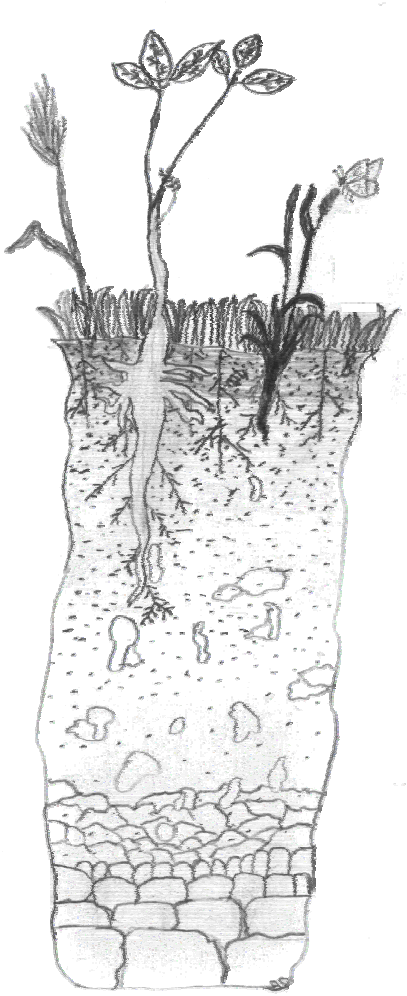
Soil Microhabitats



An Environmental Study Unit For 5th – 8th Graders

MUHLENBERG
COLLEGE

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Soil Microhabitats Field Study

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Soil Microhabitats Field Study

Authors: Laurie Rosenberg, Muhlenberg College
Marysa Nicholson, Muhlenberg College
Grade Level: 6th – 9th
Lesson Time: 180 minutes (three 60-minute class periods)
Suggested Class Structure: Cooperative teams of 4-5 students
Subject Areas: Science, Language Arts, and Mathematics

BACKGROUND

Ecology is the study of the relationships among the biotic, (living) and abiotic, (nonliving) parts of the environment. In order to study the environment in a methodical way, ecologist divide the living world into systems centered on a particular set of plants and animals living in an area with similar conditions. These are called communities. Ecologists analyze the effects that various species have on the system as a whole, as well as the effects that the system has on the life cycle of the species.

Within a given ecosystem there may be several types of communities, and within these communities several small distinct habitat types. Forest microhabitats range from beneath the soil to the tops of the trees. Some examples include rotting logs, leaf litter, under rocks and in wet spots and puddles. Each of these would be home to a distinct community of plants and animals, all linked together by the bonds of interdependence.

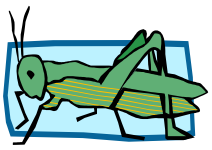
Environmental conditions such as food availability, temperature, moisture, and light intensity may vary widely from one microhabitat to another. Arthropods, because of their small size, are adept at taking advantage of these changes in abiotic factors.

Several distinct microhabitats exist within the soil, depending on the depth. The upper layer typically is drier and contains more organic material. The amount of sunlight and moisture reaching the top layer of soil, along with the physical and chemical makeup of the soil, will determine the types of plants growing and decaying there. These in turn will determine the animal life. Within the litter all sorts of animals such as beetles, ants, leafhoppers, centipedes, sowbugs, crickets, grasshoppers and spiders can be found. Bees and wasps may visit flowers in bloom, and leaf miners and gall making insects may burrow into the leaves and stems of the plants. In the top layer of soil, worms and nematodes will be numerous.

These microhabitats include all the elements present in larger ecosystems, and provide opportunities for a wealth of environmental studies. Examples include population densities, food webs and pyramids, species diversity, and the relationships between species and various abiotic components such as temperature, moisture, nutrients, soil pH and composition.

GOAL

Over the course of this lesson, students will select a microhabitat for study and develop a plan for collecting, analyzing and displaying their results. During the course of this study, they will develop skills in observation, classification, organization and analyzing data.



MATERIALS

- ☐ Berlese funnel (optional)
- ☐ Bug boxes (optional)
- ☐ Clipboards
- ☐ Crayons
- ☐ Data recording sheets or log books
- ☐ Distilled water in a spray bottle
- ☐ Flip chart paper
- ☐ Forceps
- ☐ Goose neck lamp (optional)
- ☐ Hand lenses
- ☐ Hula hoops
- ☐ Insect/Arthropod key
- ☐ Meter sticks (optional)
- ☐ Plant keys
- ☐ Plastic bug samples or bug pictures
- ☐ Plastic collecting jars or petri dishes
- ☐ Plastic marker flags
- ☐ Rulers
- ☐ Sieves or strainers (optional)
- ☐ Small plant press (optional)
- ☐ Soil borer
- ☐ Soil characteristics tables (for older students)
- ☐ Soil nutrient test kit (for older students)
- ☐ Soil pH test papers
- ☐ Soil thermometers
- ☐ Spoons
- ☐ Stereoscope (optional)
- ☐ String (optional)
- ☐ Tarps
- ☐ Trowels or bulb planters
- ☐ White sheets or paper/plastic plates
- ☐ Ziploc bags (optional)

ADVANCE PREPARATION

- ✓ Run off soil creatures key for each study group, (optional for older students, see *Appendix B*)
- ✓ Run off soil characteristics references tables for each study group, (optional, for older students, see *Appendix B*).
- ✓ Gather insect collecting equipment—sieves, tarps, trowels, collecting jars, hand lenses
- ✓ Gather soil test kits (younger students – pH only, older students add NP and K kit)
- ✓ Gather soil-sampling equipment—jars, distilled water, soil borer, soil thermometers
- ✓ Scout out sampling areas and get permission to take field samples. If possible, take pictures to show to students.
- ✓ Create student cooperative learning groups
- ✓ Advanced students: run off copies of *Microhabitat Data Sheets*
- ✓ Younger students: run off copies of *Field Study Log Book*

PROCEDURES – Outline and Narrative

First Class Period—Field Study Preparation

Introduce the field study topic – 10 min.

