



## CLASSROOM TOOLKIT (2023-2024)

---

### **About the Urban Bee Lab**

The Urban Bee Lab (UBL) is a 501(c)(3) non-profit on a mission to improve bee health. We see bees as the ultimate tie that binds food security, climate change, natural disaster mitigation, and ecological preservation. In partnership with The Best Bees Company, the UBL analyzes beehive data and reports results to elucidate trends and advance our understanding of global pollinator health. We aim to conduct cutting-edge research to stabilize honeybee health, and then extend those approaches to other, lesser studied species of pollinators in order to promote and preserve biodiversity at corporate, residential, and government sites, and beyond.

### **Our Goals**

At the UBL, we hope to educate students about bees and beekeeping, honeyDNA, pollinators, habitats and biodiversity. We want to inspire students to take action by becoming citizen scientists where they commit to building biodiversity in their neighborhood through planting. We are eager to encourage research, data collection and analysis. Lastly, we hope to build long term engagement with students, teachers and STEM coordinators.

### **Indicator Species: The Honeybee!**

Honeybees are a perfect indicator species because they live in large colonies and are easy to monitor, whereas solitary native bees are not. The data we collect from honey bees is helping make decisions that benefit all pollinators, native species included.

---

### **How to Use the Classroom Toolkit**

The UBL has made this toolkit available online for teachers to use in their classrooms. It is adaptable for grades 7-12. It may be used in its entirety or in sections. The lesson plan to use with the toolkit can be downloaded [here](#). The toolkit includes:

1. Worksheet, Think, Pair, Share
2. Info Sheet on Building a Bee Habitat
3. Info Sheet on Planting a Native Pollinator Garden
4. Info Sheet on HoneyDNA
5. Info Sheet on the UBL Foundation, how to apply for a grant!
6. Worksheet, What is your Big Idea?



## Think, Pair, Share Questions

*Choose the essential questions to accommodate a shorter time frame or younger students; choose the challenge questions to add time or accommodate older students.*

---

- 1. What are native pollinators?** (essential)  
**What are some examples in our own local neighborhood?** (challenge)
- 2. Are honey bees native pollinators?** (essential)  
**What is the relationship between honey bees and native pollinators?** (challenge)
- 3. Where are native pollinators found?** (essential)  
**How can you distinguish between a good and poor foraging habitat?** (challenge)  
**What makes for a good nesting habitat?** (challenge)
- 4. What is an invasive species?** (essential)  
**How do non-native species compare to invasive species?** (challenge)  
**What are ways that native and indigenous species are impacted by non-native and invasive species?** (challenge)  
**How can you measure the presence or absence of native and invasive species?** (challenge)
- 5. Which native pollinators are endangered?** (essential)  
**What are some causative factors threatening pollinator populations?** (challenge)  
**What can be done to protect, preserve, and promote endangered species?** (challenge)  
**Can you design an experiment to test how effective those efforts will be?** (challenge)
- 6. What are the benefits of creating pollinator habitats?** (essential)  
**How do pollinator habitats benefit humans?** (challenge)  
**Why should your community care about this?** (challenge)

## How to Build a Bee Habitat\* (page 1)

---

\*Sourced from Crown Bees (<https://crownbees.com/blog/diy-how-to-make-a-solitary-bee-house/>)

Solitary bees are important pollinators and a gardener's friend, and providing nesting habitat is a great way to help declining native bee populations - especially in the human environment.

### House/Hotel Design

The first thing you'll have to do is design the house. It can be as simple or elaborate as you'd like it to be. While there are no limits to design, there are some basic rules to follow when building the structure of a house:

**Wood Houses:** Natural, untreated wood is best. If you want to paint the house, make sure you allow plenty of time, about a month, for the paint to cure because the smell of wet paint or stain can repel bees. To promote sustainability, consider using recycled or waste wood. Avoid composite materials such as chipboard or particleboard, as they will disintegrate in the rain.

**Container Houses:** If woodworking isn't your thing, you can easily build a container house with items around your home. Some examples include milk cartons, plastic buckets, and cut PVC pipes. When designing, make sure you poke a few air vents in the sides or bottom of the container to prevent mold and provide an overhang to protect the nest materials from rain. To promote sustainability, consider repurposing old containers. Just make sure they are adequately cleaned and dried to remove any smells.

