Elementary School Lesson Plan
Integrated Pest Management and Habitat

Overview:
- What is an insect? What groups do other “buggy” animals fall into?
- Who are our friendly arthropods?
- Where do arthropods live? What is their habitat?
- How can we change our habitat to entice friendly arthropods and discourage pest arthropods?
- Diorama a bug and its habitat.

Objectives:
- Students learn to identify common arthropods.
- Students learn where arthropods live.
- Students learn how to reduce pest habitat.
- Students learn about beneficial arthropods.
- Students learn how to apply knowledge to create an insect diorama.
- Students gain presentation skills by presenting their arthropod diorama to the class.

Game Plan:
The parts can be done all at once, or broken up over several days.
- Part 1 – What is an Insect?
- Part 2 – Who’s a friend and who’s a foe?
- Part 3 – Where do these arthropods live?
- Part 4 – Create a diorama of a bug and its associated habitat.
- Part 5 – Altering our Space

For an electronic copy of this document, please visit:
http://www.scibugs.com/#!lesson-plans/c1g8k
Part 1 – What is an insect?

Objectives:
- Students determine what insects, arachnids, and myriapods are.
- Students learn about taxonomic groupings.

Materials Needed:
- Arthropod cutouts. Available at the end of the document.
  (Extras available at http://www.scibugs.com/#/lesson-plans/c1g8k)

Plan:

Setup:
1. The instructor assembles the students into groups. The size of the group should be between two and four students.
   • Each group of students receives a pile of cutout arthropods.

Group Work:
2. The students, in their groups, organize the different arthropod together into three groups based on the characters they see fit.

Class Discussion:
3. After the students are given some time, the instructor brings the class back together for a class discussion.
   • **Taxonomy** (Grouping Organisms):
     ◦ The instructor should ask how different student groups organized their arthropods and what features the students used to generate those groups.
     ◦ The instructor should lead the group to discuss how the different animals are grouped taxonomically using the definitions in the vocabulary box.
   • **Perception:**
     ◦ Do students like these animals? Are their friends or families afraid of them? Were there bad experiences?

**Vocabulary:**

**Taxonomy**: is the science of classifying, grouping, and naming biological organisms.

**Insect**: A class of animals that includes arthropods with six legs and antennae.

**Arachnid**: A class of animals that includes arthropods with 8 legs and no antennae.

**Myriapod**: A subphylum of animals that have long bodies, many legs, and antennae.

This **wasp** is an **insect**. It has six legs and a pair of antennae.

This **spider** is an **arachnid**. It has eight legs and no antennae.

This **millipede** is a **myriapod**. It has many legs and a pair of antennae.
Arthropod Relatedness

Myriapods
- Centipedes
- Millipedes

Arachnids
- Spiders
- Mites/Ticks
- Scorpions

Insects
- Termites
- Cockroaches
- Grasshoppers/Crickets
- Mantises
- Mantis/Cicadas
- Aphids/Stinkbugs
- Bees/Wasps/Ants
- Butterflies/Moths
- Flies
- Beetles
- Lacewings
- Earwigs
- Dragonflies/Damselflies
- Silverfish

* Photo Credit: Bruce Marlin, Jud McCranie, Nancy Miorelli, Olei, Nancy Miorelli, Lildobe, Nancy Miorelli
Part 2 – Friend or Foe?

Objectives:
- Students can identify basic arthropod groups including insects, spiders, scorpions, centipedes, and millipedes.
- Students learn which arthropods are beneficial and which arthropods are pests.
- Students learn about specific pests: cockroaches, termites, ants, flies, and silverfish.

Materials:
- Insect cutouts of at least the following organisms: (available at the end of the document)
  - butterfly
  - **spider
  - **centipede
  - **ant
  - **wasp
  - **bee
  - cockroach
  - house fly
  - silverfish
  - **scorpion
  - termite
  - dragonfly
  - lacewing
  - millipede
  - ladybug
  - aphid
  - mosquito
  - mantis
  (extras available at http://www.scibugs.com/#lesson-plans/c1g8k)

Plan:

Setup:
1. The instructor picks several arthropods of different groupings. These can be the same as in the previous activity.
2. The instructor assembles the students into groups of 2-4 students.
   - Each group receives a pile of the arthropods.

