An Arthropod Adventure

Teacher Instructions

Grade Level
Upper elementary

Subject Areas
Science

Duration:
Two class periods

Setting: Outside

Vocabulary:
Arthropod
Biodiversity
Class Arachnida
Class Chilopoda
Class Diplopoda
Class Insecta
Crustacean
Entomologist
Exoskeleton
Habitat
Invertebrate
Leaf beating
Litter sorting
Metamorphosis
Molting
Terrestrial

Overview:
This lesson introduces students to terrestrial arthropods in Louisiana wetland ecosystems by using observation techniques to discover and categorize arthropods found on your school's campus.

Learning Objectives:
The students will:

- Explore terrestrial ecosystems to determine types and quantities of arthropods that live there.
- Use terrestrial observation methods of collection (leaf beating and leaf litter sorting).
- Work in groups to study a microhabitat on the school's campus.

Materials List:

- Arthropod Field ID Guide
- Clipboards **(teacher provides – 3 per group)**
- Cups **(teacher provides)**
- Paint stir sticks **(teacher provides)**
- Pencils
- Rulers
- White fabric **(a 2-foot-by-2 foot piece for each group – teacher provides)**

Grade Level Expectations:
Science
Third Grade

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
6. Use the five senses to describe observations (SI-E-A3)
8. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
12. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)
35. Compare structures (parts of the body) in a variety of animals (e.g., fish, mammals, reptiles, amphibians, birds, insects) (LS-E-A3)
38. Classify groups of organisms based on common characteristics (LS-E-A4)

39. Compare organisms from different groups (e.g., birds with mammals, terrestrial plants with aquatic plants) (LS-E-A4)

Fourth Grade

1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms) (SI-E-A1)
7. Use the five senses to describe observations (SI-E-A3)
9. Select and use developmentally appropriate equipment and tools (e.g., magnifying lenses, microscopes, graduated cylinders) and units of measurement to observe and collect data (SI-E-A4)
12. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
13. Identify and use appropriate safety procedures and equipment when conducting investigations (e.g., gloves, goggles, hair ties) (SI-E-A7)
41. Describe how parts of animals' bodies are related to their functions and survival (e.g., wings/flying, webbed feet/swimming) (LS-E-A3)
53. Identify the habitat in which selected organisms would most likely live and explain how specific structures help organisms to survive (LS-E-C2)

Fifth Grade

6. Select and use appropriate equipment, technology, tools and metric system units of measurement to make observations (SI-M-A3)
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
23. Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)
24. Provide appropriate care and use safe practices and ethical treatment when animals are involved in scientific field and laboratory research (SI-M-A8)
34. Recognize the importance of communication among scientists about investigations in progress and the work of others (SI-M-B5)
26. Identify and describe ecosystems of local importance (LS-M-C3)
27. Compare common traits of organisms within major ecosystems (LS-M-C3)
48. Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population (SE-M-A2)

Common Core State Standards:

Third Grade

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well and some cannot survive at all. [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitats make up systems in which the parts depend on each other.]

Fourth Grade

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

Vocabulary Definitions:

Arthropod – A group of animals that have segmented bodies, exoskeletons, jointed legs and bilateral symmetry; includes insects, spiders, mites, crawfish, crabs, centipedes, millipedes and more.

Biodiversity – All the kinds of living organisms within a given area of habitat.

Class Arachnida – A group of arthropods that have eight legs, two body segments, no antennae and no wings; includes spiders, mites, ticks, scorpions and harvestmen.

Class Chilopoda – A group of arthropods commonly known as centipedes; characterized by large antennae, one pair of legs per body segment, typically flattened body, quickness and being carnivores.

Class Diplopoda – A group of arthropods commonly known as millipedes; characterized by having two pairs of legs on each body segment (except the first three segments, which have one pair of legs). Body is more rounded than centipede and millipedes mostly feed on dead plant matter.

Class Insecta – A very large group of arthropods that are characterized by a three-segment body, three pairs of legs (six legs total) and a pair of antennae.

