Lost Ladybug Project Curriculum 3-12-09
For Science Toolkit Grades K-2

Introduction to the Lost Ladybug Project

Some species of native ladybugs in North America are disappearing. In just the last 20 years these beneficial predators of farm and garden pests have become extremely rare. This rapid decline is of great concern.

The Lost Ladybug Project was set in motion at a small number of schools in New York State in 2004. It is a citizen science project that asks anyone of any age to look for any ladybugs they can find, and then send in pictures of each one. One of the first major discoveries came in 2006 when Jilene (age 11) and Jonathan (age 10) Penhale found a rare ninespotted ladybug near their Virginia home. This was the first ninespotted ladybug seen in the eastern U.S. in 14 years. Their finding confirmed that the species was not extinct and that with enough people working together we can find even these rare species. With recent funding from the National Science Foundation the Lost Ladybug Project has expanded and now anyone in North America can participate. Both common and rare ladybugs, whether native or introduced, are important to find. They all contribute to understanding where different species of ladybugs can be found and how rare they really are. Once we know where the rare ladybugs can be found, we can try to protect their habitat and save them!

In completing this series of units, both age groups will learn about insect life cycles, biological control of insect pests, biodiversity, conservation, and citizen science. Students from both age groups will be citizen scientists themselves who will contribute to real scientific inquiry, and they will begin to explore their own scientific research questions.

SIX UNIT SCIENCE TOOLKIT FOR GRADES K - 2

Unit ONE

The Lost Ladybug Project

Ladybug Life Cycle

Main Idea -- Ladybugs, like all beetles, undergo complete metamorphosis. The four life stages of beetles look extremely different. Both immature and mature ladybugs prey on small soft-bodied insect prey and these prey are often agricultural pests.

Motivator -- A single ladybug larva will eat about 400 medium-size aphids during its development to the pupal stage. Males may eat less but an adult female will eat about 300 medium-size aphids before she lays eggs. She can eat about 75 aphids in a day and may consume more than 5,000 aphids in her lifetime.

Pre-Activity Questions --Have you all seen ladybugs? Did you know that they are beetles? Do you know what ladybug babies look like? Did you know that ladybugs use their antennae to touch, smell, and taste?

Activity -- Make replicas of ladybug life cycle stages. Working in groups may make this faster. Show the printed photos of real ladybug life stages to the children as they work.

Supplies:
- green felt or construction paper
- packing peanuts
- toilet paper rolls
- black pipe cleaners
- empty egg cartons
- masking tape
- scissors
- stapler
- yellow paint
- red and black markers or paint
- hole punch
- glue
- print out photos of real ladybug eggs, larvae, pupae, and adults from www.lostladybug.org

To make ladybug EGGS:

1. Cut the green felt or construction paper into the shapes of leaves.
2. Cut the rounded ends off of the packing peanuts and glue the flat sides of these (approximately 10 - 20) close together on the leaves.
3. Paint the rounded eggs yellow.

To make ladybug LARVAE

1. Make slits half way up from one end of the toilet paper rolls.
2. Make ½ inch slits in the other side of the toilet paper rolls..
3. Pull the slit ends into cones and fasten with masking tape.
4. Make 6 legs by feeding 3 black pipe cleaners through the uncut portion of the toilet paper rolls.
5. Use markers or paint to make eyes on the blunt end and color the entire form dark.

To make ladybug PUPAE

1. Cut green felt or construction paper into the shapes of leaves.

2. Separate individual cups from an egg carton.

3. Using markers or paint, children can paint the egg carton cups yellow and black or a muddy mixture like brown.

4. With one piece of tape, attach the cups, open part down, to the leaves. If the artists have designed one end of the cup to be more like a head, then the pupa should be attached opposite to this.

