliata*	Myrtaceae	Woodland	0.3–1 m	White									■	■	■		Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Dillon Bush	*Nitraria billardierei*	Nitrariaceae	Floodplains	1–2 m	White									■	■	■		Sun	Moist to dry	●	●	●	●	●		●	●	●	●
Shrub	Desert Phebalium	*Phebalium bullatum*	Rutaceae	Woodland	1–2 m	Yellow									■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Shrub	Stiff Westringia	*Westringia rigida*	Lamiaceae	Woodland	0.3–0.6 m	White									■	■	■		Sun to semi-shade	Dry	●	●	●	●	●		●	●	●	●
Shrub to small tree	Small Kooba	*Acacia ligulata*	Fabaceae	Woodland, shrublands	2–3 m	Yellow								■	■	■	■		Sun to semi-shade	Dry	●		●	●	●		●	●	●	●
Shrub to small tree	Golden Wattle	*Acacia pycnantha*	Fabaceae	Woodland, shrublands	3–8 m	Yellow								■	■	■	■		Sun	Dry	●		●	●	●		●	●	●	●
Shrub to small tree	Nealie	*Acacia rigens*	Fabaceae	Woodland, shrublands	4–6 m	Yellow								■	■	■	■		Sun to semi-shade	Dry	●		●	●	●		●	●	●	●
Shrub to small tree	Kulua, Silver Needlewood	*Hakea leucoptera*	Proteaceae	Woodland	1–8 m	Cream-white									■	■	■		Sun	Dry	●	●	●	●	●	●	●		●	●
Shrub to small tree	Hooked Needlewood	*Hakea tephrosperma*	Proteaceae	Woodland, shrublands	1–8 m	Cream-white									■	■			Sun	Dry	●	●	●	●	●	●	●		●	●
Shrub to small tree	Moonah	*Melaleuca lanceolata*	Myrtaceae	Floodplain woodland	6–10 m	White	■	■	■										Sun	Moist to dry	●	●	●	●	●	●	●	●	●	●
Shrub to small tree	Sugarwood	*Myoporum platycarpum*	Scrophulariaceae	Woodland	2–10 m	White								■	■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Shrub to small tree	Weeping Pittosporum	*Pittosporum angustifolium*	Pittosporaceae	Woodland	6–10 m	Yellow									■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Subshrub	Small-leaf Ray-flower	*Cyphanthera myosotidea*	Solanaceae	Woodland	0.3–0.5 m	White								■	■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Subshrub	Shrubby Dampiera	*Dampiera dysantha*	Goodeniaceae	Woodland	0.4–0.7 m	Blue								■	■	■	■		Sun to semi-shade	Dry	●	●	●	●	●		●		●	●
Subshrub	Rosemary Dampiera	*Dampiera rosmarinifolia*	Goodeniaceae	Heath, sand dunes	0.4–0.6 m	Blue to Pink								■	■	■	■		Sun	Dry	●	●	●	●	●		●		●	●
Subshrub	Narrow-leaf Sida	*Sida trichopoda*	Malvaceae	Woodland, floodplain woodland	0.1–0.15 m	Yellow								■	■	■	■		Sun to semi-shade	Dry	●	●	●	●	●		●	●	●	●
Succulent	Inland Pigface	*Carpobrotus modestus*	Aizoaceae	Woodland	0.1–0.15 m	Purple								■	■	■	■		Sun	Dry			●	●	●		●		●	●
Tree	River Myall	*Acacia stenophylla*	Fabaceae	Floodplain woodland	4–20 m	Pale Yellow			■	■	■	■							Sun to semi-shade	Moist to dry	●	●	●	●	●		●	●	●	●
Tree	River Red Gum	*Eucalyptus camaldulensis*	Myrtaceae	Floodplain woodland	20–40 m	White									■	■	■		Sun	Moist	●	●	●	●	●	●	●	●	●	●
Tree	Black Box	*Eucalyptus largiflorens*	Myrtaceae	Floodplain woodland	15–20 m	White									■	■	■		Sun	Periodic inundation	●	●	●	●	●	●	●	●	●	●
Tree	Wilga	*Geijera parviflora*	Rutaceae	Woodland	8–10 m	White									■	■	■		Sun	Dry	●	●	●	●	●		●	●	●	●
Tree mallee	Dumosa Mallee, White Mallee	*Eucalyptus dumosa*	Myrtaceae	Woodland	4–10 m	White									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Yorrell	*Eucalyptus gracilis*	Myrtaceae	Woodland	5–7 m	White									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Yellow Mallee, Ridge-fruited Mallee	*Eucalyptus incrassata*	Myrtaceae	Woodland	3–5 m	Cream-white										■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Red Mallee, Giant Mallee	*Eucalyptus oleosa*	Myrtaceae	Woodland	4–6 m	Cream-white										■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Blue Mallee, Blue-leaved Mallee	*Eucalyptus polybractea*	Myrtaceae	Woodland	4–8 m	White									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Peppermint Box, Black Mallee Box	*Eucalyptus porosa*	Myrtaceae	Woodland	8–12 m	Cream-white									■	■	■		Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Grey Mallee, Christmas Mallee	*Eucalyptus socialis*	Myrtaceae	Woodland	6–10 m	Cream-white											■	■	Sun	Dry	●	●	●	●	●	●	●	●	●	●
Tree mallee	Green Mallee	*Eucalyptus viridis*	Myrtaceae	Woodland	4–8 m	Cream-white			■	■	■								Sun	Dry	●	●	●	●	●	●	●	●	●	●