Crustacean – A group of arthropods that are mostly aquatic; include shrimp, crawfish, lobsters and crabs.

Entomologist – A scientist who studies insects.

Exoskeleton – A hard outer shell that protects an invertebrate's body.

Habitat – Home environment; the natural conditions and environment in which a plant or animal lives (e.g., forest, desert or wetlands).

Invertebrate – Animal that lacks a backbone (bones).

Leaf Beating – a sampling technique to study arthropods that live on or frequent shrub branches

Litter Sorting – A sampling technique to study arthropods that live on or frequent the ground.

Metamorphosis – A change in form from one life stage to the next.

Molting – The shedding of the exoskeleton of arthropods during life stage changes or seasons.

Terrestrial – Of or relating to the Earth.

Background Information:

The term "insects" has loosely been used to describe all of the small creeping, crawling, flying and swimming critters that don't have bones. People, however, have incorrectly grouped spiders, scorpions, ticks, centipedes and "roly-poly" bugs into the insect category. All of these critters do belong to the same phylum as insects, phylum **Arthropoda**, but they are not insects. All of these critters belong to the animal kingdom and more specifically phylum Arthropoda, named from the Greek *arthros* (= jointed) and *poda* (= foot). In addition to **insects** and **arachnids**, **crustaceans** also fall under this phylum (e.g., crabs, shrimp, lobsters and crawfish). We won't be discussing crustaceans in this lesson, so, for the sake of saving time, the remaining information is centered on insects and arachnids.

Of the estimated 1.3 million species of animals that have been identified on Earth, organisms of the phylum Arthropoda make up over 80 percent of those – or around 1.2 million! Beetles alone account for about 400,000 species. Arthropods are considered the most successful of all animals to ever inhabit the Earth because of their abilities to adapt and change. They currently inhabit all areas of the Earth, including land, air, freshwater and the seas. Many even live on and inside of animals and plants, including humans! Species in this phylum have been responsible for some of the most devastating plaques and famines in history. On the other hand, many species of arthropods directly or indirectly are responsible for food, clothing, medicines and protection from other harmful organisms.

Arthropods are characterized scientifically as having jointed legs, a segmented body and an **exoskeleton**. The existence of an exoskeleton indicates these animals do not possess bones and are thus **invertebrates**. To grow, arthropods must shed their exoskeleton through a process called **molting**. Arthropods molt several times during their lifetime to grow, and some change life forms between molts through a process called **metamorphosis**, such as is seen with a dragonfly or a butterfly. Similarly, many insects begin their life as aquatic animals, living in the water, and move to life on land after molting and changing body forms.

Today's lesson focuses on several classes of arthropods that live on land, termed **terrestrial** arthropods. Class Insecta, one of the study groups for this lesson, is characterized by having six legs, a three-segmented body and antennae. Insects include flies, true bugs, grasshoppers, beetles, roaches, butterflies, dragonflies, damselflies, bees and more. Species within class Arachnida include spiders, mites, ticks, daddy long-legs, scorpions and more. Arachnids are characterized as having eight legs (versus six legs in the insects). Unlike species classified in class Insecta, arachnids do not have antennae, and their bodies are in two sections (rather than three). Finally, class Chilopoda (centipedes) and class Diplopoda (millipedes) will be studied during this lesson. All centipedes and millipedes are terrestrial. Centipedes have flat bodies (typically), antennae and one pair of legs on each segment. This means that for every segment along the body, one leg is coming out of each side. Millipedes differ from centipedes in two main ways: first, millipede bodies typically are cylindrical (rounded), and second, millipede bodies have two pairs of legs coming out of each segment. This means a total of four legs protrude from each segment. Other major differences between centipedes and millipedes include that centipedes move quickly while millipedes move slowly. Also, centipedes are predominately predators (carnivores), capturing and eating other arthropods and small animals, while millipedes are mostly herbivores, eating live and dead plants.

