



ECOQUEST

Field Tech Badge





A Note About the Illustrations

Unless otherwise noted below*, illustrations for this EcoQuest Field Journal and the EcoQuest Badges were created by two of our extremely talented high school Eco-Leaders, Jiali Pickering and Sadie Pickering. We thank them for their amazing contributions to EcoQuest!

Sincerely,

Ashley Alred & Amelia Goldstein

EcoQuest Authors + Educators

*Illustrations retrieved from *Eco-Inquiry* (1994) by Kathleen Hogan are cited below:

p. 16 *To be a careful observer*. *Eco-Inquiry* (1994), p. 67

p. 61 *Habitat chamber*. *Eco-Inquiry* (1994), p. 90

p. 61 *Supporting notetaking (Earthworm feeding)*. *Eco-Inquiry* (1994), p. 92

p. 62 *Food for Ants*. *Eco-Inquiry* (1994), p. 101

p. 64 *Signs of Animals Eating Plants*. *Eco-Inquiry* (1994), p. 360

p. 66 *Seed Stations*. *Eco-Inquiry* (1994), p. 103



Field Tech Badge

Field Technician (noun): a person who collects data in nature to learn more about animals, plants, and other organisms. They often set traps for animals for ecology research and identify what they catch.

Eco-Challenge

The mission of this badge is to learn techniques to “take attendance” of the animals that live in your habitat and practice identifying them.

To earn the **Field Tech** badge, you must:

- ☐ Set up a *Study Square*
- ☐ Observe the Study Square at least 5 different times
- ☐ Identify 5 heterotrophs
- ☐ Identify 2 pieces of *evidence* of heterotrophs
- ☐ Master at least 1 field investigation method



A **method** is a step-by-step way of doing something.
It's like my recipe for chocolate chip cookies!

Visit us online for the Field Tech Badge! <https://padlet.com/caryecoquest/FieldTech>

Create a Study Square

Part 1: Set Up

The whole ecosystem is huge, and too big for scientists to study all at once. So, we use **samples**, or smaller pieces of an ecosystem, that help us understand the whole ecosystem.

One tool ecologists use to create a sample of their ecosystem is a **quadrat**: a small square of land they can use to study animals and plants.

You will use pencils and string to create your own quadrat, or **Study Square**! For this badge, you will work on recording the living organisms that you find within it.

Study Square Materials

- ☐ Small piece of land outside
- ☐ Pencils (4)
- ☐ String or yarn cut to 8-feet long & tied at ends
- ☐ Ruler or tape measure

Step 1: Find a spot with dirt, soil, or sand that you can stick a pencil into. Push & twist your first pencil into the ground. Leave at least half of your pencil above the ground.

Step 2: Measure 2 feet up from the first pencil and push the second pencil in the ground.

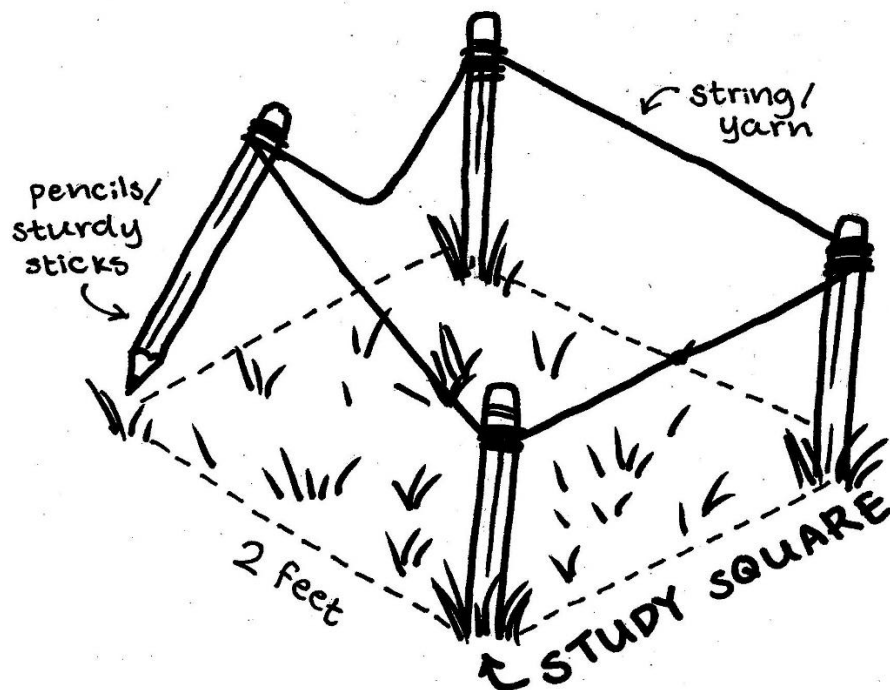
**Hint: If you don't have a ruler or tape measurer, hold out your arm straight in front of you. The length from your fingertips to your shoulder is about two feet.*

Step 3: Measure 2 feet to the right of the second pencil and push the third pencil into the ground.

