

ECOSYSTEM ON A STRING

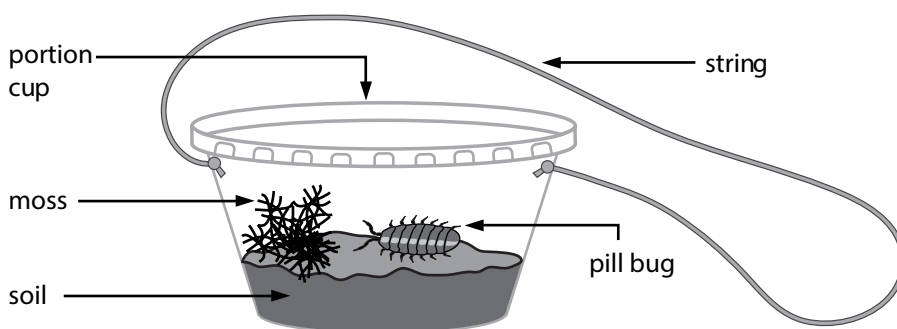
Background Information for Activity Leaders

Overview

Children will explore the interaction between living and non-living things by constructing a small scale ecosystem. Children will investigate how food, air and water play a crucial role in the life found in an ecosystem, and observe how living things interact with their environment.

Key Concepts

- **Ecosystems** include both living and non-living things that interact with each other and share a common physical environment. An ecosystem can be very large or very small. For example, the pill bug and the plant are living things that interact with non-living things such as air, soil, and water in the physical environment of the portion cup.



- The model of an ecosystem the children will build have different components:
 - Soil provides a place for the plant to anchor and grow, as it absorbs water and nutrients.
 - The plants recycle the carbon dioxide and oxygen in the ecosystem through photosynthesis and also serve as food for the pill bug.
 - The water is essential to the normal life processes of both the plant and the pill bug.
- The pill bug is important because it returns nutrients to the soil and carbon dioxide to the air.

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Background Information for Activity Leaders

What to Expect

- Children will notice that condensation (water vapor becoming liquid water) forms on the walls and lid of the portion cup. The condensation will make the sides look “foggy” and may eventually drip down in small raindrop-like precipitation.
- Children may notice that too much water can cause harm to the living things inside their ecosystem. The pill bug may die or the plant may rot from overwatering. Fungi may also start to grow.
- Children may notice that too little water may also cause harm to the living things inside their portion cup. The pill bug’s gills may dry up and be unable to get enough oxygen, causing it to die. The plant may dry out and die as well.
- Children will notice the pill bug’s behavior. They will have many questions concerning some of its life processes, so it is recommended that you become a “pill bug expert.” Additional information on the pill bug has been included in the following pages.

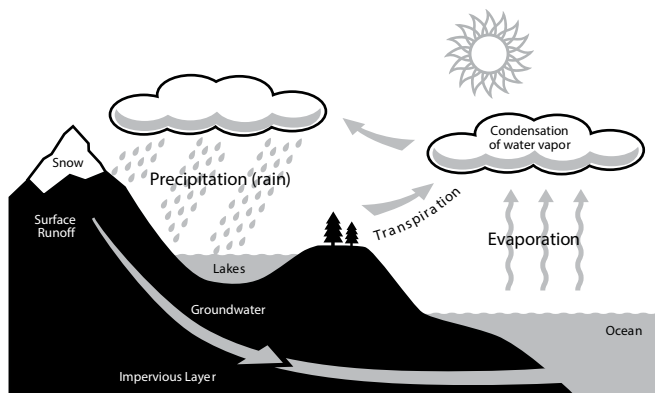
Common Misconceptions

- *Children may think: “Living things conduct most of their activities during daylight hours.”*

Most children know that there are nocturnal (night) animals, but once they begin to observe the pill bug they maybe surprised to discover that it prefers to scurry about and find food when it is dark.

- *Children may think: “The water in the ecosystem gets used up.”*

Water does not get used up. The amount of water on Earth stays constant. Water may change from a liquid to a solid to a gas or vice versa during the water cycle. The water children pour into the portion cup will evaporate with the heat of their bodies and condense on the inner walls and lid of the portion cup. The condensed water will then drip back down into the portion cup. Because the portion cup is not completely airtight some of the water vapor will escape, requiring that they add water to their ecosystem occasionally.



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Guide to Becoming a Pill Bug Expert

What are they?