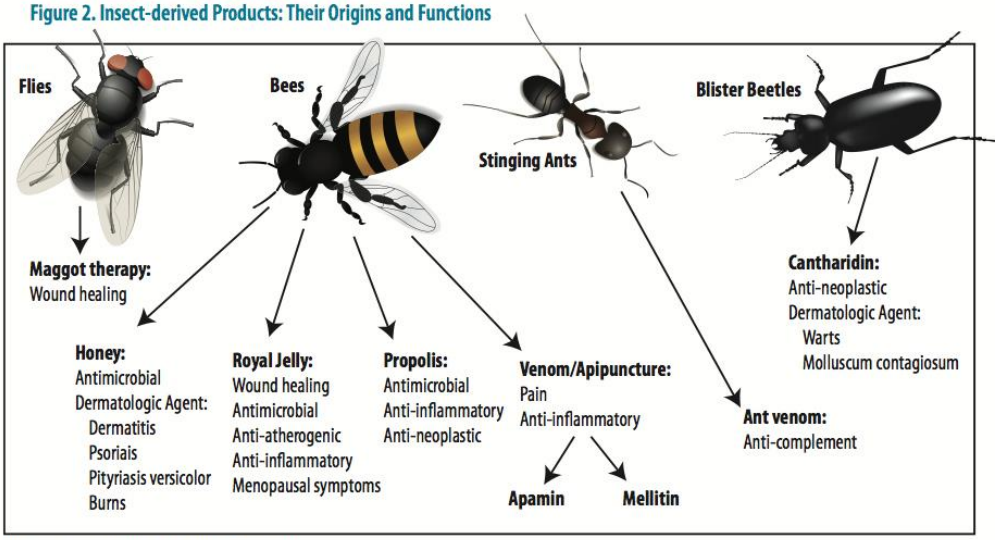
Importance of Arthropods

Scientific studies of arthropods can lead to greater understanding of environmental health by cataloging the types of arthropods that exist within healthy and unhealthy ecosystems. With regular observation and exploration, scientists are able to determine if the ecosystem is changing based on the species found and whether the ecosystem is healthy or not. Some scientists specialize in particular groups of arthropods, such as **entomologists**, who study insects. One specific field of entomology that greatly influences the lives of humans is forensic entomology. This field has become an extremely useful tool for solving crimes by determining time of death, as well as the locations of where the crimes took place and where the victims or suspects visited beforehand. Similarly, the entomological field of pest management is important to human lives and works to reduce the number of harmful arthropods that could potentially threaten human or crop health.

Arthropods are an important component of almost any food web, including wetland food webs. Louisiana wetland animals, such as frogs, turtles, lizards, alligators, fish, birds and mammals, prey on arthropods. Arthropods even prey on other species of arthropods. For example, dragonflies eat mosquitoes and help to keep mosquito numbers down. Similarly, spiders capture and consume many flying arthropods but also have been known to capture small mammals and birds in their webs. Without arthropods, many of the animals that live in our wetlands would not survive and, thus, higher order animals would follow suit. In time, life as we know it would end on Earth if arthropod species and populations were threatened.

Arthropods also play direct and indirect roles in our food, medicine and clothing. Arthropods are responsible for most of the pollination necessary for our food plants to survive and thrive, including vegetables, fruits and plants that are necessary for other animals to survive (e.g., oaks, magnolias, etc). Crustaceans also are a large part of some cultures' diets, including crawfish, crabs and shrimp in south Louisiana. In medicine, many arthropods, including flies, bees, ants and beetles, contain chemicals or characteristics that are used in traditional and nontraditional medicine around the world. For example, honey is used to treat wounds, burns and gastrointestinal disorders. Similarly, venom from ants and bees is used to combat inflammation, arthritis, muscular sclerosis and pain. (See Figure 1.)

