CHAPTER 6: ARTHROPODS IN THEIR MICROHABITATS

"No matter who you are or what level you are working on, before you go out to do collecting, you have to have a plan. You need to think about what the purpose of your study is, what exactly you want to accomplish, what the questions are that you want to answer." —LIZ JOHNSON

(*Responsible Collecting*, p. 185)

TARGET QUESTIONS: **What microhabitats exist at our site? Do different arthropods occur in different microhabitats?**

PREREQUISITES: Team Plot Selection
Core Activities in Chapter 5

CORE ACTIVITIES:

LESSON 1

Planning to Study Arthropods in Their Microhabitats

LESSON 2

Observing Arthropods in Their Microhabitats

LESSON 3

Analyzing Data

LESSON 4

Displaying Data Graphically

ASSESSMENTS:

Overview

WEB COMPONENTS:

FOR STUDENTS

- Key to Arthropod Orders
- Other Methods to Capture Arthropods
- How to Set up a Berlese Funnel
- How to Make a Yellow Pan Trap
- How to Set up a Pitfall Trap
- How to Make Your Own Net

OVERVIEW OF CHAPTER 6

Using prior knowledge, students review basic ecological concepts and discuss habitat requirements of arthropods. Then they list the microhabitats they have observed at their site and predict the kinds of arthropods they might find in each location.

In preparation for their fieldwork, students make a plan for observing and recording the arthropods they find in the various microhabitats they listed. They discuss the kinds of data they might collect and the tools they will need. Then they implement their plan in the field.

Afterward, students analyze their data. They discuss questions relating to the kinds and numbers of arthropods they found in each microhabitat and compare the data for all habitats. From their data, they attempt to draw conclusions and discuss the implications of habitat loss.

After discussing and analyzing the data, students create graphic displays to illustrate their findings. As teams present their work, the class is encouraged to critique it and to compare it with their own.

TEACHING TIP: ANALYZING DATA

Histograms, line graphs, and pie charts can be used to view data collected at the plot level, site level, or biome level. Line graphs and histograms can be used to compare:

x axis	y axis
temperature precipitation time soil type (only at site level and biome level) microhabitat (only at site level) site elevation (only at biome level)	plants by genus arthropods by order

Pie charts can be used to show abundance of organisms over a given span of time.

BACKGROUND INFORMATION FOR THE TEACHER

A habitat is defined as the natural home of a plant or animal, the place in which it lives and finds the resources it needs to survive. Smaller habitats may exist within larger ones. For example, in the coniferous forest there might be a small pond; at the edge of the pond, a fallen tree. Each habitat—forest, pond, dead tree—is home to a distinct community of plants and animals, and all are linked by complex bonds of interdependence.

Ecology is the study of the interrelationships among plants and animals and their environment (both living and nonliving components). In order to study an environment systematically, ecologists divide the living world into units focused on a particular set of plants and animals in a given habitat—they call these sets ecosystems. These communities of plants and animals may be very large and their relationships very complex. Since the boundaries of an ecosystem are defined by humans, they are considered arbitrary, and some prefer to think of the entire globe as one huge ecosystem.

Ecologists work to analyze an ecosystem in depth. They look at the effects that each organism has on the system as a whole as well as the effects the whole system has on the individual organisms of which it is composed.

MICROHABITATS

An ecologist may also investigate a very small part of a habitat, or a microhabitat, in great detail. Within the larger habitat of a forest, for instance, a great number of microhabitats might exist—under rocks, in rotting logs, in leaf litter, or in puddles. Although small in area, microhabitats are complex and challenging to study.

Environmental conditions such as food availability, temperature, moisture, and light intensity may vary widely from one microhabitat to another. An organism's response to environmental conditions determines its ability to use a particular microhabitat. Arthropods are especially adept at taking advantage of these very local changes in abiotic factors. Because of their small size and specific habit requirements, they are able to carve up a habitat into very fine divisions.

MICROHABITATS IN A TEMPERATE FOREST

In a typical temperate forest, the range of potential microhabitats extends from beneath the soil to the tops of trees. Within the soil layer exist several distinct microhabitats, depending on depth. The upper soil layer is usually drier and contains more organic material. Here you would expect to find soil mites and springtails, as well as some non-arthropods such as earthworms and nematode worms.

The litter layer interfaces with the soil, so there is some overlap in organisms found there. In a forest, this microhabitat contains the greatest amount of biodiversity. The litter layer is moist, dark, and rich in food in the form of

fallen leaves. Expect to find springtails in huge numbers, many different types of mites, millipedes, sowbugs, ants, beetles, true bugs, and daddy longlegs, as well as a wide range of predators including spiders, centipedes, and pseudoscorpions.

Above the litter layer, all sorts of ground cover provides microhabitat: stones, moss, grass roots, fallen logs, bark, acorns, or even trash. Here you might find ground beetles, termites (in wood), ants, centipedes, sowbugs (in moist locations), cockroaches, crickets, grasshoppers, and spiders.