Step 4: Measure 2 feet down from the third pencil and stake the fourth pencil into the ground.

Step 5: Your four pencils now form a SQUARE!

Step 6: Use a ruler or measuring tape to cut string or yarn to be 8 feet long. Tie the ends together so you now have a huge circle. Loop the string a few times around one pencil, then stretch the string to the next pencil. Loop the string a few times around this pencil, and stretch to the third pencil. Repeat until string is tight between the four pencils.



**You can also watch a video of how to set up a Study Square.
Go to [YouTube.com](https://www.youtube.com) and search "Cary Institute Study Square."*

You are now all set to observe your Study Square!

Part 2: Observe Your Study Square



Just like at your Sit Spot...remember your Field Journal & a pencil!

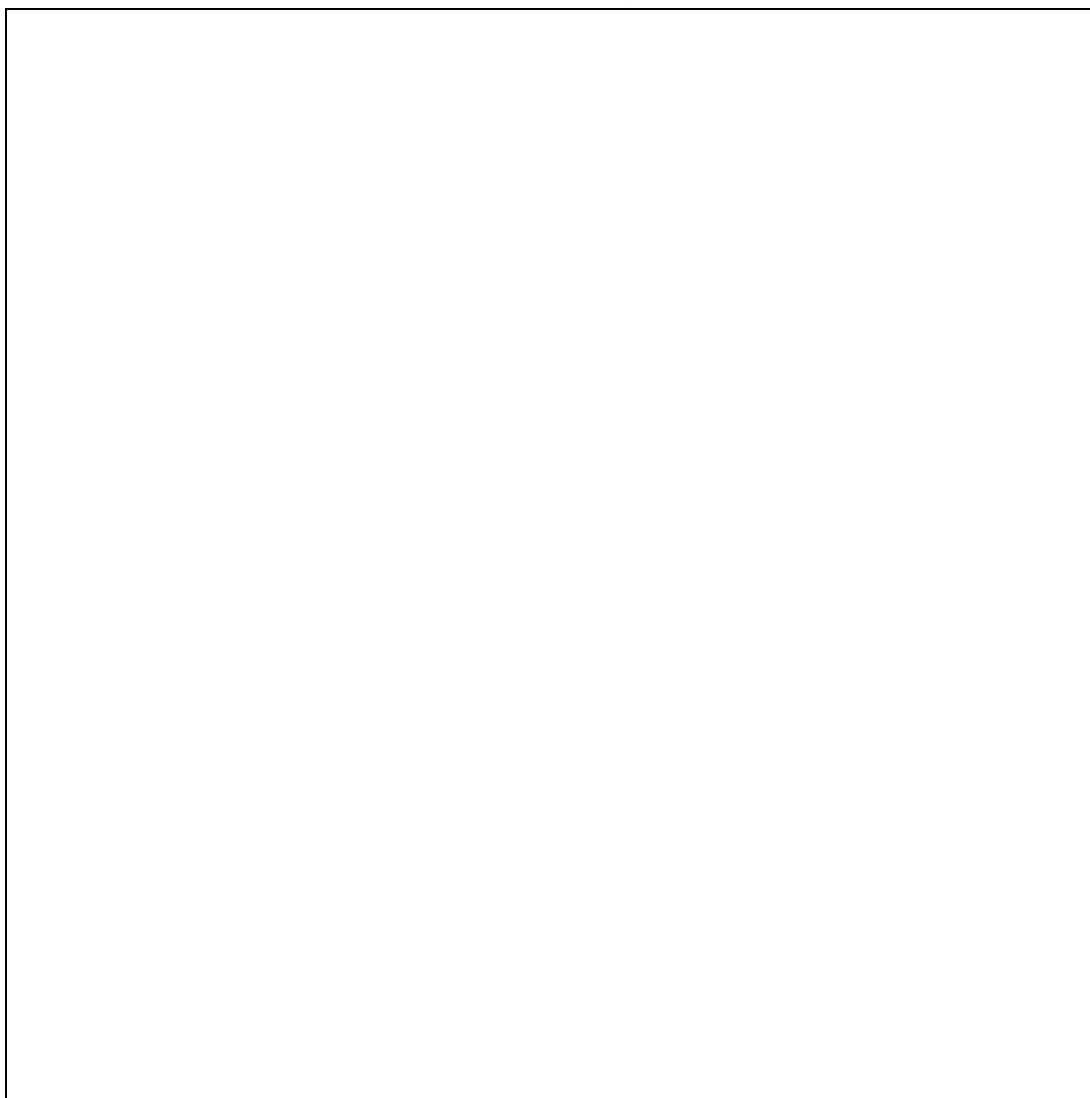
- Sit and get comfy –and move around a little, too!
- Carefully observe your Study Square for a few minutes—don't forget your magnifying glass!