*Buzz Pollinated

Know your pollinators

European honey bee
(*Apis mellifera*) © iStock

European honey bees have have two pairs of wings and long, segmented antennae. They are day-flying and feed on nectar and pollen. They are generalist pollinators and provide the bulk of pollination services for horticulture and crop plants. Honey bees and native bees are both essential to functioning ecosystems and food security in Australia.

Honey bees have become an important part of the Australian landscape. Honey bees live as colonies, and have a long history of coexistence with humans and co-evolution with agricultural farming systems. Hives can be transported by beekeepers to support crop pollination and to take advantage of flowering events to make honey.

Leafcutter bee
(*Megachile maculariformis*) © Karen Retra

There are more than 2000 species of **native Australian bees,** which provide essential pollination services. Native bees are generally solitary and live in nests in the ground or in hollow stems, old borer holes and other cracks and crevices, and some have evolved to pollinate particular native flowers through 'buzz pollination'. Although many Australian native bees are generalist foragers, some species have co-evolved with native plants and adapted to be the most effective pollinators of their flowers. Plants such as *Scaevola, Persoonia, Daviesia, Pultenaea* and *Swainsonia* require special skills to access their nectar and enable the transfer of pollen to the stigma. Most native bees are solitary, but some species found in northern Australia (*Tetragonula* sp. and *Austroplebeia* sp.) are social bees and are used for commercial pollination of crops like macadamia nuts.

Bee fly
(Family *Bombyliidae*) © Karen Retra

Flies can be identified by having only one pair of flight wings. A second set of wings are modified into club-shaped paddles that allow flies to hover and stabilize their flight. Unlike bees and wasps, they have very small, clubbed antennae at the front of their head. Flies feed on nectar, and many of them have hairy bodies that easily collect pollen while they are feeding. Flies are often attracted to flowers that smell carrion-like, and even blowflies will feed on nectar and are pollinators.

Hoverfly
(Family *Syrphidae*) © Karen Retra

Hoverflies are a type of fly, distinguishable by their large eyes, short antennae, bright black and yellow abdomen and their hovering flight behaviour. Adult hoverflies are nectar and pollen feeders. Hoverfly larvae feed on pests such as aphids, thrips and leafhoppers and are useful biocontrol agents.

Horned beetle
(*Rhipicera femorata*) © J. Hort

Beetles have hard outer wings that form their distinctive beetle shape. Their outer wings form a T-shape where they join at the top, unlike bugs where the outer wings make an X- or Y-shape. Beetles feed on nectar and pollen, usually by crawling over flower surfaces.

Meadow argus
(*Junonia villida*) © J. Hort

Butterflies have wings covered in tiny scales. They have clubbed antennae and hold their wings upright when at rest. They are day-flying and have long tongues that they can use to feed on nectar in flowers with deep tubes. Butterflies are usually brightly coloured.

Beautiful leaf moth
(*Gastrophora henricaria*) © Karen Retra

Moths also have wings covered in tiny scales and tend to be subtle in colour. They have antennae without clubs and hold their wings flat when at rest. They are generally dusk- and night-flying but there are some exceptions: the grapevine moth is a commonly seen day-flying moth. Moths feed on nectar.