To make ADULT LADYBUGS

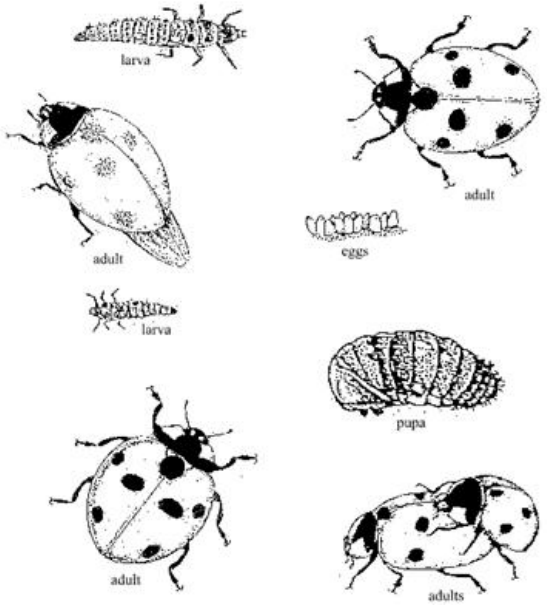
1. Separate individual cups from an egg carton.

2. Using markers or paint, children can paint the egg carton cups red or yellow or orange. Then, using black paint, color about a quarter of the outside of the cup. This will be ladybug pronotum. The true ladybug head would hardly be visible but can be envisioned at the very front of this. Children can draw a vertical line down the ladybug body (abdomen) and make symmetrical spots on either side of that line.

3. Using the point of a scissors or a hole punch, an adult should make 6 small holes (3 on each side) at the base of the cup near along the front half of the cup. These will be for the legs. Make 2 small holes (for antennae) at the very front where the head will be.

4. Insert a black pipe cleaner into each a side hole and out the other side for the legs. Use half a pipe cleaner for the antennae.

During this activity, instructors may wish to relate to following introductory information about ladybugs (from All About Ladybugs at www.lostladybug.org)



What do the different stages of the life cycle look like?

Eggs are tiny, spindle-shaped, and arranged in clusters.

Larvae are elongated, “alligator” shaped, slightly pointed at the rear, and their body is covered in tiny bristles.

Pupae are slightly round and dark colored. You can find them attached to a surface by their hind ends.

Adults are sphere-shaped, smooth, and have easily recognizable colors and markings.

How do ladybugs fly? Ladybugs hold their stiff front wings up, something like a parachute, and use the motion of their hind wings to move forward. Check out this photo!

Photo by Pat Prindle, 6-7-09, La Jolla, California. *Harmonia axyridis*, submitted to the Lost Ladybug Project.

What do ladybugs eat? Both adult and larval ladybugs are known primarily as predators of aphids but they also prey on many other soft-bodied insects and insect eggs. Many of these are agricultural pest such as scale insects, mealybugs, spider mites and eggs of the Colorado Potato Beetle and European Corn Borer. A few ladybugs feed on plant and pollen mildews and many ladybugs supplement their meat diet with pollen.

What eats ladybugs? Ladybugs are not commonly eaten by birds or other vertebrates, who avoid them because they exude a distasteful fluid and commonly play dead to avoid being preyed upon. However, several insects, such as assassin bugs and stink bugs, as well as spiders may commonly kill ladybugs.

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You can finish with a round of "Plant, Plant, Ladybug!" (Duck, Duck, Goose!)

This game reinforces the roles of ladybugs as predators and aphids as likely prey and was invented by a 9 year old student in one of the first groups collaborating with the Lost Ladybug Project in 2008. Everyone sits in a circle except for one Aphid who walks around designating, Plant, Plant, Plant, until she or he calls someone a Ladybug! The Ladybug gets up and the chase is on! If the Ladybug catches the aphid, the aphid must sit in the middle and the Ladybug becomes the next aphid, and so on until the Ladybugs have eaten all the aphids.

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<u>Vocabulary</u>

Ladybug

Lady beetle

Egg

Larva

Pupa

Complete metamorphosis

Predator

Prey

Science Checkup

Are ladybugs "bugs" or "beetles"?
Ladybug larvae and adults have legs. What about the pupae?
Do ladybug larvae and ladybug adults eat the same things?
Can you think of some other "predators" and other "prey"?

Extensions

Is there a difference between lady beetles and ladybugs? Although commonly called “lady bugs,” they are in the Coccinellidae family of the beetle order, Coleoptera. They are characterized by their oval-shaped body and distinctive coloring. The Coleoptera undergo complete metamorphosis (that is, they have egg, larval and pupal stages in their life cycle), and are unique from other insect orders in that their forewings have modified into a hardened protective cover (elytra). “True” bugs belong to the insect order Hemiptera, and include box elder bugs, plant bugs, and squash bugs.