What do you notice? Grass, flowers, leaves, any bugs? Are some things living and some things not?

What do you wonder? When you look at your square, what are you curious about? How many ants live in my entire home habitat? Why is the grass shorter in this part of my yard than in other parts?

Sketch what you see in your Study Square below. Add to this each day! Add color, too!

My Study Square



Study Square Observations

Day 1:	The weather today:
I notice...	I wonder...

Day 2:	The weather today:
I notice...	I wonder...

Day 3:	The weather today:
I notice...	I wonder...

Day 4:	The weather today:
I notice...	I wonder...

Day 5:	The weather today:
I notice...	I wonder...

What was your favorite thing you observed in your Study Square? Share it here!

***Eco-Alert!** Have you added all of the heterotrophs (organisms that eat other things) you found in your Study Square to your Eco-List?

Part 3 (Bonus): What does my Study Square tell me?

Think about your "I Wonder..." questions. Which question could be answered using your Study Square?

Example: How many yellow flowers are in my entire Home Ecosystem?

Let's learn how to think like an ecologist!

Step 1. Your study square is a 2ft x 2ft square that represents the whole of your outdoor space (aka your Home Habitat).

Use your ruler to figure out (roughly) how many study squares you could fit in your WHOLE Home Habitat you are studying.

I could fit _____ study squares in my Home Habitat.

Step 2. Pick an organism that lives inside your study square. This could be a blade of grass, a weed, an ant... anything you can see or count.

I picked _____.

Step 3. How many of this organism are in your study square?

I found _____ in my study square.
(Number) (Organism)

Step 4. Multiply the number of organisms you found in your square by the total number of study squares you could fit in your Home Ecosystem.

$$\frac{\text{_____}}{(\# \text{ of organisms})} \times \frac{\text{_____}}{(\# \text{ of squares})} = \frac{\text{_____}}{(\text{TOTAL number of organisms})}$$

What OTHER questions could you answer using your study square?

I wonder...



IDENTIFICATION

What kind of creature is this, and how do I know?

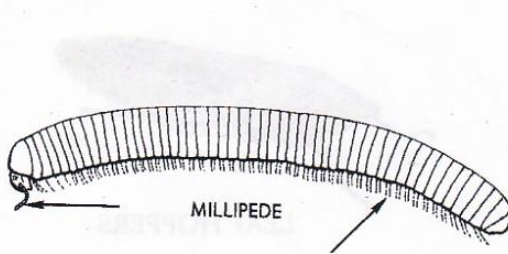
When you find a new bug, you can identify what it is by asking yourself the following questions:

Questions for Bugs

- ★ How many legs does it have?
- ★ Does it have wings? Are these wings parallel or do they stick out?
- ★ Did you find it near water?
- ★ Does it have antennae?
- ★ Does it have a parallel line down its back?
- ★ Did you find it near a specific plant?

You can also use the following field guides to identify common bugs and signs of bugs.

Common Soil and Litter Invertebrates



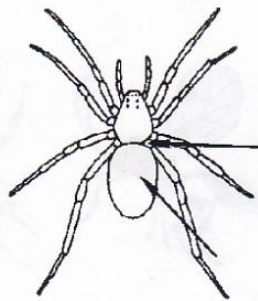
MILLIPEDE



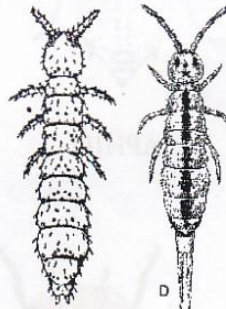
CENTIPEDE



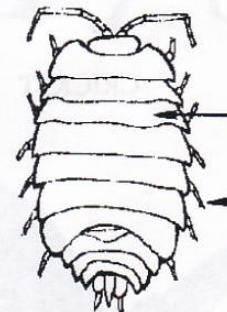
SLUGS & SNAILS



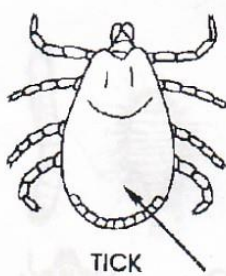
GROUND SPIDER



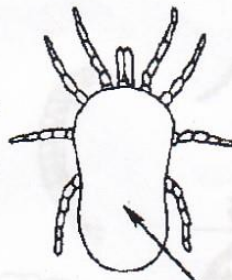
SPRINGTAILS



SOWBUG (isopod)



