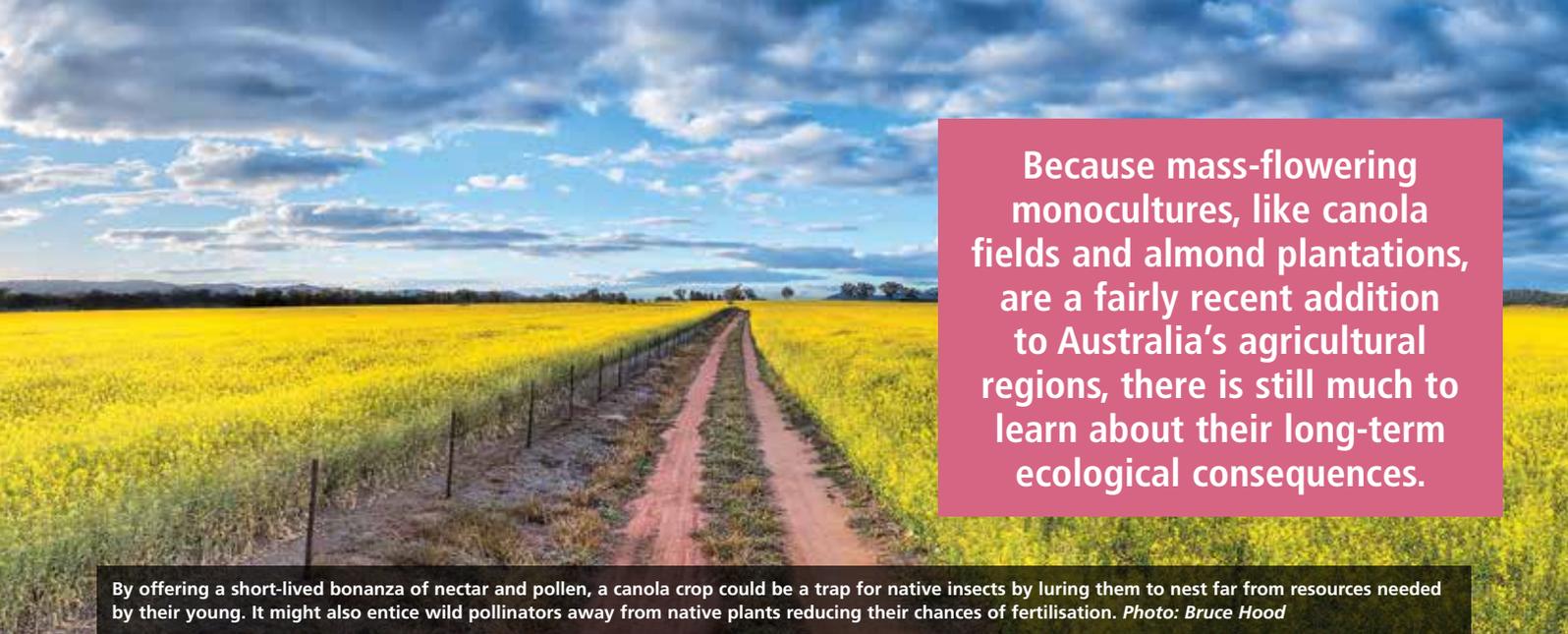


# LOST IN A FLORAL DESERT

Crops offer bounteous nectar and pollen but how sweet are they for native insects? Ecologist **Manu Saunders** considers Australia's blooming plantation industries from the viewpoint of wild pollinators.

The blossoms of fruit trees in genus *Prunus*, including cherries, almonds, peaches and plums, lure many insects, probably with sweet volatiles (they are in the same family as roses). But whether insects benefit from orchards depends on whether other essential resources – such as food for their progeny – are accessible.

Photo: Paula McManus



Because mass-flowering monocultures, like canola fields and almond plantations, are a fairly recent addition to Australia's agricultural regions, there is still much to learn about their long-term ecological consequences.

