



## **Lesson Plan:**

### **Plant Something Bee Friendly**

#### **High School**

Bees (honeybees and solitary bee species) are essential pollinators for much of the world's food including many food and forage crops across British Columbia. It has been estimated that honeybees are responsible for the production of \$160 million worth of crops in BC every year.

In recent decades, there has been much talk of population declines of pollinator insects, especially in agricultural areas. In this lesson, students learn about some of the threats to bee populations, as well as ways in which they can help support bee populations through planting bee-friendly plants.

#### **Suggested Grade/Subject Levels**

Food Studies 10/11/12

Science 10

Science for Citizens 11

Life Sciences 11

Environmental Science 11/12

Socials 10

Human Geography 11

Physical Geography 12

Urban Studies 12

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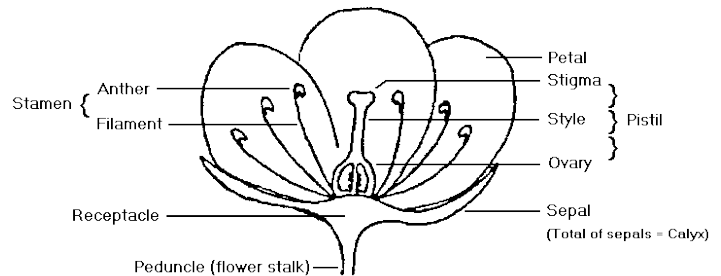
## Teacher Guide

Course	Curricular Competencies	Content Connections
Applied Design, Skills and Technologies	<ul style="list-style-type: none"> <li>• Engage in a period of research and empathetic observation in order to understand design opportunities</li> <li>• Critically analyze and prioritize competing factors, including social, ethical, and sustainability considerations, to meet community needs for preferred futures</li> </ul>	<p><b>Food Studies 10</b></p> <ul style="list-style-type: none"> <li>• Simple and complex food systems and how they affect food choices, including environmental, ethical, economical, and health impacts</li> </ul> <p><b>Food Studies 11</b></p> <ul style="list-style-type: none"> <li>• Issues involved with food security</li> </ul> <p><b>Food Studies 12</b></p> <ul style="list-style-type: none"> <li>• Food justice in the local and global community</li> </ul>
Science	<ul style="list-style-type: none"> <li>• Experience and interpret the local environment</li> <li>• Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>• Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>• Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions and representations</li> </ul>	<p><b>Science 10</b></p> <ul style="list-style-type: none"> <li>• Mechanisms for the diversity of life</li> <li>• Applications of genetics and ethical considerations</li> </ul> <p><b>Environmental Science 11</b></p> <ul style="list-style-type: none"> <li>• Biodiversity: species and their ecological roles; relationships and interactions in ecosystems</li> <li>• Humans as agents of change: unsustainable and sustainable ecosystem practices</li> <li>• Ecological restoration principles and practices</li> <li>• Engagement in ongoing and potential stewardship projects</li> </ul> <p><b>Life Science 11</b></p> <ul style="list-style-type: none"> <li>• Taxonomy principles for classifying organisms</li> <li>• Unifying characteristics of the evolutionary continuum across the kingdoms</li> </ul> <p><b>Science for Citizens 11</b></p> <ul style="list-style-type: none"> <li>• Agriculture practices and processes (chemicals used in agriculture, environmental impacts, impacts of personal choices)</li> </ul> <p><b>Environmental Science 12</b></p> <ul style="list-style-type: none"> <li>• Land management and personal choices</li> <li>• Human health and environmental impacts of population growth</li> <li>• Environmental ethics</li> </ul>
Social Studies	<ul style="list-style-type: none"> <li>• Use social studies inquiry processes and skills to ask questions; gather, interpret, and analyze ideas; and communicate findings and decisions</li> <li>• Evaluate how particular geographic actions or events influence human practices or outcomes</li> <li>• Identify how human and environmental factors and events influence each other</li> </ul>	<p><b>Social Studies 10</b></p> <ul style="list-style-type: none"> <li>• Human environmental interaction (ex. demographics, land and resources, climate change)</li> </ul> <p><b>Human Geography 11</b></p> <ul style="list-style-type: none"> <li>• Global agriculture practices</li> <li>• Increased urbanization and influences on societies and environments</li> </ul> <p><b>Physical Geography 12</b></p> <ul style="list-style-type: none"> <li>• Characteristics of global biomes, including climate, soil, and vegetation</li> </ul> <p><b>Urban Studies 12</b></p> <ul style="list-style-type: none"> <li>• Urban planning and urban design</li> <li>• Contemporary issues in Urban Studies</li> </ul>

