Mason Bee Resource Guide

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Newly hatched mason bee - Photo Credit: Inner City Farms

Native Bees

Bumble bee on sunflower - Photo Credit: "Pollination" by Joshua Mayer

With over **20,000**[1] species of bees worldwide, native bees play a critical role in ecosystems and also in the production of our food. In fact, we are very lucky to have more than **450**[2] species of native bees in B.C alone, and over **4000**[3] in North America!

Ecosystem services are "the processes by which the environment produces essential resources, such as clean water and air, that we often take for granted."[4] One of the ecosystem services that we rely on the most is pollination by native species of birds, bats, flies, moths, and bees. Although honey bees are used in agriculture, they are not always the most efficient pollinators for certain crops, nor are they always as proficient in pollinating native plant species as pollinators that are native to specific ecosystems.

While it is true that native bees are in sharp decline due to pesticide use, loss of habitat, and forage fragmentation, all is not lost! Planting wildflowers is a great way to encourage native pollinators and so is choosing not to use pesticides or herbicides in your garden.

In the classroom, one of the easiest ways to teach your students about native bees is to set up a mason bee "house" in your school's garden, or hanging from a South or East facing wall. Since mason bees are active in the spring from the beginning of March until the end of June, they are perfect for using as part of classroom activities.

What are Mason Bees?

Orchard Mason Bee on apple bloom - Photo Credit: Red58bill

The Blue Orchard Mason Bee, more commonly known as the Blue Orchard Bee, is native to parts of North America including Southern B.C. The subspecies found West of the Rockies is *Osmia lignaria propinqua* which is the subspecies that is native to parts of Southern B.C.[5]

*Keep an eye out for the right subspecies when purchasing cocoons. There are many species of mason bees and you want to make sure you're using the native subspecies. Avoid *Osmia lignaria lignaria* as this is the subspecies found East of the Rockies and that is not native to B.C.[6]

When most people think of bees, they immediately think of the European honey bee or *Apis mellifera.* Since honey bees are not native to B.C, let alone to North America, integrating theory and hands-on experiences with mason bees in the classroom is an incredible way to show students the life cycle of a native bee species up close.

In fact, honey bees tend to be the exception, not the rule, when it comes to bee species. Unlike honey bees that live in social colonies and produce honey, mason bees are solitary bees that do not produce honey. In fact, most bee species are similar to mason bees in that they are solitary (meaning that the females have individual nests and do not have a caste system of worker bees and a single Queen bee who lays eggs.) Not only that, but only about 5% of the world's bee species make honey with even fewer than that producing honey in large quantities like honey bees.[7] The majority of bee species don't even live in hives like we traditionally see with honey bees. Some bee species (even some species of bumblebees) actually live underground!

Male mason bee - see the white patch? Photo Credit: "Mason Bee (Osmia lignaria)" by John Brandauer

Male mason bees, which cannot sting, have a distinct patch of white fuzz on their heads. They are a metallic dark blue colour and are about two-thirds the size of a honey bee. Female mason bees are larger than males, and can sting (although they very rarely do). Females do not have the white patch on their faces and are also a metallic blue-green colour.

Cocoons

Mason bees are native to B.C., so you can choose to not purchase cocoons and, instead, just leave a mason bee house outdoors in the hopes that wild populations will move in.

However, purchasing cocoons and placing them out by your mason bee house increases the chances of females finding your site and moving in. I would highly recommend buying cocoons, at least to get you started during the first year. Not only does it increase your chances of success, but they also provide a fantastic opportunity for learning and exploring!

An empty mason bee cocoon - this one has hatched! - Photo Credit: "Empty mason bee cocoon" by Amber Strocel

Cocoons house adult mason bees that started out as eggs in the previous spring, spun a cocoon around themselves, went through the pupal stages of growth and then overwintered as adult bees.

The cocoons that you buy in February or March contain bees that have been patiently waiting for spring to come for months. Watching them hatch is such an amazing thing to witness! Remember to listen closely as you can often hear the bees chewing their way out of their cocoons.

If you have purchased cocoons, or if you have some stored in your fridge from the previous year, it is best to put them outside once it starts to warm up in the spring (around mid March). On a sunny and preferably windless day you can set them outside and begin to watch them hatch.

Male mason bee hatching from cocoon – Photo Credit: Inner City Farms

The males hatch first and generally hatch out of noticeably smaller cocoons than the females. You can tell that a bee is male by the white patch of fuzz on his head. Again, the males cannot sting and are very shy, so students can hold them gently in their hands without any worry of being stung.