How did ladybugs get their name? The most common legend as to how ladybugs got their name is: During the middle ages in Europe, swarms of aphids were destroying crops. The religious farmers prayed to the Virgin Mary for help – and help came in the form of ladybugs that devoured the plant-destroying pests and saved the crops! The grateful farmers named these insects “Our Lady’s beetles,” a name which had endured to present day.

How long do they live? After a female lays her eggs, they will hatch in between three and ten days, depending on ambient temperature. The larva will live and grow for about a month before it enters the pupal stage, which lasts about 15 days. After the pupal stage, the adult ladybug will live up to one year.

Why are they so brightly colored? Ladybugs bright colors serve as a warning – they indicate any potential predators of the distasteful repellents the beetle will release if attacked.

Why do they have spots? Ladybug spots are part of the bright warning pattern discussed in the previous question.

Resources

www.lostladybug.org
http://www.enchantedlearning.com

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Unit TWO

The Lost Ladybug Project

Ladybug Diversity

Main Idea -- Ladybugs can be found all over the world and there are many different species. Learn to recognize important characteristics.

Motivator -- There are over 4500 species of ladybugs in the world and over 500 identified in the United States. Only about 70 of these are the cute red, yellow, and black ones we think of most.

Pre-Activity Questions -- Do all ladybugs look alike? What colors do they come in? About how many kinds do you think you might find in one place?

Activity -- Carefully drawing ladybugs to learn important characteristics for identification of different species. Alternatively ladybugs could be modeled with clay or play dough.

Supplies: large ladybug poster (download from www.lostladybug.org) [This is nice and big but not absolutely necessary if printing is not easily accomplished.]
ladybug field guides (download from www.lostladybug.org)
blank paper or ladybug outlines (download from www.lostladybug.org)
crayons, markers, or paints
ladybug bingo chips (can be made of paper, felt, etc.)
up to 30 different ladybug bingo game boards (download from www.lostladybug.org)

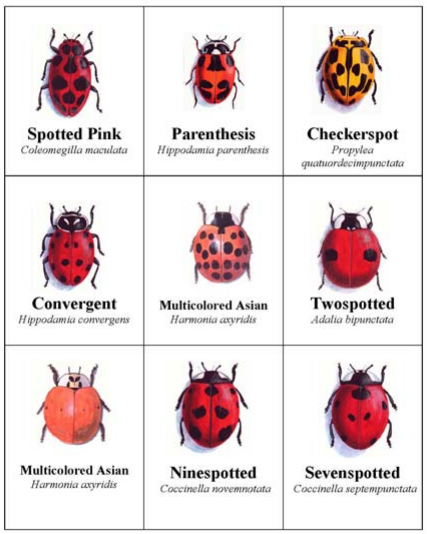
1. Have children pick a ladybug from the poster or Field Guide to draw freelance or fill in on ladybug outline sheets, or model with clay or play dough. Engage discussion on observing particular ladybugs look: identify body parts; colors of wings, head, antenna; color, size, shape, number and placement of spots. Then compare to other ladybugs.

2. **Ladybug Bingo!**

Give each child a ladybug bingo game board and discuss the differences and names of the ladybugs on the game boards. Cut up a few other game boards for pieces to pull out of the hat, and cut up something for chips. Have a great game and learn about ladybugs at the same time!

Information about each of the ladybug species on the game board can be found on the ladybug field guide.

Ladybug Bingo Card



Vocabulary

Pronotum

Elytra

Rare

Common

Native

Introduced

Biodiversity

Conservation

Science Checkup

Are all ladybugs red?
Do the patterns of both the wings (or elytra) and the pronotum vary?
Where do introduced ladybugs come from?
How do ladybugs fly?

Extensions

Bio/diversity, Bio=life and diversity = many different kinds. So biodiversity means many different kinds of life.

Quick Demo of Jobs Concept for Games:

Gather a toolbox or bag with different tools. "Here are different tools that people use to do different jobs. Here's a hammer for, here's a screwdriver for, measuring tape for..….. (Hold up a hammer) So the hammer is good for pounding nails, why don't we just have lots of hammers, why don't we fill our toolbox with just hammers? Why do we need all these different tools?