Flower forms

© Meredith Cosgrove

Generalist flowers can be pollinated by many different insects and animals. They are typically saucer shaped with many stamens and have a surface that insects can walk on. *Eucalyptus* flowers and daisy flowers are generalist flowers – they can be pollinated by bees, flies, beetles and butterflies.

© Meredith Cosgrove

Specialist flowers have modifications to their shape and size that only let certain pollinators access the nectar and pollen. These flowers might have deep flower tubes or narrow entry points so that only a select group of pollinators can access them. The advantage of specialisation is that pollination is very targeted and efficient, with accurate pollen placement made possible by co-evolution between flowers and insects. The disadvantage is that if the correct pollinator isn't there, the flowers aren't pollinated. Often, nectar is produced at the base of the flower, forcing pollinators to enter the flower fully and in the process, become covered in pollen.

Pollinator rewards

Nectar is a sugary solution, rich in vitamins and minerals, that is produced by flowers and sometimes by glands on leaves or stems (called extra-floral nectaries). Nectar is attractive to insects, giving the instant energy needed to keep foraging.

But sugar alone doesn't support everything needed for health and growth, so insects also need pollen.

Pollen is rich in protein, fats and nutrients. Without pollen, bees and bee colonies cannot survive and raise young.

Buzz pollination

Some flowers do not produce any nectar; they specifically target pollen-collecting bees, and only offer pollen rewards. To limit pollen loss and ensure effective pollination, some plants produce flowers with specialised, tubular anthers, that only open at the tip. To extract pollen, bees use vibrations to 'buzz' the pollen grains out of the pores of these anthers. Many crops are buzz pollinated, including tomatoes, potatoes, eggplants, capsicum, chillies, tomatillo and cranberries.

European honey bees are unable to buzz pollinate flowers, but several native bees, such as the blue-banded bee, and teddy bear bee (*Amegilla* sp.) and carpenter bee (*Xylocopa* sp.) are exceptionally good large buzz pollinators, and have evolved to pollinate native plants such as flax lilies (*Dianella* sp.). Many of our smaller, ground nesting bees utilise vibration to help them excavate their burrows, and they also use that skill to buzz pollen from the anthers of native plants.

Planting buzz-pollinated species will encourage populations of buzz pollinators for successful pollination of food crops and ensure seed set in native plants. Many small ground nesting bees also buzz pollinate native flowers.

Nectar feeding

Grevillea flowers and other tubular flowers are often adapted to be successfully pollinated by birds. Pollen is 'presented' on a floral stigma that extends outside the flower. When birds feed on the nectar, pollen is deposited on their beaks or heads. Bees, also attracted to the sugary nectar, crawl into the side of the flower and feed on the nectar without encountering the pollen-laden stigma. The plant doesn't receive the pollination benefit from the insect, but flowers such Grevillea species can be a very useful source of nectar for insects in the cooler months.

Wholesale Nurseries

Most of the plants shown in the planting guide will be available at nurseries that have a good stock of native plants. But if your local nursery doesn't stock the plant you're after, ask them to order it in. For a list of wholesale nurseries that stock all the plants shown in the planting guide, plus other useful resources, visit the Wheen Bee Foundation website or scan the QR code.

SCAN ME

WheenBeeFoundation.org.au/our-work/powerful-pollinators

Wheen Bee Foundation

Powerful Pollinators Planting Guides are produced by Wheen Bee Foundation. We fund vital strategic research and education initiatives that strengthen bees, improve pollination efficiency, and protect our food security and ecosystem health. Visit the website for more information.

WheenBeeFoundation.org.au

Far left: The spreading flax lily, *Dianella revoluta*, is buzz pollinated.

Left: This European honey bee is 'side-working': feeding on the nectar-rich flowers without coming into contact with the plant's pollen.

Front cover:
1. Australian native blue-banded bee, *Amegilla* species. (Photo: Anwit Pandit)
2. Almond plantation in the Mallee. (Photo: Almond Board of Australia)
3. European honey bees, *Apis mellifera*. (Photo: Kirrily Hughes)

This project is supported by: Smart Farms, through funding from the Australian Government's National Landcare Program, and our project partners Burt's Bees and Sustainable Farms.

Australian Government | National Landcare Program

BURT'S BEES® TRUE TO NATURE™

BurtsBees.com.au

SUSTAINABLE FARMS

SustainableFarms.org.au

WHEEN BEE FOUNDATION