

Bee Kind to the Little Guys

Nearly 90% of the world's plants rely on animals to reproduce¹, with bees being the single most important pollinator. With people increasingly living in towns, how can we ensure we make space for these important creatures?

Types of bee

Bees come in all sorts of shapes and sizes, and behave in all sorts of different ways.

A bees' primary foods are **nectar** and **pollen**. The nectar provides them with energy and the pollen supplies protein and nutrients for adult bees and and larvae².

Because some pollen that the bees collect is lost along the way as they flit from flower to flower, bees play a **crucial role in plant reproduction**. After collecting food they find their way back to their nest by navigating using the sun.



- 1 https://www.researchgate.net/publication/227696464_How_many_flowering_plants_are_pollinated_by_animals_Oikos (short link: chk.me/n8hqMK3)
- 2 'Baby' bees – read more about the honey bee lifecycle here: buzzaboutbees.net/honey-bee-life-cycle.html (short link: chk.me/WxwP6Yd)



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EXPO SCHOOL
PROGRAMME
من مدينة إكسبو دبي
BY EXPO CITY DUBAI

Roots & Shoots UAE and the Expo School Programme

This resource was put together by Roots & Shoots UAE in partnership with the Expo School Programme by Expo City Dubai. The Expo School Programme's mission is to inspire the next generation of thinkers and change makers by offering students the knowledge, tools, and platforms needed to foster creativity, innovation, and meaningful collaborations for a sustainable future for all.

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Find all the links used in this resource on our website – scan the QR code or typing this link into your web browser: janegoodall.ae/bee-kind

Honey bees

Honey bees are found across most of the world³. They live in colonies and have a complex social structure. They are called honey bees because some of the nectar they collect is made into honey and stored in the colony to provide food over the winter.

The bees of Terra



Western honey bee. Image by Andreas Trepte, CC BY-SA 2.5 <https://creativecommons.org/licenses/by-sa/2.5>, via Wikimedia Commons.

The western honey bee (scientific name *Apis mellifera*, the species most often used for honey production) is not native to the UAE and you would not expect to find them living wild. However, sometimes nature has other ideas.

Back in 2019 the contractor tasked with building Expo 2020's Sustainability District "Terra" found something unexpected in a pile of steel rebar: a colony of western honey bees!



© Beekeepers Foundation UAE, all rights reserved. Reproduced here with permission.

It wasn't easy, but the specialists at the Beekeepers Association (beekeepersfoundation.ae) managed to move the colony of approximately 30,000 bees around 20 km to the bee garden at the Sustainable City (thesustainablecity.ae) where they have been thriving and producing honey.

Now the work on Terra at Expo City is complete, it's planned to return the hive and continue honey production there in the near future.



Hear the full story from Ayesha Al Marzooqi (Associate – Sustainability and Innovation, Expo 2020) and Zahira Nedjraoui (President – Beekeepers Association) on YouTube: youtu.be/7O7x6Ji9YsE

Dwarf honey bees (scientific name *Apis florea*)



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Dwarf honey bees building a nest. Image by Markus Stolte, CC BY 4.0 <https://creativecommons.org/licenses/by/4.0/>, via Wikimedia Commons.

- ▶ The only honey bee species native to the UAE.
- ▶ Around 7-10mm (1/4-3/8) in length.
- ▶ Reddish in colour.
- ▶ They produce a small amount of honey, but it's rarely commercially viable.
- ▶ Live in relatively small colonies in nests made from a **single, open comb** of wax on the underside of branches. They may also make their nests on the ceiling of balconies, plant supports or garden furniture.
- ▶ They **rarely sting if left undisturbed** (and their sting does not pierce human skin easily) so they are usually not problematic should some decide to share your garden!

Read more on Wikipedia at wikipedia.org/wiki/Apis_florea (short link: chk.me/GrffG3o)

Got a taste for honey (bees)?