Group Work
3. The instructor asks the groups to place their arthropods into two piles, “Friend” or “Foe”

Class Discussion:
4. The instructor leads a discussion about why the students grouped their insects the way they did.
   - What arthropods did the students think were foes? Why?
   - What arthropods did students think were friends? Why?

The Foes:
- Most insects are not pests, but here are a few to watch out for.
  1. Cockroaches – indoor pest
  2. Termites – structural pest
  3. **Ants – indoor pests (some carpenter ants can be structural)
  4. Aphids – garden/crop pests
  5. Mosquito – outdoor pest/transmit disease
  6. Silverfish – usually not a problem, but high populations can cause book damage
  7. House flies - spread diseases

The Beneficials:
- Many arthropods are very important to have around.
  1. **Bees/**wasps/butterflies pollinate
  2. **Wasps attack plant pests such as aphids
  3. Ladybeetles eat many plant pests such as aphids.
  4. **Spiders eat many pests both indoors and outdoors.
  5. **Scorpions eat many outdoor pests.
  7. **Centipedes eat many pests including cockroaches
  8. Millipedes are harmless and are mainly decomposers.
  9. Dragonflies are predacious and eat mosquitoes
  10. Mantises eat many garden pests.

- Do the foes have any benefits? What might their purpose be in the ecosystem?
  - Ants/termites/silverfish break down dead trees and recycle nutrients back into the ground
  - Flies are important decomposers to decompose non-vegetative biological matter.
Part 3 – Where Do They Live?

Objectives:
- Students learn about the arthropods and their habitat.
- Students learn to hypothesize and justify their ideas.
- Students record observations.

Materials Needed:
- Sticky traps (provided)

Plan:

Setup:
1. The instructor should define habitat, or have students determine the definition.
2. The instructor explains the purpose of a sticky trap.
   - A sticky trap is a sticky surface placed where pests normally navigate. The pests become stuck to the trap.

Class Discussion:
3. The instructor should lead a class discussion as to where to place sticky traps in the classroom.
   - Instructors should ask why the students want to place the traps where they do. Do the students think their spots are high traffic areas? If so, why?
4. The instructor should lead a class discussion as to where to place the sticky traps outside.
   - Instructors should ask why the students want to place the traps where they do. Do the students think their spots are high traffic areas? If so, why?
   - The instructor should ask the students what arthropods they think they’ll find both inside and outside.

Student Activity:
5. Place the traps in the predetermined places in the classroom.
6. The instructor brings the students outside
   - Students should place their sticky traps down in the areas that were discussed.
   - The students should look for other arthropods while distributing the sticky traps noting the locations they find the insects. (Ex. Asphalt, mulch/dirt, grassy areas, flowers etc...)
7. Students are to bring a notebook outside and record the arthropods they see and where they saw the arthropods.

Class Discussion:
8. The instructor asks the students what were observed and where the students observed them.
9. The instructor makes a table of the arthropods and habitats the students found.

Group Work:
10. Students are to form groups between 2-4 students.
11. Students discuss why they think these arthropods can live where they do. How does the arthropod’s body shape help it live and survive where it does?

Class Discussion:
12. The instructor asks the students to share their ideas. A list is made of common body forms.
Part 4 – Create a Diorama of an Arthropod and its Habitat

Objectives:
- Students learn about a particular arthropod and habitat.
- Students learn to physically show their ideas.
- Students learn research skills.
- Students learn presentation skills.