The females will also begin to emerge as the temperature warms up, but they emerge some time after the males.

*Do not worry if the bees don't emerge right away. Sometimes it is not warm enough, and the bees tend to emerge at their own pace. Also, you may notice all the bees have hatched but none have stayed. Don't take this personally! Maybe there wasn't enough food nearby, or they found a different nesting site.

If you want to increase the chances of success, try putting some cocoons out in March, and then again in early April when it is warmer and there is more food available.

Several local stores carry mason bee cocoons including:

- West Coast Seeds: www.westcoastseeds.com
- Homesteader's Emporium: www.homesteadersemporium.ca
- Beediverse: www.beediverse.com
- Two Bees Apiary: http://www.twobeesapiary.com
- Local beekeepers like Brian Campbell - https://thebeeschool.wordpress.com/ and Derry Walsh - http://derrysorchardandnursery.ca/

Forage, Water and Clay – Oh my!

Since mason bees are an early season pollinator (they are normally only active from March until the end of June), it is important that there is enough for them to eat in the area that you are hoping that they will nest in. Unlike honey bees which can travel long distances to find food, mason bees are solitary bees and do not normally go farther than a 100 m distance from their nesting site.

In order to encourage mason bees to take up residence in your garden, make sure that you put your cocoons out when early-season flowers are beginning to bloom. It also helps to plant bee-friendly plants* near the place where you would like mason bees to take up residence.

*Flowering plants that are sold through big box stores and nurseries are often laden with pesticides that negatively affect, and can even kill, bees. Planting organic seeds yourself is the best way to avoid this, but if that is a challenge, then try to look for plants that are organically-grown.

Here is a helpful article from June, 2014 in the Georgia Straight if you want to learn more about pesticide use on flowering plants sold at nurseries and big box stores:
http://www.straight.com/news/674881/garden-centres-sell-plants-bee-killing-pesticides

Here is a great list of bee-friendly plants from the David Suzuki Foundation[8]. Remember the more diverse your garden, the more diverse the pollinator population in your garden will be!

Heather is great early season forage for bees – Photo Credit: "Heather bee 1" by Samuel Winter

Early	Mid-season	Late
Blueberry	Blackberry	Aster
Cotoneaster	Cat mint	Beggar's tricks
Crabapple	Catnip	Borage
Cranberry	Chives	Coneflower
Crocus	Dahlia	Cornflower
Foxglove	Hyssop	Cosmos
Heliotrope	Lavender	Goldenrod
Hazelnut	Raspberry	Pumpkin
Heather	Sunflower	Sedum
Primrose	Yarrow	Squash
	Willow	

The Environmental Youth Alliance also has a fantastic resource on "bee-friendly plants" here: http://www.eya.ca/uploads/file_87.pdf

There are other ways that you can make your garden more attractive to mason bees. One way is by putting a tray or small tub filled with water near your mason bee house. If you also put a few stones in the container (large enough that their tops stay dry), then the bees can use them to land on and won't drown in the water while they are attempting to get a much needed drink! Check the container every few days and top it up with fresh water. This won't just help the bees, but other beneficial insects as well.

When building their nests, female mason bees use clay to separate the eggs in their nests – hence the name "mason" bees. By leaving bare patches of earth near the nesting site, or even by providing clay near the site, you can make it easier on the female bees as they gather the materials necessary to make their nests. For example, West Coast Seeds sells "Mason Mud" which you can hang near your mason bee house making it more attractive to female mason bees looking for a suitable place to build their nests.

West Coast Seeds "Mason Mud" - http://www.westcoastseeds.com/productdetail/Gardening-Supplies/Pollination/Mason-Mud/#sthash.Rl3aJcKS.dpbs

Providing Habitat

There are some pretty fancy (and expensive) mason bee condos out there, but don't be discouraged because there are cheaper options available like making your own mason bee houses or, at the very least, buying ones that are simple. You don't need a five-star hotel for bees to move in and for them to be happy and healthy!

Orchard Mason Bee House - Photo Credit: born1945

The key with mason bee houses in our climate is that they need to provide some sort of roof or overhang to prevent moisture from getting into the nests. If you do choose to make your own house out of a wood block, a tin can, or a bucket for example, make sure that there is enough overhang to keep the nests dry. You can always place a house with no roof inside a hanging terra-cotta pot or something else that provides protection from the wind and the rain.

The mason bee house pictured on the left is a great example of a house that provides protection from the elements. I also like it because it provides a spot right underneath the roof to put the cocoons in the spring (see that cardboard box with a hole in it right under the roof?)