There are plenty of places to learn more about honey bees in the UAE in addition to the Beekeepers Association (beekeepersfoundation.ae). If you are on Instagram then check out Olivers Bee Farm in Dubai (@[oliversbeefarm](https://www.instagram.com/oliversbeefarm)) and The Beefairy Lady (@[beekeepingbackstagewithmeriem](https://www.instagram.com/beekeepingbackstagewithmeriem)).

³ commons.wikimedia.org/wiki/File:Apis_distribution_map.svg (short link: chk.me/JCErAK4)

Solitary bees

Found the world over, there are thousands of species of solitary bees in a vast array of shape, size and colours. It can be extremely difficult for a non-professional to identify the exact species of any one bee, but it is possible to classify them into broad groups based on their behaviour. These groups are **cavity-nesting bees**, **ground-nesting bees**, and **cuckoo bees**. None of the solitary bees of the UAE are aggressive and they only rarely sting, so unless you have an allergy they do not pose any threat to humans.

Cavity-nesting bees

Cavity-nesting bees nest in cavities that are above the surface of the ground.

Carpenter bees

Carpenter bees chew out tunnels in dead wood or soft wood to create their nests which can sometimes cause property damage.



A black carpenter bee in the UAE. © Georgina Pereira, all rights reserved. Reproduced here with permission.

- ▶ Carpenter bees tend to be considerably larger than other cavity nesters
- ▶ Many have the characteristic black and yellow bodies we associate with bees we see in books and in cartoons, but you'll also spot them in black and metallic blues, greens and purples.

Mason and leafcutter bees

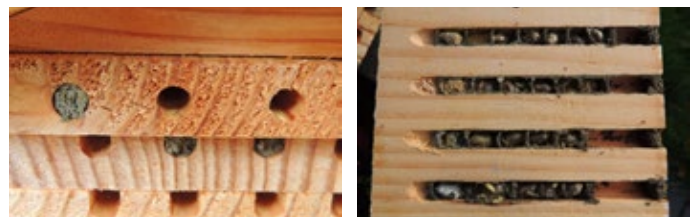
Mason bees and leafcutter bees nest in reed stems (think the inside of a bamboo garden cane) or pre-drilled holes in wood or stone.

Mason bees use mud or clay to seal their nests to deter predators. Leafcutter bees cut neat circles from leaves to seal theirs.



Mason bee emerging from its home (this example has the scientific name *Osmia cornifrons*). Image by Beatriz Moisset, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons.

- ▶ Nests are segmented into cavities and stocked with pollen and provide a safe space for the eggs and the larvae.
- ▶ The sex of the bee that hatches from each egg is determined prior to laying. Female-producing eggs are laid at the back of the nest, males towards the front.
- ▶ **Excellent pollinators**, particularly for early blooming plants and fruit trees because they tend to feed on just a few types of plant.
- ▶ Navigate using the sun, just like honey bees.



left: Cavities used as nests. Three of the holes have been filled up by the mason bees. The other two round holes in the top row have traces of yellow from the pollen on the scopa underneath the bees' abdomen. **right:** Mason bee nest cells in a bee hotel. Images by Orangeaurochs. CC BY 2.0 <<https://creativecommons.org/licenses/by/2.0/>>, via Wikimedia Commons



Opened nest of a red mason bee (scientific name *Osmia rufa*). Image by tpjunier. CC BY 2.0 <<https://creativecommons.org/licenses/by/2.0/>>, via Wikimedia Commons

Ground-nesting bees

Ground-nesting bees nest in tunnels they make for themselves in well-drained soil.



A ground-nesting bee (this one is an unidentified species from the genus *Colletes*). Image by Katja Schulz, CC BY 2.0 <<https://creativecommons.org/licenses/by/2.0/>>, via Wikimedia Commons.

- ▶ Also known as mining bees or miner bees.
- ▶ Most common solitary bee.
- ▶ Smaller than honey bees.
- ▶ Carry more pollen on their bodies than honey bees, making them very effective at transferring pollen between flowers.