Discuss what "ecology" means and what ecologists do (see Background Information on page 1, paragraph 1). Show the class pictures of the study site. Brainstorm a list of microhabitats and the biotic and abiotic factors present at the site. (*Note: If you don't have pictures of the site to show students in advance, you should make an initial visit to the site with the class, at which time they should do the brainstorming and take notes).* Make predictions of what kind of animals students might find in these microhabitats. Discuss ways of collecting the organisms.

Explain how to use the field study tools and the data collection sheets – 30 min.

Explain how to set up study sites and take random samples. Students should either mark off a 1-meter square area using flags and string, or use a hula-hoop to mark the boundaries of their study sites. Random sampling areas can be selected by tossing three coins into the study area and taking samples from the spots where the coins land. Mark spots with flags.

Show the insect PowerPoint presentation to introduce students to the different kinds of soil dwelling organisms. Show the students how to use the insect and plant keys. Use the key and plastic bug samples to practice identifying organisms. Each group should get 3 critters and 3 different plants to practice identifying.

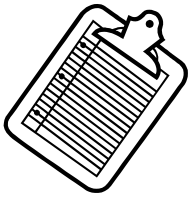
Explain how to take the soil samples. Explain how to test the chemical and physical parameters of the soil. (See the sampling kit directions for chemical tests. See the *Lesson Appendix* for physical characteristics tables and descriptions—color, texture, drainage, etc.)

Develop ideas for field study – 20 min.
Based on the introductory discussions, have students get into their groups and develop a plan for an ecological field study of the soil microhabitat. They will need to decide what variables they will study and how they will record and report their data. Show the class a list of study ideas.

There are several approaches the instructor can use for this section of the activity. In the Lesson Appendix there are copy masters for different ways in which students can organize their studies—suggested questions and ideas on how to collect and report the findings. The teacher has the option of allowing groups to freely form their own questions, or to assign questions. Which approach the instructor chooses will probably depend on the age, background and skill level of the students.

For groups choosing their own questions, you will have to circulate among the groups and give guidance for the study proposals. By the end of the class period the student-groups should have decided on a study plan and written up a one-paragraph proposal. The proposal should include the study question and a description of how the group intends to investigate and report their results. Review student-group proposals before they begin their fieldwork.

Divide up group responsibilities
Student study groups often run more efficiently if specific jobs are assigned such as ***communicator***, (someone who communicates with the instructor and with communicators from other groups to ask questions and check information), ***data recorder, tracker***, (someone who keeps the group on task and makes sure they are following procedures correctly), a ***materials manager***, and possibly a ***researcher*** who helps find information in the reference guides.



Second Class Period—Field Study – 60 min.

Distribute Field Study Materials
Each group should elect a materials manager to get the data collecting tools and to return them when the group is finished using them.

Create Study Plots – 10 min.
Student groups can create study plots by measuring off and marking a meter square area, or by simply laying down a large hula-hoop.

Gather Data – 40 min.
Students should gather all of the relevant data listed on the data sheets, completing the plant and animal inventory and the physical and chemical soil tests. Some arthropods may be difficult to identify and can be brought back to the class for further identification. Samples of soil may be sealed in Ziploc bags and brought back to the class to complete the tests and data collection.
Note: Students should not step in or on their study plots while doing the investigation.

As the groups are doing their fieldwork, circulate among them and ask guiding questions such as:

- How will the environmental factors you are recording—temperature, moisture, nutrients, soil type—influence the types of plants and animals you find?
- Have you included drawings, written descriptions and accurate measurements on your data sheets?
- Are your collecting methods working or are there other strategies you can use?
- Are there any arthropods or plants you can't identify?

Before leaving the field study site, make sure all the equipment has been picked up and the site has been left in good order.

Data Sheet Wrap-Up—10 min.
Back in class, give students time to check their data for clarity. They may want to use a stereoscope to further identify some of the animals. They can also set up a berlese funnel and create settling jars to identify the amount of sand, silt and clay present in the soil.

Give students a chance to prepare their visual presentation of data—pie chart, food web, bar graph, or x/y frequency table.

Third Class Period—Data Summary and Discussion– 60 min.

Groups Present Data—Approximately 35 min.
Give each group five minutes to present their data. Afterwards, bring out the list of previously brainstormed ideas. Discuss how the findings backed up or were different from the predictions the class made about the microhabitats.

Drawing Inferences From the Data—25 min.
Lead a class discussion centered on the following questions:

- What are some of the most common arthropods? Why are they the most common?
- What are the characteristic plants and animals of each microhabitat?
- Did some microhabitats have more diversity than others? Why?
- Are there any limitations to the reliability of the data the groups collected? What are they, and how could the data be expanded upon to make it more accurate or more reliable?
- What could happen to seriously disrupt or destroy a microhabitat? Which animals would be most likely to survive and which would be less likely and why?
- What can studying microhabitats tell us about the quality of the larger ecosystem?

Assessment

The assessment for this unit includes the student's final presentations, (for older students) and the answers to the log book questions, (for younger students.)

Correlation with PA Standards for Environment & Ecology

Standard 4.3.7 Environmental Health
C. Explain biological diversity.

Standard 4.4.7 Agriculture and Society
B. Investigate how agricultural science has recognized the various soil types found in Pennsylvania.

Standard 4.5.7 Integrated Pest Management (IPM)
A.Explain benefits and harmful effects of pests**.**

Standard 4.6.7 Ecosystems and Their Interactions
A.Explain the flows of energy and matter from organism to organism within an ecosystem.

Standard 4.7.7 Threatened, Endangered and Extinct Species

A.Describe diversity of plants and animals in ecosystems.
B.Explain how species of living organisms are adapted to their environment.

RESOURCES

Books for the teacher:

Soil and Water Conservation Society. ***Soil Biology Primer***. 2000. To obtain a copy contact them at 7515 Northeast Ankeny Road, Ankeny, IA 50021. Phone: (800) 843-7645, ext. 24. E-mail: pubs@swcs.org.
Online: [**http://www.swcs.org**]

Lawlor, E. P. ***Discover Nature Close to Home***. Harrisburg, PA: Stackpole Books. 1993. Loaded with simple ideas for nature study related to plants and animals commonly found around schools and neighborhoods. This book shows you where to look and what to look for. Excellent illustrations. This book is appropriate also for advanced students with good reading skills.

