



Science Unit: *Ecologists Grow a Garden*

Lesson 1: *Garden Ecosystem*

School Year: 2012/2013

Developed for: David Lloyd George Elementary School, Vancouver School District

Developed by: Lea Elliott (scientist); Barbara Hinson and Mai McHardy (teachers); Erika Wilson and Joyce Ycasas (student teachers)

Grade level: Presented to grade 4 and 5; appropriate for grades 2 – 7 with age appropriate modifications

Duration of lesson: 1 hour and 20 minutes

Notes: Activity 2 in this lesson, Research a Garden Organism, requires a few periods to complete. An organism research workbook guides the research. The activity ends with students displaying the organisms as a food web on a bulletin board. This lesson is richer if delivered concurrently with two other lessons from the Ecologists Grow a Garden Science Unit: Lesson 3 Habitat Garden; and Lesson 4 Orchard Mason Bees.

Objectives

1. Learn about ecosystems, community, food webs, habitat, resources, lifecycles and adaptations by researching a garden organism.

Background Information

Habitat gardens are a great way to explore ecosystem concepts, such as habitat, community, food webs, interconnection, lifecycles, adaptation and resource use. A habitat garden provides resources and habitat for local organisms. Habitat gardens come in different forms, such as a native plant garden, butterfly garden or beneficial animal garden.

In this lesson, students are introduced to garden organisms common in an urban beneficial animal habitat garden. Beneficial animals help a gardener with jobs such as pollination and pest management. Beneficial garden animals require the right habitat and food to attract them to the garden. Gardeners need to understand the lifecycle of beneficial insects in order to attract them. For example, some beneficial garden insects, such as parasitic wasps, ladybugs and hoverflies, need different foods in the adult and larval stages. Often the adults only eat nectar and the larvae are predators of pest insects, such as aphids. As a gardener plants a garden and attracts beneficial animals, they build an ecosystem. Understanding ecology and researching garden organisms helps a gardener create a sustainable garden ecosystem.

Students will research one garden plant, bird or invertebrate and learn about the relationships between organisms. The organism research workbook provides guidance for students' research. The lesson concludes with a demonstration of the relationships between garden organisms. There are 20 organisms suggested for this research project (Please see list at the end of this lesson).



SCIENTIST IN RESIDENCE PROGRAM

Vocabulary

<u>Adaptation:</u>	The way in which an organism is suited to its habitat.
<u>Ecology:</u>	The science of the relationship between organisms and between organisms and their non-living environment.
<u>Ecosystem:</u>	A system formed by the interactions of all the living and non-living things in an environment.
<u>Food Web:</u>	A system of interconnected feeding relationships in an ecosystem.
<u>Habitat:</u>	The home of an organism, such as a plant or animal.
<u>Organism:</u>	A living animal, plant or fungi.
<u>Resources:</u>	Any living or non-living thing that animals (including humans) use to meet their needs.

Materials

- Organism research workbooks
- Research materials

In the Classroom

Introductory Discussion:

- Use the Hover Fly to introduce students to the garden and this week's concepts, including: adaptation, ecosystem, habitat and resources.
- Hover flies (*Syrphidae*), also called syrphid flies or flower flies. There are thousands of species of hover flies worldwide. Hover flies are great pollinators. As they move from flower to flower, eating nectar, they also move pollen. Some hover fly larvae eat aphids and some are also decomposers. The adults have interesting adaptations. They look like bees or wasps to deter predators from eating them and their mouthpart is a short tube with a sponge on the end that soaks up nectar. How did they get their name? They hover as they search for food. This is an easy way to recognize them and fun to watch! They need water to drink and nectar to eat. Small flowers that are easy to land on, such as coriander, dill and alyssum, are ideal food sources.
- Show students a video: [Hover Fly Feeding](#). What type of adaptation do you see? What resources do you think a Hover Fly needs?
- What is an ecosystem? The garden will be habitat for the garden plants and beneficial animals it will attract. What is habitat?

Science experiment/activity:

- Student partners will randomly draw a garden organism to research over a few weeks.
- Explore the vocabulary words by thinking about humans as organisms. Each student writes their ideas down and then discuss as a group.



Science Activity/Experiment

Activity 1: Me As An Organism

Purpose of Activity: To explore the vocabulary by thinking about humans as organisms.

Methods and Instructions: Set-up prior to experiment: Give each student a blank piece of paper.

