

How to Make and Manage a Bee Hotel: Instructions that Really Work

By Marc Carlton, updated November 2017

What are Solitary Bees ?

As well as Bumblebees and Honey bees (that live socially) there are over 240 species of wild bees in the UK that are called 'solitary bees' because they make individual nest cells for their larvae. Most species nest in small tunnels or holes in the ground or in sandy banks, piles of sand, or crumbling mortar or sparse starved lawns. You can leave areas of bare soil or gravel in your garden for these.

Others use the hollow stems of dead plants such as brambles, or tunnels previously bored into dead wood by beetles. A number of species of small solitary wasps share a similar lifestyle. Harmless to us, they are predators of small insects. Some of the more distinctive ones that are common in gardens are described in my fact sheet about solitary bees and gardens.

Although they are known as solitary bees, some species will group their nest cells together in aggregations, and a few have evolved social behaviour rather like bumblebees. Many solitary bees are very small and you may not have realised they are bees. All collect nectar and pollen from flowers, except the so-called 'cuckoo' species that lay their eggs in the nest cells of other species.

Solitary bees are harmless and not aggressive. They rarely if ever sting unless trodden on or squashed between your fingers. They do not have painful stings like honeybees. In most cases if they attempt to sting, you will not even feel it. They do not live in hives, make honey, build honeycombs, or swarm.

If you find them (for example in old house walls) please leave them alone. Colonies are very faithful to their nest sites and may have been living there for many decades. They are part of the 'fine grain' of your local biodiversity—something to be cherished.

A number of the species that are commonly seen in gardens, such as Red Mason and Leafcutter Bees, nest in tubes or tunnels. They are very useful as they pollinate fruit crops. Gardeners can easily encourage these bees by providing artificial nest sites, by drilling holes in dry logs or blocks of wood.

These bee houses are also called 'trap nests', or in America, 'bee condos'. It has become fashionable to call them 'bee hotels' but I feel that this is misleading, as they are not short-term accommodation like a hotel room, they are the bee's permanent home for eleven months of its short life as it develops from an egg through a larval stage, then as a dormant pupa, and finally emerges as an adult.

Buying Bee Houses ('Bee Hotels')

Bee houses only provide nesting sites for a small number of bee species, but it is interesting and educational to watch bees using them.

In the light of public concern about sudden bee declines as reported in the media, (a story in fact originating from honey bee declines in North America), many horticultural suppliers have jumped on to a lucrative bandwagon and a number of commercially-made wooden bee houses are now available. Most of them are expensive, and sadly many of them are inadequate for a number of possible reasons:

- they offer insufficient protection from wet weather
- the holes are too large, because they are made abroad to cater for species that do not live in the UK
- tubes have splinters inside
- tubes have no solid back wall and are simply open-ended wind tunnels
- they contain glass or plastic tubes which cause condensation and fungus moulds

The manufacturers do not provide proper instructions about long-term management, nor do they mention that Red Mason Bees and Leafcutter Bees (which are the species they aim to attract) are not found in some parts of Britain and Ireland. So beware wasting your money! The only commercially-made bee houses that I would suggest trying out are those from [Nurturing Nature](#). Alternatively follow my instructions below and make your own inexpensive bee houses.

Bee Houses Must be Managed!

Once you have made a bee house, for the sake of the bees using it, you should not simply site your bee house and forget it. You may end up with unoccupied cells, winter mortality of larvae due to fungus moulds, and the spread of parasites.

Ideally you need a system where you can:

- Identify at the end of the summer any cells that remain in a walled-up condition from the previous year because no young bees emerged. The contents of these cells will be dead and should be removed and destroyed.
- Identify any cells which have been taken over by the fly *Cacoxenus indigator*, whose larvae eat the pollen store and bee larvae. The contents of these cells should be removed and destroyed before the adult flies emerge.
- Replace drilled blocks with brand new ones every two years. This is done in the summer, after the young bees have emerged. It will help to prevent the build-up of fungus moulds, mites and other pests and parasites.

Later in this article I explain how to carry out these management tasks.

Instructions for a Simple DIY Bee House

The beauty of home-made bee houses is that you can use re-cycled or waste wood and logs and make them fairly cheaply. All you need is a wooden box, open on one side, with a sloping roof to deflect rain. Fix it to a sunny fence or wall. Fill it with blocks of wood or small logs into which you have drilled small holes. A variety of solitary bees will use these tunnels as nest sites. The box should be a minimum of 20cm (8ins) deep, and needs an overhang at the top to keep rain off. You may already have a wooden box or a drawer from an old wooden chest of drawers that you can adapt for this purpose. If not, you can make one. The one in the picture is 20cm deep, 30cm (12ins) high at the front and 30cm wide, made out of untreated European spruce. I have given it a sloping, slightly overhanging roof to deflect rain.



