

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.



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. They 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.

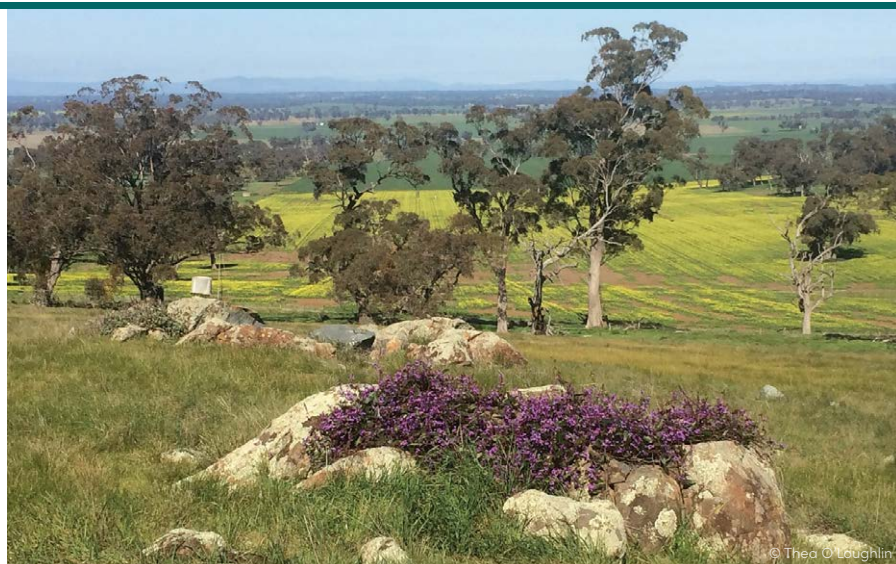
Pollinators and food security

Without insect pollinators, the quantity and diversity of food grown for humans 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, vegetables and canola, as well as many crops grown for seed production. 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.



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.

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 get 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 this 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.

Epacrids (native heaths) provide late winter flowers that attract bees. If you have them on your property, protect the areas where they grow. Epacrids have delicate root systems and are not easy to propagate, so are not included in the planting guide.

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

Consider selecting a subset of plants from drier regions to build in climate resilience for your pollinators. Plant a mixture of wet- and dry-loving plants in moist areas to provide resilience through a range of seasons. On dry hills select a collection of species that can tolerate moderately dry and extreme conditions. Consider developing 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 massed many smaller flowers together 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 wetland and grassland 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 there. 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

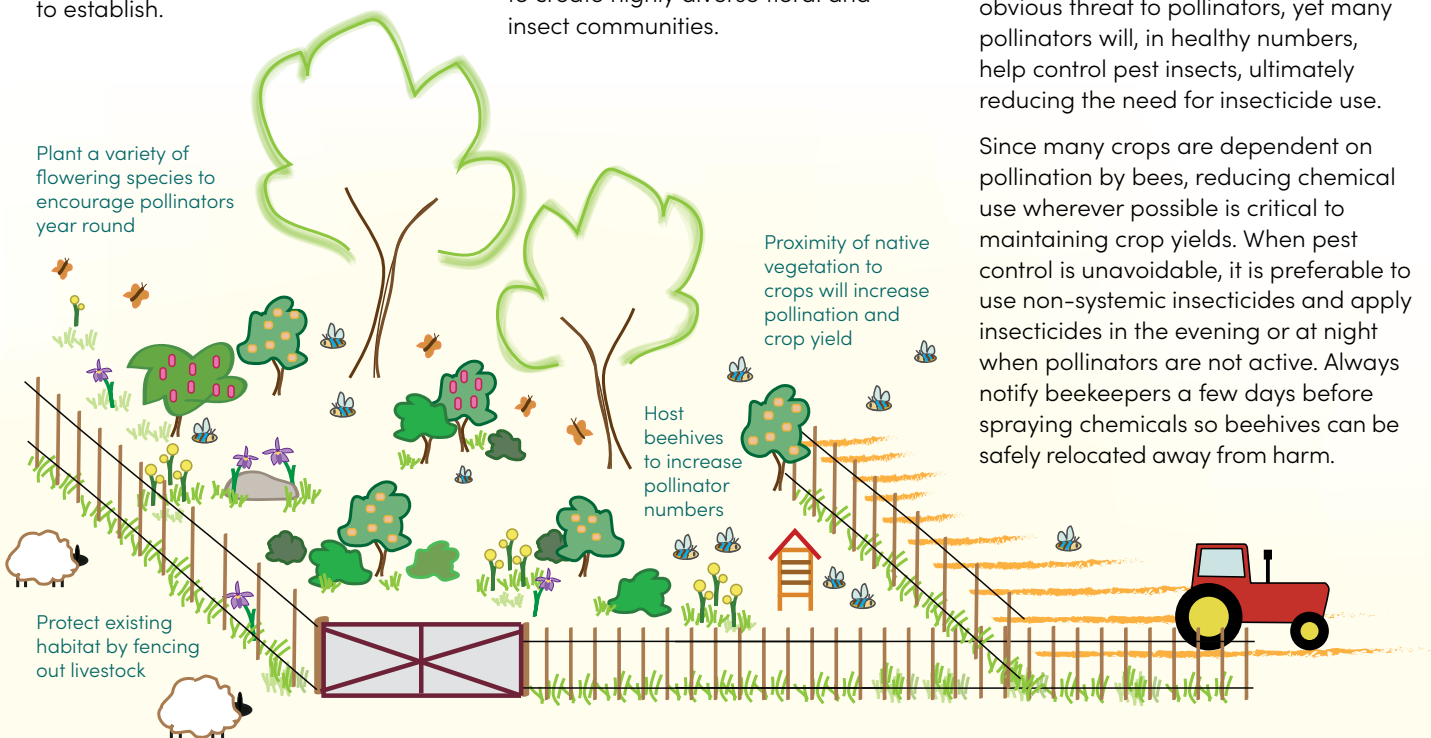
Plants that are pollinator-attracting are sometimes crops in their own right and can be used to diversify farm production. Bush foods such as desert limes, bush tomato, yam daisy and many more are in high demand for use in fresh and manufactured products. Native plant seed is needed for revegetation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