- Use “Me as an Organism” sheet in Research Organism Workbook
- Give students time to record their habitat, 3 resources they need and a human adaptation.
- Next discuss and record ideas as a class.

Activity 2: Research A Garden Organism

Purpose of Activity: With a partner, students research a garden organism.

Methods and Instructions: Set-up prior to experiment: Place names of garden organisms in a hat. Assign students pairs. Copy organism research workbooks. Source books and websites.

Students work in partners. The students draw a garden organism out of a hat to research over the next few weeks. The organism research workbooks (grade 4 and 5) guide the research.

20 organisms are suggested for the research project (For a detailed description, Please see list at the end of this lesson).

Birds - American Robin (*Turdus migratorius*), Black-capped Chickadee (*Parus atricapillus*), Northern Flicker (*Colaptes auratus*), Northwestern Crow (*Corvus caurinus*)

Invertebrates – Earthworms, Blue orchard mason bee (*Osmia lignaria*), Aphid (*Aphididae*), Ladybug (Ladybeetle, *Coccinellidae*), Parasitic wasp (Parasitoid Wasps, *Hymenoptera*), Hover Fly (Syrphid Fly, Flower Fly, *Syrphidae*)

Plants – Strawberries, Dill, Coriander (also called Cilantro, Chinese Parsley), Crimson Clover, Kale, Sunflowers, Alyssum (Annual and Perennial), Crocuses, Winter Heather

The project is wrapped up with a display of the relationships between the garden organisms and their physical environment: Each student sketches their garden organism (done ahead of time). Their sketch is placed on a school hallway bulletin board.

- Students use string to connect their garden organism to other garden organisms.
- Students place a tag on each string describing the relationship (i.e. predator/prey, pollination, etc.).
- Non-living parts of an ecosystem (i.e. soil, water, sun) could also be included.

Closure Discussion

What interesting organism facts do you have to share? Why is it important to understand the relationships between organisms? What is the difference between an ecosystem and a community?

References

BioKIDS. Kid's Inquiry of Diverse Species. <http://www.biokids.umich.edu/critters/> Accessed June 14, 2013.

Chapman, A, C Dawkins, B Deeter, B Herrin and C Roltberg. 2006. B.C. Science Probe 4. Nelson.

Doyle, S, J Bowman, S Martin and H Stannard. 2006. B.C. Science Probe 5. Nelson.



SCIENTIST IN RESIDENCE PROGRAM

Elliott, Lea. 2011. Birds and Bees Landscape Plan.

<http://naturehood.ca/pdfs/birdsandbeesplantingplan.pdf> Accessed February 18, 2013

Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1988. The Birder's Handbook. A Field Guide to the Natural History of North American Birds. Fireside Books. New York, New York.

Evergreen. School Ground Greening. <http://www.evergreen.ca/en/resources/schools/index.sn>

Gilkeson, L.A. 2011. Backyard Bounty. The Complete Guide to Year-Round Organic Gardening in the Pacific Northwest. Salt Spring Island, BC.

Gilkeson, L.A. 2013. West Coast Gardening. Natural Insect, Weed and Disease Control. Salt Spring Island, BC.

Hover Fly Feeding. 2009. YouTube Video. <http://www.youtube.com/watch?v=tFKjuhgsoCJ> Accessed February 18, 2013.

Think Eat Green. thinkeatgreen.ca Accessed June 14, 2013.

Vancouver School Board. Garden Policy. <http://www.vsb.bc.ca/district-policy/io-garden-policy> Accessed June 14, 2013.

Extension of Lesson Plan

To get ready for the other lessons in this unit which all take place outside, make a waterproof cushion. Students work with a partner to weave the cushion (Alouette District Girl Guides). Source eight plastic grocery bags per student and lots of staplers. Tuck the handles of each bag in. Lay four bags parallel to each other. Lay the other four bags at 90 degrees to the first four bags. Weave these four bags under and over the laid out bags. Staple all four sides of the cushion to hold it together.

Alouette District Girl Guides. Plastic Grocery Bag Sit-Up-on. <http://www.myunit.ca/plastic-grocery-bag-sit-upon/> Accessed February 18, 2013.

List of Garden Organisms

Birds

American robin (*Turdus migratorius*) The American robin is typically found in forests, gardens, fields and parks. It is omnivorous. It eats a variety of insects, earthworms, fruits and berries. It may nest near by if there are dense shrubs or small trees to place their open cup nest in.

