A LIFE WITHOUT BEES

With an ever-growing number of threats putting pollinators at risk, now is the time to ask, what would the world be like without these industrious insects?

Words **Adam Millward**

It's no secret that bees are in trouble. Britain alone has lost 22 species of bee in the last two centuries and an IUCN study into Europe's almost 2,000 wild varieties, published in March 2015, suggests that as many as one in ten are on the brink of extinction. In all likelihood, this figure is much higher, because the populations of more than half of those species remain undetermined.

Even more worrying is that this is not just a European trend. Among the thousands of species across the world – both wild and managed – numbers are almost universally on a downhill slope. This is the result of a wide range of factors, man-made and natural, resulting in ever-shrinking populations and more and more deserted hives. Such a bleak outlook has major implications not just for bees, but for us too.

They may be small, but the monumental role bees play in both wild ecosystems and agriculture cannot be overstated. At a global level, around a third of all the food we eat depends on pollinating insects, of which bees are by far the biggest contributors. That equates to more than £112 billion ($171 billion) in revenue every year according to the United Nations' Environment Programme, a staggering sum that provides many people's livelihoods as well as putting food on our tables.

Eminent scientist Albert Einstein is often credited with the prediction that humankind would not survive four years if honey bees were to be wiped out. Whether they were his words or not, you don't have to be a genius to see that if action isn't taken soon, our way of life – and even the future of our planet – could be in jeopardy.

Why bees matter

Picture Earth. Most of us will imagine a blue and green ball floating in space. While the blue comes courtesy of water, the green is from our rich diversity of plant life. With around 80 per cent of flowering plants – and crops – relying on pollinating creatures to survive, we'd be imagining a very different planet if bees were no longer a part of it.

If these industrious insects were to be driven to extinction, some of our most staple foodstuffs would, for most of us, become a distant memory. Everything from onions and apples to tea and coffee would be drastically depleted, as pollination – something we have taken for granted for millennia – suddenly became a painstaking manual task. Foods that were once commonplace would become the preserve of the lucky few who could grow them themselves or afford their skyrocketing prices.

And it's not just the plant crops we consume that would disappear from our lives; sunflowers and rapeseed would no longer be available for oil. Cotton, a cornerstone of the textiles industry, would become as rare and expensive as silk. Even farmers of livestock would be hit by a bee-less world, owing to the huge loss in fodder crops, such as turnips and clover.

Putting ourselves aside for a moment, taking bees out of the natural order would be devastating for virtually every creature further up the food chain. The majority of the world's berries and seeds would be lost without bees to act as a pollen delivery service. In the short term, birds and small mammals would feel the loss of this food source most keenly, but the ripple effect means larger predators would also have to quickly adapt or risk going extinct. And, of course, many bears would be bereft of their beloved snack: honey!

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Bees in numbers

If you're in any doubt what all the buzz is about, get a feel for the true impact bees make with these amazing statistics

30% of all food relies on pollinating insects

60% reduction in hives between 1947 and 2008 in the US

BEES POLLINATE **70** TYPES of crop in the UK alone

BEES ARE WORTH **£112.5 BILLION** to agriculture per annum

One honey bee colony

POLLINATES **4,000m²** of fruit trees

CAN POLLINATE **300 MILLION** flowers in a day

CONTAINS AROUND **50,000** BEES

GENERATES AROUND 15KG OF HONEY EACH YEAR

IT TAKES **12** bees a lifetime's work to make one teaspoon of honey

Life without bees would be no picnic

A meal in a world without bees could look very different from today

10 foods in danger of extinction...

Coffee
Broccoli
Strawberries
Chocolate
Pumpkins
Almonds
Pears
Coriander
Coconuts
And, of course, honey!

Jam sandwich
Without bees: no strawberry jam

Apple and blackberry pie
Without bees: no apples or berries

Lemonade
Without bees: no lemons

Greek salad
Without bees: no cucumber, onions or tomatoes

Crisps and dips
Without bees: no salsa or guacamole

Fruit salad
Without bees: no melon, kiwis or strawberries

The bee family

It can be easy to fall into the trap of thinking that once you've seen one bee, you've seen them all. With some 25,000 known species across the globe, that couldn't be further from the truth.