TICK



MITE



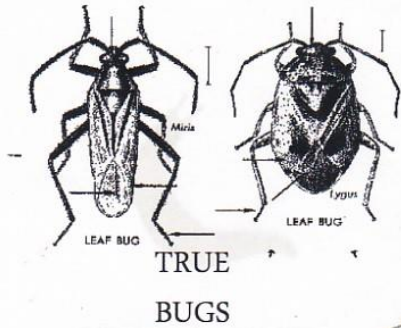
WORM



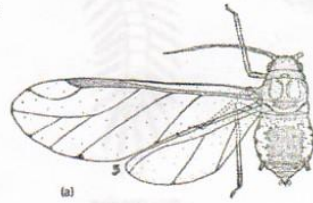
NEMATODE,
UNSEGMENTED WORM

Images taken from: <http://www.colby.edu/biology/BI131/Lab/Lab08SoilinvertebrateGuide.pdf>

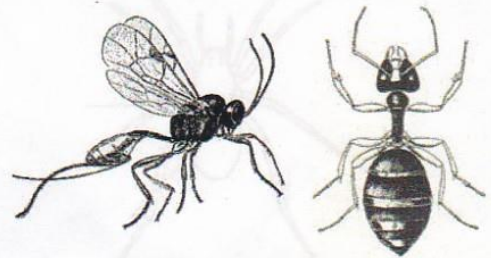
Common Flying Invertebrates



LEAF HOPPERS



APHID



ANTS, BEES &
WASPS



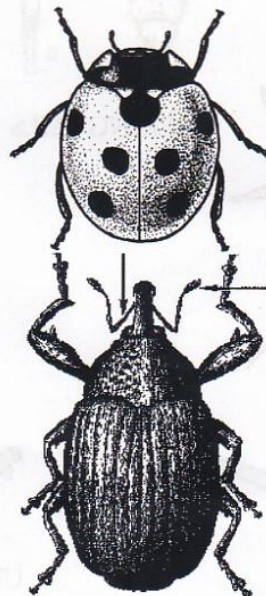
CRICKET



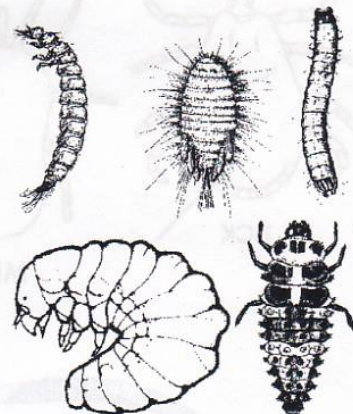
MOTH



FLY

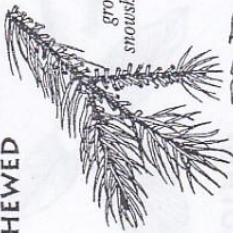
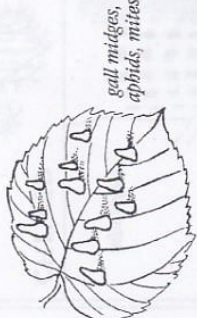
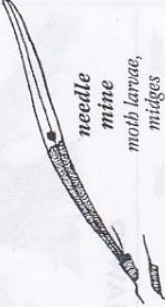


