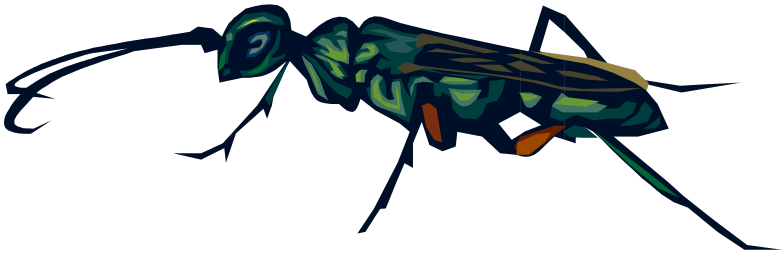
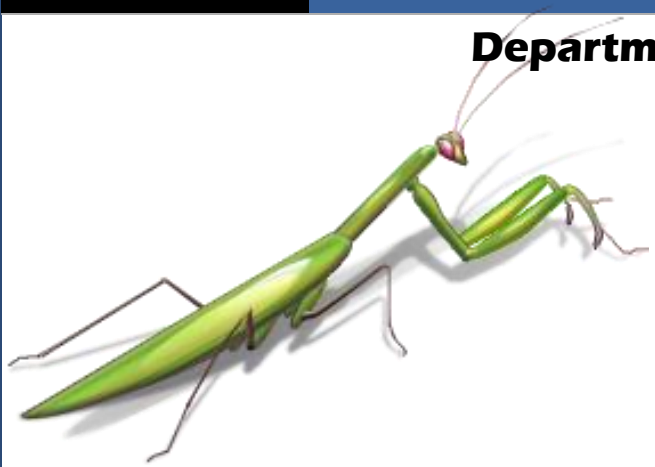


University of Georgia

Middle School INTEGRATED Pest Management and Habitat Lesson Plan

Department of Entomology



Nancy Miorelli

Middle School Lesson Plan

Integrated Pest Management and Habitat

Georgia Standards		Next Generation Science Standards	Common Core
7th Grade	8th Grade	6-8th Grade	6-8th Grade
Habits of Mind ˚S7CS1 ˚S7CS3 ˚S7CS4 *S7CS6 *S7CS7	Habits of Mind *87CS1 ˚S8CS3 ˚S8CS4 *S8CS6 *S8CS7	Earth and Human Activity: ˚MS-ESS3-3 ˚MS-ESS3-4	CCSS.ELA-LITERACY.RST.6-8.3 CCSS.ELA-LITERACY.RST.6-8.4 CCSS.ELA-LITERACY.RST.6-8.9
The Nature of Science ˚S7CS8 ˚S7CS9	The Nature of Science ˚S8CS8 ˚S8CS9	Ecosystems ˚MS-LS2-1 ˚MS-LS2-4 ˚MS-LS2-5	
Co-requisite: ˚S7L1 ˚S7I4	Life Science: ˚ S3L1		

This lesson plan should be completed during the Spring or Fall when insects are most active

List of Materials Needed:

In class Activities

- Sticky Traps (Found at Home Depot or similar) http://thd.co/1x1z3fe
- Colored plastic bowls (red, orange, yellow)
- Soapy Water

List of Suggested Materials

Optional

- Glow in the dark paint (for making bowls with UV patterns)
- Sharpies (for labeling)
- Insect Cutouts (for review)
- Ethyl alcohol (to store sample)

Overview:

- What kinds of habitats do insects and other arthropods live in?
- What insect and arthropod biodiversity is at the school?
- What do insects and arthropods need in their habitat?
- How does manipulation of habitat affect diversity, abundance, populations, and composition?
- What is the scientific method?
- What are proper scientific sampling techniques?

Objectives:

- Students learn to identify arthropods and insects.
- Students see, observe, and understand what can affect biodiversity.
- Students learn about arthropod natural history.
- Students determine how humans modify environments.
- Students learn how habitats can be modified for our benefit.
- Students associate habitat modification with pest control.
- Students learn scientific sampling methods and the importance of repeatability.
- Students learn to communicate scientific procedures, results, and concepts.

Game Plan:

The parts can be done all at once, or broken up over several days.

