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.

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The power of pollinators

Pollinators – mostly insects, but also birds and mammals – assist the formation of seeds and fruit in many plant species by visiting flowers in search of food (nectar and/or pollen). Whilst foraging they transfer pollen from one flower to another, facilitating fertilization, which results in fruits and seeds.

Honey bees, native bees and other native insects like hoverflies, wasps and butterflies provide essential pollination services for native plants, garden flowers, 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 and flowers grown in backyard gardens would be severely restricted. Many of the foods we eat, from gardens and farms, benefit from pollination.

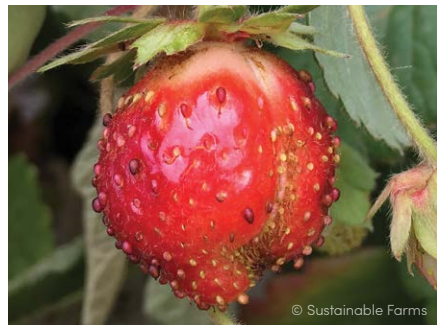
Pollinator-dependent foods include citrus, apples, stone-fruits, zucchini, pumpkins, strawberries and tomatoes, as well as plants grown for seed such as sunflowers, coriander and parsley.

The quantity and diversity of insect pollinators are key drivers of production as they influence both food yields and quality. Under-pollination results in smaller and misshapen fruit or seed that isn't viable to grow.

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

Pollinators are essential to, and dependent upon, healthy ecosystems. A growing human population and increasing demand for food puts pressure on ecosystems, with potential negative impacts on biodiversity, the environment and food production.

Insect populations are in decline worldwide due to land clearing, intensive or monocultural agriculture, pesticide use, pollution, colony disease, increased urbanisation and climate change. Low pollinator numbers mean not all flowers are pollinated, leading to low fruit or seed set. This in turn reduces fruit and vegetable harvest yields, and decreases food supply.



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

Backyard biodiversity

Insect pollinators are a prime example of the importance of healthy ecosystems in urban gardens, parks and reserves. Insects are the 'canaries in the coal mine' of our urban and rural environments. Without our 'littlest creatures', we lack pollinators, natural beneficial pest control services, and critical food source for other insects, birds, amphibians, reptiles and mammals.

The presence of connected and widespread pollinator habitat is critical to support insect populations if we are to maintain sustainable cities and productive, healthy gardens and urban farms for food security and biodiversity.

Pollinators require habitat that contains year-round food sources, breeding resources and nesting sites. The presence of pollinator habitat adjacent to food crops has been shown to improve food production by enabling a greater variety and number of pollinators to persist year-round, providing pollination services 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 continue to benefit from available pollen and nectar during this time.

If there are low numbers of insect pollinators in your local area, 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 in your garden

Create pollination reservoirs

Pollination reservoirs are areas that provide floral resources for pollinators. They can be gardens, new planting or existing habitat such as established trees, or even local bushland, parks or reserves. 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 where pollinators live to ensure that they can fly easily to them.

Improve on what you have

Enhance and improve your existing pollinator habitat where possible. Gardens that already contain established trees, rockeries, ponds, bare soil and organic matter, and a variety of flowering plants, are a valuable resource for beneficial insects and pollinators.

Nature-strips, verges, laneways, vegetable gardens, orchards, nature reserves, and riverbanks and creeks can all be important pollinator-attracting areas. Protect and enhance native pollinator plants in your garden and surrounds for the future.

Plant trees, shrubs and groundcovers

Planting a variety of species of groundcovers, shrubs and trees to in your garden will further attract pollinators to your patch. Initial watering and protection will improve the success rate of young plants. Some species such as wildflowers or native pea species are excellent pollinator attractors and reward careful attention by keen gardeners.

Be a citizen scientist and do some detective work to discover local pollinators in your patch. Visit **inaturalist.ala.org.au** to be involved.

Construct insect real estate

Insect hotels, which are both functional and attractive, are a great way to add to habitat and nesting places for pollinators and insects in your backyard or garden. The hotels are easily moved to be close to flowering plants and those needing pollination, especially if you have a new garden that is still growing. Include lots of different sized holes, cracks and crevices to provide homes for various solitary insect pollinators.