Figure 2. Insect-derived Products: Their Origins and Functions



Adapted from a drawing by Maggie Cherniack

How to Study Arthropods

Scientists and amateur naturalists collect and study arthropods to determine the **biodiversity** of an ecosystem, as well as its health. Decreases in arthropod diversity and abundance often are the first signs that something is wrong with the ecosystem, such as pollution. Scientists study both aquatic and terrestrial arthropods to investigate system health, but in this study, we will focus on the terrestrial species.

Terrestrial arthropods are great to study in the classroom because they can be found anywhere and you don't need a lot of tools! Different techniques for finding and observing these arthropods can lead to a discovery of different ecosystems on your school's campus. Some arthropods live in shrubs or on trees while others live on the ground. Some even spend all of their lives underground. Thus, by using different techniques to explore these different micro**habitats**, students can observe differences in species.

In this study, we will focus on terrestrial arthropods in shrubs and on the ground. To explore arthropods that live on shrubs, students will use the **leaf beating** technique to shake loose the critters that are hiding on the leaves and branches. To do this, place a white piece of fabric (pillowcase, cut fabric, etc.) on the ground under some overhanging branches of a shrub. Use a stick, broom handle or something similar to beat the tops of the branches several times to release the arthropods and let them fall onto the fabric. Students can then use small cups or containers to gently collect the species for closer observation. Students can use observation to determine the number of body segments, number of legs and presence/absence of antennae. They also can compare these to the characteristics of the arthropod classes described earlier.

Another technique students can use to explore terrestrial arthropods is **litter sorting**. Litter sorting involves students finding areas of leaf and plant litter to uncover what arthropods are bustling around in there. Students should choose an area where they will explore (maybe a 10-by-10- foot area) and begin sifting through the leaf litter with their fingers and pencils. As they discover arthropods, they can temporarily capture them in cups to get a closer look. Again, using the distinguishing characteristics, students can determine which class an arthropod belongs to.

Other techniques of arthropod exploration include log busting, aerial nets, sweep nets and aquatic sampling. This study will not focus on those techniques, but with research, any classroom would be able to use those with additional materials.

Advance Preparation:

1. **Day 1:**
    a. Download pictures of the following arthropods to display to the class: mosquito, snail, inchworm, grasshopper, beetle, spider, pill bug and centipede.
    b. Choose several shrubs on the school grounds that students will use to perform the leaf beating technique. Palmetto leaves work great, but other chest- and waist-high shrubs work great, too. Mark them, if desired.
    c. Make copies of the *Arthropod Tally Chart* for students (one per group of five). (See the blackline masters.)
    d. Gather the following materials for each group of five students: one clipboard, magnifying lenses (several per group), two rulers, one piece of white fabric and one broom handle or sturdy stick.
2. **Day 2:**
    a. Make copies of the *Techniques and Jobs* sheet (one per group) and the *Habitat Observation Log*. (See the blackline masters.)

b. Reorganize study materials from Day 1 for distribution to groups.

Safety:

- Stay away from ant hills when conducting all outdoor investigations.
- Discuss what to do and what not to do during observation and collection.
- Talk about observing animals with your eyes only. You don't know if it has a dangerous defense mechanism that could harm you!
- Explain it is important to return the section of land to its original state (or as close as possible) when finished investigating.
- Stay with group members during group investigation.
- Stay within teacher-set boundaries of habitat selected on school grounds.

Procedure:

Guiding Questions

- What terrestrial arthropods are prevalent in our school-grounds habitat?
- How do various habitats differ with respect to types of arthropods found?
- What do arthropod species say about an ecosystem?