Web sites: Since the Web is constantly changing, check Muhlenberg's Outreach Web site for updated listings. **http://www.muhlenberg.edu/cultural/graver/index. html**

Web sites for the teacher:

University of Florida. ***On-Line Publications by University of Florida Entomology and Nematology Personnel***
[**http://entnemdept.ifas.ufl.edu/publicat.htm**] June 2002. Lots of accessible information on insects, including keys to identifying pests, integrated pest management, and other teaching resources.

Choate, P. M. ***Introduction to the Identification of Insects and Related Arthropods***. [**http://entnemdept.ifas.ufl.edu/choate/insecpdf.htm**] 1999. PDF version of a relatively simple dichotomous key. Extensive illustrations.

American Museum of Natural History. ***Biodiversity Counts***.
[http://www.amnh.org/learn/biodiversity_counts/] June 2002. This supplementary life science curriculum for middle-school students presents a hands-on, inquiry based, and authentic approach to science, and is linked to national science standards. *Biodiversity Counts* takes students into their backyards and schoolyards to inventory the plants and arthropods that live there. Students observe behavior, collect data, make identifications, and interpret and share their findings.

Meyer, J. R. ***The Ground Crew.***
[**http://www.cals.ncsu.edu/course/ent591k/soil.html**] Spring 2001. An online unit on soil organism surveying—how to organize it and what to do with your data. Part of a North Carolina State University course called "Entomology for Educators." Check it out at [**http://www.cals.ncsu.edu/course/ent591k/**]. Other topics include identification, diversity, symbiosis, mimicry, wood dwelling insects, and aquatic invertebrates.

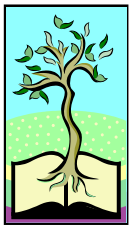
US Forest Service. ***Investigating Your Environment***.
[**http://www.na.fs.fed.us/spfo/ce/iye/contents.htm**] A PDF version of an extensive forestry curriculum, including a soil survey, watersheds, ponds, wildlife and vegetation. Includes all data sheets and background information.

Archbold Biological Station. ***How to Make a Berlese Funnel***. [**http://www.archbold-station.org/discoveringflscrub/unit3/unit3b1part2.html**]

Educational Development Center Inc. Youth Learn Initiative. *The Soil Around Us Project*. [**http://www.youthlearn.org/learning/activities/inter/soil_project/overview.html**] EDC is a private, nonprofit educational organization loosely affiliated with MIT. This Web site offers an extensive guide to conducting an inquiry-based soil study. Included are thorough explanations of techniques to build student skills including investigation, collaboration and use of technology. There are also opportunities for teachers to submit a description of their project and have it featured on the Web site.

United States Department of Agriculture. ***National Soil Survey Center Soil Science Education Website***. [**http://soils.usda.gov**/]

Center for Improved Engineering and Science Education (CIESE) and Bank Street College of Education. ***Square of Life: Studies in Local and Global Environments,*** [**http://www.ciese.stevens-tech.edu/curriculum/squareproj/**] An Internet-based collaborative project in which students will investigate their local environment and share that information with other students from around the country and the world. CIESE is located at Stevens Institute of Technology in Hoboken, New Jersey.



Curriculum for the teachers

Denee, J., & Hand, J. ***Exploring the Secrets of the Meadow-Thicket.*** Montpelier, VT: Food Works. 1994. This is a seasonal, integrated activity guide that includes art, writing, social studies, literature and science activities revolving around the natural history of everyday plants and animals. Loaded with creative ideas to spice up the school day.

Outdoor Biological Instructional Strategies, (OBIS), available from the Lawrence Hall of Science, University of California #5200, Berkeley, CA 94720-5200. Phone: 510-642-7771, e-mail: gems@uclink.berkeley.edu. Also available from Delta Education, Inc., P.O. Box 915, Hudson, NH 03051. Phone: 800-442-5444. To see an overview of OBIS, go to [**http://www.lhs.berkeley.edu/OBIS/**]

Teaching Soil and Water Conservation, A Classroom and Field Guide, contains 24 activities on soil and managing soil, for primary and junior high students. Free. From the USDA-NRCS, their Pennsylvania office can be reached at: One Credit Union Place, Suite 340, Harrisburg, PA 17110-2993, Phone: 717-237-2207.

Penn State Cooperative Extension, ***4-H Entomology Member's Guide—"Catch the Bug."*** Although this booklet is designed to assist 4-H'ers creating an insect collection, it contains an excellent set of worksheets and handouts on insect characteristics and insect families. To obtain a copy in Lehigh County, contact Liesel Dreisbach, Youth Development Extension Agent, Lehigh County Cooperative Extension, Lehigh County Agricultural Center, 4184 Dorney Park Road, Allentown, PA 18104-5798. Phone: 610-391-9840, E-mail: ldreisbach@psu.edu. To obtain a copy in Northampton County, contact Phyllis Laufer, Youth Development Extension Agent, Northampton County Cooperative Extension, Greystone Building, Gracedale Complex, Nazareth, PA 18064-9212. Phone: (610) 746-1970, E-mail: pxl10@psu.edu. If you don't live in either of these counties, contact your local extension agent or the Penn State Integrated Pest Management Program, 501 Agricultural and Industries Building, University Park, PA 16802-3508. Ask for

Lyn Garling, Phone: 814-863-8884, E-mail: ljg5@psu.edu.

Institute of Ecosystem Studies. *Schoolyard Ecology Leader's Handbook.* [**http://www.ecostudies.org/syefest/contents.htm**] 2000. In addition to resource materials on how to run a workshop to train teachers to do hands-on investigations in the schoolyard, this site contains a complete activity guide for grades 4-8, coordinated to national standards and various other educational frameworks. Includes lesson plans, case studies, and an annotated resource list.

NOAA/Forecast Systems Laboratory. *GLOBE*, ***Global Learning and Observations to Benefit the Planet***. [http://www.globe.gov] This site has lesson plans and directions on how to inventory soil characteristics. When you get to the home page, click on "Teacher's Guide" in the left hand toolbar. Then select "Soil Chapter" from the guide menu. You can download a PDF of the entire chapter to keep as a reference.