When you place your cocoons outside it's a good idea to keep them as close to your erected house as possible in order to encourage the females to find your house and use it for their nesting sites. The house on the left, that has a spot to put the cocoons, increases your chances of success since the bees will be emerging right at a potential nesting site. Alternatively, you can also tape your box of cocoons to your house, or put an elastic band

around the box and your house. Anything you can do to encourage the female bees to find your house is a good thing!

Native Pollinator Nesting Station, Mason Bees - Photo Credit: born1945

One thing that is missing in the above photo that is often seen on mason bee houses is a *predator guard*. These can come in many forms, but they are mainly to prevent larger predators like birds from getting into the nests. Some teachers have also commented that they can also be helpful in keeping out little wandering hands!

This picture on the left shows an example of a type of predator guard. Most pre-made houses normally come with one that is not a screen, but a piece of wood or plastic with Velcro that you attach to the front. They always have a space that provides the female bees room to fly in and out of their nests. Predator guards are an added bonus, especially when your bees are hatching out of their cocoons, or if there are little hands who might want to disturb the nests.

Interlocking trays - normally made out of corn or wood. These can be reused each year. Photo Credit: "Mason Bee House" by Erin Brown-John

Depending on what type of house you make or buy, you may also need to buy or make tubes for the bees to nest in. Both of the houses shown above have *interlocking trays.* This is a type of nest that is really easy to use, especially if you plan to clean out your nests in the fall. Each "hole" is actually able to come apart so that you can then just pop out the cocoons with a tool like a screwdriver. <u>You do not need to buy tubes for this type of nesting system.</u> Instead, wash and reuse the trays each year.

If you are making your own house out of a pot, buckets, tin can, or a wood block and don't have interlocking trays, or have a space that won't fit interlocking trays, then you can also purchase cardboard tubes that you can compost each year.

These tubes are good and some beekeepers swear that mason bees like them better, but I've also had a teacher point out that the cardboard tubes are easier

Cardboard tubes - make sure you provide a roof- Photo Credit: "Mason Bee House" by John Hritz

to squish, so you have to be quite gentle with them. The main difference is that in the fall, when you are cleaning the cocoons, you unwind the cardboard tubes and compost them, as opposed to the interlocking trays which you pop open, wash and reuse. The cardboard tubes *can* become moldy as well if there is too much moisture in your house. In the end, you have to pick what makes the most sense for you and your students, and what's the most affordable.

If you are planning on making your own house by drilling holes in a block of wood, I would highly suggest that you still place a cardboard tube in each hole so that you can clean out the nests in the fall.

You can also have your students roll their own tubes out of parchment paper. Using standard paper seems to lead to moldy tubes which kill the bees living inside. Here's a great resource on how to make your own tubes out of parchment paper: http://ext100.wsu.edu/snohomish/wp-content/uploads/sites/11/Paper-liners-that-work.pdf

Several local places do sell pre-made mason bee houses, interlocking trays, and tubes including:

- West Coast Seeds: www.westcoastseeds.com
- Homesteader's Emporium: www.homesteadersemporium.ca
- Beediverse: www.beediverse.com
- Some Wild Birds Unlimited locations: http://vancouver.wbu.com/
- Two Bees Apiary: http://www.twobeesapiary.coml

If you would like to make your own mason bee house there are several great resources:

- http://www.uoguelph.ca/canpolin/Fun/Project%20Bee%20Box%20Canadian%20Gardening.pdf - Again, I would use parchment paper or the cardboard tubes instead of newspaper.
- http://boingboing.net/2014/05/16/build-your-own-mason-bee-house.html

"Capped" nests – Photo Credit: "Mason Bee House" by Erin Brown-John

If possible, it is best to hang the house on a South or East facing wall so that the nest gets the morning sun. The house can be hung at eye level in a sunny location. It is also best to hang the house from a fence or a wall that is uniform instead of a post in the middle of the garden because bees can see the house better when it's up against a uniform background.

If female bees take up residence in your house, you will see them flying in and out of their nests as they collect clay, pollen, and nectar. Once a tube is "capped" with clay at the front, then that nest is full, and the female may have started another one in a different tube. This will continue until about the end of June, when all of the females die, leaving their nests behind with newly laid eggs (females at the back and males at the front), separated by walls of clay and lying atop of food "balls" made up of pollen mixed with nectar.