Plant for the future

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 climate change. Rehabilitate weedy areas into managed pollination reservoirs by introducing lots of flowering plant diversity. Be careful not to plant invasive or listed weeds, and look for suitable replacements.

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 contain different vegetation layers — combine a species-rich mixture of wildflowers, ground-covers, herbs, lilies, rushes, climbers, shrubs and trees.

Connectivity counts

Insect pollinators benefit from greater connectivity of habitat in a landscape, which allows them to forage over a wider radius and increase in numbers in a local area. Encourage friends and neighbours to plant for pollinators and create connections in your community.

Get to know your local flora

Your local government area has distinct populations of insects, depending on the local flora and environment. Knowing your local insect species will help you develop better plantings.

The plants growing in nearby nature reserves or bushland will be suited to your climate and soils. Local environment groups and specialist native nurseries can provide information about local plants.

Grow a bumper crop

Pollinator-attracting plants include many fruits and vegetables grown in backyards, community and market gardens, and orchards. Pollinators ensure good yields of crops such as apples, beans, avocado, and almonds, and bush foods such as lilly-pilly and yam daisy.

Reduce chemical use

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.

Safeguard the bees? The best way to 'save the bees' and protect our pollinators is to create an abundance of diverse habitat — from the ground up! There is much interest in keeping a bee hive to promote pollinators, but there are serious legal and biosecurity responsibilities that must be considered, and that the introduction of a bee hive does not displace existing native pollinators and insects. Be a friend of pollinators and say it with flowers!

A guide to planting for pollinators for the Sydney Basin Coastal region

Healthy populations of insect pollinators are important for sustainable and resilient farms, orchards, gardens, and native flora.

This Guide will help you select plant species to attract and sustain pollinators in agricultural areas and gardens throughout the year.

The eastern portion of the Sydney Basin Bioregion within New South Wales encompasses coastal subregions extending from the Illawarra to Nowra. The coastal subregions within the Sydney Basin feature vegetated cliff-faces on coastal escarpment, with waterfalls and streams. The variety of high-fertile loam soils support species-rich vegetation communities. The coast hosts mixed warm-temperate and subtropical rainforests, coastal dunes, freshwater swamps, lakes, mangroves and estuaries. It is dominated by a temperate climate characterised by warm summers with no dry season.

The plants listed in this Guide will help supply rewards to pollinators, with an emphasis on species that are indigenous and suited to local climates.

Garden centres sell many common pollinator-attracting ornamental flowers and herbs labelled as 'bee-friendly'.

The eucalypt species in this Guide are mostly large trees, and not suitable for all gardens, but have been included for their value as good nectar producing species. Most eucalypts do not flower every year, so choosing diverse species will help create continuously flowering habitat.

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The pollinator plant list

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

For each species, the planting Guide lists:

- life-form/'habit' (climber, herb, shrub or tree) and height (m).
- the vegetation type in which they naturally occur
- flower colour and flowering season
- growth requirements (sun/shade, moist/dry)
- insect groups that may visit each plant and the floral reward (pollen and/or nectar).

The coloured bars indicate the flowering months for each species. Darker shading denotes the peak flowering period, with a lighter shading for non-peak flowering months. Flowering dates may differ between regions and seasons, particularly for non-peak times, if your local climate is consistently warmer or cooler than average, with earlier or later flowering.

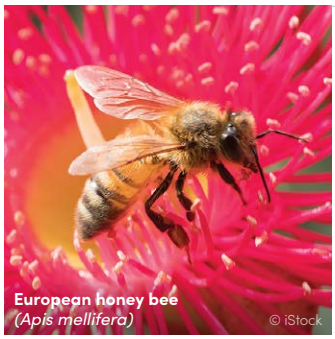
Sourcing plants

Most of the plant species listed are available from retail or wholesale nurseries or native plant growers, and local environment groups. If you can't source these plants at your local garden centre, or indigenous nursery, ask them to contact the local wholesale nursery suppliers and plant growers listed online. See the reverse of the Guide for details.