Day 1: Leaf Beating

1. Read the background information and vocabulary to become familiar with arthropods and the methods of exploration.
2. Inside the classroom, show the pictures of arthropods to the students – one at a time – and ask the students to raise their hands and identify what each thing is (e.g., mosquito, snail, inchworm, grasshopper, beetle, spider, pill bug and centipede).
    a. Don't accept "bug" as a correct answer. Have the student tell you what type of "bug" it is.
    b. Ask the student how to correctly identify an organism (e.g., number of legs, colors, shapes, insect parts, etc.). Call on two more students for the other two cards, repeating the questioning above.
3. Ask the class, "What do these organisms have in common?"
    a. Call on students to gather their thoughts. (*Answer: All have legs, no bones and a segmented body*. O*ther answers about where they live and how they act also can be accepted.*)
    b. Tell the students these organisms are invertebrates (invertebrate – lacks a backbone). Note: They are not all insects. The spider is of the arachnid class, not the insect class.
    c. Not all invertebrates have exoskeletons, however. Ask students if they think they can name one? (*Answers: Worm, snail or slug*)
4. Tell the students that even more importantly, these animals are all arthropods. This means they have jointed legs, a segmented body and an exoskeleton.
    a. Use the background information to teach the students about arthropods and interesting topics about arthropods.
5. Tell the class: "Today, we will be acting like scientists by observing our school-grounds habitat. We will then investigate some common groups of terrestrial arthropods that live on shrubs. This is a way for scientists to collect and identify species found in an ecosystem. We will be using the leaf beating technique of finding arthropods in today's study."
    a. Define terrestrial for students – growing on land (versus water). Thus, terrestrial invertebrates are animals that lack backbones and inhabit land.

6. Break students into groups of five students per group.
7. Pass out the *Techniques and Jobs* sheet. Allow time for students to choose roles and read over the sheet.
8. Ask the students to tell you who has the role of the reporter since this is the only person who can approach you with questions during the two-day study.
9. Inform them that they will not be using the litter sorting technique until tomorrow.
10. Pass out one *Arthropod Tally Chart* to each group and explain they will use it to record and categorize the animals they find today and tomorrow.
    a. The data dude(tte) will keep up with the information gathered and record it on this chart.
    b. Ask students to look at the how each arthropod grouping on the chart is categorized (class, order, common name).
    c. What do they notice? Which ones do they recognize? Are there any new creatures they are not familiar with?
11. Explain how to fill in the *Arthropod Tally Chart* by reading the directions and giving examples.
12. Pass out one *Habitat Observation Log* to each group and allow all students in the group to look the sheet over.
    a. The habitat logger will keep track of this log for both days once the groups are outside.
13. Pass out the remaining materials for today's study:
    a. For each group, they will need three clipboards (cardboard pieces); pencils; *Techniques and Jobs; Habitat Observation Logs* (one per student); *Arthropod Tally Chart*; white fabric; paint stir sticks; and cups.
    b. The head honcho, data dude(tte) and habitat logger in each group all need a clipboard. Head honcho should keep track of the *Techniques and Jobs* sheet; the data dude(tte) has the *Arthropod Tally Chart*; and the habitat logger has the *Habitat Observation Log.*
    c. The materials manager will keep track of the materials.
14. Take the whole class outside to observe a predetermined shrub and the surrounding area. Palmettos work well for this activity, if available.
15. Sit the class down as you stand near the shrub, so they can get a good view of the process.
16. Explain that when scientists explore habitats they like to keep a log of animal and plant species they find, as well as other things in the area.
    a. Ask students to think about why this occurs? How does it help scientists? *(Answer: Scientists study organisms to make sure the ecosystem is balanced and healthy. In most ecosystems, scientists know what species belong there. If they find a species that doesn't belong, or find that an important species if missing, they would try to find out why.)*
17. The first step scientists take is to just observe their surroundings. *Open your eyes, ears and nose to take in your surroundings. Talk with your group members about what you see, feel and hear. Do not record anything at this time.*
18. Give students two to three minutes for this. It is important to understand where the arthropods live. Why do you think this is important? *All scientists need to understand where arthropods live to determine how they survive there and if they are healthy.*
19. Now, demonstrate the leaf beating technique to the class:
    a. Find a branching shrub.

b. Put a white piece of fabric on the ground under overhanging branches.
c. Use a paint stir stick to beat the leaves about four times from the top of the branch(es), dropping the arthropods onto the white fabric.