Books for the Students

OBIS Lawn Guide, ($3.95), Berkley, CA: Lawrence Hall of Science. 1980. ***Outdoor Biological Instructional Strategies, (OBIS),*** available from the Lawrence Hall of Science, University of California #5200, Berkeley, CA 94720-5200. Phone: 510-642-7771, E-mail: gems@uclink.berkeley.edu. Also available from Delta Education, Inc., P.O. Box 915, Hudson, NH 03051. Phone: 800-442-5444.

Appelhof, M. ***Worms Eat My Garbage***. Kalamazoo, MI: Flowerfield Press. 1997. Although this is a book on composting with worm power, it contains a wealth of information on worm biology and the process of soil formation through the work of worms and many other decomposers. Lots of fun illustrations.

Zim, H. S. ***Golden Guide to Insects***. New York: St. Martin's Press. 2001.

Levi, H.W. ***Golden Guide to Spiders and Their Kin***. New York: St. Martin's Press. 2001.
Martin, A. C. ***Golden Guide to Weeds***. New York: St. Martin's Press. 2001.

Silver, D. M. ***One Small Square Backyard***. NY: Learning Triangle Press. 1993. This book is outstanding in every respect. It is the perfect introduction to outdoor field study, full of easily implemented suggestions. It has a myriad of appealing illustrations nicely mixed in with text that is well organized, engaging and highly readable. There is also a CD ROM available to go along with the book. There are other books in the series such as *One Small Square Woods, Pond, Seashore, etc.*

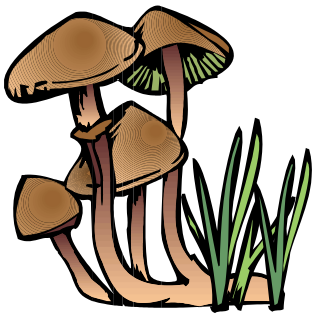
Web sites**:** Since the Web is constantly changing, check Muhlenberg's Outreach Web site for updated listings. [**http://www.muhlenberg.edu/cultural/graver/index.html**]

Web sites for the students

University of Illinois Extension. ***Four Major Components of Soil***. [**http://www.urbanext.uiuc.edu/gpe/case2/c2facts1.html**] This is part of a larger Web-based plant investigation unit.

Digital Learning Center for Microbial Ecology. ***The Microbe Zoo***. [**http://commtechlab.msu.edu/sites/dlc-me/zoo/index.html**] 2000. Sponsored by Michigan State University. The zoo includes pictures of microbes; data about their size, scientific classification, feeding habitats, and more; and descriptions of how the

microbes fit into and interact with their environment and other microorganisms. Zoo specimens are arranged in pavilions representing the habitats in which they naturally dwell, such as Water World, DirtLand, and the Animal Pavilion. Subsections of the zoo pavilions representing specific microbial habitats include the "compost heap," the "toxic waste dump," the "habitat on humanity," the "termite gut," the "house of horrors," and several others.



Digital Learning Center for Microbial Ecology. ***Microbes in the News***. [**http://commtechlab.msu.edu/sites/dlc-me/news/news.html**] 2000. Sponsored by Michigan State University. News stories from the popular press related to microbial ecology and microbiology, with added commentary from scientists. Stories are grouped into four categories: Heroic, Dangerous, Ancient and Strange. Articles are listed in chronological order based on publication dates, as well as by groupings based on what newspaper or magazine in which they originally appeared.

National Aeronautics and Space Administration (NASA) ***Soil Science Education Homepage***. [**http://ltpwww.gsfc.nasa.gov/globe/index.htm**] June 26, 2002. Produced in conjunction with the GLOBE program. An excellent site with good graphics and a compelling presentation of information appropriate for middle school students. Includes lesson plans.

Appendix A
Supplemental Materials for the Teacher

Copy Masters for:

How to Make a Berlese Funnel
Answers to Field Study Questions (for the Teacher)
Soil Dwelling Invertebrates and Plant Types PowerPoint Outline

How to Make a Berlese Funnel

The Berlese funnel trap (pronounced ber-lace-ee) is named after an Italian entomologist who invented the trap more than 100 years ago. Berlese funnel traps are essential to scientists who study very small organisms that live in leaf litter. These animals prefer moist, cool conditions and rarely leave the cover of dead leaves. A Berlese funnel works by making the soil at the top of the pile warm and dry, thereby forcing the organisms to move to the bottom areas in an attempt to find better conditions. As the light bulb in the trap warms up the plant material, the animals seek a cooler, wetter place to hide, and they fall into your trap!

A Berlese funnel should take approximately 20-25 minutes to make.

Materials needed (for one trap):

- ❑ One 2 liter plastic soda bottle
- ❑ Knife or scissors for cutting the bottle
- ❑ One moistened, white paper towel
- ❑ Paper clips, tape, or bamboo skewers for attaching the funnel
- ❑ Circular piece of stiff wire screen approximately 3 inches in diameter with holes big enough for insects and animals to pass through. (Window screen will not work because it is too flexible and the holes are too small.)
- ❑ One incandescent light bulb (Gooseneck lamps work well. Do not use florescent lights!!)
- ❑ Small container such as a film canister of rubbing alcohol for preserving insects (optional)
- ❑ Magnifying lens for observing trapped animals

Directions:

1. Cut the neck of the soda bottle off where it begins to curve into the bottle. Save the top.

2. Place a white piece of moistened paper towel into the bottom of the bottle. This will give your creatures some moisture and make them easier to see.

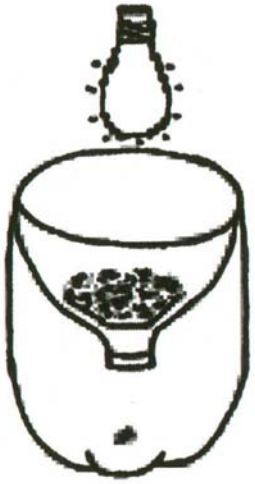
3. Take the top and turn it upside down to make a funnel. Put the funnel into the soda bottle so that the top edges are flush. Secure the funnel with tape, staples, or plastic glue.