Whether you call them pill bugs, sow bugs, or roly polys, these comical creatures that roll up into little balls when they feel threatened are not insects. Pill bugs belong to the same class of animals as crabs, lobsters and shrimp. This class of animal is called crustacean. Pill bugs belong to a special group of crustaceans called isopods. Isopod means “equal foot.” Most crustaceans live in water but pill bugs live on land.

Will they hurt me?

Many species are fast walkers, but can be easily observed when held in the palm of your hand. They do not bite. They will not mistake you for food. Remember to wash your hands with soap and water after handling.

Where do they live?

Pill bugs require moist habitats because their delicate, gill-like breathing organs must be kept moist. Pill bugs are found under logs, stones, and in other damp places, and they feed mostly on decaying vegetation.

What do they eat?

Pill bugs, like all isopods, are omnivores, or scavengers feeding on dead or decaying plants or animals. Some may eat live plants.

How can you tell males and females apart?

On the underside, females have leaf-like growths at the base of some legs.

How do they reproduce?

They can reproduce in two ways:

- Parthenogenesis is Greek for “virgin birth.” A female pill bug can self fertilize and form another identical female.
- Sexual reproduction, which involves both a male and a female.

The female produces about two-dozen tiny white offspring, which she carries around in a pouch on her underside, until they can fend for themselves. They can have two or three broods per year, and their lifespan is about two years.

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Guide to Becoming a Pill Bug Expert (continued)

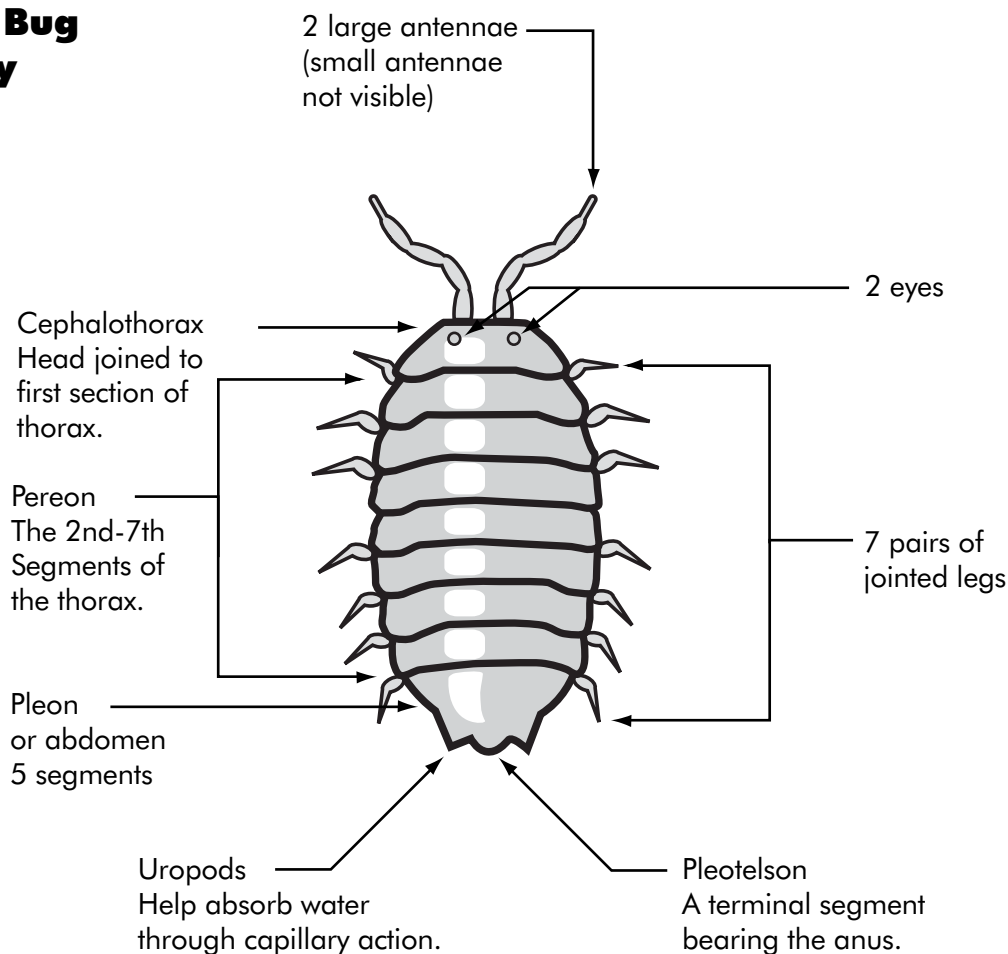
How do they grow inside their hard outer skeleton?