I have not put a back on the example in photograph, because if you intend to fix the box against a wall or solid fence, you don't need to put a back on it. If the bee house is to be free standing, fixed to a pole, you must give it a solid back, to give protection from rain and wind. You can treat the exterior of the completed bee house with a water-based varnish or fence paint if you wish. Do not use solvent-based wood treatment products as these have a strong odour which could deter bees.

Dimensions

The dimensions do not have to be exact and you can make a larger bee house if you want. It is also possible to make a very large, free standing one, and pile up drilled logs and timber into it. (See photograph at foot of this page), however there is a debate as to whether this is a good idea, as Mason Bees in the wild would never live in such large numbers in close proximity to each other, and these large concentrations of tubes could be inviting invasions by parasites and diseases if not carefully managed. It is harder to manage such large bee houses in the way that I explain later in this article. I currently believe it is better to make smaller bee houses and spread them around the garden in different locations.

What Wood to use?

For the structure of the house you can use any timber that you have to hand, so long as it has not been recently treated with a solvent-based wood preservative. If you don't have any timber around that you can re-cycle, builders merchants often have off-cuts of wood available cheaply. Composite materials such as hardboard, chipboard or particleboard are not suitable because they will disintegrate in the rain.

Drilling the Tunnels

Inside the shell of the bee house you stack dry logs or sections of untreated timber, up to about 18cm (7ins) in length. If you choose logs make sure that they are not cracked or split making it easier for pests or fungus spores to spread. I find that logs tend to split so frequently that it is safer to use blocks of untreated building timber. (Do not use fencing timbers as these are normally treated with chemicals). Cut long timbers into short blocks. Drill a selection of holes into them of varying diameters **between 2mm and 10mm**, but no bigger. The depth of the holes that you make depends ultimately on the length of your drill bits. Most drill bits are fairly short anyway. If you do have longer drill bits, you can make the holes deeper, and the bees will still use them. Do not make a hole all the way through to the opposite side, bees prefer a closed end tunnel.

The open ends of these holes should face outwards, and must be **smooth, and free of splinters**, as should the entire length of the tunnel/cavity. This is very important. If necessary use a countersinking drill bit, or sandpaper, to clean and smooth the entrance to each hole, as the bees will not enter holes with rough splintered wood around them, as this can easily damage their wings. Carefully clean away any sawdust, as this will also put them off.

Siting your Bee House

The bee house must be positioned in **full sun**, facing south east or south, at least a metre off the ground, with no vegetation in front of it obscuring the entrances to the tunnels. Again this is very important. Solitary bees are cold-blooded and rely on the sun's heat to warm them up in the morning, hence the need for a sunny site. Unlike bumblebees, they have no furry coats to keep themselves warm! If you site your bee house in the shade or hidden behind vegetation it is unlikely to be used. A bee house must be **firmly fixed**, so that it does not swing or sway in the wind, so you should not hang it from a branch.

Which Bees Will Live in Bee Hotels?





The range of species that may occupy your bee house depends where you live, with SE England having the greater diversity. Further north, and in Scotland and Ireland, the bee fauna is not so rich, and some of the species described here are not yet recorded in your areas. You can view distribution maps at the BWARS website, and in Falk and Lewington's field guide (see details [below](#) at foot of page). North America has different species from the same genera.

Tunnel Diameters for Solitary Bees



Different species of **Mason Bees** (e.g. *Osmia bicornis*, *Osmia leaiana*, or the Blue Mason Bee, *Osmia caerulea*) occupy different diameters of tunnels. They will construct a series of 'cells' in each tunnel. They collect and deposit pollen inside a cell, from nearby flowers, lay an egg, and wall it up. (See image of walled-up tubes below right). Red Mason Bees do this with mud, collected from the ground nearby where they usually create a 'quarry'. In dry weather you should make a small mud patch for them, and water it occasionally if the weather stays dry (see image left). The smaller species of Mason Bees, *O. leaiana* and *O. caerulea* use masticated plant matter to wall up each nest cell.



Later in the summer, **Leafcutter Bees** (e.g. *Megachile centuncularis*, and *M. willughbiella*) may also use the tunnels, lining their cells with circles of leaf that they cut from wild rose bushes. In the picture on the left a Leafcutter Bee has walled up the cell at the top and a Red

Mason Bee has walled up the cell below with mud.