Materials Needed:
- Shoe Box or a Shadow Box

Possible Materials:
- Clay
- Plastic Insects
- Pipe Cleaners
- Paint/brushes
- Colored paper
- Fake foliage
- Foam board
- Craft foam
- Glue
- Fabric/stuffing
- Tissue paper
- Felt
- Paper mâché
- Cellophane
- Clay
- Plastic Insects
- Pipe Cleaners
- Paint/brushes
- Colored paper
- Fake foliage
- Foam board
- Craft foam
- Glue
- Fabric/stuffing
- Tissue paper
- Felt
- Paper mâché
- Cellophane

Note: This was designed to be an individually led student research project; however it can modified to be done in a class period.

For an idea on how to make a diorama, visit here [http://www.wikihow.com/Make-a-Diorama](http://www.wikihow.com/Make-a-Diorama).

Plan:

Homework:
1. Students research an arthropod that can be found in Georgia. Students learn the arthropod’s name (common, scientific, or both), the habitat they are usually found in.
2. Students create a diorama depicting their arthropod and the arthropod’s habitat.
   - It would be good for students to include what the arthropod feeds on.
3. Students determine if their arthropod is a friend or foe.

Class Presentation:
4. Students bring their dioramas to class and present them to the other students.
5. Presentations should include the arthropod’s name, what the habitat is, how their diorama reflects the animal’s habitat, and if their arthropod is a friend or foe.

A diorama created in the UGA Entomology Service Learning Class.

This diorama depicts ladybugs in different areas in which they can be found, and has attached a list of facts about ladybugs.

It was created from a variety of materials including fake plants, crafting moss, and plastic insects.
Part 5 – IPM and Altering Our Space

Objectives:
- Students learn that changing our space encourages or discourages arthropods.
- Students learn how to change habitat to reduce pest numbers.
- Students learn how to change habitat to increase beneficials.

Plan:

Setup:
1. The instructor should break the students into groups of 2-4 students.
2. The instructor should check the aforementioned sticky traps.

Group Work:
3. The instructor should ask students to think about what an organism needs in its habitat to survive. What makes a habitat suitable for any organism?
4. Groups of students look at the sticky traps and discuss where they were placed. Where were the sticky traps with the most arthropods placed? Which sticky traps had the most diversity (different kinds) of arthropods?

Class Discussion:
5. The instructor has the class discuss what animals need in an environment to survive.
   - Access to resources (food/water)
   - How individuals find each other.
   - Access to shelter
6. The instructor asks the students about the sticky traps.
   - What were general trends/what did students notice?
   - Which traps had the most “foe” arthropods?
   - Were sticky traps placed in dark corners or by trashcans more populated than sticky traps in other areas?
   - Why do the students think this is?
7. What does the presence/absence of arthropods on the sticky trap tell students about the presence of arthropods?
8. How can we as a group reduce the amount of “foes” seen in the classroom?
   - Removing food and water
9. How can we promote habitat for beneficial arthropods?
   - Providing shelter/food (flowers/grasses)
   - Reducing chemical sprays

American cockroaches can be very prolific. Reducing their access to food, water, and shelter will help coax them back outside.

This is a parasitoid wasp attacking an aphid. Oftentimes, pests natural predators are suppressed more effectively by chemical than the pest.

This is a honeybee pollinating a magnolia flower. Planting flowering species is a good way to attract pollinators.

Bug Hotel built by the RHS Flower Show. This bug hotel is specifically designed to attract solitary bees and wasps that not only help pollinate but also eat common pests!

Lesley Bardsley
**Insect Cutout Descriptions:**

**Pests (“Foes”):**

1. **The German Cockroach** *(Insect: Blattella germanica)* is a common pest found in homes, restaurants, and hotels. It has two dark lines down its thorax and is relatively small measuring about a half inch long. Like most cockroaches, it prefers dark, tight, spaces to live in.

   *(Photo Credit: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org)*

2. **The American Cockroach** *(Periplaneta americana)* is large measuring 1.5-2 inches. Like most cockroaches, it prefers dark, tight, spaces to live in.