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
Climber/Forb	Creeping Bossiaea	*Bossiaea prostrata*	Fabaceae	Variable	0.6 m	Yellow, Red													Sun to semi-shade	Dry	●	●	●	●		●				
Climber/Forb	Climbing Saltbush	*Einadia nutans* subsp. *linifolia*	Chenopodiaceae	Variable	1 m	Green													Sun to semi-shade	Dry	●	●		●					●	●
Forb	Common Woodruff	*Asperula conferta*	Rubiaceae	Woodland, Grassland, Forest	0.3 m	White													Sun to semi-shade	Moist	●		●	●	●					●
Forb	Grass Daisy	*Brachyscome angustifolia*	Asteraceae	Swampy ground	< 0.7 m	Purple, Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	
Forb	Rock Daisy	*Brachyscome multifida*	Asteraceae	Sclerophyll forest, Grassland	0.1–0.2 m	Purple, Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	
Forb	Pale Grass-Lily	*Caesia parviflora*	Anthericaceae	Heath, Woodland, Dry Sclerophyll Forest	< 0.6 m	White-purple													Semi-shade to shade	Moist to dry	●		●	●	●	●	●	●	●	●
Forb	Yellow Burr-Daisy	*Calotis lappulacea*	Asteraceae	Sclerophyll woodland, grassland	< 0.5 m	Yellow													Sun to semi-shade	Moist	●		●	●	●	●	●		●	●
Forb	Billy Buttons	*Craspedia variabilis*	Asteraceae	Sclerophyll forest, Woodland, Grassland	< 0.5 m	Yellow													Sun to semi-shade	Moist	●		●	●	●					
Forb	Blue Flax-Lily	*Dianella longifolia*	Phormiaceae	Sclerophyll forest	0.8 m	Purple													Sun to semi-shade	Dry	●		●							
Forb	Nodding Chocolate Lily	*Dichopogon (Arthropodium) fimbriatus*	Antheriaceae	Sclerophyll forest, Woodland, Grassland	0.35–1 m	Purple													Sun	Moist	●		●			●				
Forb	Native Geranium	*Geranium solanderi*	Geraniaceae	Woodland, Grassland	< 0.6 m	Pink, White													Sun to semi-shade	Moist	●	●	●	●	●	●			●	●
Forb	Branched Goodenia	*Goodenia paniculata*	Goodeniaceae	Woodland, Grassland, Heathland, Swamp fringe	< 0.5 m	Yellow													Sun	Moist	●		●	●	●	●				
Forb	Small St. John's Wort	*Hypericum gramineum*	Clusiaceae	Open forest, Grassland	0.1–0.4 m	Yellow													Sun to semi-shade	Dry	●		●	●	●	●				
Forb	Native Flax	*Linum marginale*	Linaceae	Grassland, woodland, Open forest, Grassy wetland	0.1–0.6 m	Blue													Sun to semi-shade	Moist	●	●	●	●	●	●			●	●
Forb	Cockspur Flower	*Plectranthus parviflorus*	Lamiaceae	Variable	0.1–0.7 m	Blue, Purple													Sun to shade	Moist to dry	●	●	●				●	●		
Forb	Showy Copper-Wire Daisy	*Podolepis jaceoides*	Asteraceae	Woodland, Grassland	< 0.7 m	Yellow													Sun to semi-shade	Moist to dry	●		●	●	●	●				
Forb	Matted Pratia	*Pratia pedunculata*	Lobeliaceae	Wet sclerophyll forest	< 0.2 m	White													Sun to light shade	Moist to dry	●	●	●				●		●	
Forb	Pastel Flower	*Pseuderanthemum variabile*	Acanthaceae	Rainforest, Wet sclerophyll forest	0.15–0.3 m	White, Mauve													Sun to light shade	Moist	●	●	●				●		●	
Forb	Chamomile Sunray	*Rhodanthe anthemoides*	Asteraceae	Open forest, Grassland	0.15–0.3 m	White, Yellow													Sun	Dry	●	●	●	●	●	●	●	●	●	●
Forb	Swamp Dock	*Rumex brownii*	Polygonaceae	Woodland, disturbed habitat	0.5–0.8 m	Green, Red													Sun to semi-shade	Dry	●	●							●	●
Forb	Purple Fan Flower	*Scaevola aemula*	Goodeniaceae	Dry sclerophyll forest	< 0.5 m	Purple, Yellow													Sun to semi-shade	Dry	●	●	●	●	●	●			●	●
Forb	Forest Nightshade	*Solanum prinophyllum*	Solanaceae	Sclerophyll forest	< 0.5 m	Purple													Semi-shade	Moist	●*	●	●							