In July, you can choose to bring in your nest to limit predation. Often, bringing the nest in to a warm, dry space (like a garage) and, if possible, laying it on its back is a great way to limit predation while also ensuring that the larvae are not too far away from the pollen ball inside each cavity. Laying the nest on its back so that it is upright makes the larvae and the food slide back so that they are closer together. If it is not possible to bring the house indoors, then simply leave it in a protected area outdoors until the fall when you can bring in the nest for cleaning. If you have a predator guard, now is definitely a good time to use it!

Cleaning Cocoons

I would highly advise cleaning out your nest each year in order to maintain a healthy bee population. Otherwise, pests and diseases can build up in the nest site and negatively affect the bees' chances of survival.

Interlocking trays - Photo Credit: "Opened mason bee trays" by Steph L

Cleaning the cocoons can be done in the fall (early to mid October). If you have the interlocking trays, then you can simply pop them apart and, using a tool like a screwdriver, gently pop out the cocoons one by one. Then, wash the trays well in warm soapy water. Some people like to also wash them in a solution with bleach, but that decision is completely up to you. If you have tubes made out of cardboard or parchment paper than you can unroll them and put the paper in the compost.

Cleaning out the bee house is a fantastic chance to learn and explore since each nest will be different. You may find some cocoons that have pin-prick sized holes in them – the work of a parasitic wasp. You may also find some cocoons that are overrun with, what looks like, a very fine orangey-reddish "dust" that may be moving if you look at it closely enough. This "dust" is actually a type of mite called a Pollen Mite that naturally feeds on pollen.

Parasitic wasps are tiny insects that are natural predators of mason bees. The female parasitic wasps will bore a pin-prick sized hole through a cardboard tube and then into the cocoons in order to lay her eggs. Bring your house inside in July in order to decrease the number of cocoons that fall prey to these wasps.

Look for pin-prick sized holes in the cocoons as a sign of parasitic wasps. Photo Credit - "Parasitic Wasp Interlude" by Steph L.

Pollen mites are brought into the nest when the female brings in pollen. When she seals off the cavity, the mites continue to feed on the pollen which is also the food source for the bee larva. Sometimes, the pollen mites will completely overrun the cavity and also kill the bee larva. Honey bees bring pollen mites into their hives as well, but they have other worker bees to clean off the mites which lessen their impact.

Gently wash off the cocoons in water. Photo Credit: "Parasitic Mites on Female Mason Bee Cocoon" by Steph L.

The best thing to do is to put all of the cocoons in a bowl of cold water and gently swirl them around, rinsing off any mud or mites in the process.* Any cocoons that are dead will sink to the bottom of the bowl, and can be put in the compost. Any cocoons that are alive will float and can be gently dried with a paper towel.

*Some people also like to rinse the cocoons in a solution with bleach, but I find that rinsing them in water does the trick and that bleach is a bit too harsh.

After the cocoons are dry there a couple of possible ways to store them:

- In the fridge – It's best to put the cocoons in an open Ziploc bag inside a mason jar. You can also put a moist (not dripping wet) paper towel inside the mason jar (not in the bag) in order to ensure the cocoons don't dry out. Cover the mason jar with a lid, but poke a few holes in the lid to allow for air flow. *<u>If you have a frost-free fridge, ensuring that there is some moisture is key or else the cocoons will dry out and the bees will die.</u>
- In a box with air holes to allow air flow in a dry, cool location like a garage or a shed.

*Keep an eye on the cocoons as it gets closer to the spring. I have definitely had mason bees hatch in my fridge because I left them too long!

A Note on Safety

I should emphasize that this note on safety is definitely not meant to scare you away from the wonderful world of mason bees. With that said, I felt that it was important to mention a few things about the potential for the female bees to sting.

From what I've researched, most sources compare a sting from a female mason bee to that of a mosquito bite. Everything that I've read about mason bees stresses that the females will normally only sting if their lives are threatened.

With that said, it is always good to take precautions because reactions to bee stings can be unpredictable, and can also differ depending on the species of bee that is doing the stinging.

My best suggestion, if you are concerned about the potential for allergic reactions to mason bee stings, is to familiarize yourself with the symptoms of allergic reactions to insect stings so that you know what to look for in the event that someone does get stung. I would also suggest placing the nest at a level high enough from wandering hands and installing a predator guard to limit interactions with the bees.

One other thing to remember is that the male bees cannot sting and can be identified by their noticeably small cocoons, by the white patch on their head, and by the fact that they hatch first.