When pill bugs outgrow their hard outer skeleton, they shed it and grow a bigger one. This process is called molting and it occurs in two stages. First, the back half molts, then two to three days later, the front half molts. Coloration of both halves may be different at this time. Young pill bug molts four or five times.

What predators do they have?

Natural predators include frogs, newts, toads and small mammals that live and hunt at night in the moist areas where the pill bugs live. Sometimes as they molt, when they are still soft, they can be eaten by other pill bugs. Another main predator is the spider, which injects them with venom before devouring the inside contents of their body.

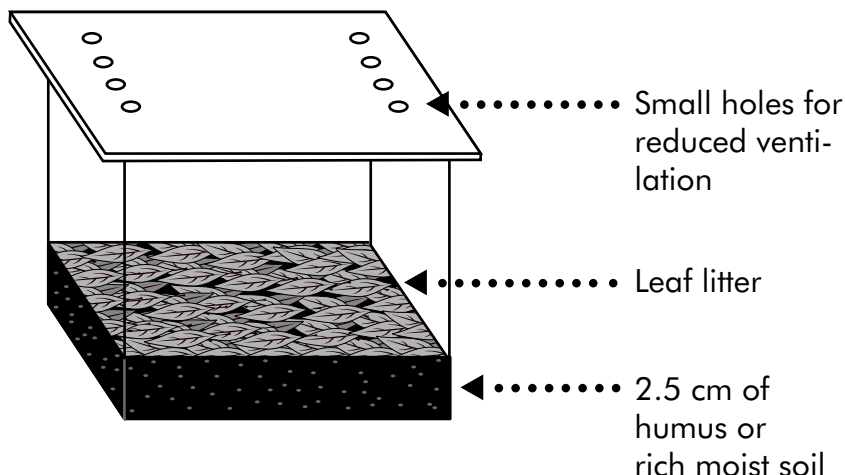
The Pill Bug Anatomy



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What You Need to Keep Pill Bugs in Your Science Center

- Clear shoebox, clear plastic container or side resting soda bottle
- Lid with small holes for reduced ventilation
- 2.5 cm of humus or rich, moist soil or sand
- Leaf litter, or other dead vegetation
- Water spray bottle



Directions

Place a 2.5 cm layer of soil in the bottom of the container. Cover the soil with leaf litter or decomposing pieces of bark. Cover the container with a lid that has small holes punched in it.

Water

The soil needs to be moist, but not soggy. Periodic (maybe daily) misting of the container will help increase humidity. Do not allow the soil to dry out or the isopods will die.

Food

In captivity they can eat fish food flakes sprinkled on the soil surface, leaf litter (from the place they were collected), or small pieces of potato, apple, or carrot. Do not overfeed, or the food will begin to decay and may encourage fungi to grow.

Cleaning

If there are many isopods in the container, waste gases may become strong and deadly to the isopods. Open the top of the container daily for a few minutes. Also, remove uneaten food as soon as it becomes moldy.

Precautions

Mold and fungus can grow in the moist conditions found in the pill bug habitat. To prevent mold:

1. Remove and replace moldy food or leaves.
2. Reduce misting.
3. Increase ventilation in lid. If problem continues, create a new, clean set-up and follow precautions.

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Resources

Biological Supply Companies:

Biological supply companies are good sources of pill bugs and ferns or mosses if it is not possible to collect them around your area.