In the vegetation layer, you will find arthropods exploiting microhabitats in and on stems, leaves, flowers, fruits, and bark. Bees, wasps, and butterflies feed directly on flowers. Well-camouflaged crab spiders, preying mantids, robber flies, and ambush bugs sit on the plant to await prey. Leaf miners and gall insects burrow into the leaf or stem. True bugs, aphids, and hoppers suck fluids from the plant's vascular tissue.

Trees are rich in microhabitats. Moss on the trunk is often home to springtails and mites. Spiders, millipedes, and scorpions inhabit the bark surface. Under the bark layer of a dead tree you may see engraver beetles, carpenter ants, or termites at work.

Water of any type also creates microhabitats for arthropods. Depending on the water's depth, movement, and size, you may be able to find larval stages of insects such as caddisflies and dragonflies, or water-dwelling arthropods such as water boatmen and back swimmers. Even a tree hollow that collects water or a small puddle can contain some very interesting fauna.

1 LESSON

LESSON 1

PLANNING TO STUDY ARTHROPODS IN THEIR MICROHABITATS

TIME 1 class session

MATERIALS

- ❑ Journals
- ❑ Chart paper and markers

WEB COMPONENTS

Other Methods to Capture Arthropods

How to Set up a Berlese Funnel

How to Make a Yellow Pan Trap

How to Set up a Pitfall Trap

How to Make Your Own Net

1. Review students' prior knowledge of some basic concepts of ecology. Focus the discussion on some of these questions:

- What is a biome? (Refer to Chapter 2 in which students determined their biome.) What are the characteristics of our biome? How far does it extend?
- What is an ecosystem? Give an example. How does it relate to a biome? What do ecologists study?
- What is a habitat?
- Encourage your students to brainstorm on the different microhabitats that they have observed in their plots. Ask them to consult their field journals for specific examples. Record the list of examples. It may include some of the following:

Microhabitats

soil
leaf litter
grassroot layer
herbaceous plants
woody plants
rotting log
bark
under rocks
acorns and acorn caps
in and under trash lying on the ground
in the water

Questions	*Possible Responses*
What is a biome?	A biome is a land surface of Earth. Biomes are classified into broad vegetation types. Major biomes include tundra, coniferous forest, deciduous forest, tropical forest, temperate grassland, savannah, and desert.
What is an ecosystem?	An ecosystem is a unit in the living world focused on a particular set of plants and animals in a given habitat.
What is a habitat?	A habitat is the natural home of a plant or animal, in which it lives and finds the resources needed to survive. Students might also explore the idea that smaller habitats may be found within larger ones.

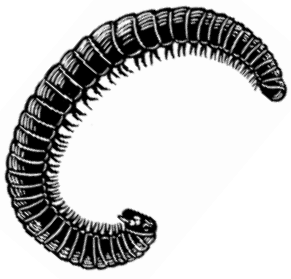
2. Next to each microhabitat that students list, ask them to predict what kinds of arthropods they might find there. They can make some of their predictions by reviewing previous field study arthropod sightings.

Record students' predictions. Have them explain and give reasons for their predictions based on their previous investigations.

3. Discuss the trapping and collecting techniques that would be most productive for each microhabitat. In the previous chapter, students may have had experience with some of these techniques, such as the Berlese funnel and the pitfall trap (for arthropods that live in soil, leaf litter, and rotting wood), the yellow pan trap (for some types of flies, wasps, and beetles), beating (for arthropods that live in trees and bushes), and netting (for flying or hopping arthropods).

Have students review the on-line resources listed above that refer to capturing arthropods, if necessary.

4. Then, based on their predictions of what they expect to find in their microhabitats and on their discussion and research about trapping and collecting techniques, have students develop a plan for their field study. Encourage them to make decisions about which microhabitats at the site they will study in detail and to get or invent the appropriate trapping and collecting equipment.



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LESSON

LESSON 2

OBSERVING ARTHROPODS IN THEIR MICROHABITATS

TIME 1 or more field trips

MATERIALS

- ❑ Journals
- ❑ Hand lenses
- ❑ Collecting equipment (nets, traps, containers)
- ❑ Field guides and keys

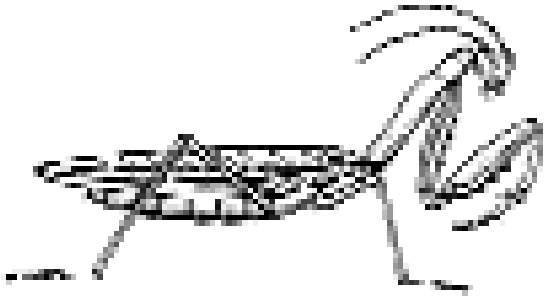
1. ***During the field study, students will record every arthropod they find in the microhabitat they have chosen to study. Students are to record both the kinds and the numbers of each kind of arthropod they find.***

   Because they may not be able to identify all of the arthropods they find, they may also need to collect specimens to bring back for further work in identification.