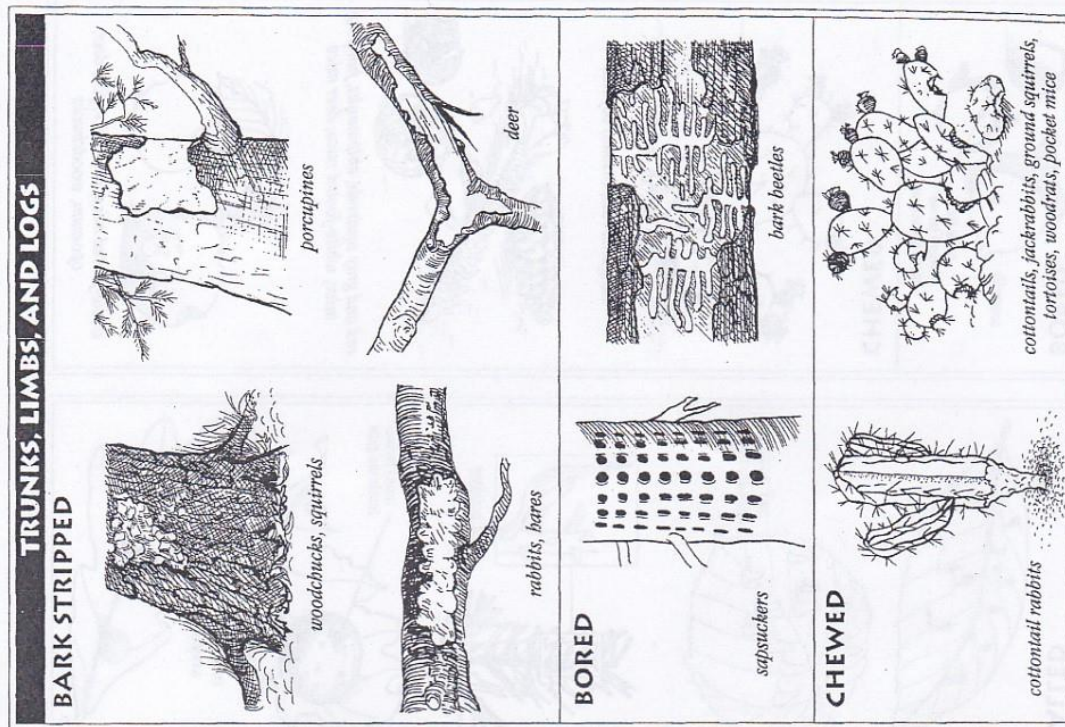
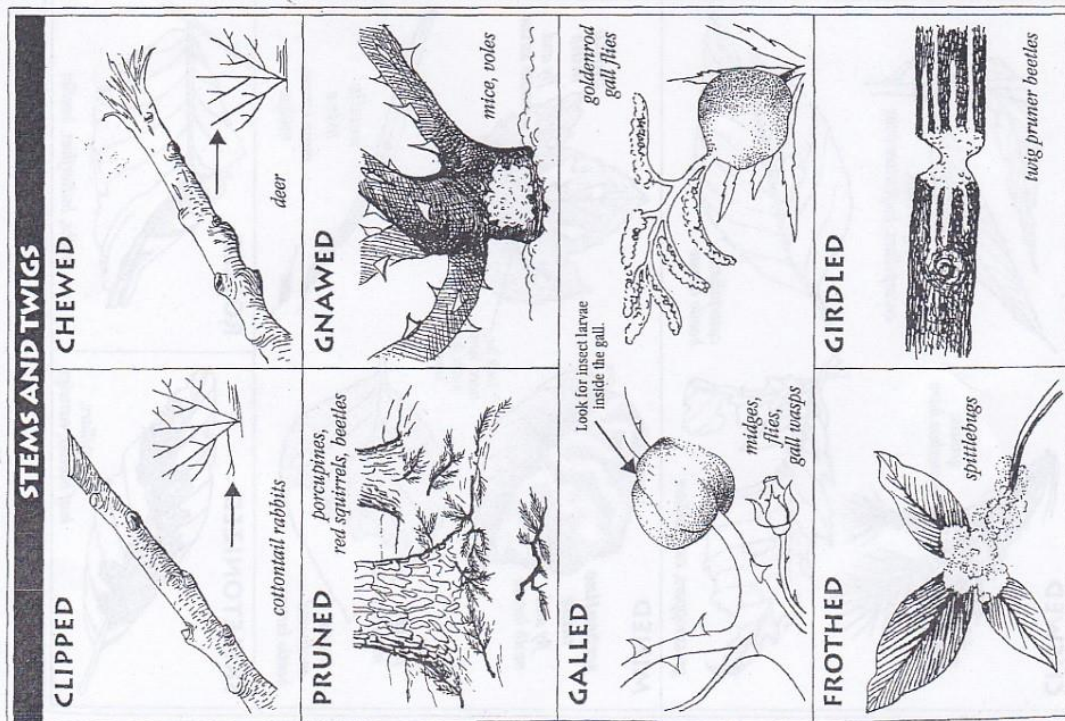
BEETLE