The better known 'social' species, including honey bees and bumblebees, live in complex societies where every individual is born into one of three specific roles: queen, worker or drone. The longer-lived queen picks the site to build a nest and spends her life laying eggs. Male drones only exist to reproduce with the queen, while female workers do everything else, including collecting the nectar to make honey, building and maintaining the hive, rearing the young and defending the colony if it falls under attack.

Despite a common misconception that all bees live in huge, swarming colonies, the majority of species – around 90 per cent, in fact – lead a solitary lifestyle. This group includes leafcutters, miners, masons and carpenters, all named depending on the material in which they like to excavate their burrows to lay eggs.

Solo bees do not produce honey or wax (at least not enough to be worth harvesting), but their huge diversity and distribution, as well as naturally hardier genes, mean they are critical to pollination. In fact, a global study published in the journal *Nature Communications* in 2015 suggests that wild bees contribute crop pollination worth £2,118 ($3,250) per hectare (2.5 acres) per year compared to £1,898 ($2,913) by managed honey bees.

BELOW
Worker honey bees collect nectar to make honey, spreading pollen as they travel from flower to flower

Bees and the law

In July 2015, the UK Government granted farmers the right to use neonicitinoid pesticides for 120 days, despite the fact that they have been banned by the European Commission since 2013, after studies indicated they posed a threat to insect pollinators. In response, more than half a million Brits signed a petition calling on the Environment Secretary to reinstate the ban.

However, the Department for Food, Environment and Rural Affairs argued its decision was based on new evidence, which suggests that neonicitinoids are less harmful than previously thought. The pesticides will be used on around five per cent of England's rapeseed crop in an attempt to counter a growing number of pests that are damaging crops across the country.

"More than half a million Brits signed a petition to reinstate the ban on neonicitinoids"


Carpenter bee


Bumblebee


Miner


Euglossine bee


Leafcutter


Cuckoo bee


Honey bee

Why are bees under threat?

While it's hard for anyone to deny that bee populations are shrinking, reaching a unanimous explanation as to why they are disappearing is much more contested. This unresolved debate is compounded by an ongoing shortage of data and funding for research, particularly into wild and native bees.

When it comes to honey bees, we at least have an umbrella term to describe their affliction. Colony collapse disorder (CCD) – where a hive's population drastically diminishes and struggles to survive as a result – has gone by many names over the years, including 'disappearing disease' and 'spring dwindle', but whatever you call it, it's on the rise. Indeed, in a recent survey of 5,000 beekeepers in the US, it was reported that a staggering 42.1 per cent of honey bee hives were lost between April 2014 and April 2015 – up from 32.4 per cent in the previous year.

Numerous causes for CCD have been proposed, but no single one has proven definitive. These include man-made chemicals used in agriculture, habitat destruction, parasites and fungi, less diverse crops, and environmental factors like drought and air pollution. The most widely accepted view is that the decline of bees is probably caused by a combination of several of these factors, and perhaps others still yet to be identified. On the right we take a closer look at some of the key threats in more detail.

Mind your beeswax

As if providing the vast majority of our foods wasn't enough, bees also produce wax to construct their hives, which we have found many uses for in our own homes. From giving furniture a glossy finish to providing lighting in the form of candles, beeswax is also an essential ingredient in many beauty products, including lip balm, hair wax and eyeliner.

Five major buzzkills

Pesticides
Although studies into the correlation between pesticides or fungicides and CCD have had mixed results, a growing body of evidence suggests that certain chemicals, even if not immediately lethal to bees, can ultimately lead to a colony's downfall. Adverse effects that have been highlighted include lowered immunity to disease and fungal infection, as well as damage to bees' homing ability, preventing them from returning to their hives.

Malnutrition
A common factor which appears in virtually all cases of CCD is poor levels of nutrition. Although this can be the result of environmental factors like drought, many argue this has arisen due to an agricultural trend towards monoculture farming, where growing a single crop on a huge scale is favoured over planting a range of crops. Studies suggest this lack of diversity in the bees' diet has a huge impact on their wellbeing.

Parasites
In some areas, Varroa mites are regarded as the biggest killers of honey bees. These parasites infest a hive, feeding on adult bees' blood and raising their young on bee larvae. The open wounds left from their bites leave bees more susceptible to pathogens, such as deformed wing virus.