2. ***As they work, circulate among the groups and ask some of these questions:***

Tasks	*Focus Questions*
To select a microhabitat for study	Which microhabitat are you observing? What do you expect to find?
To make use of appropriate collecting tools and techniques	How will you collect arthropods in this microhabitat? Why have you chosen that method?
To analyze the microhabitat in detail	What environmental factors are you recording? How might they influence what you find?
To record observations	How are you recording? Have you included drawings, written descriptions, and measurements?
To identify arthropods found in the microhabitat	Have you been able to identify the arthropods you found? Are you collecting specimens to take back for further identification?

3. ***At the end of the field study, remind students to make a last-minute check of the site and to leave it in good order. Have them make sure that they have collected all of their equipment to bring back to the classroom.***



3 LESSON

LESSON 3 **ANALYZING DATA**

TIME 1 or 2 class sessions

MATERIALS

- ❑ Student-generated chart of microhabitats and predictions from Lesson 1
- ❑ Journals
- ❑ Chart paper and markers
- ❑ Reference materials
- ❑ Hand lenses
- ❑ Microscopes
- ❑ Supplies for preserving arthropods
- ❑ Living accommodations for captive arthropods (optional)

WEB COMPONENT

Key to Arthropod Orders

1. Give students time to take care of the specimens they have brought back. After the discussion, they may want to add them to the preserved collection or keep them in the live collection.

2. Allow ample time for students to identify the arthropods they found in the microhabitats they studied. Identification may take several sessions. As before, students will need to use hand lenses, microscopes, and reference materials, and would benefit from contact with local and on-line experts.

3. Ask students to organize their data in preparation for a class discussion on their findings.

4. Display the student-generated chart (from Lesson 1) listing microhabitats and predictions about the arthropods students expected to find in each one. Work through the list and have student teams report their data on each microhabitat and compare them with their predictions. Record their data on a large sheet of chart paper. Cover some of these questions:

- What arthropods did you find living at the grassroots level (for example)?
- How many different kinds?
- How many of each kind?

Continue to work through the list until students have reported their data for all the microhabitats they observed.

5. Then compare the compiled data. Ask:

- Which microhabitat(s) contained the most/the fewest arthropods? What can you conclude from that data?
- Which microhabitat(s) displayed the most/the least biodiversity? What conclusions can you draw from that data? Is your sample big enough to compare with other classes?
- If several teams studied similar microhabitats, how do they compare in numbers and in kinds of arthropods present?
- How many arthropods appear in more than one microhabitat?
- How many seem to be restricted to just one microhabitat?

6. Ask students to summarize the conclusions they drew from their data. Have them think about what would happen if their microhabitat were damaged or destroyed. Which organisms would probably survive, and which would perish? Why?

4 LESSON

LESSON 4

DISPLAYING DATA GRAPHICALLY

TIME 1 or 2 class sessions

MATERIALS

- ❑ Graph paper
- ❑ Student-generated charts from Lesson 3

1. ***Focus attention on the compiled data recorded on the charts generated in Lesson 3. Ask students to suggest several different ways that they could organize the data graphically. They may suggest pie charts, bar graphs, line graphs, histograms, and spread sheets.***

2. ***Ask students to suggest several important findings that their graphic displays could illustrate. They may suggest (but need not be restricted to) some of the following:***

- The total number of arthropods present in each of the microhabitats. Displayed in a bar graph, each bar would represent a different microhabitat.
- The diversity of arthropods in each microhabitat. In this case, a pie chart could show how many different groups of arthropods were found in a single microhabitat. Students would have to create a different chart for each microhabitat.
- The frequency with which a particular species of arthropod appeared in each of the microhabitats. Histograms might best display this type of data.

3. ***Discuss which graphic displays (graphs, pie charts, or histograms) each team will develop and then give students time to create their graphs and charts.***

4. ***When the data displays are completed, invite each team to present its work. Encourage students to ask questions of the presenters, compare their data, and critique the clarity and accuracy of the displays.***

5. ***Hang the work on a bulletin board for the class to study further. Save the products for the final public presentations at the conclusion of the unit.***

ASSESSMENT: OVERVIEW

Return to the discussion about why certain groups of arthropods occur only in certain microhabitats, and why others are more widely distributed. Discuss the reasons for habitat specificity. This is a difficult topic, and students may find it challenging to give reasons. Encourage them to do more research into the subject.

Discuss the implications of habitat loss. How might the loss of a microhabitat affect the larger macrohabitat in which it exists?

Review the explanation of biodiversity that students wrote at the conclusion of Chapter 5. Ask them to expand on the explanation to include concepts relating to arthropod ecology. Record their expanded explanation on the chart or concept web.