## Teacher Background

Three quarters of the world's flowering plants, and about thirty-five percent of the world's food crops depend on pollinators to reproduce. Pollination is the transfer of pollen from the anther (male part) to the stigma (female part) within the same flower or of another flower of the same species. Pollination is necessary for fertilization to occur: the fusion of the nuclei from the pollen grain with the nuclei in the ovule (egg). It is fertilization that allows the flower to develop seeds, and fruit production to occur.

Most plants need help moving pollen from the anther of one flower to the pistil of another. In cases such as grasses and corn, wind is the vector that aids this process. However, the majority of pollination makes use of living organisms, such as insects, birds, and bats to carry pollen between flowers.



It is believed that many plants have co-evolved with their pollinators, developing characteristics such as smell, color, and shapes that favour certain pollinators over others. Pollinators are attracted to the flowers in search of food (nectar for energy and pollen for protein), and during their visit, pollen adheres to their body. When they visit a subsequent flower of the same species, the pollen rubs off onto the stigma, thereby pollinating that plant.

Bees (honeybees and solitary bee species) play a key role in the production of many food and forage crops across British Columbia including, alfalfa, apples, blueberries, cherries, cucumbers, kiwifruit, tomatoes, and pumpkins. The tree fruits in the Okanagan and berry crops in the Fraser Valley are very dependent on an abundance of bees when these crops are in bloom. Fruit growers rent large numbers of colonies from beekeepers. It has been estimated that honeybees are responsible for the production of \$160 million worth of crops in BC every year.

In recent decades, there has been much talk of population declines in pollinator insects, especially in agricultural areas. Reasons for the pollinator declines include agriculture activity, exposure to pollutants, habitat fragmentation, pests, and climate change.

An important factor affecting honey bee health is access to adequate nutrition. Without collecting enough good sources of nectar and pollen from flowers during the warmer months, honey bee colonies can face serious challenges during the winter. Large acreages of single crops (monocultures) means that much greater concentrations of pollinators are needed at bloom time, but the area can be forage poor or even deadly to bees for the rest of the season.

To counteract these trends, it's important that both public and private sectors contribute to bee-friendly habitats. Farmers can use bee-friendly cover crops and hedge rows along ditches and berms. Home gardeners and urban landscapers can include bee-friendly plants in residential and commercial landscapes. Teachers and students can plant bee-friendly flowers in their school gardens. Studies have shown that an abundance and diversity of nectar and pollen bearing plants can enhance pollinator populations, and that this in turn supports greater biodiversity and a healthier sustainable environment.

## Materials

- Video: *Which future do you choose?*  
<https://www.youtube.com/watch?v=zhLDs3fqOMc>
- Video: Marla Spivak *Why bees are disappearing*  
[https://www.ted.com/talks/marla\\_spivak\\_why\\_bees\\_are\\_disappearing](https://www.ted.com/talks/marla_spivak_why_bees_are_disappearing)
- Worksheet (optional) – Video: *Why Bees are Disappearing*
- List of some common crops pollinated by bees
- BCLNA Poster: Top Pollinator Picks for your Garden (available for order for free on the BCAITC website)
- 1/student BCLNA Postcard: Top Pollinator Pics for your Garden (available for order for free on the BCAITC website)
- Handout – Project: Planning a Bee-Friendly Garden
- Access to internet on laptops/tablets/smartphones/etc

## Extension Suggestions

- Flower dissection
- Observations: Which flower colors, or color combinations receive more bee visitors? Which less? Try to compare varieties that are similar in scent and amount of nectar when making these comparisons Watch flowers and see how many pollinators visit it in a certain amount of time (ex. 10 min).
- Watch pollinators visiting individual flowers. How do they move on the flower? Why do you think they behave this way? Try adding a few drops of sugar or honey water to a few flowers. Do pollinators act differently on flowers with extra nectar as compared with natural flowers without supplemental nectar?
- Try pollinating the flower by hand, moving pollen from the anthers to the stigma. Depending on the flower you can try using a small paintbrush or a toothpick. Cover the flower with a bag after you pollinate it so no other pollinators visit the flower. Does a fruit start to develop? It make take a few days or even a couple of weeks to tell. How much work would it be if you had to pollinate all of the flowers in a field by hand?