20. Return the living organisms back to the habitat by shaking the white fabric onto the ground nearby or underneath the shrub. Don't allow any students to hurt or disrupt the arthropods.
21. Each group should now choose a shrub and talk as a group as they fill out the *Habitat Observation Log* for their chosen site. *Talk with your group and log a list of observations and make a quick sketch of the area where your shrub is located (Habitat Logger records this).*
22. Students should then perform the leaf beating technique on their own study shrub and record their data on the *Arthropod Tally Chart*.
    a. Use the arthropod chart to help students determine the common name groupings of the arthropods. Ask questions like how many legs do you notice? Color? Body shape?
    b. Have students use the magnifying lenses to get a better view and rulers to measure the creatures.
    c. All the different species don't have to be correctly identified.
23. Clean up area, gather all materials and return to the classroom.

Day 2: Continuation of Leaf Beating and Litter Sorting

24. In the classroom, review what students did during the previous day's lesson. Also, review the vocabulary used – invertebrate, classify, exoskeleton, habitat, terrestrial, etc.
25. Explain that in small groups, students will explore a different habitat type using a new exploration technique known as litter sorting.
    a. Explain the litter sorting technique. Find an area with some leaf and plant litter on the ground (dead leaves and sticks). Using your fingers, move the litter around carefully to uncover any arthropods that are dwelling there. Use the magnifying glasses to get a closer look.
26. Note: Students can bring their materials to perform the leaf beating technique again today if you wish.
27. Distribute the tools they will need today: clipboards (three), pencils, magnifying glasses, *Arthropod Tally Chart, Habitat Observation Log* and *Techniques and Jobs* sheet.
28. Tell the students how scientists go into habitats and respect their observation areas – trying to leave no trace that they were there. A good rule for the students would be to explore gently. For example, they may lift up a rock, but they will need to replace it where they found. It. Do not take any species from the study site, and be sure to leave the site as you found it!
29. Lead the students outside to the study area again.
30. Dismiss the students to locate a plot where leaf litter exists.
31. Give the students about three minutes to have silent observation of their sites and to fill out their *Habitat Observation Logs* for Day 2.
32. Allow students 20-30 minutes to explore the leaf litter.
33. Make certain that the data dude(tte) for each team is recording its findings on the *Arthropod Tally Chart*.
34. Clean up area, gather all materials and return to the classroom.
35. As a close to the group investigation, allow the students to record their individual thoughts independently in their science notebooks. Here are the journal questions.
    - What are the similarities and differences between the two microhabitats you observed on Day 1 and Day 2 while exploring shrub branches and leaf litter?
    - Did you find different types of arthropods in the two habitat types?

- If so, why do you think this is so?
- Did you find different species within the same common name groupings?
- What can the study of terrestrial arthropods tell us?

36. Have groups share and explain the findings on their habitat logs and journals.

Extension Ideas 

- Project Noah: Education. Turn your students into citizen scientists! Project Noah was created to provide people of all ages with a simple, easy-to-use way to share their experiences with wildlife. By encouraging your students to share their observations and contribute to Project Noah missions, you not only help students to reconnect with nature, you provide them with real opportunities to make a difference. http://www.projectnoah.org/education
- Repeat this activity if your class participates in a field trip where students would have time to explore.
- Create a blog for your students to extend their thinking and share what they have discovered during this investigation. The blog can be accessed in school or at home. You could put the questions for the science notebook journals (Day 2) on a kid-safe blog. Allow students to blog about their findings. See the link for Edublog in the technology section of this lesson plan.
- You may want to have students use their video clips and photographs to create a narrated, simple movie. Here is a link to four simple steps for using Windows Movie Maker. http://windows.microsoft.com/en-US/windows-vista/Make-a-movie-in-four-simple-steps

Blackline Masters:

- Arthropod Tally Chart
- Habitat Observation Log
- Techniques and Jobs
- Homework Observation Assessment

Resources:

