Mass-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 Crow Principle, after the seductress in Homer’s epic poem who waylaid Odysseus on her island, keeping him from his true course.

Because mass-blooming 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.

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—California 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.

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 allowing a short-lived bonus 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: Bron Nook)
Many studies have found that crop yields are higher when multiple insect species visit flowers.

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. Bees tend to favour pale flowers with strong, fruity scents, while native bees often go for bright yellow or purple flowers with high UV content against vegetation. Large bees are most often found on flat or bowl-shaped flowers, which give their short mouthparts 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 of choice.

Alveolate pollinators also need other plant resources, like nectar and nectar. Stingless bees use plant resins as a chemical defence against predators and pathogens, and a recent study by Nici Scharler 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 stumps, 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

Almond blossom monocultures have inspired poets, artists and romantics for centuries, and symbolic 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 tree flowers to awaken from hibernation, almond trees have a strong emotional effect. Their fragrant and fearless flowers aroused D.H. Lawrence to poetic rhapsody: 'The alien trees in alien lands, and yet The least of blossoms, The unprecocious heart of blossoms'.

I spent two glorious springs in blooming almond orchards investigating wild pollinator communities and habitat characteristics. In late August, the early winter stillness of a leafless plantation is shattered into a million pieces of light by a coordinated buzz, making it impossible to get excited about anything else. The semi-arid mallee regions of southwest Australia, with dry summers and wet winters, provide ideal conditions for almond flowers, which originate from the desert regions of Iran and the Middle East. Almost three-quarters of these groves 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 on the region 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. Grasses and weeds are sprayed and mown to reduce nurse plants in the nut piles 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 western 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 colourless pan drops, I collected insects in almond plantations and native mallee vegetation, and found very few native bees, hoverflies and other pollinating insects and flies inside plantations. They are not native 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 kilometer, so are more likely to reach the centre of small than large orchards. Many, particularly bees, prefer open vegetation, like grassland, open woodlands and heath. Native bees can be found in the centres of large 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 landscapes.

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 riches and resources of disorderly shrublands and woodlands, with flowering herbs randomly interspersed among many leaf litter and dead branches.


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NATURE — HOW DO WE VALUE THEE? LET ME COUNT THE WAYS

Ecologists Gary Luck and Manu Saunders explore one of conservation’s most pressing issues — how to value nature and acknowledge that value in ways that have social and political force.

As we hurtle into the planet’s sixth great extinction event, debates rage in conservation biology about how to strengthen society’s regard for nature. We need much greater recognition of nature’s values but how do we understand, identify and measure them? The framers of Australia’s biodiversity conservation strategy envisage a society that values nature “fully in its own right and for its essential contribution to our existence.” For many years philosophers and biologists have debated which of these two ways of valuing nature — intrinsically or instrumentally — is the more legitimate and useful. Should we advocate the protection of nature for its own sake because this is the right thing to do regardless of any benefits for humans, or should we acknowledge that not everyone shares the same moral compass, and focus on promoting the ‘use’ values of nature (what nature does for us)? The first is intrinsic, the second is the human-centred.

Valuing nature’s services
One prominent framework for promoting the utility of conservation is based on the concept of ecosystem services (sometimes more appealingly called ‘nature’s services’). Biologists have identified many ‘services’ beneficial to humans that derive from ecological processes, including pollination of crops by bees and other insects, climate regulation by carbon-storing forests, cycling of nutrients and dispersal of seeds from useful plants by animals, and promote human and pest control by insect-eating birds. The service concept was boosted by the 2005 publication of the Millennium Ecosystem Assessment in which more than 1300 experts evaluated the consequences for human wellbeing of 24 ecosystem services, including the supply of products (such as food, fibre and fuel), regulation of ecosystem processes (such as air and water), and the maintenance of life support systems such as soil formation and nutrient cycling. The report concluded that 95% of ecosystem services are estimated to provide US$33-54 trillion per year of economic value worldwide.