Cuckoo bees

Cuckoo bees don't build their own nests or gather pollen. Instead, they sneak their eggs into the nests of other bees, letting them raise their young.



Cuckoo bee (probably from the genus *Thyreus*). Image by Milind Bhakare, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons.

- ▶ The cuckoo bee larva hatches first and eats most of the pollen and nectar.
- ▶ In some cases, the cuckoo bee larva may eat the host bee larva.
- ▶ Cuckoo bees often resemble their host species in appearance, but they lack their pollen-collecting structures.

Activity: Which bees can you spot?

Best carried out on a warm (but not too hot), dry day in the spring when there are plenty of flowering plants to be seen. Take a notebook and a camera to the school garden or a local park and spend some time looking for bees and their homes. Can you identify bees from each of the broad categories outlined here? Can you spot any mining bees entering/leaving their tunnels in the ground? Any masons or leafcutters emerging from reed stems? Or honey bees hanging from the trees? Keep a note of what you see where, along with any pictures you can take, then gather results together from the whole class when you get back to school. What was the most common type of bee that you all saw?

Optional: Other pollinators

Although they are the most common, bees are not the only creatures that perform pollination as they go about their lives. What else can you spot paying a visit to the flowers? Keep a tally of the different types of creatures you see, and which flowers they are particularly attracted to. You can find more information on different pollinators in this article on [ZME Science](https://www.zmescience.com) (short link: chk.me/OOLjSWE)

Let's bee kind

Now you've learned about bees, let's help them out by building a 'bee hotel' from recycled materials, to provide nesting sites for mason and leafcutter bees.

DISCLAIMER: Although bee stings from solitary bees are rare, they can happen. If you or anyone in your group – or anyone living/working in the direct vicinity – is allergic to bee stings then DO NOT carry out this activity!

Step 1: What does a bee hotel need?

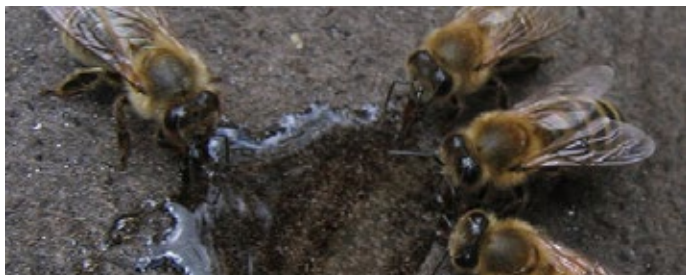
Make a list of what your bee hotel needs to have to provide a safe, effective nesting environment for mason and leafcutter bees based on the information that you have already learned plus some general knowledge. Fill in anything you missed from this list below:

- ▶ Some bees like to use existing cavities, some drill their own.
- ▶ For bees that like existing cavities, reed stems (think the centre of a bamboo cane) are the most common nest sites, but some bees prefer holes drilled into solid wood.
- ▶ Bees come in different sizes.
- ▶ Bees like to create sealed chambers within their nests, and certain species lay different sex eggs depending on depth.
- ▶ Bees navigate using the sun.
- ▶ Bees need access to food (pollen/nectar) and water.
- ▶ Bees rely on external heat to maintain their body temperature.

Step 2: Where will you put your bee hotel?

To navigate using the sun, the bees need to be able to see it, so a south-facing hotel is perfect. Also, to maintain a suitable body temperature, it should not be in direct sunlight at the hottest parts of the day – look for a place that maintains a temperature range as close to 20°C to 30°C as you can. As these are very similar needs to human beings, a spot on a balcony or terrace can often work well.

If you are building your bee hotel at school and have a wildlife garden, then place the hotel nearby so they have easy access to food. If you are building at home, can you plant some bee friendly plants on your balcony/allow a small patch of your garden to grow wild? As you are encouraging local bees, local flowers are best – this will vary according to your exact location so ask your local garden centre or neighbourhood gardener for advice.