Forb	Native Violet	*Viola hederacea*	Violaceae	Woodland, Forest	0.1–0.2 m	White, Purple, Mauve													Semi-shade to shade	Moist	●	●	●	●						●
Grass	Basket Grass	*Oplismenus imbecillis*	Poaceae	Shady forest	< 0.3 m	Green, Pink													Semi-shade to shade	Moist	●	●								●
Tussock Grass	Weeping Grass	*Microlaena stipoides*	Poaceae	Widespread	< 0.7 m	Green													Sun to semi-shade	Moist to dry	●								●	●
Tussock Grass	Kangaroo Grass	*Themeda triandra*	Poaceae	Variable	< 1.2 m	Green, Brown													Sun to semi-shade	Moist to dry	●								●	●
Vine	Wombat Berry	*Eustrephus latifolius*	Luzuriagaceae	Sclerophyll forest, Woodland, Heath	Climber	Cream, Pink													Sun to semi-shade	Moist to dry	●	●					●	●	●	●
Vine	Sweet Morinda	*Gynochthodes jasminoides*	Rubiaceae	Sclerophyll forest, Rainforest	Climber	White													Semi-shade to shade	Moist to dry	●	●	●	●	●	●			●	●
Vine	Dusky Coral Pea	*Kennedia rubicunda*	Fabaceae	Variable	Climber	Red													Sun	Dry	●	●	●	●						●
Vine	Bower of Beauty	*Pandorea jasminoides*	Bignoniaceae	Rainforest	Climber	Pink													Sun to semi-shade	Moist to dry	●	●	●	●		●	●	●		
Palm & palmlike	Cabbage-tree Palm	*Livistona australis*	Arecaceae	Rainforest margins, Moist sclerophyll forest	< 30 m	Yellow													Sun to shade	Moist to dry	●		●	●	●	●				
Shrub	Wattle	*Acacia longifolia*	Fabaceae	Dry Sclerophyll Forest, Woodland, Heath	3–10 m	Yellow													Sun to semi-shade	Dry	●		●	●	●	●	●	●	●	●
Shrub	White Aspen	*Acronychia oblongifolia*	Rutaceae	Rainforest margins, Moist sclerophyll forest	< 2.7 m	White													Sun to semi-shade	Moist	●	●	●	●	●	●			●	●
Shrub	Grey Myrtle	*Backhousia myrtifolia*	Myrtaceae	Warm rainforest	3–4 m	White													Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Coffee Bush	*Breynia oblongifolia*	Phyllanthaceae	Warm rainforest, Woodland, Eucalypt forest	< 3 m	Red, Green													Sun to semi-shade	Dry	●	●					●	●	●	
Shrub	White Paper Daisy	*Coronidium elatum*	Asteraceae	Eucalypt forest	< 2 m	White, Yellow													Sun	Dry	●	●	●	●	●	●	●	●	●	●
Shrub	Gorse Bitter Pea	*Daviesia ulicifolia*	Fabaceae	Open forest	1 m	Yellow & red													Sun to semi-shade	Dry	●	●	●	●	●	●				●
Shrub	Sieber's Parrot-Pea	*Dillwynia sieberi*	Fabaceae	Dry Sclerophyll Forest, Woodland	0.50–2.5 m	Yellow													Semi-shade	Dry	●	●	●	●	●	●				●
Shrub	Blueberry Ash	*Elaeocarpus reticulatus*	Elaeocarpaceae	Tall Eucalypt forest, near Rainforest	4–10 m	White, Pink													Sun to semi-shade	Moist to dry	●	●	●	●	●				●	●
Shrub	Winter Apple	*Eremophila debilis*	Myoporaceae	Woodland	< 0.5 m	Blue, Pink or Mauve													Sun	Dry	●	●	●	●		●				●
Shrub	Hop Goodenia	*Goodenia ovata*	Goodeniaceae	Woodland, Forest	1–1.5 m	Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●				●
Shrub	Hoary Guinea Flower	*Hibbertia obtusifolia*	Dilleniaceae	Variable	< 0.6 m	Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●				●
Shrub	Native Indigo	*Indigofera australis*	Fabaceae	Woodland	1.5 m	Mauve													Semi-shade	Moist to dry	●	●	●	●	●	●	●	●	●	●
Shrub	Tea-tree	*Leptospermum morrisonii*	Myrtaceae	Sclerophyll woodland, shrubby communities	2–5 m	White													Sun to semi-shade	Moist to dry	●	●	●	●		●			●	●
Shrub	White Feather Honeymyrtle	*Melaleuca decora*	Myrtaceae	Swampy ground	< 7 m	White													Sun to semi-shade	Moist	●	●	●	●	●	●			●	●