- Optional Overview – Arthropods Friend or Foe
- Part 1 – Determining Insects
- Part 2 – Designing an Experiment
- Part 3 – Conducing the Experiment
- Part 4 – Identifying Arthropods and Data Collection
- Part 5 – The Write Up
- Part 6 – Student Presentations
- Part 7 – Altering Habitat and IPM

For an electronic copy of this document, please visit:
http://www.scibugs.com/#lesson-plans/c1g8k

Optional Overview – What is an insect?

Objectives:

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

Materials Needed:

- Arthropod cutouts. Please see the elementary school lesson plan (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 group, 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.

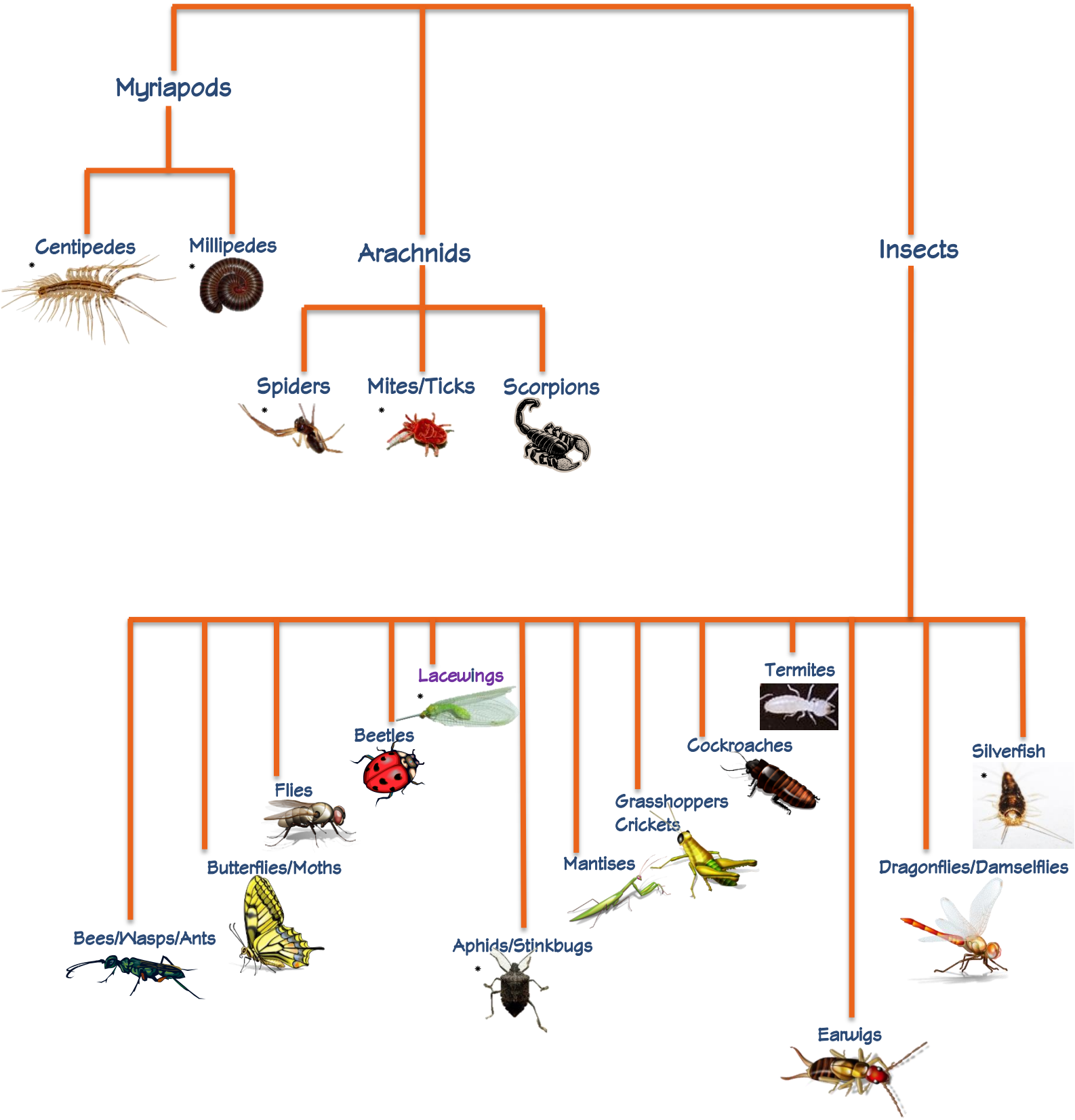
Myriapod: A subphylum of animals that have long bodies, many legs, and antennae.