BEETLE
LARVAE

SIGNS OF ANIMALS EATING PLANTS

LEAVES		SEEDS, NUTS, AND FRUITS	
CHEWED	 grouse, snowshoe hare	GALLED	 mites
	 grasshoppers, caterpillars		 gall midges, aphids, mites
MINED	 serpentine mine fly and moth larva	ROLLED	 blotch mine fly and moth larva
	 patch mine beetles, moth and beetle larvae		 needle mine moth larvae, midges
SKELETONIZED	 caterpillars, leaf beetles, earwigs	BORED	 weevils Look for weevil larvae inside the acorns.
			 kangaroo rats, orioles, coyotes
			 red and gray squirrels, chipmunks, jumping mice, white-footed mice, deer mice
			 white-footed mice, deer mice, fox, deer, opossum, woodchucks

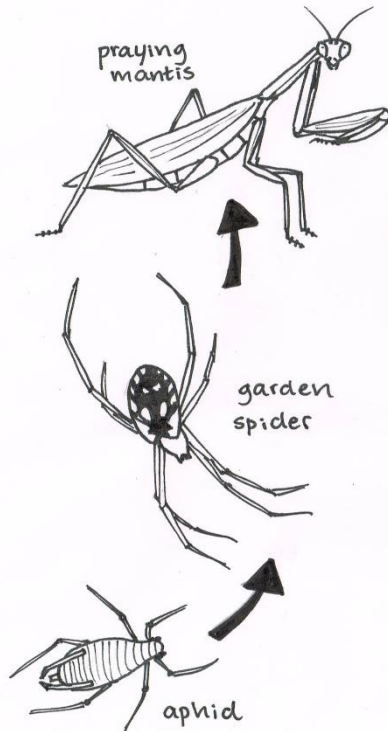


If you find any plants that look like bugs ate them,
tape them into your booklet here!



If you use **glue**, be
sure to let this page
dry before closing—
or else you'll have a
sticky situation!

INSECT FOOD CHAIN



Hungry Heterotrophs

A heterotroph is any living thing that gets energy by eating other living things. Sometimes heterotrophs eat plants. Sometimes...they eat...other heterotrophs!

Are you a heterotroph?

Do you eat? Then YES, you are a heterotroph!

Which heterotrophs have you observed so far outside your home?

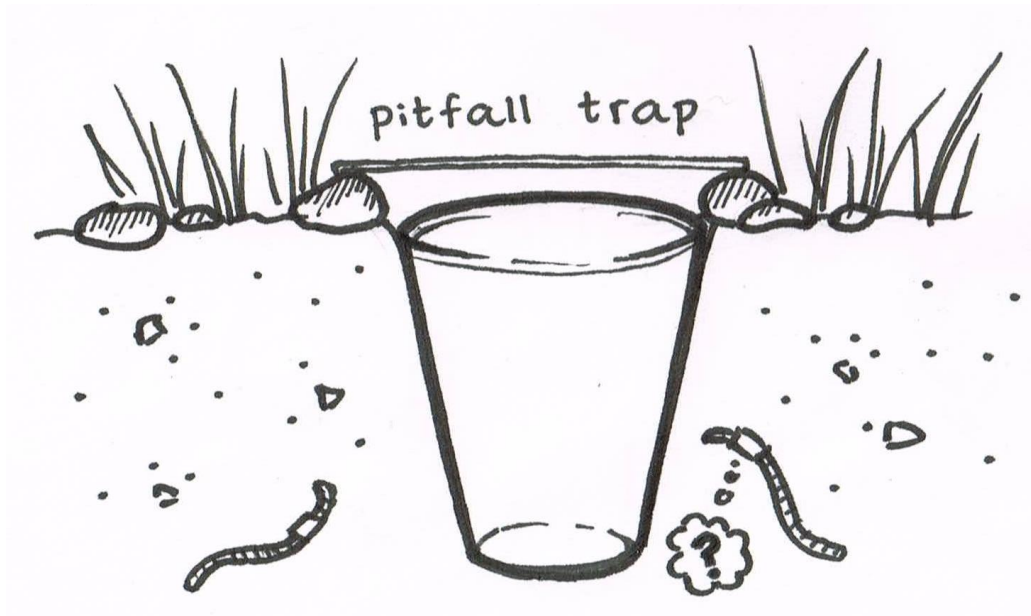
Which heterotrophs have you observed so far inside your Study Square?

Go to the [Field Tech Badge Padlet](#) webpage to learn more tools, apps, and activities you can use to identify plants, animals, and fungi!

Field Methods

How do field techs perform studies outside?

To earn your **Field Tech Badge**, you must complete at least ONE of the following field methods: Pitfall Trap, Coverboard, Critter Catching, or Beat Sampling.