4. Take the piece of wire screen and fit it into the funnel about 2 inches from the top edge.

5. Put in a small handful of leaf litter.

6. Place the incandescent light bulb a few inches over your trap. Allow it to warm and dry the leaves overnight. You need an incandescent light because it provides heat as well as light.

7. To observe your live animals more closely, remove the funnel and leaf litter carefully and quickly cover the bottle with a Ziploc plastic bag. Gently turn the bottle over and shake the contents into the bag. Secure the bag opening and examine your specimens! You can also put a small amount of water in the bottom container which will trap the critters and slow them down so they can be transferred to a petri dish or shallow tray. You can also shake the critters into a bug box or observation jar.



Burlese funnel

Answers to Field Study Questions

A. Use the information you have gathered from your field study to answer the following questions.

What is the most common type of animal in your microhabitat?

Answers will vary.

Why is it the most common?

*The reason an animal lives in a given area is because it finds the **food, shelter** and **moisture** conditions it needs to survive. The key feature of a correct answer is that it relates in some way to the animal finding something that it needs to survive in the area.*

Some possible answers:

Worms and mollusks will thrive in shady areas with rich, moist soil, such as the forest floor, where conditions favor their food habits of eating decaying vegetation and their camouflage adaptations of dark brown coloration.

Arthropods, especially insects and spiders will thrive in areas dominated by a variety of surfaces to hang out on and in and under—i.e. vegetation. The vegetation provides them with lots of types of food and places to hide. Arthropods have a whole variety of adaptations to take advantage of many types of environments. For example, their exoskeletons are an adaptation that allows them to survive in drier areas and move around more to take advantage of larger areas of a particular habitat.

Insects have a variety of mouthparts for feeding on vegetation, such as sipping mouthparts for nectar, drilling mouthparts (for getting into seeds), needle-like mouthparts for sucking up plant sap, chewing mouthparts for vegetation, etc.

How do the soil and the plants affect the animals in your microhabitat—do they help them or hurt them?

Rich, loose soil can support more variety of living things than dry packed soil. However, for some plants and animals adapted to harsh conditions, dry soil gives them a competitive edge. For example, grass plants often take up as much space below the ground as above the ground—their bushy root systems are adapted to getting every bit of available moisture and nutrients from the soil. These dense roots also provide an environment hospitable to many types of microscopic soil-building organisms.

B. Use the information you have gathered from your field study to answer the following questions.

Some examples of **physical** adaptations are camouflage, warning coloration, stingers, protective body coverings, feelers, etc. Which ones do your animals have?

Answers will vary

Are there any adaptations that were not listed that your animals have?

Answers will vary

Describe how these adaptations help the animals survive.

Answers will vary. Some possible examples:

Animals that live in grassy areas may be light colored or look like small seeds or leaves. Leaf-hoppers and small red ants are two such organisms. Animals that live in leaf litter may be brown, gray or tan, such as wolf spiders and sowbugs. Animals that live under logs and in the soil are usually dark brown or black, such as earthworms, snails and centipedes.

Insects have a variety of mouthparts for feeding such as sipping mouthparts for nectar, drilling mouthparts (for getting into seeds and the bodies of other insects), needle-like mouthparts for sucking up plant sap and insect fluids, chewing mouthparts for vegetation, fangs and saw-like mouthparts for tearing up prey, and lapping mouthparts for slurping mushy decaying vegetation. Snails have scraping mouthparts like sandpaper for scraping away the surface of damp vegetation.

Many soil dwelling animals are colored bright red. This usually indicates that they are poisonous to eat and so predators will avoid them.

Some examples of **behavior** adaptations are weaving webs, running away quickly, staying still so not to be noticed, curling up in a ball, etc. Which ones do your animals have?

Answers will vary. Some possible examples:

Soil critters have various behavior strategies for avoiding capture by prey. Some well-camouflaged critters will stay very still to avoid being seen, such as millipedes which will curl up in a ball and just hang out like a clump of dirt. Other

critters will scoot away fast, wiggling their legs and generally startling their predators, such as many squirmy centipedes.

Are there any behavior adaptations that were not listed that your animals have?

Answers will vary

Describe how these adaptations help the animals survive.

Answers will vary. Here is an example:

Some soil critters will twist about grotesquely or give off an offensive odor that will cause kids to jump away from them in fear. You can tell the kids they have just seen an example of how effectively the adaptation works—the big predator was scared away!

C. Use the information you have gathered from your field study to answer the following questions.

What kind of plant is most common in your study site, mosses, monocots or dicots?

Answers will vary

Why is it most common?

Answers will vary. Here are some examples:

Because they have shallow "roots" and can go into a dormant state, mosses can survive in many types of environments—moist or dry. They can live on rocks, bark or other marginal areas. However, mosses are susceptible to getting eaten up by animals since they don't have any spines or tough skin to stop animals from grazing on them. Mosses are also susceptible to getting disturbed by foot traffic and other large-scale disturbances by big animals. Because they have zillions of spores, mosses can quickly re-colonize disturbed areas.

Grasses (monocots) do well in slightly dry conditions with shallow, less fertile soil, due to their extensive and aggressive root systems. Dicots on the other hand have long, hardy taproots and wide leaves. This gives them an advantage when the soil is fairly deep and in the shade. Their wide leaves optimize the amount of sunlight they can soak up in shady environments. ***Note: these are generalizations—not all dicots have taproots or wide leaves, and some monocots have deep roots and wider leaves.***

How do the animals affect the plants in your microhabitat—do they help them or hurt them?

Answers will vary. Here are some examples:

Many plants will show evidence of insects or other small invertebrates eating them. Whether or not this is harmful to the plant depends on the extent of the damage from the feeding.

Some insects make galls or tunnels in the leaves and stems of plants. This does not always harm the plant, but extensive nests and galls weaken a plant and make it more susceptible to disease or insect pests.

Nectar feeders such as flies, butterflies and bees help the plants by intermixing pollen.

Many seed-eating insects help plants by carrying their seeds from one place to the other. The insect might have been intent on eating the seeds, but if something happens to the insect along the way before it eats the seed, the seed gets planted. Ants are a good example of this type of seed-spreading behavior.