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



* **Photo Credit:** Bruce Marlin, Jud McCranie, Nancy Miorelli, Olei, Nancy Miorelli, Lildobe, Nancy Miorelli

Part 1 – Determining Habitats for Arthropods

Objectives:

- Students determine what habitat is and what it needs to contain to harbor organisms.
- Students determine life needs for insects.
- Students develop hypotheses to test in an experiment

Vocabulary:

Habitat: an environment or area in which an organism lives.

A cockroach's natural habitat is under tree bark.

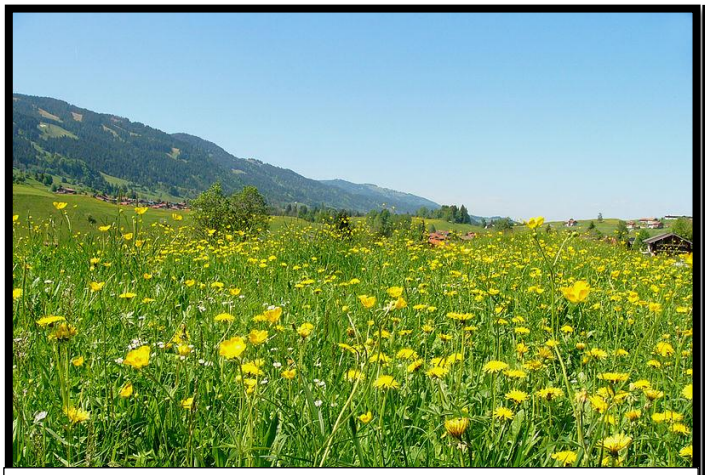
Photo Credit: Nancy Miorelli

Plan:

1. **Teacher Led Class Discussion:**
   The instructor leads a class discussion covering the following topics
   - What are things that all organisms need to survive?
   - Ask students to name insects or arthropods they know of. Where do the students think these animals live?

2. **Group Work**
   The instructor divides the students in groups of 2-4 students. These students will work together for the remainder of the project.
   - Students are told they will conduct a project determining arthropod diversity and composition in different habitats.
   - Each group of students should determine where they expect to find which kinds of arthropods. Students should be able to explain their reasoning. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
     - Students should consider available food and water sources in addition to shelter.

3. **Class Discussion:**
   The instructor asks each of the student groups their hypotheses and reasoning behind their hypothesis.



Grassy, weed fields support a wide range of arthropod diversity including spiders, grasshoppers, and pollinators.

Photo Credit: Public Domain

Lakes, ponds, and small bodies of water can host a multitude of arthropods including spiders, dragonflies, water skimmers, beetles, and flies. Many immature insects develop in water both standing and running.

Photo Credit: Nancy Miorelli

Part 2 – Designing an Experiment

A **Hypothesis** is a testable idea that objective and empirical evidence collection could support or reject the proposed idea.

Objectives:

- Students assess the feasibility of their hypothesis
- Students determine how to test their hypothesis
- Students design an experiment

Materials:

- Groups will be given pan traps and sticky traps, so the instructor should mention them. Good pan trap colors include red, orange, and yellow.
- Many insects can see UV, teachers can provide glow in the dark or black light paint for students to utilize.

Notes:

1. Teachers may either encourage
   a) Groups to design their own experiment for discussion about experimental design and method while allowing creative freedom
      i. Ex. Some groups could test different location or use different colored pan traps
   b) The class to design one experiment and group tests a different facet.
      i. Ex. The class wants to test different locations and each group will take a location to put their traps
2. There are many variables that can be assessed in this lesson plan. The instructor should decide what is most logical for the students to focus on given the available locations for sampling and what the instructor sees fit for the curriculum.
3. Generally, orange and yellow pan traps are effective for collecting pollinators (bees, wasps, beetles, butterflies) around sunny floral areas. Generally sticky traps are effective in dark, moist, and protected areas and usually collect pest species (silverfish, cockroaches)

Instructions for Trapping:

1. Pan traps are specifically for outdoors near flowers
2. Pan traps are typically used for collecting pollinators because the pollinators are attracted to the colors
3. Most insects cannot see red light, but can see from orange to ultra violet
4. Sticky traps are usually used indoors to catch pests. If used outside, make sure they are weighed down.
5. Sticky traps collect information about what is present by random chance and not by attraction.