- Carolina Biological Supply Company
<https://www.carolina.com/>

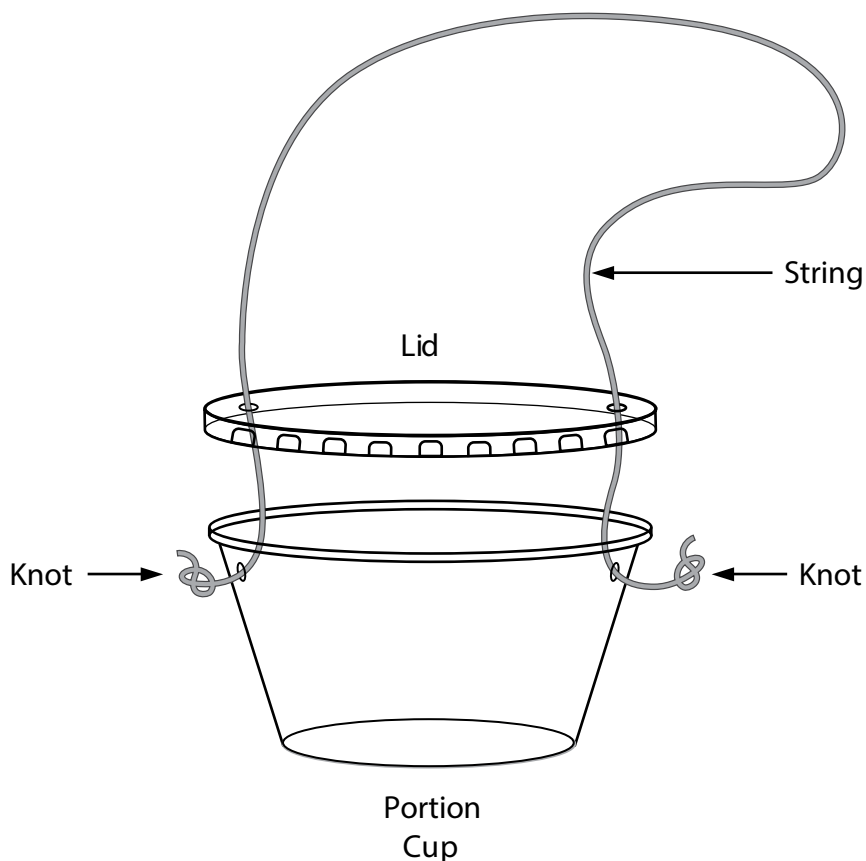
For this lesson you will need to go outside to collect one pill bug per child or place an order:

1. Pill Bugs (*Armadillidium*), one per child
2. Fern or moss that grows no more than 10 cm
3. Humus or soil
4. Portion cups

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Ecosystem Container Instructions

1. Use a large unfolded paperclip to make a small hole near the rim of either side of a portion cup. (The pointy side of a protractor can also be used to make the holes.)
2. Make corresponding holes on the lid.
3. On one side, thread a piece of string or yarn through the portion cup and then through the corresponding hole on the lid.
4. As indicated in the diagram below, secure the string by making a knot on either side of the portion cup.
5. Repeat on the opposite side of the portion cup and the lid.
6. Make one ecosystem container for each child.



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Data Collection Sheet

Name: _____

Date: _____

WONDER How do living things depend on their environment?

RECORD Write or draw all the interesting things that you observed about your ecosystem.

DATA TABLE

Living	Non-Living

CONCLUDE What did you discover about your ecosystem?

Observation	Time	Date

Observation	Time	Date

Live with your organisms and learn from them and about them.

Be curious about what is changing in your ecosystem.



Observe your ecosystem. Take time at least once a day to observe your ecosystem. What do you notice? Record the date, time and your observations.



Investigate things you are curious about.

Understand how living and nonliving things depend on each other.



ECOSYSTEM OBSERVATION JOURNAL

Date	Time	Observation

Set Up the Expedition

Materials

For each group:

- *Ecosystem On a String* Learning Cards
- (1) small tray
- (1) small bowl of water
- (1) bowl of decomposing leaves
- (1) small bowl of soil

For each child:

- (1) *Ecosystem On a String* Data Collection Sheet
- (1) live pill bug
- (1) small fern or moss clump
- (1) magnifier
- (1) pair of tweezers
- (1) brown paper bag
- (1) 2 cm section of straw
- (1) ice cream sampling spoon
- (1) portion cup and lid with string attached

Prepare the demonstration:

1. Order materials that are not available in your area (see the Resources page).
2. Find an area where children can collect decomposing leaves and pill bugs.

Prepare the exploration:

1. Separate the clump of ferns or mosses so that they can be easily picked up with tweezers. Each student will need one small clump.
2. Make a cup for each child by following the directions in this lesson.
3. Place the materials each group will need at the science center.

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Activity Leader's Guide

Group Size: 4 children

Time: 45 minutes

Engage

- 1 Gather the children together.

Say:

“How can we tell the difference between living and non-living things?” Allow children time to contribute their answers.

- 2 **Say:**

“Today you are going to build a small ecosystem in a cup. Ecosystems include living things such as animals and plants, and non-living things such as water, air, and soil. An ecosystem can be very large or very small.”

Say:

“We are going to collect soil, decomposing leaves, ferns or mosses, and a pill bug to make an ecosystem.”

Arrange for the children to go outside with collecting bags (brown paper bags). Divide children into four collecting groups: brown rotting leaf collectors, fern or moss collectors, pill bug collectors, and soil collectors. Children can use their brown paper bags to store what they collect. See the Guide to Becoming a Pill Bug Expert for collecting tips and precautions. Return to the science or activity area once enough supplies have been collected for each child.