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

Reduce chemical use where possible

Insecticides (especially neonicotinoids), 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 bacterial fauna 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.

Since many crops are dependent on pollination by bees, reducing chemical use wherever possible is critical to maintaining crop yields. When pest control is unavoidable, it is preferable to use non-systemic insecticides and apply insecticides in the evening or at night when pollinators are not active. Always notify beekeepers a few days before spraying chemicals so beehives can be safely relocated away from harm.



Know your pollinators



European honey bee
(*Apis mellifera*)

European honey bees have four 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 both native 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. Because they are social and easy to manage, they 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.



Gold-tipped leafcutter bee
(*Megachile macularifomis*) © Karen Retra

There are more than 2000 species of **native Australian bees**, which provide essential pollination services. Native bees generally live in nests in the ground or in hollow stems, and some have evolved to pollinate particular native flowers through 'buzz pollination' (see reverse of brochure for more information). While most native bees are solitary, some genera of native bee (e.g. *Tetragonula* and *Austroplebeia*) in northern Australia 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 two 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, 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.



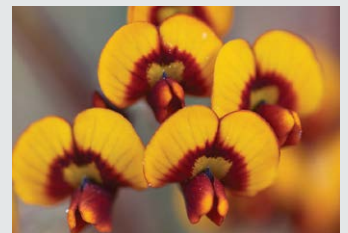
Beautiful leaf moth
(*Gastrophora henricaria*) © Karen Retra

Moths also have wings covered in tiny scales and tend to be dull 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



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.



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 this is that pollination is very targeted and efficient - they only get pollen from the same species. The disadvantage is that if the correct pollinator isn't there, the flowers don't get 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 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. Instead, they only offer pollen rewards to insects. Because pollen is in high demand by pollinators, buzz pollinated plants protect their pollen in specialized anthers that only open at the tip. To extract pollen, insects use vibrations to 'buzz' the pollen grains out of the pores in the anthers. Many crops are buzz pollinated including tomatoes, potatoes, eggplants, capsicum, chillies, tomatillo, blueberries and cranberries.

European honey bees are not able to perform buzz pollination, but some native bees, such as the blue-banded bee, teddy bear bee and carpenter bee are exceptionally good buzz pollinators. They have evolved to pollinate native plants such as flax lilies (*Dianella sp.*), chocolate lilies (*Arthropodium sp.*), senna and guinea flowers (*Hibbertia sp.*). Plantings of these species will encourage populations of buzz pollinators, which can pollinate crops effectively and ensure seed set in native plants.

Nectar feeding

Grevillea flowers are adapted to be successfully pollinated by birds. Their flowers are tube shaped and contain plenty of nectar. 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. This means the plant doesn't get the pollination benefit from the insect. Plants like grevillea are thus predominantly bird-pollinated, but can be a very useful source of nectar for insects in the cooler months.

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

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



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 — the wholesale nurseries listed below stock all the plants shown in the planting guide. Details current at February 2020.

Wholesale Nurseries

Jayfields Nursery
180 Clifton Ring Rd, Pulletop NSW 2650
T: (02) 6036 7235 | F: 02 6036 7254
E: sales@jayfieldsnursery.com.au

Provincial Plants and Landscapes
Three locations in South East NSW and the ACT
T: (02) 6492 7242
www.plantsandlandscapes.com.au

Plantmark
Six locations in Victoria, NSW and Queensland
T: 1300 787 401 | F: 1300 787 402
www.plantmark.com.au

Bushland Flora Pty Ltd
110 Clegg Rd, Mount Evelyn Vic 3796
T: (03) 9736 4364 | F: (03) 9736 4716
E: sales@bushlandflora.com.au

Mt William Advanced Tree Nursery
539 West Goldie Road, Lancefield Vic 3435
T: (03) 5429 1517
www.advancedtrees.com.au

Goldfields Revegetation
230 Tannery Lane, Mandurang Vic 3551
T: (03) 5439 5384 | F: (03) 5439 3618
E: info@goldfieldsrevegetation.com.au
www.goldfieldsrevegetation.com.au

Cool Country Natives
5A Beltana Rd, Pialligo ACT 2609
T: (02) 6257 6666 | 0402 307 275
E: wholesale.nursery@coolcountrynatives.com.au

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