Decomposer animals such as sowbugs and worms help plants by breaking down dead material and turning it into soil. They do this by eating the dead plants and then defecating. Their waste, (worm poop to be exact), is one of the main sources of nutrients in the soil. Also, when they break the plant material down into small pieces, this provides food for ever smaller and smaller microorganisms in the soil that create soil fertility.

Why do you think the animals in your study site help or hurt the plants?

Answers will vary. One important idea for the kids to learn is that whether something helps or hurts a plant or is neutral often depends on the rate at which it is occurring. It also depends on environmental conditions. For example a plant may not be harmed by the usual level of insect grazing in years of high moisture, but the same grazing could kill a plant weakened during drought conditions. That is why nature has checks and balances—when the population of insects feeding on plants goes up, then eventually more and more of their predators will arrive and hopefully bring the system into balance again. This is one reason why invasive insects from other continents cause many problems, the new environment lacks the presence of any of their predators to keep their rate of population growth in check.

D. Use the information you have gathered from your field study to answer the following questions.

Where did you find the most animals in your study site?

Answers will vary.

Why do they like that environment best? Do they like the soil? Do they like the plants? Do they like the food or shelter or water? Give a detailed explanation for your answer.

In general, critters thrive best in areas of soil that are not too dry and too compacted.

In the answers to other task questions you will find suggestions of the types of plants that certain animals like for food and shelter.

In general, the areas with more vegetation will have more animals, because the plants provide the animals with food and shelter. Needed water collects around their leaves and roots.

Areas around dead logs and under rocks usually have more animals because those features provide physical shelter from the elements and from predators.

E. Use the information you have gathered from your field study to answer the following questions.

Observe the mouthparts of the organisms you collected. Look at the plants you collected them on or near. See if you can figure out what they eat. What is the most common type of food that these animals eat? Explain your answer.

Answers will vary. Here are some examples:

Soil critters have a variety of mouthparts for feeding such as sipping mouthparts for nectar, drilling mouthparts (for getting into seeds and the bodies of other insects), needle-like mouthparts for sucking up plant sap and insect fluids, chewing mouthparts for vegetation, fangs and saw-like mouthparts for tearing up prey, and lapping mouthparts for slurping mushy decaying vegetation. Snails have scraping mouthparts like sandpaper for scraping away the surface of damp vegetation.

What are some other types of food that the animals you collected eat? Explain your answer. What clues did you use to figure out what the animals eat?

S*ome animals are predators and they will have adaptations for catching and eating prey. This includes camouflage, webs, and various types of body parts for snaring prey such as pincers and legs with spear-like or club-like projections.*

F. Use the information you have gathered from your field study to answer the following questions.

How many of these types of animals do you have in your study site—

Worms: *Answers will vary*

Mollusks: *Answers will vary*

Arthropods: *Answers will vary*

Is one type more common than another?

Answers will vary.

Why?

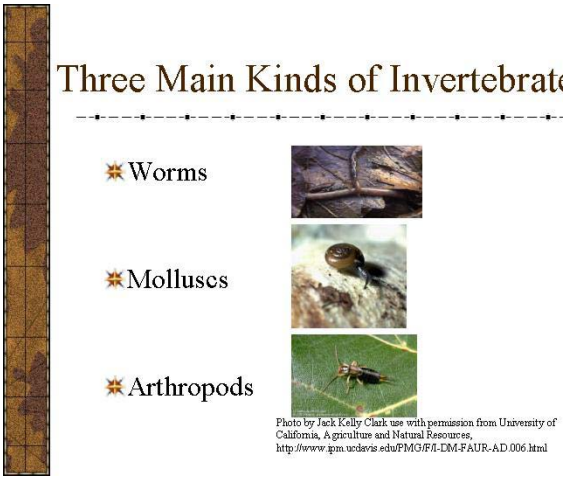
Some possible answers:

***Worms and mollusks** will thrive in shady areas with rich, moist soil, such as the forest floor, where conditions favor their food habits of eating decaying vegetation and their camouflage adaptations of dark brown coloration.*

***Arthropods**, especially insects and spiders will thrive in areas dominated by lots of surface vegetation. The vegetation provides them with lots of types of food and places to hide. Arthropods have a whole variety of adaptations to take advantage of this environment. For example, their exoskeletons are an adaptation that allows them to survive in drier areas and move around more to take advantage of larger areas of a particular habitat.*

***Insects** have a variety of mouthparts for feeding on vegetation, such as sipping mouthparts for nectar, drilling mouthparts (for getting into seeds), needle-like mouthparts for sucking up plant sap, chewing mouthparts for vegetation, etc. They will congregate in areas where the type of food they like is located.*

Soil-Dwelling Invertebrates and Plant Types
PowerPoint Outline



Invertebrates are animals without backbones. The three "kinds" of invertebrates mentioned in this slide, *worm, mollusc* and *arthropod*, refers to easily identified characteristics of six phylum of the kingdom Animalia. These phyla represent the animals that students will be most likely to find and observe in their soil microhabitats.

The **worm** phyla are quite varied. Segmented worms such as earthworms belong to the phylum Annelidea. The representative phylum of non-segmented worms commonly seen in the soil is Nematoda, tiny nematode worms.

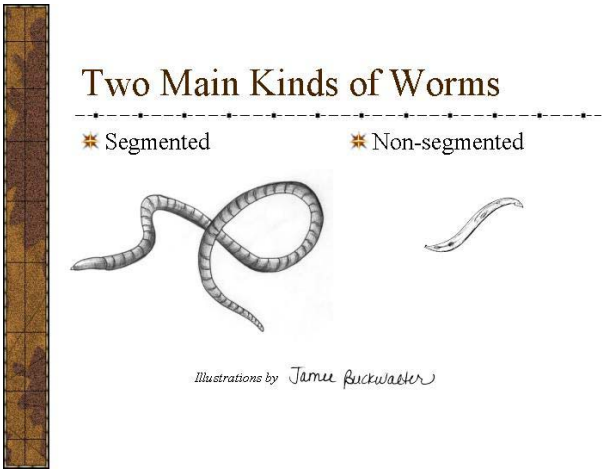
Molluscs belong to the phylum Mollusca, and on land that means snails and slugs.