National Geographic: Bioblitz. Accessed Sept. 06, 2013, at http://education.nationalgeographic.com/education/program/bioblitz/?ar_a=1

"Lab 5 – Arthropods." Tulane University. Accessed Sept. 06, 2013, at http://www.tulane.edu/~bfleury/diversity/labguide/arthropod.html

Myers, P. 2001. "Arthropoda" (Online), Animal Diversity Web. Accessed Sept. 06, 2013, at http://animaldiversity.ummz.umich.edu/accounts/Arthropoda/

Klappenbach, L. "How Many Animal Species Inhabit Our Planet?" (Online). Accessed Sept. 06, 2013, at http://animals.about.com/od/zoologybasics/a/howmanyspecies.htm

BioKIDS. "Arachnids" (Online). Accessed Sept. 06, 2013, at http://www.biokids.umich.edu/critters/Arachnida/

Cherniak, E.P. “Bugs as Drugs, Part 1: Insects. The ‘New’ Alternative Medicine for the 21st Century?” (Online). Accessed Sept. 06, 2013, at http://altmedrev.com/publications/15/2/124.pdf

Name _____

Habitat Observation Log

DAY 1 – Shrub Habitat	**DAY 2 – Leaf Litter Habitat**
Location: (Be Specific) _____	Location: (Be Specific) _____
Weather Conditions:	Weather Conditions:
Describe Your Surroundings:	Describe Your Surroundings:
Other Observations: (Include what each living thing you find needs to survive. Did you find everything it needed (food, water, shelter and space) in your section of habitat? FOOD: _____ WATER: _____ SHELTER: _____ SPACE: _____	Other Observations: (Include what each living thing you find needs to survive. Did you find everything it needed (food, water, shelter and space) in your section of habitat? FOOD: _____ WATER: _____ SHELTER: _____ SPACE: _____

Name _____ Date_____

Arthropod Tally Chart

Directions: Make a tally mark for each species you find within the common groups below.

Phylum Arthropoda			**Number Found**	
Class	**Order**	**Common Name**	**Day 1**	**Day 2**
Insecta	Blattodea	Roaches		
Insecta	Blattodea	Termites		
Insecta	Coleoptera	Beetles		
Insecta	Dermaptera	Earwigs		
Insecta	Diptera	Flies		
Insecta	Hemiptera	Aphids		
Insecta	Hemiptera	Cicadas		
Insecta	Hemiptera	Plant Hoppers		
Insecta	Hemiptera	Stink Bugs		
Insecta	Hymenoptera	Ants		
Insecta	Hymenoptera	Bees		
Insecta	Hymenoptera	Wasps		
Insecta	Lepidoptera	Butterflies/Moths		
Insecta	Mantodea	Mantids		
Insecta	Neuroptera	Lacewings		
Insecta	Odonata	Dragonflies		
Insecta	Odonata	Damselflies		
Insecta	Orthoptera	Grasshoppers		
Insecta	Orthoptera	Crickets		
Arachnida	Trombidiformes+	Mites		
Arachnida	Ixodida	Ticks		
Arachnida	Araneae	Spiders		
Arachnida	Opiliones	Daddy long-legs		
Arachnida	Pseudoscorpiones	Pseudoscorpions		
Arachnida	Scorpiones	Scorpions		
Chilopoda	Lithobiomorpha+	Centipedes		
Diplopoda	Spriobolida+	Millipedes		
Malacostraca	Isopoda	Pill bugs (Roly Poly)		

+ indicates that more than one order exists for this group.

Distinguishing characteristics (how to tell them apart with sight).
Class Insecta - 3 body segments; 6 legs; 2 antennae.
Class Arachnida - 2 body segments; 8 legs; no antennae.
Class Chilopoda -many body segments; one pair of legs per segment; flat body; fast.
Class Diplopoda - many body segments; two pair of legs per segment; round body; slow.