This is the monetisation of nature’s services that provides the strongest comparisons. What if the dollar value of conserving forest patches for pest control is less than a homeowner can obtain by clearing forest to grow more coffee, or if pesticides cost less than managing orchards to support bird diversity? A narrow focus on monetary values risks commodifying nature to the point where conservation is an option to be discarded if destruction is more lucrative. Focusing primarily on economic reasons for conservation also risks undermining moral motivations for protecting nature. In a process known as ‘moral calculus crowding out’, paying people to do what they would have done for other reasons can sap their interest in doing it without payment, which is counterproductive for conservation if the payments come to an end.

However, valuing services provided by nature does not require assigning monetary value to all of nature’s ecosystem processes. The great value as a communication tool, for fostering a better understanding of human-nature relationships and a deeper appreciation of the importance of nature for human wellbeing. The language of nature’s services translates particularly well in policy fields, where greater emphasis is placed on tangible social outcomes than on seemingly less tangible moral imperatives. The concept can help guide land-use planners and managers to identify and protect sites that provide important services. For example, protecting mangrove forests can save lives and infrastructure in coastal communities by blocking storm surges. Recognition of this value in land planning does not depend on applying a dollar value. Many such values are the role of the Amazon rainforest in regulating global climate is the exemplar — how value beyond boundary conditions. The nature’s service concept is also helpful for motivating multidisciplinary research because the concept requires a better understanding of how nature functions and the social and economic implications of this — an understanding we can only be achieved with the input of ecologists, sociologists, and economists.

Valuing nature for being
If we avoid assigning economic dollar values, a focus on nature’s services can supplement rather than undermine moral or cultural motivations for conservation. This focus does not mean that we have a moral responsibility to maintain biodiversity for its own sake. It means the debate as a simplistic case of instrumental versus intrinsic values overlooks the bigger picture and the complementary role of the two approaches.

Moreover, we think the singular concept of intrinsic value is limited in explaining what really motivates conservation. Many people believe that nature has intrinsic value, but on closer reflection, express more specific reasons for wanting to protect nature — for its beauty, its cultural or spiritual significance, or the pleasure of interacting with wildlife. Or they might be motivated by a sense of justice, or because they care deeply for particular species. All these reasons can be encompassed under the umbrella of intrinsic value but, when detailed, are more revealing of the great diversity of ways for valuing nature in non-instrumental terms.

Are nature’s values countable?
The debate raging in conservation journals about how to value nature has brought into sharp focus how inadequate both instrumental and intrinsic values are in explaining the complexity of human-nature relationships. Many ways of appreciating nature are not easily pigeon-holed as either — think about the feelings that come when watching sunsets over the ocean, walking through rainforest or staring at orphaned wildlife. Rather than framing the debate in terms of intrinsic instrumental values, it would be more instructive to consider the many factored relationships people have with nature (relational values) and the myriad ways in which nature contributes to a good (satisfying, fulfilling life) (experiential values). Many people feel a strong sense of linkship with nature or see themselves as stewards or protectors, and view a relationship with nature as essential to a meaningful life.

Research into the many wellbeing benefits of nature is growing, particularly in the field of urban ecology, revealing, for example, that people in England who use urban parks with higher bird and plant richness (or perceived richness) report higher wellbeing than those with lower richness, and that residents of ‘green’ suburbs in Australian regional cities enjoy more wellbeing and decision-making about the inevitable trade-offs in human development. Properly conserving and the conversion of forest to cropland in these terms would involve weighing up what would be lost — social and economic gains from biodiversity; water filtration, soil stabilisation, food provision, wildlife habitat, recreational and cultural values, human-nature relationships and the life satisfaction of people using the forest, as well as the social and economic gains from expanded agriculture.

A focus on nature’s services can supplement rather than undermine moral or cultural motivations for conservation.

We need deeper reflection on our relations with the natural world and our responsibilities to protect nature’s intrinsic values. Some values can be captured in markets, and assigned a price to help societies understand some of nature’s importance to humans, but many values have no price, and trying to assign a market value would be to belittle nature and ourselves. Nature — how should we value it? In multiple and complex ways, we say. And appreciating nature’s services to humans does not stop us — to further paraphrase Elizabeth Barrett Browning — valuing nature “not ‘the depth and breadth and height’ [our souls] can reach”.


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