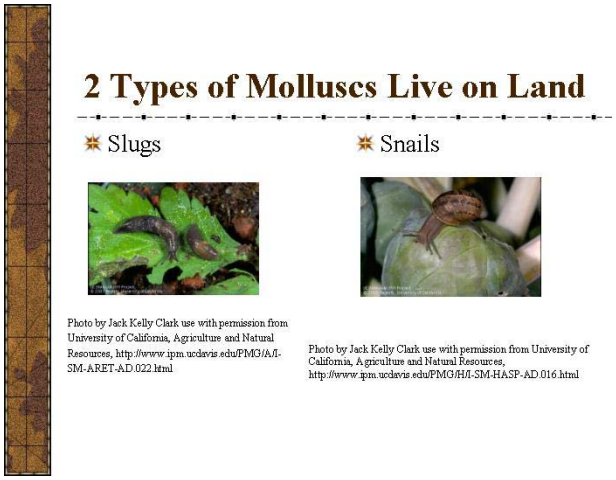
By far the most prevalent group of animals on the planet is the **arthropods**, including the phyla Crustacea--crayfish and sowbugs; Chelicerates--spiders, mites, ticks, pseudocorpions, chiggers and daddy long legs; and the Mandibulata--insects, millipedes and centipedes.

Segmented worms are a diverse group, but on land the common worm you will see with your class is the earthworm, which is an Oligochaete, meaning "few bristles." If you run a moistened finger along the length of the worm you can feel these bristles, called *setae*, which anchor the worm in the soil. The setae, along with circular contracting muscles make worms very good at burrowing. Most worms are scavengers, feeding on "detritus" which is the dead plant and animal material found in the soil.

Non-segmented worms are equally diverse. On land and in the water, tiny microscopic worms called nematodes are one of the dominant animals, but because of their microscopic size, casual observers rarely see them. Their impact is not tiny however-- many types of nematodes are significant pests of plants and animals, including humans. On the flip side, the majority of nematodes are beneficial. In the top 2 inches of an acre of soil there could be as many as a billion nematodes. They break down and recycle the nutrients in the dead organic matter of the planet, thus creating rich soil.

Nematodes are sometimes called roundworms. They have an external cuticle, which they must molt to get bigger. The cuticle often gives them a shiny appearance. Since they don't have circular muscles, only longitudinal ones, nematodes move by bending from side to side.



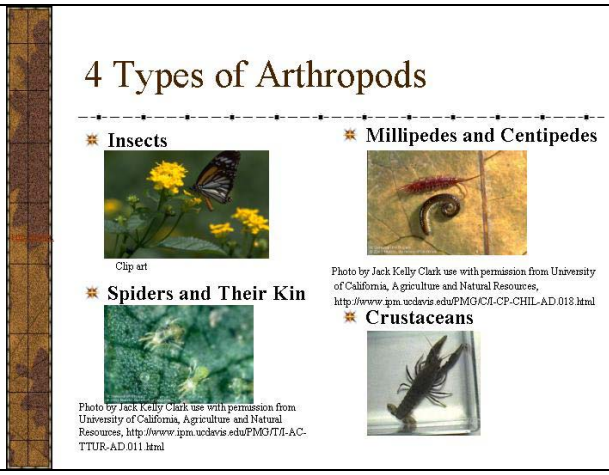


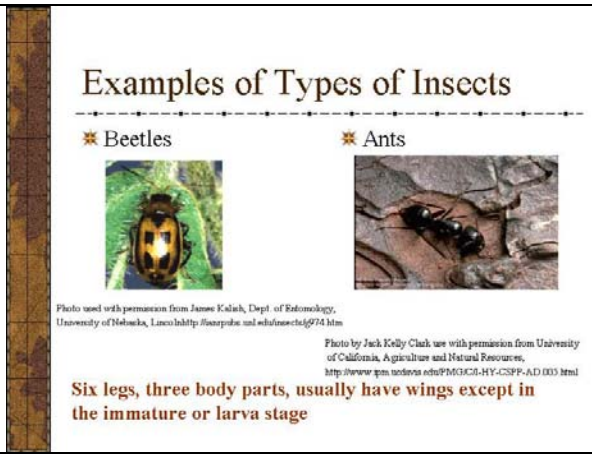
The mollusc phylum includes many beautifully colored and patterned animals. Clams, octopus, squid and other mollusks are an important source of food, and mollusc shell material is used in many types of decoration.

The class of mollusks found on land is called Gastropoda, coming from the Greek word "gaster" for stomach, and "podus" meaning foot. Their prevalent feature is a large muscular "foot" which they use for locomotion, gliding along on a slime trail they lay down. They have a well-developed head that includes eyes and 1-2 pairs of tentacles. If you look closely at a snail or slug you might be able to see this eyespot.

Gastropods eat a variety of foods, including plants and decaying vegetation; they have a set of small teeth arranged on a rasping tongue, which can be used to scrape away at their food. Because of their diversity and specialized feeding, molluscs are an important part of the food web.

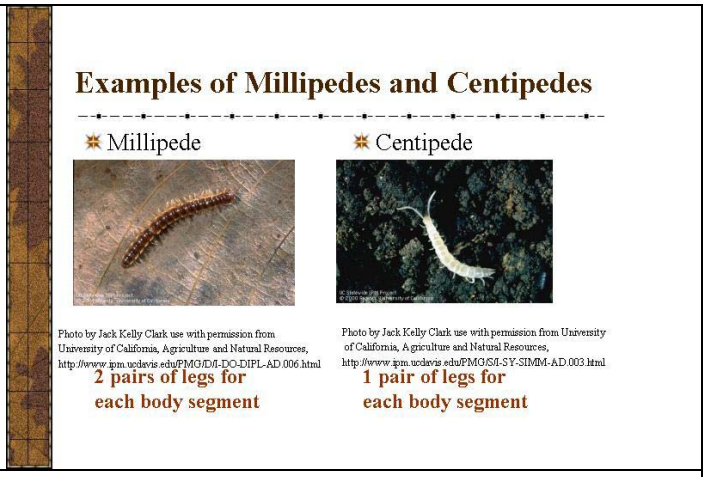
Insects, Millipedes and Centipedes
This group is known as the Mandibulata, and comprises the largest number of animal species found on the earth. Their jointed appendages and segmented bodies, and exoskeleton, made of a protein called *chitin*, are some of the observable features that identify them as arthropods.