Each tool does a different job, we need all the tools in order to do lots of different things. Just like each insect does a different job so we need different kinds of insects, not just bees or just beetles."

Alternatively ask participants to think of different jobs that people do in their community.

Each ladybug species lives best, and eats the most pests, like aphids, in specific circumstances. One way of expressing this is that they each have their own "job" like tools in a toolbox. This understanding will become the fundamentals of biodiversity and conservation.

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Unit THREE

The Lost Ladybug Project

Getting Ready to Collect Ladybugs

Main Idea -- Prepare a ladybug collection chart and make a good strong sweep net for collecting in the next unit.

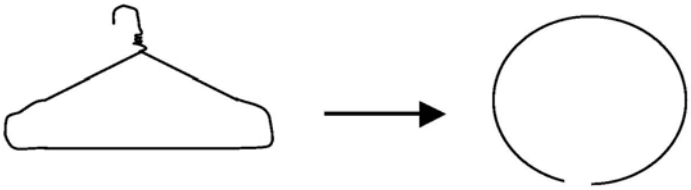
Motivator -- If ladybugs fall from a plant or fall into your net, they may play dead!

Pre-Activity Questions -- What are the differences between a butterfly net and a sweep net? How many different kinds of ladybugs do you think you will find?

Activity -- How to make a home-made sweepnet.

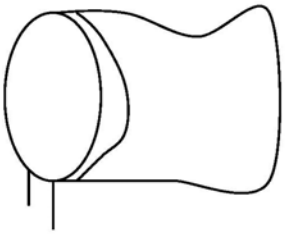
Supplies:
- pillow cases
- 2 wire coat hangars / pillow case
- 1 piece of wood or dowel approx 2 - 3 feet long for a handle
- scissors
- duct tape
- pliers
- 1 piece of poster board
- crayons or markers

1. Turn your 2 wire hangars into similar circles.

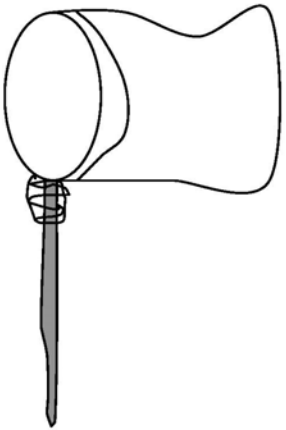


Then tape them together in several places, leaving the open end opened.

2. Now cut holes on either side of the seam where there are two layers of pillowcase fabric. Then feed the wire through the pillowcase hem. Straighten our the ends that are left so that they can be taped to the handle



3. Heavily tape the four wire pieces that are out of the pillowcase to the handle. Make sure it is sturdy because it's going to bump into thick grass, alfalfa, clover, and other plants!



4. Set up a poster board chart about like this, with different ladybug species at the top

O O O O O O O O O

The students can draw the different species of ladybugs again or cut them out from either the bingo game boards or field guides they have seen before. (Either can be downloaded from www.lostladybug.org)

After each collection (next 2 units) the students will record the dates and habitats and numbers of each type of ladybug they found. At the end of the 5th unit, or during the 6th unit, these can be compared!

Vocabulary

Pliers

Duct tape

Science Checkup

Now that you have looked at several different kinds of ladybugs three times, it is getting easier to identify them? Are you ready to go outside and find them?

Extensions

Why is "Duct Tape" so strong? Duct tape was originally developed during World War II in 1942 as a water resistant sealing tape for ammunition cases. Permacel, then a division of Johnson & Johnson, used a rubber-based adhesive to help the tape resist water and a fabric backing to add strength. It was also used to repair military equipment quickly, including jeeps, firearms, and aircraft because of these properties.

For more fun facts and the history of duct tape, visit Wikipedia (http://en.wikipedia.org/wiki/Duct_tape)

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Unit FOUR

The Lost Ladybug Project

Collecting Ladybugs Habitat I

Main Idea -- Go outside and collect ladybugs to see what kinds you find and how many. All ladybugs are important to the Lost Ladybug Project and help scientists figure out where different species are, how rare the rare ones are and how common the common ones are. The children become citizen scientists themselves!