Shrub	Prickly-leaved Tea Tree	*Melaleuca styphelioides*	Myrtaceae	Moist environments	< 20 m	White													Sun to semi-shade	Moist to dry	●	●	●	●	●	●			●	●
Shrub	Veined Mock-olive	*Notelaea venosa*	Oleaceae	Rainforest, Wet scleorphyll forest	< 10 m	Cream, Yellow, Green													Semi-shade	Moist to dry	●	●	●	●	●	●			●	●
Shrub	Toothed Daisy-bush	*Olearia tomentosa*	Asteraceae	Dry sclerophyll forest, Heath	< 2 m	Purple, Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●			●	●
Shrub	Orange Thorn	*Pittosporum multiflorum*	Pittosporaceae	Rainforest, Wet scleorphyll forest	1–3 m	White													Semi-shade to shade	Moist	●	●	●	●		●	●		●	●
Shrub	Native Daphne	*Pittosporum undulatum*	Pittosporaceae	Rainforest, Wet scleorphyll forest	< 15 m	Cream													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	●
Shrub	Wedding Bush	*Ricinocarpos pinifolius*	Euphorbiaceae	Coastal	1–2 m	White													Light shade	Dry	●	●	●	●	●	●			●	●
Shrub	Scentless Rosewood	*Synoum glandulosum*	Meliaceae	Warm rainforest	< 7 m	White													Semi-shade to shade	Dry	●	●	●	●	●	●			●	●
Shrub	Coastal Rosemary	*Westringia fruticosa*	Lamiaceae	Coastal	1.5–2 m	White, Mauve													Sun to semi-shade	Dry	●	●	●	●	●	●	●		●	●
Shrub	Sandfly Zieria	*Zieria smithii*	Rutaceae	Variable	< 2 m	White													Light shade	Moist to dry	●	●	●	●	●	●			●	●
Tree	Drooping Sheoak	*Allocasuarina verticillata*	Casuarinaceae	Grassy woodland	5–10 m	Yellow, Red													Sun to semi-shade	Dry	●		●	●		●				
Tree	Coast Banksia	*Banksia integrifolia*	Proteaceae	Coastal	4–15 m	Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	●
Tree	Old Man Banksia	*Banksia serrata*	Proteaceae	Dry sclerophyll forest, Woodland	3–15 m	Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	●
Tree	Illawarra Flame Tree	*Brachychiton acerifolius*	Malvaceae	Subtropical rainforest	< 35 m	Red													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●		●	●
Tree	Hairy Clerodendrum	*Clerodendrum tomentosum*	Lamiaceae	Rainforest margins	1–10 m	Cream													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●	●	●	●
Tree	Bangalay	*Eucalyptus botryoides*	Myrtaceae	Dry sclerophyll forest, Woodland	< 40 m	White													Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Tree	Blackbutt	*Eucalyptus pilularis*	Myrtaceae	Wet sclerophyll forest, Grassy coastal forest	< 70 m	White													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●	●	●	●
Tree	Sydney Blue Gum	*Eucalyptus saligna*	Myrtaceae	Widespread	< 50 m	Cream													Sun to semi-shade	Dry	●	●	●	●	●	●	●	●	●	●
Tree	Forest Red Gum	*Eucalyptus tereticornis*	Myrtaceae	Wet & dry sclerophyll forest, Woodland	< 50 m	Cream													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●	●	●	●
Tree	Snow Wood	*Pararchidendron pruinosum*	Fabaceae	Rainforest, Riverine forest	< 15 m	Cream, Yellow													Sun	Moist to dry	●	●	●	●	●	●			●	●
Tree	Turpentine Tree	*Syncarpia glomulifera*	Myrtaceae	Forest, Rainforest	< 15 m	Cream													Sun to semi-shade	Moist to dry	●	●	●	●	●	●	●	●	●	●
Tree	Lilly Pilly	*Syzygium smithii*	Myrtaceae	Rainforest	3–5 m	Cream													Sun to semi-shade	Moist to dry	●	●	●	●	●	●			●	●
Tree	Water Gum	*Tristaniopsis laurina*	Myrtaceae	Rainforest, Wet scleorphyll forest	3–6 m	Yellow													Sun to semi-shade	Moist to dry	●	●	●	●	●	●				