Ultimately, although I haven't been able to find a single case throughout my research of someone having a severe allergic reaction to a mason bee sting, that doesn't mean that an allergic reaction is impossible. If you are concerned, it is best to take care to be prepared about how to identify an allergic reaction to a bee sting, and place the nest in a location that will limit any interactions with the bees themselves.

Seasonal Mason Bee Activities

February
- Build and paint mason bee houses or purchase pre-made houses
- Roll tubes or purchase interlocking trays/cardboard tubes
- Plan out spring planting
- Store cocoons in fridge

Mid March
- Plant flowering plants if there aren't enough in bloom
- Hang house on a South or East facing wall
- Place cocoons outside on a warm, dry, windless day and watch them hatch over the coming days!
- Put out mason mud and water dish with dry rocks for the bees to land on

April
- Put out another round of mason bee cocoons when it is warmer, especially if none of the bees from the first round of cocoons are using your house

May-June
- Watch female mason bees fly in and out of their nests!
- Keep water dish topped up with fresh water

July
- Bring the house indoors to a dry place to prevent predation and tip it on its back to ensure the larvae come in contact with their food sources

October
- Clean cocoons and houses and store them in your fridge until the following spring

Photo Credit: "Our Mason Bees" by brewbooks

Other Great Resources on Native Bees

- The Xerces Society: http://www.xerces.org/
- The Elle Lab at SFU: http://www.sfu.ca/biology/faculty/elle/Bee_info.html
- Feed the Bees: http://www.feedthebees.org/
- The EYA: http://eya.ca/
- David Suzuki Foundation: http://www.davidsuzuki.org/what-you-can-do/downloads/Pollinators_fact_sheet.pdf

Photo Credits (All photos are from Creative Commons except Inner City Farms' photos)

Newly Hatched Mason Bee - Inner City Farms: http://ow.ly/IrPf1

Pollination - Joshua Mayer: http://ow.ly/I3ufG

Orchard Mason Bee on apple bloom - Red58Bill: http://commons.wikimedia.org/wiki/File:Orchmason.jpg

Mason Bee (Osmia lignaria) - John Brandauer: http://ow.ly/I3u7t

Empty mason bee cocoon – Amber Strocel: http://ow.ly/Istto

Male mason bee hatching from cocoon – Inner City Farms: http://ow.ly/IrOMh

Heather bee 1 – Samuel Winter: http://ow.ly/Ijazp

Orchard Mason Bee House - Born1945: http://ow.ly/I3ubd

Native Pollinator Nesting Station, Mason Bees – Born1945: http://ow.ly/I3x8f

Mason Bee House – Erin Brown-John: http://ow.ly/IstHq

Mason bee house – John Hritz: http://ow.ly/IstLU

Mason Bee House – Erin Brown-John: http://ow.ly/IjYeD

Opened Mason Bee Trays – Steph L.: http://ow.ly/IrLIQ

Parasitic Wasp Interlude – Steph L.: http://ow.ly/IrM4w

Parasitic mites on female mason bee cocoon – Steph L.: http://ow.ly/IrMsl

Our Mason Bees – brewbooks: http://ow.ly/Is72v

References

* I can't specifically point out where I've learned most of what I know about mason bees, but there's a good chance that most of my knowledge about mason bees comes from working with Brian Campbell. Learning from him has been an amazing opportunity. What I can say with confidence is that he was (even indirectly through conversation) the main source for this guide!

1) Keeping the Bees: Why all bees are at risk and what we can do to save them – Lawrence Packer (one of my all-time favourite books!)
2) The Elle Lab at SFU – Pollinators of Southern British Columbia - http://www.sfu.ca/biology/faculty/elle/Bee_info.html
3) Attracting Native Pollinators: Protecting North America's Bees and Butterflies – The Xerces Society
4) Agroecology: The Ecology of Sustainable Food Systems – Stephen R. Gliessman
5) Ministry of Agriculture – Blue Orchard Mason Bees, *Osmia lignaria* - http://www.agf.gov.bc.ca/apiculture/factsheets/506_osmia.htm
6) Ministry of Agriculture – Blue Orchard Mason Bees, *Osmia lignaria* - http://www.agf.gov.bc.ca/apiculture/factsheets/506_osmia.htm
7) Keeping the Bees: Why all bees are at risk and what we can do to save them – Lawrence Packer
8) David Suzuki Foundation – Create a bee-friendly garden - http://www.davidsuzuki.org/what-you-can-do/food-and-our-planet/create-a-bee-friendly-garden/

I am always happy to answer questions about bees or come and help you with your bee-friendly projects! Feel free to contact me at nicole.read@ubc.ca