By offering a short-lived bonanza of nectar and pollen, a canola crop could be a trap for native insects by luring them to nest far from resources needed by their young. It might also entice wild pollinators away from native plants reducing their chances of fertilisation. Photo: Bruce Hood

**M**ass-blooming crops create a glorious vista, and it's easy to assume that bees and other pollinators love it as much as we do. It's true that peak bloom in crops attracts many pollinators – how could they resist? – but the flowers last only a few weeks, after which the field becomes a floral wasteland.

This short-lived surplus of blossom can betray pollinators that build nests deep inside the field. If no resources are available within flying distance when the next generation emerges, they will not survive.

The attraction of these crops can also be detrimental for native plants nearby that miss out on pollination because their neighbours are getting all the attention. This has been called the Circe Principle, after the seductress in Homer's epic poem who waylaid Odysseus on her island, keeping him from his true course.

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### Wild pollinators

European honey bees are the favourite crop pollinators because they are easily managed. Yet, around Australia, thousands of wild insect species pollinate crops for 'free'. The challenge for conservation is that these wild pollinators can only be managed indirectly, by ensuring suitable habitat and resources are available to sustain long-term populations.

Australia has nearly 2000 native bee species, some of which,

like the stingless sugarbag bees, can be managed as working pollinators. There are also more than 400 butterflies and a few thousand wasp, fly, moth, beetle and ant species. Not all are dedicated pollinators. Flowers may be a minor source of food in their adult diet if they mainly prey on or parasitise other insects. Sadly, pollinating insects commonly regarded as pests, like blowflies or sawflies, are rarely acknowledged to have a positive side.

Non-bee pollinators are often overlooked in agriculture, where efficiency trumps effectiveness. Although some flies, sawflies and others carry a lot of pollen grains, sometimes more than bees, they are considered less efficient pollinators because they visit flowers less frequently, so their pollination services can't be guaranteed.

Yet these 'hobbyists' can be just as important for pollination as the very efficient 'career' bee pollinators. Many studies have found that crop yields are higher when multiple insect species visit flowers. This is more than simple maths. Different insects may pollinate different parts of a plant – in Californian almond plantations, honey bees showed a preference for the top section of trees while wild pollinators visited the lower parts. And in some crops, honey bees are more likely to switch between male and female flowers (and achieve fertilisation) after encountering another type of insect on a flower than if they encounter another honey bee. This type of competition between species is common in natural ecosystems, and greatly increases the chances of cross-pollination for plants. In monoculture crops where wild pollinators are few and far between, honey bees can usually forage on a single flower for as long as they like. ▶



Agricultural reliance on just one type of bee, the introduced European honey bee (shown left on canola) could be undermining profits as well as biodiversity. Maintaining native bush to sustain a diversity of pollinators, such as the native *Homalictus* bee (shown right on canola) could enhance crop yields by increasing rates of cross-pollination. Photos: Tess Peni / Truelove Studios (left), Laurence Sanders (right)



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Competition between species for the nectar of long-stalked featherflower (*Verticordia densiflora*) (right), a Western Australian shrub, greatly increases the chances of cross-pollination. In contrast, large crops and orchards rely almost wholly on the European honey bee (left). Photo: Paula McManus (left), Fred and Jean Hort (right)

Pollinator communities have co-evolved with flowering plants, so floral and pollinator diversity go together. Wild pollinators, particularly native bees, need habitats with diverse plants and structures. Flowers vary greatly in the quantity and quality of pollen and nectar on offer. Some flower visitors eat pollen grains, others the nectar, and some both. They also vary in their colour, scent and shape preferences. Beetles tend to favour pale flowers with strong, fruity scents, while native bees often go for bright yellow or purple flowers with high UV contrast against vegetation. Large flies are most often found on flat or bowl-shaped flowers, which give their short mouthpieces easy access to nectar. These are generalisations, and flower choices vary among families, species or individuals, depending on environmental factors and whether pollen or nectar is the food *du jour*.