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Activity Leader's Guide

Explore

- 3 Distribute the Data Collection Sheets and the Learning Cards.

Say:

“Follow the directions on the Learning Card to build your own ecosystem on a string.”

- 4 The children will need you to demonstrate how to use the straw to add water to the ecosystem: Dip the straw into water and cover the top of the straw with your thumb. Lift the covered straw over the ecosystem and remove your thumb from the top of the straw.

- 5 Allow children enough time to complete the WONDER, EXPLORE, RECORD and CONCLUDE sections of their Learning Card.

Conclude

- 6 Gather the children together and ask the following questions:

“What did you notice while observing your ecosystem today?” Answers may vary. Children may notice the activities of the pill bug or they may notice that the sides of the container became “foggy.” No matter what they notice, ask the children to think about how they can discover more about what they saw. Observations are an important data collection tool.

“Which things are alive inside your ecosystem and which things are not alive?” Children should be able to easily identify things that move as being alive, but they often forget to note that the plant is alive. Although soil and water are important parts of this ecosystem, they are not alive.

“After you wore the ecosystem for a few minutes, did you notice any water collect inside the cup? Where?” Some of the water will pool at the bottom of the cup, some may evaporate and then condense in the inner walls of the cup, making it look foggy.

Expand

- 7 Ask the children to follow the EXPAND instructions on their Learning Card. Distribute the *Ecosystem Observation Journal*.

Say:

“Use your Ecosystem Observation Journal to record what you observe in your ecosystem.” Children will make observations during several days or weeks. They will observe all aspects of the ecosystem and keep a written record in their journal. Younger children who can not write may verbally report back each day what they observe.

- 8 **Say:**
“Congratulations! You have earned your ‘Ask Me About Food Chains’ stamp. You are ready to tell people about food chains.”

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Expedition Learning Card

? What is an ecosystem?

 ecosystem
living
non-living

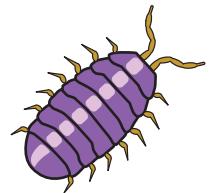
 Use an ecosystem to explore how living and non-living things depend on each other.

1 WONDER How do living things depend on their environment?

 Write or draw your ideas on your Data Collection Sheet.

2 EXPLORE Use a small spoon to place five scoops of soil in the bottom of a portion cup.

- Add one small clump of fern or moss using tweezers.
- Insert one pill bug, using your hands or one of the small spoons. Pill bugs do not bite, so feel free to observe your pill bug using a magnifier before you place it in your cup.
- Add pieces of decomposing leaves (enough to cover the soil in the cup).
- Add three straw-fuls of water. Ask your activity leader to show you how.
- Place the lid on the portion cup. Wear your ecosystem like a necklace around your neck.



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Expedition Learning Card

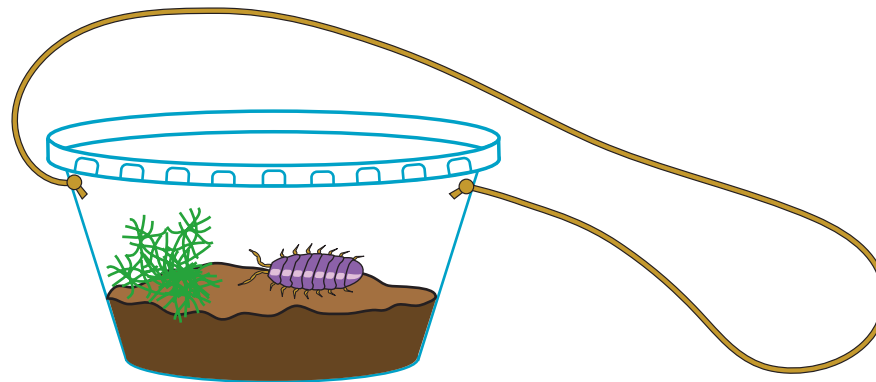
3 RECORD Notice everything you can about the ecosystem.

 Write or draw on your Data Table all the interesting things you observe.

4 CONCLUDE What did you notice about your ecosystem? Which are the living and which are the non-living parts?

 Record what you discovered on your Data Collection Sheet.

5 EXPAND Continue to observe your ecosystem for several days or weeks. Investigate things you are curious about. Use your Ecosystem Journal to keep track of what you observe.



Discovery

Why did we do that?

- Ecosystems are made up of living and non-living things.
- Living things need food, water and air.

Congratulations!

You have earned your "Ask Me About Food Chains" stamp! Now you are ready to tell people about food chains.