Black-capped chickadee (*Parus atricapillus*) The black-capped chickadee prefers forests, gardens, and parks. It is omnivorous. It eats a variety of insects and seeds. The black-capped chickadee is a great garden pest manager. It is only found in North America and in Vancouver is present all year-round. Chickadees need a cavity to nest in such as a hole in a dead tree or a nest box.

Northern flicker (*Colaptes auratus*) The northern flicker is a large woodpecker. It is common in open habitats or wooded areas with lots of dead trees and nests in large cavities. It mostly eats invertebrates, such as aphids, ants and beetles.

Northwestern crow (*Corvus caurinus*) The northwestern crow is the only crow species found in Vancouver, B.C. The northwestern Crow lives in semi-open habitats such as suburbs, cities and coastal shore lines. It is omnivorous. It eats a large variety of food including, marine and terrestrial invertebrates; small reptiles, amphibians, birds and mammals; bird eggs, fruit, seeds, carrion and garbage.

Invertebrates



Blue orchard mason bee (*Osmia lignaria*) The blue orchard mason bee is a solitary and non-aggressive bee. It can be found in orchards, farms and gardens. It is a great early spring pollinator, especially for small berries and fruit trees.

Aphid (*Aphididae*): There are many thousands of aphid species in the world. Aphids are small soft-bodied green, brown, red or black insects. They suck the sap from plant stems, leaves or roots. The sap is richer in sugar than protein. The sap is so sugary that often aphids secrete the sugary portion of the sap and keep the protein. This excretion is called honeydew. Other insects such as ants, feed on the honeydew. Ladybugs, parasitic wasps and some hoverflies are aphid predators.

Earthworms (*Oligochaeta*) There are thousands of earthworm species worldwide. They live in moist soil and decompose dead plant material.

Ground beetles (*Carabidae*) Ground beetles run fast, are nocturnal, solitary and predatory. They eat slug and earthworm eggs. They are found throughout the world and are common in forests. There are more than 26,000 species worldwide.

Hover flies (*Syrphidae*) Hover flies are also called syrphid flies or flower flies. There are 1000's of species of hover flies worldwide. Hover flies are great pollinators. As they move from flower to flower eating nectar they move pollen. They can be seen hovering nearby coriander, alyssum and dill. Their bodies often look similar to a bee or wasp, but they do not sting. Some hover fly larvae prey on aphids.

Ladybug (Ladybeetle, *Coccinellidae*) Ladybugs, also known as lady beetle or ladybirds, are found throughout the world. There are more than one hundred species in North America. Both the adults and larvae are voracious aphid predators. One lady beetle can eat up to 5000 aphids in its life. Adult lady beetles hibernate as a group in the winter. Before hibernation the adults need a pollen source, such as pollen from coriander, dill and alyssum to build enough energy reserves to survive the winter.

Parasitic wasp (Parasitoid Wasps, *Hymenoptera*) Parasitic wasps are related to wasps that most are familiar with, the kind that stings with a yellow and black striped body. Parasitic wasps do not sting. They do have a needle-like structure at the end of their abdomen. It is used to lay eggs in other eggs or insects. Their Parasitic wasp larvae are predators of other insects such as aphids and ladybugs. Adult parasitic wasps consume nectar from plants such as alyssum, dill and coriander.

Plants

Crimson clover Crimson clover is grown to protect and nourish the soil. It is planted in the fall. It survives the winter preventing soil erosion. Nitrogen-fixing bacteria in its roots captures nitrogen from the air and convert it to a form of nitrogen usable by other plants. The plants are dug into the soil in the spring to add organic matter to the soil. The bright red flowers are a source of nectar for bees.

Spring crocuses Spring crocuses are a type of bulb planted in the fall. The bulb flowers in the early spring, which make it a good source of pollen for mason and other bees. The bulbs are left in the ground and will flower again the next spring.

Dill, Coriander, Alyssum (perennial and annual) These plants all have many, small flowers. They are good sources of nectar for beneficial insects, such as ladybugs, hoverflies and parasitic wasps. Dill and coriander can also be harvested by students. They reproduce easily by seed.

Kale Kale is a brassica. It is related to broccoli and cabbage. The plants will survive the winter and begin growing in early spring. The leaves and flowers are delicious cooked or raw. The yellow flowers are a good source of early pollen for bees.