Bees drinking. By Robert Engelhardt CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons

If there is no water source nearby then can you provide one? A shallow dish in the shade kept topped up with a small amount of water is fine.

Step 3: Structure and materials

We asked an entomologist (insect expert) for some words of advice, here's what they said:



Bee hotels built by Stuart Hine. CC BY-NC-SA 4.0 <<https://creativecommons.org/licenses/by-nc-sa/4.0/>>. Provided by the photographer.

“There are two approaches, holes drilled in a suitable material or nesting tubes. For tubes you will need an open fronted container with a protective lid. The one shown in the first picture has a mix of purpose made bee tubes and lengths of bamboo cane in a selection of sizes. Most mason bees go for holes with diameters from 8-10mm and leafcutters 10mm+, but you will get smaller species in the smaller bamboo. Ideally the tubes should be around 15cm long so you get a good mixture of male and female eggs laid.

“The other method is drilling holes in a suitable wood. Holes drilled in softwood are too rough, hardwoods are better [and it should be untreated]. You should drill a mix of diameters – the variety of species you will then get is greater and includes not only those that would also nest in the tubes but also smaller species that use beetle boring holes.

“Don't be tempted to make the hotel too large. The larger you make it, and the larger the bee community, the more chance there will be of attracting parasites.”

Step 4: Design and build!

At Roots & Shoots UAE we love to use recycled materials wherever possible (you would be amazed what you can make from old PET bottles: janegoodall.ae/resource/reuse-recycle-my-pet-project). Make sure everything you use is clean of food or non-natural waste. Recycled garden canes are great to use, but not if they were previously in a garden that used pesticides.

As for a design, let your imagination run wild! Anything that follows the constraints we've discussed and fits into your chosen location should work. For those that would like a set of step-by-step instructions read on...

'Make a Brilliant Bee Hotel from Scraps'

by saviourbees

Adapted from [instructables.com/Make-a-Brilliant-Bee-Hotel-from-Scraps](https://www.instructables.com/Make-a-Brilliant-Bee-Hotel-from-Scraps) as per Creative Commons licence CC BY-NC-SA 4.0 and available for reproduction and remixing under the same terms.

Before you start

Watch the 'How To' video on YouTube: youtu.be/-DQo_o4Ck1c

Supplies and tools needed

- ▶ 2 litre plastic PET bottle
- ▶ bamboo canes with 6mm - 11mm holes
- ▶ a piece of thick or corrugated cardboard
- ▶ an old tarpaulin or some tough packaging plastic. At least 20cm wide and long enough to wrap your bottle 1½ times
- ▶ 60cm of garden string
- ▶ three screws
- ▶ scissors
- ▶ a strong craft knife (or small saw) to cut the bamboo
- ▶ sandpaper
- ▶ a ruler or tape measure
- ▶ a pen (one that can draw on the bottle would be ideal)
- ▶ something to make holes in the plastic
- ▶ 3 clothes pegs
- ▶ a chunky sewing needle
- ▶ a screwdriver to fit your screws

Prepare your bottle

Clean and dry your bottle thoroughly. Now measure 20cm from the bottom of your bottle and mark a line all the way around. Carefully make a hole somewhere along the line, insert the scissors and cut all the way around. You don't need the top part of the bottle for this project so either recycle it or set it aside for reuse elsewhere.



Prepare your cardboard

Place your cut bottle vertically onto your cardboard with the cut side down. Draw a circle around it then cut *just inside the circle* so that you have a circle of card that fits snugly inside the cut bottle. Place it inside and push it down so it's resting on the bottom of the cut bottle.

Add the bamboo



Cut 15cm lengths from your selection of bamboo canes using the craft knife/saw. Both ends of your bamboo need to be fairly smooth, so use the sandpaper to clean up the cut ends. Place your bamboo into your cut bottle so they rest against the cardboard circle. The key here is using enough bamboo so that they wedge in and don't fall out if turned upside down. Be brave and test this out... sometimes they're not as wedged as first thought.