Motivator -- Some ladybugs are found alone while others are found in huge groups of thousands that have gathered together. Some are found swept down out of the air and washed ashore of large lakes!

Pre-Activity Questions --What do you think makes a good habitat in which to find ladybugs? What kind of weather or what time of day do you think would be best? How many different species do you think you will find? (some answers to the first question can be found below)

Activity -- To prepare for going outside and collecting ladybugs locate a collecting site(s). In general the best sites will be areas of more than 100 m^2 (120 yards) that contains herbaceous (not woody or tough) plants that are at least 20 cm (8 in) high. Plants that are too tough cannot easily be swept through and plants that are too short do not host many of the prey insects ladybugs need and thus do not usually support very large populations of ladybugs. Specific collecting site possibilities would include:

Any area that has not been mowed recently, preferably with some weeds,

The plants at the edge of a wooded area, mowed area or field (e.g. a hedgerow, these long thin strips can be excellent sites if they are wide enough to sweep or search visually)

An orchard – sweeping is possible if not to recently mowed, trees themselves are excellent habitat for ladybugs and while they clearly cannot be swept lower branches can be shaken or beaten vigorously onto sheets. Note that many orchards are treated frequently with insecticides so be sure to check on the treatment schedule.

Many agricultural fields including alfalfa, clover, small grains (e.g. wheat), potatoes, soybeans can make fruitful collecting sites. As with orchards, be sure to check with the grower first.

Supplies:
- your own sweep nets
- your poster board chart
- large plain cloth or sheet
- high-sided wash basin or box
- jars, vials, or ziplock bags
- cooler w/ cold pack or ice

1. If you will be following the plan of comparing ladybug finds in two different habitats (two consecutive units) you should know that keeping ladybugs cooled in a refrigerator for more than one week is not great for their health. If your group meets one each week, the best plan would be to search for the same length of time, say ½ hour, each time and allow time for photographing the ladybugs on the second week. So, for example, if one habitat is farther from headquarters, that would be the place to go during this unit!

2. Demonstrate back and forth motion of the net, low enough to knock insects into the net but not hit the ground, or show little video clip (will be on the website soon!). In addition to the insects that will be knocked off the plant, many insects leap for the ground when disturbed, and will hopefully land in your nets.

3. Let everyone go out and sweep, search, and beat for a defined period of time.

4. Empty sweep nets onto open sheets or into wash basins and boxes.

5. Collect all ladybugs into jars, vials, or bags.

6. Try to identify which species have been found!

7. Put the ladybugs into a cooler until your reach a refrigerator. Keep them with a small bit of damp paper towel or cotton until they can be photographed (next unit). Cooling slows insects down and makes it easier for them to go without food.

Vocabulary

Habitat

Microclimate

Sampling

Collecting "Effort"

Science Checkup

How many ladybugs did you find?
How many different species did you find?
How many different ladybug species did you recognize?
Did you find them all in the same kind of habitat?

Extensions

Find out more about the ladybugs you have found so far at www.lostladybug.org

Resources www.lostladybug.org

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Unit FIVE

The Lost Ladybug Project

Collecting Ladybugs Habitat II

Main Idea -- Go outside and collect ladybugs again to see what kinds you find and how many and compare results from two different habitats. All ladybugs are important to the Lost Ladybug Project and help scientists figure out where different species are, how rare the rare ones are and how common the common ones are. Repeat collections from nearby locations and by the same "spotters" is especially valuable. The children become SUPER citizen scientists themselves!

Motivator -- The degree to which specific ladybug species are associated with particular plant hosts (of their prey) is still an unsolved mystery.

Pre-Activity Questions -- How and why do you think your second ladybug collection may be different from your first? How many different species do you think you will find? **Activity** -- Locate a second collecting site, somehow different in habitat than the first. The difference could be related to what surrounds the fields (surrounding vegetation versus neighborhood housing, for example, as much as what is different about the fields themselves (type of plant, etc.). Note recommendations from Unit Four.

Supplies:
- your own sweep nets
- your poster board chart
- large plain cloth or sheet
- high-sided wash basin or box
- jars, vials, or ziplock bags
- cooler w/ cold pack or ice
- camera (preferably digital with a close-up function)
- printed page of "the perfect grey" (downloaded from www.lostladybug.org)

1. If you will be following the plan of comparing ladybug finds in two different habitats (two consecutive units) this time you should plan to got out fast and come back with time to take photographs.