Winter heather Winter heather flowers early, which makes it a good pollen source for mason and other bees. It is a perennial. This means the plant will survive through the winter and begin to grow again in the spring.

Strawberries Strawberries are a good source of pollen for mason bees. More pollination increases the number and size of berries. Aphids commonly prey on strawberries. There are everbearing and June-bearing strawberries. Everbearing strawberries produce smaller and less berries, but they produce for



SCIENTIST IN RESIDENCE PROGRAM

longer. June-bearing strawberries are larger and more prolific, but produce for a shorter period. Strawberries reproduce by runners.

Sunflowers Sunflower pollen is popular with parasitic wasps. The seeds are a good food source for black-capped chickadees and people. They reproduce easily by seed.



SCIENTIST IN RESIDENCE PROGRAM

Garden Animal Research Sources Sites accessed January-March, 2013

BIRDS

American Robin (*Turdus migratorius*)

http://www.biokids.umich.edu/critters/Turdus_migratorius/
http://www.allaboutbirds.org/guide/american_robin/id
<http://www.hww.ca/en/species/birds/american-robin.html>
http://birdweb.org/Birdweb/bird/american_robin
<http://animals.nationalgeographic.com/animals/birding/american-robin?source=A-to-Z>

Black-capped chickadee (*Parus atricapillus*)

http://www.biokids.umich.edu/critters/Parus_atricapillus/
http://www.allaboutbirds.org/guide/Black-capped_Chickadee/id
<http://www.hww.ca/en/species/birds/chickadee.html>
http://birdweb.org/Birdweb/bird/black-capped_chickadee
<http://animals.nationalgeographic.com/animals/birding/black-capped-chickadee?source=A-to-Z>

Northern Flicker (*Colaptes auratus*)

http://www.biokids.umich.edu/critters/Colaptes_auratus/
http://www.allaboutbirds.org/guide/Northern_Flicker/id
<http://animals.nationalgeographic.com/animals/birding/northern-flicker/>
http://birdweb.org/Birdweb/bird/northern_flicker
http://www.birds.cornell.edu/nestinginfo/bios/sp_accts/nofl

Northwestern Crow (*Corvus caurinus*)

<http://www.birds.cornell.edu/birdsleuth/modules/exploring-bird-behavior/bird-guide/northwestern-crow>
http://www.allaboutbirds.org/guide/northwestern_crow/id
http://birdweb.org/birdweb/bird/northwestern_crow



SCIENTIST IN RESIDENCE PROGRAM

INVERTEBRATES

Earthworms

<http://www.biokids.umich.edu/critters/Oligochaeta/>

<http://kids.nationalgeographic.com/kids/animals/creaturefeature/earthworms/>

Blue orchard mason bee (*Osmia lignaria*)

http://www.agf.gov.bc.ca/apiculture/factsheets/506_osmia.htm

<http://www.sare.org/Learning-Center/Books/How-to-Manage-the-Blue-Orchard-Bee>

Aphid (*Aphididae*)

<http://www.biokids.umich.edu/critters/Aphididae/>

http://entnemdept.ufl.edu/creatures/veg/aphid/green_peach_aphid.htm

<http://www.agf.gov.bc.ca/cropprot/tfipm/aphids.htm>

<http://jenny.tfrec.wsu.edu/opm/displaySpecies.php?pn=430>

Ladybug (Ladybeetle, *Coccinellidae*)

<http://www.biokids.umich.edu/critters/Coccinellidae/>

http://www.canadiangeographic.ca/kids/animal-facts/lady_bug.asp

<http://animals.nationalgeographic.com/animals/bugs/ladybug/>

<http://www.ext.colostate.edu/pubs/insect/05594.html>

<http://edis.ifas.ufl.edu/in327>

Parasitic wasp (Parasitoid Wasps, *Hymenoptera*)

<http://www.biokids.umich.edu/critters/Hymenoptera/>

<http://www.agf.gov.bc.ca/cropprot/fieldguide/parasiticwasp.htm>

Hoverfly (Syrphid Fly, Flower Fly, *Syrphidae*)

<http://www.biokids.umich.edu/critters/Syrphidae/>

http://www.dirtdoctor.com/Syrphid-Fly_vq3567.htm

<http://www.entomology.wisc.edu/mbcn/kyf211.html>

Ground Beetles (*Carabidae*)

<http://www.biokids.umich.edu/critters/Carabidae/>