Plan:

1. The instructor should determine which setup he or she wants the students to complete.
2. **If the instructor wants each group to determine their own project**
   a. Break the students into groups of 2-4 students.
   b. Students should discuss in their groups
      i. What color pan traps they want to use.
         1. Students should hypothesize about what they'll find and why
      ii. Where the pan traps should be used (at least two locations)
         1. Consider open areas, flowers, turf, shady areas, sunny areas etc…
         2. Students should hypothesize about what they'll find in each location and why
      iii. Where the sticky traps should be placed
         1. Students should pick at least two locations put the sticky traps. For the purposes of this experiment, the sticky traps should be placed indoors. However, extra sticky traps can be handed out if students are interested in placing the sticky traps elsewhere.

Part 2 – Designing an Experiment (Cont)

2. Students should hypothesize in which locations they expect to find more insects and *why.*
    a. More can be in terms of diversity or numbers of individuals. However the students should be clear with their predictions.

iv. Students should hypothesize which kinds of traps they expect to collect what kind of insects. Students are encouraged to base these hypothesizes on personal experience and research.

c. The instructor should bring the students back together so each group can propose their ideas and hypothesis. The instructor and other groups should make comments about good aspects of their idea and possible improvements.

3. If the instructor wants the class to determine a project together, the instructor should start a class discussion
    a. **Class Discussion:**
        i. The instructor can either propose several options to test, or have the students discuss possibilities together.
        ii. Students should agree on a project that the class will do together. There should be multiple aspects to test.
            1. Several locations to put the pan traps and sticky traps
                a. Pan traps placement should include different outdoor areas including near flowers, grass, turf, sunny and shady areas
                b. At least some of the sticky traps must be placed inside. Students can decide where to put them.
            2. What color pan traps to use
            3. Student should hypothesize what they'll find in the different colored traps in the different locations
        iii. Students should then divide the work among the groups
            1. Ex. Each group can test different locations, or each group can test a different color pan trap and a different sticky trap location
    b. **Group Work:**
        i. Each of the groups should discuss together about the methods of their portion of sampling
        ii. Each group should make hypothesis about what they think they will find, why, and how their results might compare to other groups.
        iii. The instructor should walk around and help the students develop their methods.

Photo Credit: Elea Chang

Part 3 – Conducting the Experiment

Objectives:

- Students conduct an experiment
- Students record their methods.
- Students learn the importance of organization and labeling.

Materials:

- Different colored pan traps (plastic bowls). Enough for six pan traps per group
- Soapy water
- Sticky traps. Enough for four sticky traps per group
- Sharpies for labeling

Instructions for Trapping:

1. Pan Traps
    a. Check the weather of the week that you are planning on conducting the experiment. Pan traps can be left outside overnight, but heavy rainfall can make the traps floor and strong winds can blow them over.
    b. Fill the colored bowls half way with some soapy water. Soapy water breaks the water's surface tension so the insects become captured.
    c. The pan traps work best on warm sunny days
2. Sticky Traps:
    a. Sticky traps can be laid inside or outside, but are usually used to capture indoor pests.
    b. Keep sticky traps in areas that are untraveled and where they cannot be tampered with. They can either be hung on the wall or placed on the floor.

The Plan:

1. Students should put their traps in the areas agreed upon in their experimental setup.
2. Students should take notes about their experimental setup
    a. Label all traps with
        i. Their name
        ii. Date/time
        iii. Location
    b. Students should take notes about
        i. The weather (sunny, cloudy, hot, cold…)
        ii. Observational notes about the location (examples below)
            1. Types or how many flowers/other vegetation
            2. Cleanliness of the area
            3. Types or how many insects
            4. How well travelled the area is
3. If possible, encourage students to take pictures of their set up to include in their presentation.

A typical pan trap setup. Visit here for further instructions

A typical sticky trap

Part 4 – Identifying Arthropods

Objectives:

- Students learn data collection
- Students learn to record results
- Students learn arthropod identification

Materials:

- Trap samples
- If identification takes longer than one class period, insects can be stored in ethyl alcohol. Or the contents of the pan trap can be strained, and the insects stored in a freezer.

Notes:

- Students may want to take pictures of their traps.
- For additional help identifying arthropods visit http://bit.ly/1ulkXzA, www.bugguide.net and www.discoverlife.org
    - It is unlikely that students will be able to identify most of their insects beyond the order classification (Ex. Beetles, butterflies, spiders… etc.)