## Procedure

1. Start by having students watch the short BC Landscape and Nursery Association video: *What future do you choose?*
2. Have students brainstorm for the following questions and then discuss with the class:
  - a. What foods do we eat that require the help of bees (teacher can use the list provided to help spur their thinking)
  - b. What role/importance do bees have in the success of our food systems?
  - c. Predict what might happen if bees disappeared entirely from our planet?
  - d. What do you know about the decline in bee populations in recent years?
3. Watch Marla Spivak's TED talk: *Why bees are disappearing*. Optional: Have students complete the accompanying worksheet.
4. Have students work in groups to answer the following questions and then discuss as a class:
  - a. Compare and contrast human food deserts and bee food deserts.
  - b. What sustainable farming practices could help bee populations?
  - c. What can individuals do to help bee populations?
  - d. Is it enough to plant a single type of bee-friendly plant in your garden?
5. Introduce students to the BCLNA Poster: Top Pollinator Picks for your Garden, and provide each student with their own copy of the BCLNA postcard.
  - a. Explain the zone map. Locate where your city is on the map of BC, and as a class identify your zone.
6. Provide each student with a copy of the Project outline handout and review the project expectations.
7. Students can use the remainder of the class to research their flower varieties and plot their garden.

\*\*\* If you want to shift this project from theoretical into practical, have the students follow through with planting their garden. You will have to identify a suitable location on the school grounds to have students plant their garden. For more information about starting school gardens visit [www.aitc.ca/bc](http://www.aitc.ca/bc)

## Video – Why Bees are Disappearing

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Why are bees out there pollinating our flowers?
2. How is pollination occurring in parts of the world where there are no bees?
3. Are bees predominantly social or solitary?
4. What are two ways in which bees maintain colony health?
5. What are some of the causes of bee population decline?
6. What are two examples of cover crops that are good for fixing nitrogen
7. Why can mono-cultures be considered food deserts for bees?
8. What affect can seeds coated with neonicotinoid insecticides have on bees? Why is this a problem?
9. Who is “public enemy number one” for bees?
10. How can we help bees?
11. How can farmers and communities help bees?

## Some Common Crops Pollinated by Bees

Alfalfa	Cranberries
Almonds	Cucumbers
Apples	Eggplants
Apricots	Grapes
Avocados	Grapefruit
Bell Peppers	Kiwifruit
Blackberries	Lemons
Blueberries	Limes
Broccoli	Mangos
Brussel Sprouts	Nectarines
Buckwheat	Oranges
Cabbage	Peaches
Canola	Pears
Cantaloupe/melons	Plums
Carrots	Pomegranates
Cherries	Potatoes
Clover	Pumpkins
Coriander	Raspberries
Cotton	Squash/gourds

## Project: Designing a Bee-Friendly Garden

Bees eat two things: nectar because it's loaded with sugar and is a great source of energy, and pollen which provides the bee with proteins. Because both nectar and pollen come from flowers, plants only provide food for bees when they're flowering. This is why it's important that you plant a variety of flowers that bloom at different times... so that bees have a constant food source throughout the year.

Choose 3 plants from each season (spring, summer, fall and winter). Keep in mind, you want to provide bees with a continual supply of food, so you may want to choose at least one from early spring and one from late spring. Use the internet to research the following:

- Common Name
- Latin Name
- Climate/hardiness zone
- Blooming season
- Growing requirements (spacing, depth of seed planting, water, sunlight, etc)

Use the poster and postcards provided, as well as the following websites to find plants that are suitable for our area of BC:

<https://plantsomethingbc.ca/bee-friendly-plants/>

<http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/animal-production/bees/food-for-bees/bee-forage-plants>

Once you have identified and researched your 12 plants, create a garden plan for a 4 foot by 4 foot garden space, taking into consideration the growing requirements of each plant.

You may be creative in how you present your research information and garden plan. Examples could include a presentation, a poster, a small scale model, etc.

The due date for this project is \_\_\_\_\_.