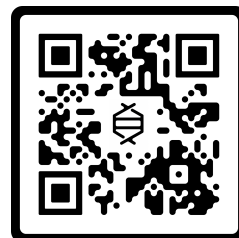
### What about using a 3D printer to build a bee hotel?

### Types of Nesting Materials

The solitary bees and wasps that will nest in your bee house are cavity-nesting, meaning they build their nests inside available nesting holes. The best way to protect bees from pathogens such as excessive mold, Chalkbrood, and pollen mites is to fill your bee house with bee-safe nesting materials.

Another thing to remember when collecting nesting materials is that different bee species use different diameter nesting holes. In general, spring mason bees prefer  $\approx 8$ mm diameter holes, while summer leafcutter bees prefer  $\approx 6$ mm diameter holes. Alternatively, place various sizes in your bee house to see what wild cavity-nesting species live in your area!

Use the QR Code to learn more about nesting materials:



## How to Build a Bee Habitat\* (page 2)

---

\*Sourced from Crown Bees (<https://crownbees.com/blog/diy-how-to-make-a-solitary-bee-house/>)

### Location & Installation

While bees don't care how expensive their house is, they're picky when it comes to their home location. Houses should be:

- Mounted to a solid object (like a post, house, or fence). Bees don't like swinging in the breeze!
- Placed in a location facing south or southeast to receive direct sunlight in the morning. They are cold-blooded and need the morning sun to start moving.
- Near open blooms and a mud-rich clay. Many wild bees only fly about 300ft searching for nectar and pollen, and some species, like mason bees, use mud-rich clay to build their nests. Place the house near flowers and a mud-rich clay source, or risk your bees flying off in search of a better home.
- At eye level (≈5ft), without any vegetation blocking the entrance. The elevation protects them from predators and is the perfect height to watch the bees at work.
- In a location free of pesticides. Pesticides are a primary driver of bee declines worldwide!

### Maintain & Clean

Maintenance is often the most overlooked part of having a bee house. Routine maintenance is just as essential as proper design! If you don't clean and maintain your bee house and nesting materials, they can harbor pests and diseases, putting local bees in more danger than if there was no house at all.

Throughout the summer, monitor for the following problems:

- Moisture in the bee house or nesting materials - You may need a broader roof on your bee house.
- Ant infestations - Can be prevented with AntCant or other ant deterrents.
- Evidence of predatory birds - Bird guards can help with this problem.
- Spider webs - Indicates the nest location may be too dark.

### Research, Analyze, Report and Share!

We would love to see your bee hotels, please tag us on social media: [@urbanbeelab](https://www.instagram.com/urbanbeelab)

## Planting a Native Pollinator Garden

---

### What is a Pollinator Garden?

A pollinator garden is a space where the health and prosperity of pollinators is prioritized. This means planting a variety of native trees, shrubs, and flowers, providing pollinators with nesting options, a water source, and a space free from pesticides.

### Why are Pollinator Gardens Important?

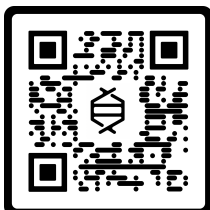
Pollinators are in decline, and the major contributing factors include the loss of habitat and use of pesticides. Commercial agricultural practices, expansion of the suburbs, and increasing urbanization all take green spaces and convert them to monoculture fields of crops, manicured lawns, parking lots, buildings, etc – all spaces that are not supportive or healthy for pollinators. Additionally, as honey bees and native bees coexist in ecosystems, they will compete with each other for resources. We want to provide all pollinators with an abundance of resources, so that they all can thrive – rather than limit the number of competitors, let's make sure there's enough of what they're competing over to go around!