When you drill holes in logs or posts, make sure you include **plenty of holes of smaller diameters** (down to 2mm). If you wish you can drill these in separate pieces of wood or have completely separate bee houses for them. You may attract other small solitary bee species to use them, including *Chelostema florissomne* and *Heriades truncorum*.

The smallest holes will attract the **Harebell Bee** (*Chelostema campanularum*) during June and July, so long as their forage plant *Campanula* is growing nearby. In the wild this species uses holes in dead wood vacated by the Furniture Beetle ('woodworm'). Using the smallest drill bit I could get I drilled the hole shown in the image on the left. It is being examined by a Harebell Bee (much enlarged).

Cardboard tubes for Solitary Bees

You can also place commercial cardboard bee tubes in your bee house, as illustrated on the right. These cardboard tubes are very popular with Red Mason Bees, but do not suit the smaller species. They are marketed by a few on-line supplier. Check before you buy that the tubes are sealed at one end. Unfortunately these cardboard tubes are not waterproof and very soon disintegrate if they get wet. They should be taken into a shed or unheated garage during autumn and winter to protect from rain. You will need to replace them regularly because Mason bees prefer to nest in new, clean tunnels.



How to Make a Bee Post or Bee Block

An even simpler alternative is to make a bee post – drill a variety of holes up to 10mm in diameter into the side of a thick piece of untreated timber, and fix to a sunny wall or fence. (See photograph). This must have a small sloping roof put on it, and Again these posts are best taken under cover in autumn.



When you drill the holes smooth down the entrances to them thoroughly so there are no sharp splinters, as these will put the bees off. New fence posts from garden centres are unsuitable because they have been treated with chemicals, but lengths of very old fence posts or old roof joists, such as you often find on skips, are ideal.

Again this **should be kept in a dry, cool place in winter** and brought out in March. If left outside to endure winter rains these small posts can soon get saturated, even with a roof, and this can mean high mortality for the bee larvae as they succumb to fungus moulds. I suggest replacing the post (or bee block) with a new one every two years, to reduce the risk of parasites and disease.

Bamboo Tubes for Bees



Bundles of bamboo canes, sawn into lengths about 20cm (8ins) long just below a joint and laid horizontally may also be occupied by solitary bees, so long as they are not blocked with dried pith or solid nodes. If any of your bamboo lengths are blocked you will have to drill through them to make them suitable for nesting bees. The diameter of the holes should not exceed 10mm.

Air Bricks for Bees

These are on occasions used by Red Mason Bees if there is nothing else more suitable available, however the holes in the air bricks are normally square and larger than required by the bees, so they are not optimal.

Bundles of Dead Stems for Bees

Bundles of dried stems of various herbaceous garden plants, especially raspberries, brambles, teasels, and elder will be occupied by other species. These should be placed in an upright position in your bee house. Many species of bees nest in dead stems and will not use drilled holes. Rolls of dried reeds (sold as portable screens in garden centres) can also be cut up and placed in your bee house will be used by very small species of solitary bees. The cuts must be clean, without splinters, and the individual reeds should not be crushed or split as the bees cannot use these. The bundles of stems must be kept **completely dry** at all times, under some sort of shelter—they will soon rot if exposed to rain. If you make a larger bee house you will have scope to include all of these nesting opportunities. Replace the stems every year or two. See advice below about how to periodically replace logs, blocks or dry stems with new ones.

Bee activity will cease by mid-September at the latest; Mason Bees earlier. Inside the tubes and tunnels, each cell will have been provisioned with a mixture of pollen and nectar by the mother bee and a tiny egg may have been laid. The egg soon hatches and the larva develops rapidly by eating the nutritious mixture of pollen and nectar before it goes mouldy. The larvae then pupate. *Osmia* will spend the next 11 months or so in a dormant state as pupae, inside a cocoon, until they are ready to emerge as adult bees the following spring or summer. Some other solitary species such as *Anthophora* spend most of this period as fully-formed but dormant adults.

Some species of small solitary wasps may also take up residence. These furnish their cells with paralysed live prey instead of pollen, otherwise have a similar life cycle to solitary bees and are closely related to bees. Note these solitary wasps do not sting people!

Protecting Bee Houses from Winter Wet

You can remove the occupied logs and tubes and keep them in a cold dry place during the winter, to protect them from winter wet, replacing them in the bee house in March. An unheated shed, porch, or carport will do. This is very important – winter wet, not cold, is their

enemy. Do not store in a warm place – they need to be cold but **protected from persistent heavy rain** during the winter.