Plan:

1. Students should break into their groups and identify their arthropods.
2. Students should make notes about
    a. Which arthropods they found
    b. How many arthropods they found
    c. From what locations
3. Students should discuss general trends they've discovered among their group
4. **Class Discussion** - the instructor can choose to have a class discussion. This would be important if the class decided to design an experiment as a whole.
    a. Groups should briefly state their experimental setup
    b. Groups should state any problems they've had or are having
    c. Groups should state if they they their hypothesis is, or will be supported by their preliminary data.
5. The instructor can request the data for the students and make a comprehensive chart.

This Jumping Spider is an arachnid an in the order "Araneae". Photo Credit: Nancy Miorelli

This carpenter bee is an insect and is in the order "Hymenoptera". Photo Credit: Nancy Miorelli

Part 5 – The Write Up

Objectives:

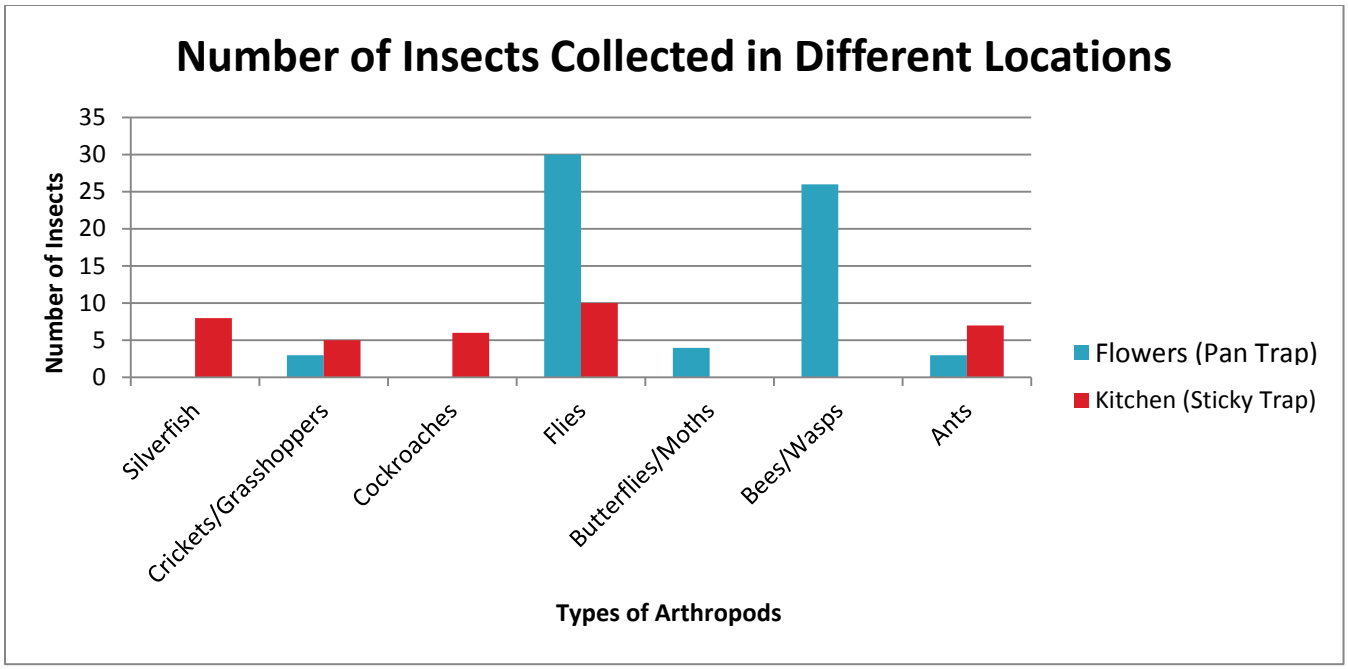
- Students practice writing a formal laboratory report
- Students learn to make conclusions from data

Notes:

- Students can write a lab report as a group or as individuals. It is up to the instructor's digression.
- This would be a homework assignment, but instructors can assign checkpoints or drafts.
- If the class designed an experiment as a whole, students should have access to all the data for the write-up.

