New South Wales

National parks along the New South Wales coastline have a high level of bee diversity and are great places to go 'bee hunting'. To the north of Sydney, many subcoastal parks are dotted with grass trees, and dead and dry flower stalks provide homes to many bees. The bright metallic green carpenter bees will burrow into the sides of these stalks and then excavate tunnels inside the stem. You can recognise their nests by a circular hole, about the size of a 5 cent coin. Ground-nesting bees are common in the sandy soil of places such as Ku-ring-gai Chase National Park. Wasps also nest in these sandy soils, but wasp nests have entrance tunnels that are irregular in shape and are usually sloped, while bee nests are always perfectly round and burrow straight into the ground, not at an angle.

The many little coastal towns up and down the New South Wales coast are also great places to find halictine bees, particularly the tiny, colourful *Homalictus* and the slightly larger, but closely related, *Lasioglossum*. The parks and headlands along the coast often have a wealth of yellow daisies that these bees can visit in abundance. While bees are easy to spot against the bright yellow flowers, be wary of being fooled by hoverflies: another wonderful group of pollinators.

The great gum forests of New South Wales, often regarded as important habitat for koalas, are also very important for bees, with individual flowering gums capable of attracting thousands of native bees. Many gums are too tall to spot these bees on, but finding smaller trees or those with lower limbs should reward you with a great bee-spotting experience. However, don't forget to look up and see the super-highway of speeding insects around the flowers above your head. If you are lucky enough to own an insect net, a few sweeps across these flowers will give you an even better idea of what is relying on these trees, particularly the difficult to see green, yellow, orange and black euryglossine bees.

Amegilla (Asaropoda) bombiformis

As the year warms up, suburban gardens along the coast from Brisbane to Sydney are enriched by these metallic orange beauties. It is easy to see why people call them 'teddy bear' bees. You may even find clusters of males roosting at night on twigs or grass stems. As the individuals get older, their colour may lose the metallic sheen and fade to pale yellow, but they are still a lovely sight as they search for their favourite flowers. Tubular flowers suit teddy bears nicely because they may contain nectar that other bees cannot reach.

Megachile ustulata

Resin bees such as this *M. ustulata* are named so because of the materials that they use to create their nests. Unlike some other bees in the family Megachilidae, which make their nests using cut-up leaves and petals, these bees mix plant material and resin from trees to make nests for their young. Resin bees often make their nests in rock crevices or holes in wood made by wood-boring beetles (or bee-friendly people). Both nest site types can be found in many old houses, meaning that these bees will readily nest in old drill holes or gaps in brick or wooden houses. Resin bees will also nest in more opportunistic places, with nests reported in the folded canvas of a caravan's awning and even some old oilskins.

Megachile ustulata is a large species of bee, with the female a bit larger than a European honeybee; it is also a very striking bee, being dark black with a bright orange abdomen. Although the scopa (a region of hairs under the abdomen) of this species is also a vivid orange colour, the lower abdomen may appear to be a different colour because these hairs are used to carry pollen: this individual is carrying yellow pollen. Footage by Tobias Smith of a mating pair of *M. ustulata* has shown some very interesting mating behaviour where the male quickly stroked the eyes and touched the antennae of the female. This is behaviour is speculated to be a way of calming females and to send 'chemical communications' to the female from odour glands on the male's legs. *Megachile ustulata* can be differentiated from the common and large leaf cutter bee, *M. mystacea*, by a lack of pale hairs on top of its head and its orange-coloured hair on its tarsi. *Megachile ustulata* has been found along the coast between Sydney and Brisbane, with one unusual capture reported in central Queensland.

Amegilla (Zonamegilla) asserta

Blue-banded bees are both beautiful and plentiful in suburban gardens. This species, with yellow face marks and a black streak down the hind leg of the female, is often seen in the cities along the eastern coast, particularly in herb gardens where many of the plants we grow have tubular flowers. Strange as it may seem, the number of different species has been unclear until very recently and the nesting habits of this species are almost unknown. The nests of one or two *Amegilla* species have been well studied and while we might assume that this species will behave similarly, we do not really know.

Male *Amegilla* bees have a larger extent of pale markings on the face than do the females. They also spend more time on the wing and less time on the flowers. If you see a blue-banded bee moving from flower to flower without touching any, then it is probably a male looking for a female. However, it is not so easy to tell one blue-banded species from another. If you are in Brisbane, *Amegilla asserta* is the one with yellow face marks and white, not orange, hair on the hind legs. In Sydney, the one with orange hair on the hind legs is not found, whereas in Melbourne *A. asserta* is the most common species. This is, of course, assuming that one of the less common species has not crept into town.

Why are bees important?