2. Gather your sweepnets, cloths, wash basins, jars, and cooler.

3. Go out and sweep, search, and beat for a defined period of time.

4. Empty sweep nets onto open sheets or into wash basins and boxes.

5. Collect all ladybugs into jars, vials, or bags.

6. Put the second collection of ladybugs into a chilled cooler. Cooling with slow them down and make them easier to photograph.

7. Once back at headquarters, while the second group of ladybugs cools down, you can photograph the first (pre-cooled) collection of ladybugs. To do this bring out your print of "the perfect grey." This grey background will help avoid the glare that can come off shiny ladybug elytra and make identification more difficult. Glare or reflection off the beetle is often more of a problem than not having enough light.

8. Place your one chilled ladybug at a time on the grey background and take the largest photograph you can while maintaining focus. Shield the beetle from bright light and use the flash only if there is very little light.

9. As this is happening, someone in the group should be recording the groups "best guess" as to the species of each ladybug being photographed.

10. Repeat the process with the now chilled newer group of ladybugs and record the "best guesses" separately.

11. Once all the ladybugs have been photographed you are ready to fill in your poster board chart and have an interesting discussion! In the upper half note the date, time, number of "spotters", habitat, and numbers found of any of the ladybugs designated at the top as well as "kinds" you may not know the names of yet. You may well recognize them as all belonging to the same species even if you don't yet know the name. (This is fine! You do not need to determine the species you find. The Lost Ladybug Project will receive the photo and determine the species.)

12. Fill in the lower half of the chart with similar data from this days collection. Discuss how and why your collections from two different habitats may have been similar or different.

13. Return the ladybugs to where you found them or to another great ladybug habitat.

Vocabulary

Habitat
Microclimate
Sampling
Collecting "Effort"

Science Checkup

On which day did you find more ladybugs?
On which day did you find more species of ladybug?
If you found differences, do you think they may be due to habitat, date, weather?
How many different ladybug species did you NOT recognize?

Extensions

Think of all the ways your two collecting expeditions differed. Do you have any hypotheses about where or when you can expect to find more ladybugs? Find out more about the ladybugs you have found so far at www.lostladybug.org.

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Unit SIX

The Lost Ladybug Project

Submitting your data to the Lost Ladybug Project

Main Idea -- Complete the process of giving your ladybug images to the Lost Ladybug Project and begin to explore how your data relates to all the other data collected for the Lost Ladybug Project.

Motivator -- The Lost Ladybug project received over 1000 ladybug photo submissions in 2008. We would love to receive 10 times that many in 2009 and ten times ten times that many in 2010!

Pre-Activity Questions -- How and why do you think your two ladybug collections were or were not different? Do you think your collections were similar or different from collections in other parts of North America?

Activity

Supplies: a computer with online access
the camera with the ladybug photos in it
your data from the two collection times

1. Download your ladybug photos from your camera and submit them online through www.lostladybug.org by following instructions. You will be asked for the names and ages and number of "spotters." You will be asked for date, time, habitat data as well the length of time spent searching, etc.

2. Congratulations citizen scientists!

3. If you have time, you can access the currently submitted data to the Lost Ladybug Project through www.lostladybug.org. You can ask questions like:

   Where have all the _____ spp. been found so far?
   Where have all the native ladybugs been found so far?
   Where have all the exotic ladybugs been found so far?
   In what month of 2008 were the most _____ spp found?
   In what habitats were _____ spp found in 2008?

<u>Vocabulary</u>

Native species

Introduced species

Science Checkup

How did your collections compare with the ladybugs already submitted to the Lost Ladybug Project?

Did you find about the same proportion of native and introduced species?

Did you find any of the newly rare species? Can you tell from the data in the Lost Ladybug Project where you might expect to find them?

Be sure to keep in mind that all ladybugs provide good information to the scientists. Without pictures of all the ladybugs you find they will not be able to tell how common the common species are or, in turn, how rare the rare ones are.

Extensions

Test your own ladybug hypotheses using the mapping features (coming soon!) at www.lostladybug.org.