   *(Photo Credit: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org)*

3. **Termites** *(Insect: Isoptera/Termiteidea)* can cause severe structural damage to wooden buildings. Termites have a caste system which include winged reproductives, soldiers, and workers. Depicted below are the soldier termites which have hardened jaws for protecting the colony, and the workers which forage for food and take care of the colony.

   *(Photo Credit: Scott Bauer, USDA Agricultural Research Service, Bugwood.org)*

4. **Silverfish** *(Insect: Thysanura)* are usually found in moist areas. While they usually go unseen, large numbers can cause damage to books as they will eat the paper.

   *(Photo Credit: Gary Alpert, Harvard University, Bugwood.org)*

Larger insect cutouts are in a separate document *(http://www.scibugs.com/#lesson-plans/c1g8k)*.
**↑ Fire Ants** (Insect: *Solenopsis*) have recently been introduced into the United States where they have quickly become invasive. Fire ants make large mounds in sunny areas and eat many small insects.

*(Photo Credit: Pest and Diseases Image Library, Bugwood.org)*

**↑ Pavement Ants** (Insect: *Tetramorium caespitum*) are commonly referred to as “sugar ants”. They are a very small ant and can be usually found in large groups on sidewalks. Oftentimes they can get into buildings to forage for food.

*(Photo Credit: Joseph Berger, Bugwood.org)*

**↑ Carpenter Ants** usually prefer damp wood to secure their colonies but one species in particular, the black carpenter ant (Insect: *Camponotus pennsylvanicus*), is a common pest species and can cause structural damage to wooden buildings.

*(Photo Credit: Nancy Miorelli)*

**↑ Bottle Flies** (Insect: *Calliphoridae*) are medium sized shiny green or blue flies. They are often attracted to garbage and rotting material.

*(Photo Credit: Joseph Berger, Bugwood.org)*

**← House Flies** (Insect: *Musca domestica*) are common pests found in public areas. House flies are usually attracted to garbage, rotting material, and exposed food items.

*(Photo Credit: Pest and Diseases Image Library, Bugwood.org)*
**Aphids** (Insect: Aphididae) are plant pests which suck the plant’s sap through their beak-like mouthparts. Aphids are usually found in high numbers and can cause severe damage to ornamental plants.

*(Photo Credit: Nancy Miorelli)*

**Green Stink Bug** (Insect: *Acrosternum hilare*) are plant pests which suck the plant’s tissue through their beak-like mouthparts. These bugs can release an unpleasant odor when they’re disturbed.

*(Photo Credit: Susan Ellis, Bugwood.org)*

**Grasshoppers** (Insect: Acrididae) can sometimes cause ornamental plant damage. They have big jumping legs for quickly escaping predators and are strong fliers.

*(Photo Credit: Russ Ottens, University of Georgia, Bugwood.org)*
Commensals (Neither "friend" nor "foe")

↑ Camel Crickets (Insect: Raphidophoridae) often get into people’s homes but do not cause damage or allergic reactions.

(Photo Credit: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org)

Beneficials (“Friends”)

↑ The European Mantis (Insect: Mantis religiosa) is found throughout the United States and eats many garden pests.

(Photo Credit: Alvesgaspar)

↑ The Chinese Mantis (Insect: Mantis religiosa) is found throughout the United States and eats many garden pests. It was imported around 1895 as a biological control agent.

(Photo Credit: James Wheeler)
Monarch Butterflies (Insect: Danaus plexippus) are important pollinators. Monarchs make a long migration from Mexico to the northern United States every year! Monarchs can be attracted with many flowering plants.

(Photo Credit: Charles T. Bryson, USDA Agricultural Research Service, Bugwood.org)

Huminbird Moths (Insect: Sphingidae) are important pollinators. They’re often mistaken for bees because of their fuzzy appearance and clear wings. Since they are moths, they cannot bite or sting you.