### How to get started:

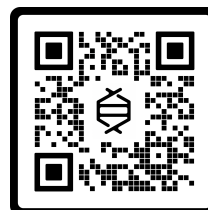
1. Your pollinator garden can be any size! From a window box to balcony pots or a large meadow!
2. Visit your local garden center and ask for native seeds for your growing region or order them online. Studies have shown that pollinators prefer native plants over non-native ones
3. Avoid any invasive or non-native plants.
4. Provide a water source for your pollinator garden. A shallow dish filled with corks is a great water source in a pollinator garden.
5. Consider sowing seeds in the late fall! Most native seeds need "cold, moist stratification". That just means winter...OR a winter-like experience.
6. We would love to see your pollinator gardens, please tag us on social media: **@urbanbeelab**

### Online Resources:

#### Pollinator Garden Checklist by Best Bees:



#### Seed Sowing by Blue Stem Natives:





## THE HONEY DNA BREAK DOWN

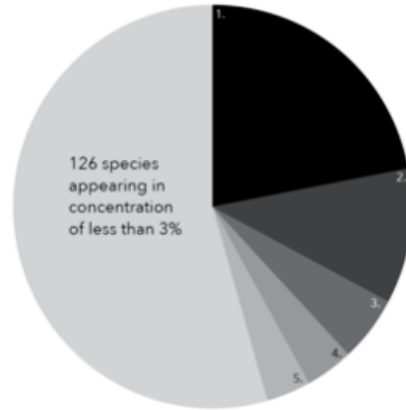
of Dr. Noah Wilson-Rich's beehive over one year

# H

oney DNA provides a unique profile of the foraging patterns of your bees. By sampling Noah's beehive over the course of a year, we observe seasonal shifts in the content and biodiversity of his bees' resources. It's no surprise that Linden (*Tilia*) pollen is so prevalent in his samples, as it is one of the most popular trees planted along the walkways of Boston.



### WINTER 2017 RESULTS



#	%	COMMON	SCIENTIFIC
1.	21.99%	Linden	<i>Tilia sp.</i>
2.	10.77%	Poison Sumac	<i>Rhus michauxii</i>
3.	5.34%	Clover	<i>Trifolium sp.</i>
4.	3.47%	Privet	<i>Ligustrum sp.</i>
5.	3.14%	Staghorn Sumac	<i>Rhus typhina</i>

### TOP SPECIES FOUND PER SAMPLE



21.99%  
Winter 2017  
Linden



13.44%  
Fall 2016  
Pine

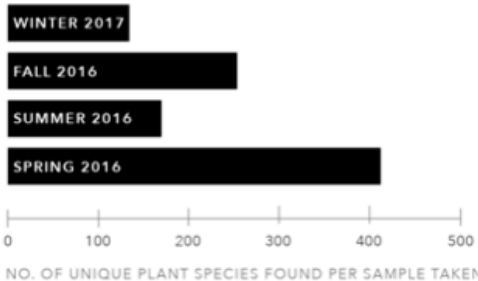


31.76%  
Summer 2016  
Linden



25.10%  
Spring 2016  
Apple

### BIODIVERSITY BY SEASON





## The UBL Foundation: Apply for a Grant!

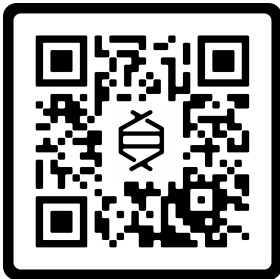
---

The UBL Foundation provides small grant funding to support innovation, social and environmental justice, and creative projects across the STEAM spectrum that support our mission to improve bee health. We're keenly focused on providing funds to fuel projects within BIPOC, AAPI, LGBTQIA+, Latinx, and other marginalized communities that have unique but historically muted perspectives. We give priority to projects that incorporate our HoneyDNA data, although it is not a requirement.

### Proposal process and guidelines

Grants are available on a rolling basis, reviewed at grant committee meetings that happen quarterly, in amounts of up to \$2,500 per project. Awardees will be required to write a blog post or submit a 60-second video as the final product of their project, as a means to draw attention to awardee's work and to support next steps and future goals in their journey. The project must be completed within one year from the disbursement of funds.

Use the QR Code below to learn more about the application process:





## BIG IDEA Worksheet!

We would love to hear your big ideas, questions or comments! Use the space below to brainstorm and when you're ready, the QR code will take you to the form to submit your BIG IDEA, or click [here](#)!