***Online video tutorials are available on the [Field Tech Badge Padlet](#) page. If you cannot complete any of these methods at home, simply watch and respond to the videos to still earn your badge! ***

Pitfall Traps

Materials

- ☐ Empty yogurt cup
(or similar sized cup)
- ☐ Spoon or trowel for digging
- ☐ Soily area outside
- ☐ Large leaf or small piece of cardboard

Pitfall traps help us catch small creatures that are walking around above the surface of the ground.

Method:

Step 1. Simply dig a hole in the ground large enough to fit a cup (like a recycled yogurt container or something of similar size).

Step 2. Place the cup in the hole and make sure the top of the cup is even with the ground.

Step 3. Place a large leaf or small piece of cardboard loosely over the top of the cup.

Step 4. Leave it for insects to fall into.

That's all there is to it!

We recommend checking every 2 hours, or even leaving it overnight and checking in the morning!

Pitfall Traps

Use this space to record what you found!

Use your **field guides** or the naturalist app **Seek** to identify the organisms you find.

Critter Catching

Materials

- ☐ Net (DIY: <https://www.youtube.com/watch?v=Y6X2VZyy0dY>)
- ☐ Bug box

Method: To catch insects without fancy tools, simply stay still and swing your net in one swift motion. If you don't have a net, you can use a recycled plastic jar with a lid, a small bug box, or make a homemade net!

Think like a bug!
Where would
YOU want to
hide?



Critter Catching

Use this space to record what you found!

Use your **field guides** or the naturalist app **Seek** to identify the organisms you find.

Beat Sampling

Materials

- ☐ Tree or bush
- ☐ Sturdy stick
- ☐ Large light-colored piece of fabric like an old bed sheet

When they're not hiding underground, some animals climb up high to hide on branches or in bushes. Beat sampling is a tool ecologists use to release creatures that are climbing up trees or hiding in bushes by shaking the branch and catching them on a cloth.

Method:

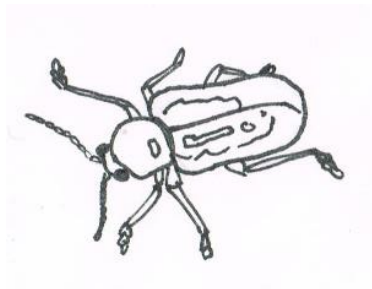
Step 1. Find a bush or tree with low-hanging branches.

Step 2. Lay the large piece of fabric on the ground.

Step. Carefully but firmly hit and shake the branches right above the fabric. You can also shake branches with your hand!

Step 4. Check out the sheet! What kind of bugs do you see?

Step 5. Capture some of the bugs in a bug box to take a closer look!



Beat Sampling

Use this space to record what you found!

Use your **field guides** or the naturalist app **Seek** to identify the organisms you find.

Hungry Heterotrophs

Now that you've mastered these field tech tools, which *new* heterotrophs (or animals that eat other things) have you observed?

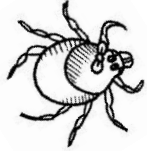
Which heterotrophs have you seen **evidence** (or *signs*) of?

This can include bite marks and poop, any sign that an organism was eating here.

***Eco-Alert!** Have you added all of the heterotrophs (organisms that eat other things) you found in during your **Field Tech Badge** to your Eco-List?

BRAINSTORM BOX

Now that you've mastered the practice of being a field tech, you are ready to become an ecologist!



An **ecologist** is
someone who
studies how **living**
things interact with
their **environment**.

Ecologists love to ask questions about the natural world. Use the space below to brainstorm some questions you might want to answer using the field methods you learned during this badge. **Hint: Think about what you learned during your Naturalist Badge, too!*

Examples:

Are there more bugs on this branch in the morning or evening?

Will more bugs fall into my pitfall trap if I leave a flower in it?

Will I catch more bugs if I dress in green?