(Photo Credit: David Cappaert, Michigan State University, Bugwood.org)

Dragonflies (Insect: Anisoptera) are often found around bodies of water and are voracious predators. They eat many nuisance insects including mosquitoes and small gnats. Dragonflies look similar to damselflies but are more robust.

(Photo Credit: David Cappaert, Michigan State University, Bugwood.org)

Damselflies (Insect: Zygoptera) are often found around bodies of water and are voracious predators. They eat many nuisance insects including mosquitoes and small gnats. Damselflies look similar to dragonflies but more slender and hold their wings over their back at rest.

(Photo Credit: Nancy Miorelli)
**↑ Thread Waisted Wasps** (Insect: Sphecidae) not only pollinate flowers, but often predate on pests such as flies and caterpillars.

(Photograph Credit: David Cappaert, Michigan State University, Bugwood.org)

**↑ Honey Bees** (Insect: *Apis mellifera*) are important pollinators. Many are shipped around the country to help farmers pollinate their crops. Honey bees can be attracted with many brightly colored flowers but are sensitive to chemical sprays.

(Photograph Credit: Joseph Berger, Bugwood.org)

**↑ Bumble Bees** (Insect: *Bombus*) are important pollinators. Bumble bees are fuzzy all over to collect pollen to bring pollen back to their young.

(Photograph Credit: David Cappaert, Michigan State University, Bugwood.org)

**↑ Paper Wasps** (Insect: *Polistes*) not only pollinate flowers, but often predate on pests such as flies and caterpillars.

(Photograph Credit: Nancy Miorelli)
↑Lacewings (Insect: Neuroptera) are nocturnal predators that feed on small pest insects. Many have been used for biological control. As larvae, lacewings also feed on small insects such as aphis.

(Photocredit: Nancy Miorelli)

↑Ladybugs (Insect: Coccinellidae) eat many crop and ornamental plant pests such as aphids and white flies.

(Photocredit: Nancy Miorelli)

↑Tumbling Flower Beetles (Insect: Mordellidae) are excellent pollinators. They get their name because when they’re startled they’ll play dead and fall off the flower.

(Photocredit: Johnny N. Dell, Bugwood.org)

↑Spiders come in all shapes and spiders. This Crab Spider (Arachnid: Thomisidae) is an ambush predators. They’ll wait for prey to come by and jump on it. They’re harmless to people but eat many pests found in the garden.

(Photocredit: Nancy Miorelli)
**Wolf Spiders** (Arachnid: Lycosidae) are medium to large spiders that do not use webs to capture prey. Instead, wolf spiders chase down their prey. Female wolf spiders (as pictured above) have a parental care where the female carries the egg sac with her. They eat many pest species. They can

(Photo Credit: Ian Fieggen)

**Zipper Spiders** (Arachnid: Argiope aurantia) are large spiders that make webs with a distinct zigzag pattern. They are harmless to humans but eat many garden pests.

(Photo Credit: Nancy Miorelli)

**Southern Unstriped Scorpion** (Arachnid: Vaejovis carolinianus) is commonly found in Georgia. It’s a small scorpion that often finds its way into homes but feasts on small pests found inside and outside the home.

(Photo Credit: Warren Savary [2005] discoverlife.org)

**North American Millipedes** (Myriapod: Narceus americanus) are large millipedes which can be found throughout Georgia. They are slow moving and feed on decaying matter. They are important decomposers in the ecosystem. When threatened, the millipede will curl into a ball and will sometimes release a brown liquid which is not harmful.

(Photo Credit: Gary Alpert, Harvard University, Bugwood.org)
**Centipedes** (Myriapod: Chilopoda) are fast predators that use their first pair of modified legs to inject venom into their prey. Centipedes eat many pests species but should not be handled as they can bite humans.

(Photocredit: John Hill)

**House Centipedes** (Myriapod: *Scutigera coleoptrata*) are commonly found inside people’s homes. They don’t bite unless provoked and are beneficial to have in the house. They eat many household pests including cockroaches and silverfish.

(Photocredit: Bruce Marlin)