Habitat loss
The growth of cities, industry and agriculture worldwide means that bees' natural forage habitats, such as flower meadows and heathland, are diminishing year on year. This puts a huge strain on these insects, as well as other pollinators like butterflies, as they're forced to travel further in search of nectar or to settle for limited flora.

Genetics
Some scientists believe the root cause of bees' decline – particularly in domestic species – is a lack of genetic diversity. Intensive commercial breeding often results in colonies prone to hereditary diseases and less well-adapted to fighting infection. Cross-breeding between lab-born bees and wild ones also weakens the overall gene pool.

Save the bees!

Make your garden bee-friendly
Don't be too over-zealous with your weeding. Find some space to let wild flowers grow in your garden and bees will thank you for it. Clovers, poppies, brambles, thistles and nettles are all favourites for pollinators.

Leave out refreshments
All that buzzing around gathering pollen is thirsty work, so don't forget to leave out a little water too. A shallow dish will work fine, or if you have a bird bath, drop in a few pebbles for bees to perch on.

Swot up on local bees
Sign up to a local beekeeping group. They'll be able to keep you up to date on all things apiary, advise on how to help bees in your specific area, plus tell you the best places to source local honey and other bee products.

Give bees a home
If you want to get more hands-on, you could always become a beekeeper yourself. You don't need much space – just a sheltered spot with partial sunlight and good drainage. Wild bees ask for even less; a pile of logs or a bundle of hollow bamboo canes makes for a perfect 'hibernation hotel'.

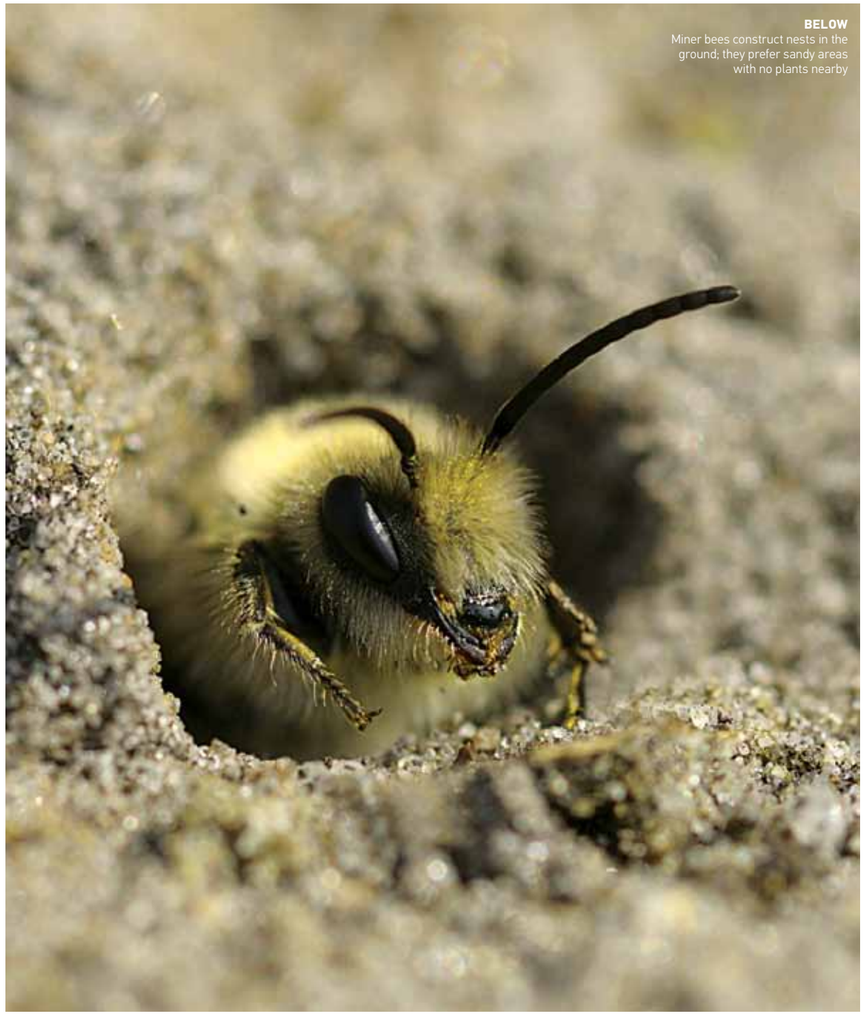
Keep it natural
Avoid using pesticides on your plants to prevent bees and other pollinators from picking up potentially dangerous chemicals. Encourage natural predators like ladybirds and dragonflies into your garden instead.