James Dorey

Australia's bees are an amazingly diverse, visually stunning and important group of animals. Their ecological importance stems greatly from the ability to pollinate the flowering plants of the world. Pollination is a vital ecosystem service, critical for sexual reproduction in plants. Pollination is provided freely in the natural world by insects, birds, bats, lizards, possums, rodents and even lemurs. Although there are many animal pollinators, bees are considered to be the most significant pollinators of the lot, particularly for crop pollination.

Crop pollination by the European honeybee alone has a commercial value of A$4–6 billion in Australia and A$240 billion worldwide, with 35% of the food that we produce and 75% of our food crops being reliant in some way on animal pollination. Bees also create wonderful and useful products such as honey, beeswax, pollen, propolis and more. Honey and beeswax production by honeybees in Australia is worth A$90 million annually. Although that is a lot of food and money, it is far from the end of the bee story.

Pollination of crops and the making of bee products are the most commonly raised topics when discussing the importance of bees. Unfortunately, these issues are often raised only in terms of the European honeybee. Although it is a very economically important species, the European honeybee is actually an invasive species almost everywhere that it resides, frequently stealing nectar from native plants without pollinating them, competing with native pollinators for food and nest sites, and pollinating exotic weeds. The role of the honeybee in crop pollination and the making of bee products is also only the tip of the iceberg when it comes to how important bees are to us and life on Earth.

With ~19 700 named species of bees across the globe, over 1600 of which are native to Australia, it should be clear that it is not just the honeybee that needs to be considered. Having co-evolved alongside flowering plants for over 100 million years, bees have become extremely important to the survival of many natural systems, as well as sustainable agriculture. Animals pollinate almost 90% of all flowering plants: that is over 308 000 plant species! Because bees are the primary pollinators in most ecosystems, it is difficult to overstate the importance of bees to the survival and success of many of these plants and the organisms that depend on them.

One way to explain how important bees are in the natural world would be to imagine what might happen if they were to disappear tomorrow. Direct effects of pollinator loss or decline would result in the loss of pollination services for the plants in that ecosystem.

Some flowering plant species rely on specialist pollinators that will pollinate only one or a few plant species. This is advantageous for the plant because it means that the pollinators must be loyal to them and are hence more likely to travel between two individuals of that same plant species, providing effective pollination. The obvious downside of such an arrangement is that both the pollinator and plant require each other to survive. Plants requiring a single species for pollination are particularly vulnerable to extinction if that pollinator were lost, and the bee would be vulnerable if the plant were lost. However, these isolated species interactions are rare and specialist relationships can also involve generalist plants and pollinators.

Most flowering plants do not require a specialist pollinator but instead attract generalist pollinators. Although generalists may not be as efficient at pollinating as specialist pollinators, the risk of using such pollinators is much lower. The loss of one pollinator species will not be as much of a problem for these plants because other generalist pollinators will be able to pick up the slack or provide adequate pollination; such redundancy is typical of many plant–pollinator relationships. However, the problem can become catastrophic when more and more pollinators are removed from an ecosystem and the in-built redundancy starts to fall apart.

The ultimate cost for any flowering plant species after the loss of pollination could be extinction. Extinction for large perennial flowering plant species that have lost their pollinator might be a slow and subtle process that may go unnoticed for many years. Other species may disappear in a flash or suffer a gradual population decline because of lessened seed set or seed quality from poor pollination.

Flowering plants make up much of the physical structure in many ecosystems. This structure provides the conditions, shelter, nesting sites and habitat that many animals and plants need to survive. Flowering plants also provide food for many animals. A reduction of roots, stems, flowers, leaves, fruits or seeds produced by plants could set off a cascade of ecological effects. The many frugivores and herbivores that rely on these food supplies would be impacted by a loss of species producing these resources. A decrease in fruit and seed set alone would have a negative impact on the many bird, mammal and insect populations that use these resources. The cascade would then continue onto the many predators, parasites and parasitoids that prey upon these species and each other.

There are many ecological and monetary reasons to preserve bee species and diversity. Perhaps the most often overlooked reason is the non-material benefits that people get from bees, and the wealth of biological history stored in the behaviour and genetics of each species. Without our wonderful diversity of bees, you would not be reading this book or enjoying these photos. You would not be able to go out in the garden or bush and see a multitude of bees conducting their important business.

It is very unlikely that we will lose all our bees overnight. Bees are not our only pollinators and many flowering plants do not require animals for successful pollination. Yet, any pollinator species that is lost or whose population declines could be another chink in the armour that nature's diversity and redundancy provides. Every chink could bring about unforeseen effects that might be another step towards the end of a population, a species, a crop or an ecosystem. Awareness and knowledge of the importance of bee diversity to humanity and the natural world is essential to the conservation of bees worldwide.