Insect pollinators also need other plant resources, like saps and resins. Stingless bees use plant resins as chemical defence against predators and pathogens, and a recent study by Nora Drescher and others in southeast Queensland showed that a mixture of resins can be more effective than just one. Pollinators also need to nest or overwinter somewhere, such as under bark, leaf litter, in plant stems, stone cavities or dead wood. And if there is no food around when the young insect emerges from its nest, the nest-building will have been in vain. This is where mass-flowering crop landscapes fall short.

### Almond blossom monocultures

Fruit tree blossoms have inspired poets, artists and romantics for centuries, and symbolise life, fertility and awakening in many ancient and modern cultures. There is something inherently joyous

about a whole tree, still leafless, bursting into bloom at the first hint of warmth, as if it can't wait any longer for winter to be over.

As one of the first fruit trees to awaken from hibernation, almond trees have a strong emotional effect. Their 'superb and fearless flowers' aroused DH Lawrence to poetic rhapsody:

'The alien trees in alien lands; and yet  
The heart of blossom,  
The unquenchable heart of blossom!'

I spent two glorious springs in blossoming almond orchards investigating wild pollinator communities and habitat characteristics. In late August, the eerie winter stillness of a leafless plantation is shattered into a million pieces of light by a coordinated budburst, making it impossible to get excited about spring when it arrives.

The semi-arid mallee regions across southern Australia, with dry summers and wet winters, provide ideal conditions for almond trees, which originate from the desert regions of Iran and the Middle East. Almost two-thirds of those grown commercially in Australia are in northwest Victoria, where I did my research. As the industry expands, huge plantations, many exceeding a thousand hectares, are encroaching on mallee woodlands and shrublands. Ecological research in the region

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The bee *Amphylaeus obscuriceps* on a bottlebrush. Photo: Jenny Thynne



A jewel beetle. Photo: Beth Kinsey



A katydid nymph on *Petrophile brevifolia*. Photo: Fred and Jean Hort



Poet Edwin Arnold called almonds 'Flora's fairest daughterling'. Almond blossoms inspire northern hemisphere writers in particular because they are often the first flowers to break the winter bleakness. Although the orchard above is beautiful when flowering, its tidiness indicates few resources to sustain native pollinators.  
 Photos: Manu Saunders (above), Paula McManus (right)



has mostly focused on fire and wildlife dynamics. Little is known about how the expansion of plantations may affect the unique mallee ecosystems.

Almonds are managed as intensive monocultures. Grass and weeds are sprayed and mown to reduce byproduct in the nut piles and to allow the mechanical sweepers and shakers that harvest nuts at the end of summer to travel unimpeded.

From late August into September, the landscape sparkles with almond blossoms. They are almost completely dependent on insect pollination for fruit set, and for this service commercial producers rent European honey bees. Every year, more than 100,000 hives are trucked into Victoria's almond plantations for the few weeks of bloom, costing growers millions of dollars.

Using coloured pan traps, I collected insects in almond plantations and native mallee vegetation, and found very few native bees, hoverflies and other pollinating wasps and flies inside plantations. They are not averse to almond blossom, but usually visit flowers only at the edges next to native habitats. The deeper you go into plantations, the less plant diversity there is and the fewer native pollinators.

Native insect pollinators are far more plentiful in small organic orchards, where grasses and weeds provide diverse food sources. Most wild pollinators have a home range of less than one kilometre, so are more likely to reach the centre of small than large orchards. Many, particularly bees, prefer open vegetation, like grassland, open woodland and heath. Native bees can be found in the centres of huge open fields of crops like canola, but tree crops are too much like a dark forest to be inviting. Conserving wild

pollinator diversity in farmland therefore requires crop diversity and a mix of natural and agricultural systems.

Beauty is in the eye of the beholder. A plantation with measured rows and clean floors is a scene of orderly beauty, but pollinators don't care for tidiness. They prefer all the niches and resources of disorderly shrublands and woodlands, with flowering herbs randomly interspersed among messy leaf litter and dead branches. ■

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A fly from genus *Apiocera*.  
 Photo: Fred and Jean Hort



The bee *Paracolletes crassipes* on cadaghi.  
 Photo: Laurence Sanders



A longicorn beetle on heath myrtle.  
 Photo: Marc Newman