Name _____ Date_____

An Arthropod Adventure

student activity sheet (continued)

Use the Arthropod Tally Chart to count numbers for day 1 and day 2.
Answer the following discussion questions in your science journal, based on your data and observations.

a. Did you find the same types of arthropods at both sites? Explain.

b. If you found different types of arthropods at each site, what are some physical characteristics that made them adapted to the site found? (For example, think about the color of the animal based on the color of the habitat or the presence/absence of wings and what this means).

c. What role do arthropods play in the food web? What do you think the arthropods eat? What do you think eats the arthropods in your ecosystem?

d. What would happen to the ecosystem if the arthropods disappeared?

e. What would happen to the arthropods if the ecosystem disappeared?

f. What can you do at home to help arthropods thrive in your backyard?

Name _____

Terrestrial Exploration Techniques

Leaf Litter Sorting

1. Locate a pile of dead leaves on the ground under a tree.
2. Use tweezers and magnifying lenses to sift through the leaves and pick out any invertebrates you find.
3. Collect these invertebrates in a cup.
4. Transfer the invertebrates onto a tray for closer inspection with rulers and magnifying lenses.
5. As a group, complete the invertebrate species charts and habitat observation logs.
6. On the ground under the tree and on top of the leaf litter, gently shake the tray with the invertebrates to return them to their habitat.

Leaf Beating

1. Find a branching shrub.
2. Put a white pillowcase or other white fabric under overhanging branches.
3. Use a stick or broom handle to beat the leaves on the shrub about four times from above.
4. Observe invertebrates that fall on the white fabric.
5. Use rulers and magnifying lenses to help you observe and identify the invertebrates.
6. As a group, complete invertebrate species charts and habitat observation logs.
7. On the ground under the bush, gently shake the cloth with the invertebrates to return them to their habitat.

Group Member Jobs

****Remember: Every member of the group takes part in the terrestrial observations and collections.****

Guide Guy/Girl
Keeps the group on task. He or she asks the team questions like: What do we see here – critters and plants? How can we classify the invertebrates? Do you think they are crawling or trying to hide? Why?
Name: _____

Data Dude(tte)
Is in charge of the group's logs and the invertebrate species charts. He or she records what the group observes, using words, numbers and pictures. He or she also is responsible for making sure everything is turned in to the teacher at the end of the lesson.
Name: _____

Materials Manager
In charge of all materials used during the study. He or she assigns collection/observation tools to group members, gathers the tools and returns them to the classroom.
Name: _____

Habitat Logger
Records the group's comments and observations of habitat from Day 1 and Day 2 on the habitat observation log.
Name: _____

Reporter
This is the only student allowed to approach the teacher and ask questions during the investigation. This student also shares what the group observed during discussion time. He or she is the voice of the group and a helping hand to other members in the group.
Name: _____

Name _____ Date_____

Homework Assessment

Directions:

1. *Choose a terrestrial area to observe around your home or another place where you are completing this assignment. Pick something that is outside, such as a tree trunk, grass, leaves, flower or soil in the garden. Look closely to spot arthropods. You may even want to lift large rocks. Just remember to "leave no trace" and put everything back where it was before you started! That rock is probably the shelter for more than one animal.*
2. *Use your experience with the litter sorting technique to explore.*
3. *Thoughtfully complete the following questions. You may use "jots" and short answers.*

I am observing _____ (type of site)

Hot or cold? _____ Wet or dry? _____

Hard or soft? _____ Sun or shade? _____

Smooth or rough? _____ Leafy or bare? _____

Describe and explain the arthropods you see. You may use their common names. How many did you find of each?

Do the animals' colors or shapes help in their environment? Explain how.

Think about what these organisms need (food, water, shelter and space). Explain how they survives in the place you are observing.

Create a question you could answer by conducting an experiment in your microhabitat section? Explain it. Would you observe another spot if you were given the chance to do the assignment again? Why?

Illustrate what you are observing. Please sketch and color your illustration. Use arrows and labels to diagram the parts of your illustration. Use the back of the sheet, if needed.