Add weather protection and a hanger

Cut your tarpaulin/plastic sheet into a rectangle that is 20cm wide (the length of the cut bottle) and long enough to wrap 1½ times around your cut bottle (an excellent chance to practise your maths! Remember, the circumference of a circle is π , or put simply, 3.14 times the diameter of your cut bottle).



Place the cut bottle in the middle of your sheet and bring the two ends of the plastic together around the bottle. Fold the ends over and peg them together so that they stand proud above the cylinder of the bottle, like in the picture.

Remove the bottle from the plastic jacket without disturbing the pegs. Use your needle and string to sew a basic line of stitches between the two pegs, remembering to secure the string so that it won't unravel when you're done. Once sewn, remove the pegs and reinsert your bottle into the plastic jacket.

Finally, make some holes in the plastic ridge you have created. A really strong material like tarpaulin will only need two holes, with weaker plastic 3 or even 4 holes is better. These holes will be suspending the bee hotel when you install it by screwing hooks or screws through the holes and into a secure vertical surface like a wall or fence.

Install your bee hotel

Hopefully you've already researched where to place your bee hotel (if not then see 'Where will you put your bee hotel?' earlier in this resource). Make sure the hotel is at least 1m above the ground to deter predators and secure it so that it won't swing around in the wind.

Looking for a more extensive project?

There are plenty more designs available on Instructables for inspiration such as...



Images from each of the Instructables projects listed below. All CC BY-NC-SA 4.0 <<https://creativecommons.org/licenses/by-nc-sa/4.0/>> from [instructables.com](https://www.instructables.com)

- ▶ 'Mason bee hotel' by alois. Made from bamboo and discarded building materials: [instructables.com/mason-bee-hotel](https://www.instructables.com/mason-bee-hotel)
- ▶ 'Make an Experimental Bee Hotel' by saviourbees. Made from an old book, bamboo, a tetrapak and some old packaging: [instructables.com/Make-an-Experimental-Bee-Hotel](https://www.instructables.com/Make-an-Experimental-Bee-Hotel)
- ▶ 'Rustic Bee Hotel' by amtrudell: Made from scavenged wood scraps and featuring a water supply: [instructables.com/Rustic-Bee-Hotel](https://www.instructables.com/Rustic-Bee-Hotel)

A Place to Live: Beena the Bee

Groups that are based within travelling distance of Expo City Dubai can take part in a live storytelling-led workshop about the different homes that animals build, with a chance to create a habitat for Beena the Bee.

Find out more about 'A Place to Live: Beena the Bee' workshop at schools.expocitydubai.com/en/journeys/workshops/a-place-to-live (short link: chk.me/xHbhQ4K). You can find a full list of all the things to do at the Expo School Programme by Expo City Dubai at schools.expocitydubai.com/en/journeys

Tell us how you got on

When your bee hotel is finished we'd love to see what you have created! Your group leader can upload a story with images to the Roots & Shoots UAE website (find us at janegoodall.ae). If your school or youth group does not already have an account then just fill in the web form on janegoodall.ae/join-roots-shoots-uae and we can set you up.



Keep up to date with Roots & Shoots UAE and the Expo School Programme

You don't have to have an account to keep up to date with what our groups are up to. Head on over to janegoodall.ae to sign up for our email newsletter packed with all the latest information on what our members in the UAE have been doing.

If social is more your thing then you can also find Roots & Shoots UAE on Facebook at fb.com/RootsnShoots.ae, on Instagram as @JaneGoodallUAE, and on LinkedIn as "Jane Goodall's Roots & Shoots UAE" (direct link: chk.me/bkGPm7M). You can even get an alert for all our latest stories as they are published on Mastodon by following botsin.space/@janegoodbot. Give the Expo School Programme a follow on Instagram (@exposchoolprogramme), Facebook (fb.com/ExpoSchoolProgramme) and YouTube (short link: chk.me/tpuWe7U).