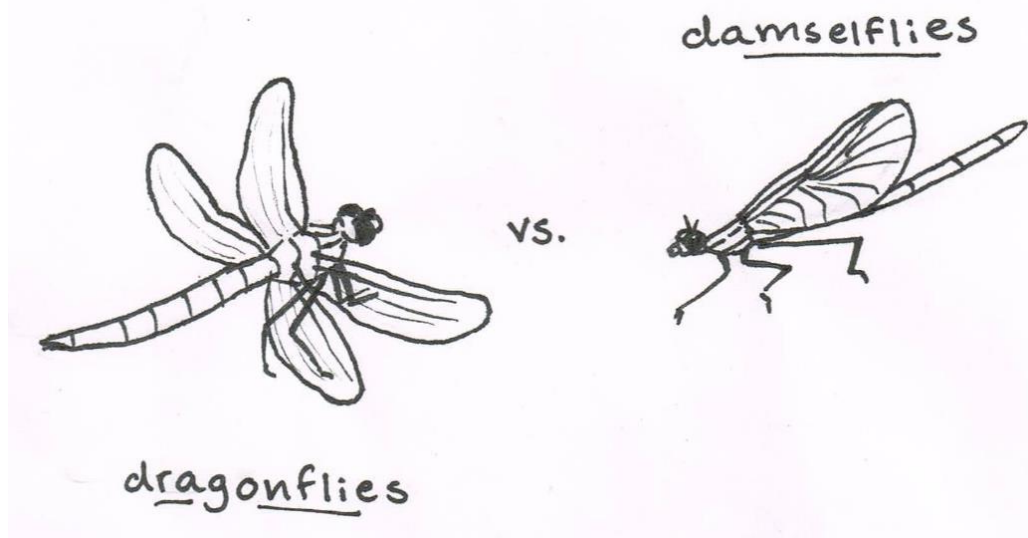
Your Questions:

E-mail your favorite answerable question to an educator at caryeducation@caryinstitute.org so that you can get ready to conduct an experiment for your Field Ecologist Badge. We can help!

Field Tech Eco-Challenge Check

When you complete this check-list, scan or take a photo of it and send to caryeducation@caryinstitute.org.

✓	Challenge Steps	Eco-Explorer Signature	Adult Initials
	Set up a Study Square.		
	Observe the Study Square at least 5 different times.		
	Identify 5 heterotrophs.		
	Identify 2 pieces of <i>evidence</i> of heterotrophs.		
	Master at least 1 field investigation method.		





Thank You!

We at Cary Education created EcoQuest as a way to provide families with a fun ecology education opportunity since we had to cancel Cary Eco-Discovery summer camps during the COVID-19 Pandemic in 2020. We are incredibly grateful to all the families, teachers, and students who participate in this brand new program, as well as to our amazing team of high school Eco-Leaders for their creative ideas and dedicated educational contributions.

We are excited to inspire—and be inspired by—children discovering the ecosystem of their own homes and schoolyards.

Thank you for supporting our educational endeavors!

With Gratitude,

Cary Education

References

Hogan, Kathleen. *Eco-Inquiry: A Guide to Ecological Learning Experiences for the Upper Elementary/Middle Grades*. Kendall/Hunt Publishing Company, PO Box 1840, 4050 Westmark Drive, Dubuque, IA 52004-1840., 1994.

Cary Education Teaching Materials: <https://www.caryinstitute.org/eco-inquiry/teaching-materials>

About the Authors

The Cary EcoQuest (2020) curriculum and accompanying online materials were created by Ashley Alred and Amelia Goldstein, with priceless guidance from Dr. Alan Berkowitz, *Cary Head of Education*, and Shelly Forster, *Cary Educator*.

Ashley Alred, Cary Education Program Leader

Before joining Cary, Ashley served as a k-12 environmental educator at the Urban Ecology Center in Milwaukee, Wisconsin. She received her MS in Science Literacy Research at the University of Nebraska-Lincoln ('16) and her BS in Fisheries & Wildlife Biology from the University of Georgia ('12). Over the years, her academic research interests have ranged from captive chimpanzee behavior to understanding how undergraduates make decisions about conservation issues. She has been an environmental educator in five different states across the country.

As Education Program Leader, Ashley is excited to devote her skills in education, ecology, and research to teaching youth using inquiry-based and data-driven methods during local school field trips and summer camp, while also contributing to innovative ecology education research. Her career focus is to inspire youth to think critically and creatively about ecology and cultivate meaningful, fun connections to their local environment.

Amelia Goldstein, Cary Summer Camp Instructor

Amelia's path to becoming an ecology teacher began in college where she studied the *Sociology of Science*--that is, how scientists act, what rules they follow, who gets to be a scientist and how. She became passionate about making sure that everyone who *wanted* to do science *could* do science. She realized that the best way to make science accessible to everybody was to teach it! When in graduate school for *Biology Education*, Amelia discovered the incredible world of ecology, and she loved that there was room for everybody in it. There was no turning back!

Last year in summer 2019, Amelia became a summer camp instructor for the Cary Institute of Ecosystem Studies where kids spend every day outside exploring ecology. We were lucky enough to have Amelia back for a second summer as an instructor for EcoQuest. During the school year, Amelia is a high school science teacher. This fall, Amelia will be teaching a trifecta of Biology, Ecology, and Environmental Science to high school students at Oakwood Friends School in Poughkeepsie, New York.