Persistent wind-blown rain can dissolve the mud walls of the cells, and cause both wooden blocks and cardboard bee tubes to rot, and the young bee pupae will succumb to fungus diseases. If your bee house has a good overhanging roof and is completely rainproof you can leave the tubes there during autumn and winter. From April onwards, young bees that have over-wintered in a dormant state inside the tunnels will emerge, and start the cycle over again.

I'm afraid that many of the elaborate 'insect habitat hotels' illustrated in gardening programmes on TV, in magazines and at gardening shows are ornamental rather than functional, designed to appeal to human aesthetics more than being actually beneficial to solitary bees. Unless they incorporate serious shelter from winter wet including a robust roof, the wood will become saturated and the structure will not be suitable for over-wintering insects such as solitary bees. Roofing an insect hotel with damp turves is not good enough.

Beware Birds!

If you notice Woodpeckers or other birds attacking the tunnels looking for bee larvae, fix a piece of chicken wire across the front of the bee house. This does not seem to deter the bees.

Annual Management of Bee Houses

The following techniques will help you maintain a healthy population and may help to prevent the build-up of parasites such as the *Cacoxenus* fly.

Dealing with *Cacoxenus indigator*

This is a very small fly with red eyes that you may see around your Red Mason Bee tunnels. It is a [cleptoparasite](#). The larvae of these flies eat the pollen store and the young bee larva in the Red Mason Bee's cells. The fly larvae then bite small holes in the mud walls of the cells, before pupating. They remain as pupae throughout the winter and the adult flies emerge in spring, using the small holes in the mud walls to escape. They are the most important biological factor in the reduction of Red Mason Bee populations. In late summer or autumn you should examine all the tubes that have been walled-up with mud during the summer and identify any in which there is now a small hole. These have been taken over by the fly, and these tubes or tunnels should be cleaned out and the contents destroyed. Note that this fly only affects Red Mason Bees.

A Suggested Method to Identify Tunnels in which the Bee Larvae Have Died

If dampness gets into a cell the pollen store can go mouldy or the bee larva or pupa itself can succumb to fungus diseases. Also bee larvae can be killed by the *Monodontomerus* wasp, or by invasions of pollen mites that eat the pollen store so that the bee larva starves. During winter, after removing the contents of any tunnels that have fallen prey to the *Cacoxenus* fly,

mark all sealed tunnels with a coloured marker pen. This will not harm the emerging bees next season as they do not ingest any of the mud wall of each cell, they simply break it up to get out. At the end of next season (i.e. next September or October), any tunnels that still have the coloured mark represent those from the previous year in which the bee larvae died and did not emerge. These should be cleaned out, or in the case of bamboo or cardboard tubes, removed and destroyed.

How to Replace Bee Blocks, Logs and Dry Stems with New Ones

You should replace blocks every two years with brand new ones. The tricky bit is to ensure that the old blocks have been completely vacated and that young females do not start to re-occupy them with new nest cells. Proceed as follows:

Get new tubes, drilled blocks or drilled logs prepared and ready before the emergence season. Get a bucket made of thick black plastic, and cut a triangular notch in the lip. You can also use any other large opaque plastic container, or an old wooden box for this purpose. Cardboard boxes can also be used but as they are not waterproof they have to be protected from rain in some way. Move the occupied tubes or blocks from your bee house just before the first adults are due to emerge, and place them on dry ground beneath the inverted bucket or box, near your bee house. When the bees emerge from the tubes they will fly towards the light and leave the upturned bucket or box through the small gap where you cut the notch. Place the new tubes or blocks in your bee house and the young bees will occupy those. Keep the old tubes and blocks under the bucket or box through the summer until the Leafcutter bees have emerged. They tend to emerge up to two months later than Mason bees. Inspect under the bucket or box occasionally to make sure that ants, earwigs, or slugs are not becoming a problem. After any Leafcutter bees have emerged from the old blocks or tubes, take them away and destroy them.

The same technique can be used to replaced dried stems that have been occupied by solitary bee nests.

Of course the procedures outlined here need some care and dedication, but if you want your bee house to be successful you should not just create it and forget it. That will not help bees.

Solitary Bee Houses are not Bumblebee Nest Boxes

Only tube-nesting solitary bees will use the kind of bee house I describe here. The needs of bumblebees are very different—their nests consist of communal wax combs, which they construct mostly in holes underground, in long tussocky grasses, bird boxes, under eaves or compost bins. Bumblebee boxes are available from many wildlife gardening outlets, and some are hugely expensive—*yet bumblebees rarely take to them*. Beware wasting your money! Better to encourage the kind of flowery habitat, not over-manicured, that bumblebees like, and let them find their own nest sites. The website of the Bumblebee Conservation Trust has good advice about [bumblebee nests](#), and how you can make inexpensive nest sites yourself. There is more information about Bumblebees and a downloadable plant list on my [Bumblebees and gardens](#) page.