*Buzz Pollinated

Know your pollinators



European honey bee
(Apis mellifera) © iStock

European honey bees have two pairs of wings and long, segmented antennae. They are daytime-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, including in domestic gardens.

Leafcutter bee
(Megachile maculariformis) © Karen Retra

Australian native bees comprise more than 2000 species, 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. Many native plant species, such as *Dianella* and *Grevillea* require specially adapted insects 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

Fly species number up to 30,000 in Australia, and 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 stabilise their flight. Unlike bees and wasps, they have very small, clubbed antennae at the front of their head. Flies, including blowflies, are often attracted to flowers that smell like carrion; they generally have hairy bodies that easily collect pollen while they are feeding. Flies provide a range of services in the garden, including pollination, decomposition and predation.

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. There are around 30,000 species of beetles in Australia, with many yet to be formally described.

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, with approximately 600 species found in Australia.

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. Australia has a high diversity of moth species, with up to 22,000 species thought to exist across the continent.

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 carbohydrates, vitamins and minerals, produced by flowers and sometimes by glands on leaves or stems (called extra-floral nectaries). Nectar is attractive to insects, and provides an immediate energy source needed for tasks such as hunting pest insects, laying eggs in decomposing organic matter, collecting pollen, or parasitising other insects.

Carbohydrates alone don't support everything needed for health and growth, so insects also need pollen.

Pollen is rich in protein, fats and nutrients. Bees are vegetarian, and need to collect pollen to feed their offspring.

Buzz pollination

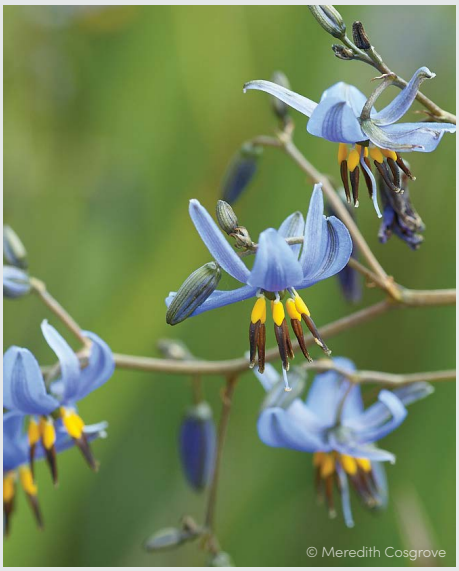
Some flowers do not produce any nectar; they specifically target pollen-collecting bees, and only offer pollen rewards. To limit pollen loss and ensure effective pollination, some plants produce flowers with specialised, tubular anthers, that only open at the tip. To extract pollen, bees use vibrations 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.

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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. *Austroscolia soror* on *Backhousia citriodora.* (Photo: Amy-Marie Gilpin)
2. Illawarra escarpment, NSW. (Photo: Laura Lopresti)
3. European honey bees, *Apis mellifera.* (Photo: Kirrily Hughes)

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