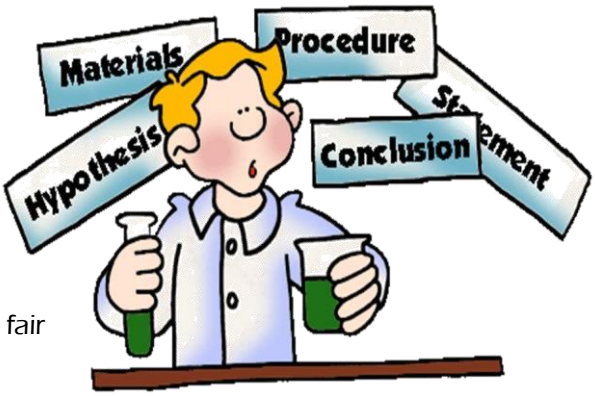
What Goes in the Report:

1. Introduction
    a. Usually this includes background information. This can be included but is not necessary
    b. The student's hypothesis and reasoning for formulating the hypothesis.
2. Methods
    a. What did the students use?
    b. What did the students do?
    c. What was the reasoning behind their methods
3. Results
    a. How many insects were found in each of the traps in each of the locations?
    b. Charts can be included (All charts should include a title, legend, and labeled axes [if applicable])
4. Discussion
    a. Did their results match their hypothesis
        i. If so – why do they think that?
        ii. If not – why do they think that
    b. Do they think the experiment could have been conducted better?
        i. What problems did they have?
        ii. How do they think the problems could be resolved?
    c. Why do they think they got the results they did? What do the results suggest about the locations?



Sample chart showing example data. This may not be representative of what the class finds.

Part 6 – Student Presentations



Objectives:

- Students practice presenting information
- Students create presentation
  - This can be like a science fair presentation
  - This can be a PowerPoint
- Students evaluate information presented and ask questions
- Students practice answering questions from their peers
- Students learn time management in a presentation
- Students can use this practice if they plan on entering the science fair

Plan:

1. The presentation should be 10-15 minutes
2. The presentation should include the same parts and information as the report
   a. Introduction/Hypothesis
   b. Methods
   c. Results/Data
   d. Discussion of hypothesis and results
3. Students should take notes on the other students' presentation.
   a. What places did presenters sample?
   b. What color traps did they use?
   c. Generally what did the students find?
4. The instructor should take notes on the general findings of the class as a whole.

Optional Class Discussion:

1. If each group designed their own experiment
   a. How could each of the groups improve their experiment?
   b. What would happen if the groups had more traps, more colors, or more locations?
   c. Were some traps more effective at collecting arthropods? (Most arthropods/most diversity)
      i. Do the students think this was random chance?
      ii. Do the students think that there was a way to fix this?
2. If the class decided on an experiment as a whole
   a. How could the experiment be improved?
   b. Which traps had the most arthropods/diversity overall
      i. Did some traps have more than others? (even of the same type in the same location?)
      ii. Do the students think this was random chance?
      iii. Do the students think that the amount of traps placed gave them an understanding of the situation?

Part 7 – Altering our Habitat

Objectives:

- From the experiment, students determine that habitat affects
  - Populations
  - Abundance
  - Diversity
- Students learn about how habitat are important for abundance of organism and diversity of organisms,
- Students lean that habitats can be modified to attract beneficials or discourage pests
- Students use the data they collected to determine how they can help alter habitat to suppress the abundance of pests

Notes:

1. If the instructor has compiled the class data into charts, they should be displayed for the class
2. The students should understand that by keeping their area clean, it dissuades pests from staying because there is no food/shelter for them.
3. The students should understand that not all insects are pests and to use pesticides when necessary and other control measures can be effectively employed as well.

Plan:

1. **Class Discussion:** The instructor should prompt the class to answer the following
   a. About their experiments
      i. Where were the most arthropods found?
      ii. Where was the most diversity?
   b. What habitats did pollinators seem to prefer?
   c. What habitats did pests seem to prefer
   d. Why do you think the arthropods preferred these habitats?
   e. How can we promote beneficial arthropods by modifying our environment?
   f. How can we suppress pest species by modifying our environment?
   g. If beneficial insects are found near our school building, what affect do you think spaying pesticides might have on them?
2. The class should make a short list of things that they can do to help promote a cleaner space that is undesirable for pests

Classrooms and other spaces that students use should be kept clean, but it's everyone's responsibility to keep the area tidy.

This hover fly (Diptera) is a pollinator and can be found in sunny areas with flowers. The use of pesticides could be detrimental to its survival so it's key to practice responsible pest management strategies.