Bee-spoke technology

Bee specialists are increasingly turning to technology to help better understand these insects and their population crisis. In August 2015, technology company Intel teamed up with Australia's Commonwealth Scientific and Industrial Research Organisation to launch the Global Initiative for Honey Bee Health. This involves shrinking technology down to a bee-size scale and attaching tiny radio tags to the backs of several residents. These tags communicate with a micro-sensor placed inside their hive. It's hoped that the data gathered from the tagged bees will help shine a light on hive dynamics and pinpoint what can lead to a colony's collapse.

Similar bee-mounted microchips have been trialled at Kew Royal Botanical Gardens in London, this year, with a much greater detection range than previous examples. This technology could one day be deployed as an integrated network across a series of fields to track bees' response to various scenarios, including pesticide use and habitat fragmentation.

"Data from tagged bees will help shine a light on hive dynamics and what can lead to a colony's collapse"



BELOW
Miner bees construct nests in the ground; they prefer sandy areas with no plants nearby

All abuzz about bees

Two experts outline the greatest threats to bee populations around the world and what can be done to safeguard these precious pollinators

Blake Shook owns the Desert Creek Honey Company in Blue Ridge, Texas, and is a board member of the American Beekeeping Federation

Tim Lovett is the public affairs director of the British Beekeepers Association (BBKA), which represents the interests of UK apiarists

How have bee numbers changed over the last ten years?
BS: The number of annual hive losses has steadily increased over the past decade, while the number of commercial beekeepers steadily decreases. Commercial beekeepers have proven their resilience, but we are still seeing huge annual losses that are increasingly hard to recover from.

TL: There has been a long-term decline in honey bee colony numbers since World War II and this was accelerated by the arrival of the Varroa mite in the 1990s. Since then, the number of honey bee colonies has depended fundamentally on beekeepers themselves, to manage the impact of Varroa. Wild honey bee colonies essentially no longer exist because beekeepers are unable to look after them. Winter colony losses over the last five years or so have been as high as 30 per cent (which if similar levels of, say, our national cattle had been lost would result in devastating price rises). Most recently, winter colony losses were around 15 per cent.

What are the three greatest threats bees are facing right now?
BS: Varroa mites and the viruses that come with them, a lack of areas to produce honey and the routine use of pesticides applied in ways that are harmful to bees.

TL: The principal threats to honey bees are the Varroa mite, against which we have only limited measures, poor forage availability and bad weather patterns, such as wet summers or 'on-off' weather swinging from good to bad over short periods.

Why is there so little data about these insects?
TL: There is considerable literature on honey bees compared with other wild bees, but there are large gaps in our understanding. It's down to inadequate research funding.

BS: Bees are one of the most studied insects, however they are also extremely complex – so complex that despite the millions of dollars and tens of thousands of hours spent researching them, there are still many things we have yet to learn.

Are there any success stories?
TL: The number of beekeepers has increased strongly since 2009 when, for example, the BBKA had some 8,500 members; there are in excess of 24,000 today. This has come about as a positive collateral effect of the BBKA's campaign to draw attention to the plight of bees. Although bees are under downward pressure, beekeepers are working hard and broadly succeeding in maintaining colony numbers. Clearly the increased number of beekeepers has helped greatly in offsetting losses.

BS: Absolutely! If you are willing to work very hard, beekeeping can still be a viable career. We are seeing more young people get into commercial beekeeping, which is encouraging. We are also seeing more hobby beekeepers.

What action is your organisation taking to help bees?
BS: We work hard legislatively to make sure harmful pesticides are kept off the market and to promote beekeeping on a national level. We offer grants to students that are studying beekeeping and offer huge amounts of educational material. We are the voice of the beekeeping industry and work hard to make sure our voice is heard on all levels of the government, media and general public.

TL: The BBKA exists to promote the public's knowledge and understanding of bees and to promote the craft of beekeeping. It is an educational charity and, through its member associations, trains and educates large numbers of beekeepers.

If our readers were to do one thing to help bees, what would you recommend?
BS: Donate or become a member of your national beekeeping association or group.

TL: Plant bee-friendly plants or subscribe to the BBKA charity through the Adopt a Beehive and Friends of the Honey Bee schemes.