Making a Larger Bee House



It is easy to make a larger house for solitary bees. I first saw one like this in Switzerland in the early 1980s. Since then I have seen them on several occasions in Germany and Switzerland. The one on the left is about 5ft (1.5m) high. I made it out of recycled wood with part of a disused fence panel at the back. It has an overhanging tile roof to deflect rain.

Are larger bee houses a good idea?

I think it is fair to say that the jury is out on this question. Bear in mind that these houses need to be managed and the blocks, drilled logs or tubes have to be inspected and replaced in the way I suggest above. I have seen large bee houses that simply contain hundreds of cells for Red Mason Bees, which is an unnaturally large concentration. This must surely be difficult to manage, as the large concentration of bees of one species is a target for parasites and disease, and there also needs

to be a sufficient amount of forage flowers growing close by. The resources must be available in terms of time and effort needed to sustain and manage a large bee house on an annual basis. Otherwise you could be doing your local solitary bee population a disservice. This issue has recently (2017) been discussed in an [article](#) by the Dutch entomologist Jo-Lynn Teh-Weisenburger that is well worth looking at.

Mining Bees

Most species of solitary bees are in fact Mining Bees, and do not use the tube nests described above. They build their nest cells in open sandy soil, banks or short grass. Unfortunately gardeners tend to overlook them. Current gardening advice that encourages you to dig soil, or to mulch it, or to grow ground-cover plants, means that there is often little habitat for Mining Bees in gardens.

On the continent some wildlife-friendly gardeners build special **bee walls** of soft mortar for Mining bees. I have had no success with this so far, but I urge you to experiment. In any case to help Mining Bees you should keep some patches of sunny ground in your garden clear of vegetation and clear of mulch. Light sandy soil is ideal. Stacks of upturned turfs, left to rot

down in a sunny place are sometimes colonised by mining bees, so long as you clip the grass on the side facing the sun. You can also try creating mounds or slopes of sand or sandy soil in a sunny place specifically for Mining Bees. You will need to hand-weed the patches occasionally to keep them clear of vegetation. The invertebrate conservation charity Buglife provides a pdf guide to building a bee bank [here](#) (click on the image to access the pdf.) Mining bees remain difficult to attract in artificial areas specially made for them, and we still have a lot to learn about how to achieve this successfully.

Acknowledgements

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For more info go to:

My [Fact sheets page](#) to download the 'Solitary Bees in your Garden' fact sheet for info about some common solitary bees in the UK and what flowers will attract them.

My [Citizen Science page](#) for details how to submit records on-line for a range of solitary bees (to BWARS or iRecord).

For more detailed discussion of bee houses and their design the primary source is the [website](#) of Dr Paul Westrich. He is the leading authority on wild bees in Europe. His web pages are in German; if you do not read German you can cut and paste sections of text into on-line translators such as Google Translate, which will give you a pretty good translation into English. (Click on the text box 'Zur nächsten Seite dies Kapitels' at the bottom right of each of Dr Westrich's web pages to move on to the next page.) Bear in mind that the wild bee fauna of central Europe is much larger than that of the UK and Ireland.

This leads me neatly on to the [Field Guide](#) to the Bees of Great Britain and Ireland by Steven Falk, illustrated by Richard Lewington (2015). A fully illustrated reference work which includes individual species accounts, distribution maps, and advises which species will use bee houses. Published by British Wildlife Publishing.

Solitary Bees by Ted Benton (Pelagic Publishing, 2017). It is not an identification handbook, but explains identification to genus level. This excellent book contains information for specialist and non-expert alike, including chapters on bees and flowers, and the conservation of solitary bees.

More information and fact sheets about bee homes and the conservation of various species wild bees in the UK are available from [Hymettus Ltd](#), a conservation charity for wild bees and related insects.

For links to sites with images of wild bee houses around the world and other info wild bees, take a look at: [Resonating Bodies](#).

Steven Falk's [page of bee images](#) has excellent pictures, background information and links to further useful websites about bees

If you are reading this page in the USA or Canada, you have different species of solitary bees to those here in the UK, but lots of them will benefit from providing nest sites exactly like the ones I describe here. On my [North America](#) page there are some more links to sites that will tell you about solitary bees and other pollinators in your countries.

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