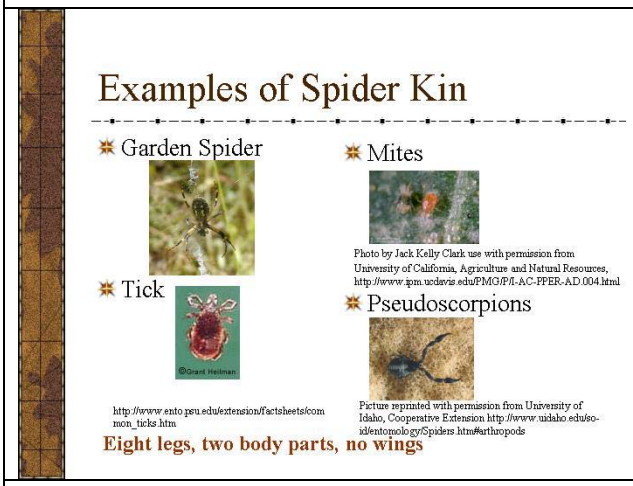




Insects
Insects' unique characteristics include three main body segments, three pairs of legs, one pair of antennae, and one or two wing pairs. Other than birds and bats, insects are the only animals capable of flight.

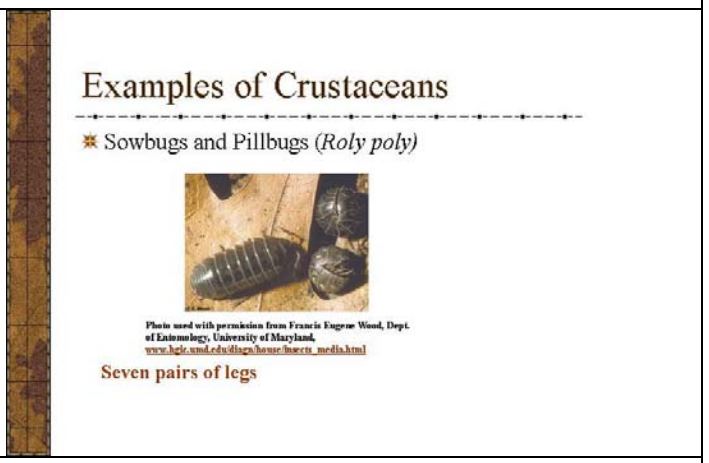
Millipedes and Centipedes
Millipedes and centipedes have a pair of antenna like the insects, but they also have many body segments, from 15 to 200. The legs are arranged two to a body part in centipedes, and four to a body part in millipedes. Centipedes are nocturnal predators, who inject a nerve toxin into their prey. Hard-shelled millipedes are mostly scavengers, but they too have toxins, in this case used to deter predators.

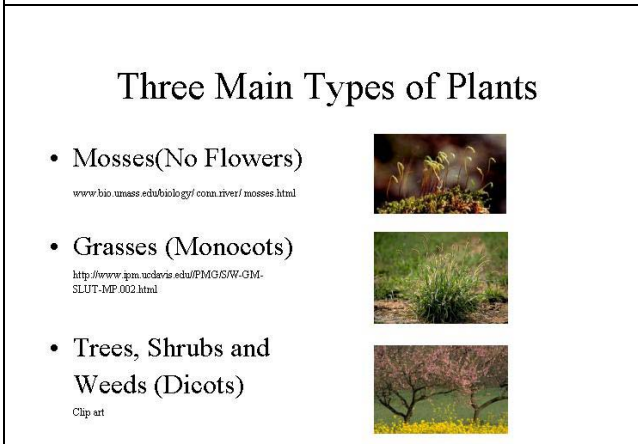




Spiders and Their Kin
This class, called Cheliceratea, lacks antennae, and the head and thorax are fused into what is known as a cephalathorax. Instead of having mandibles as a mouthpart like insects, chelicerates have a feeding appendage known as *chelicera*, which in spiders are what we call "fangs." Spiders feed mostly on insects and are significant natural pest controllers. Their cousins, the minuscule mites, feed primarily on decaying vegetation, and thus are an important part of the soil formation process. Both spiders and mites are key players in the soil food web. Some mites are pests, as are their tick cousins.

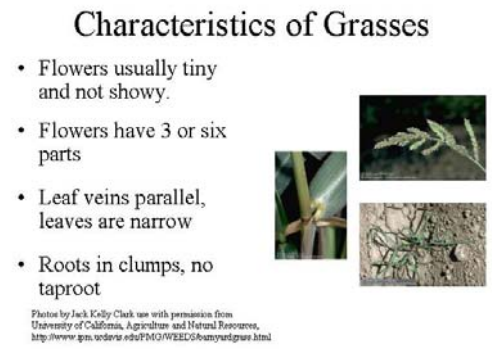
Crustaceans
The most recognizable members of this phylum are the aquatic ones--crayfish, crabs, lobsters and shrimp. But the soil dwelling "pillbug" or "roly-poly" loved by children is also a member. The unique characteristics of this phylum are two pairs of jointed antennae, and pairs of branched appendages (legs, pincers, claws, etc.) numbering from five to 13.
Pillbugs seek out moist dark places, and feed on detritus. They are docile creatures; hence another name for them is "sowbugs."





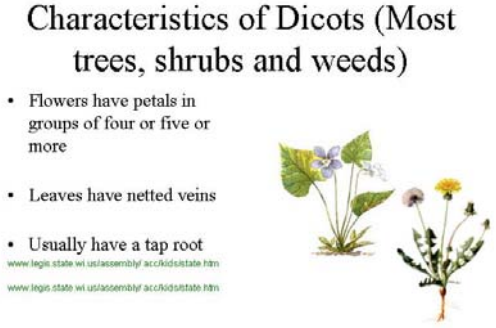
Three kinds of plants
The three groups represented in this slide include one nonvascular type of plant, the mosses, which are members of the phylum Bryophyta, and two types of vascular, flowering plants—the monocots and dicots. Monocots and Dicots are differentiated by the structure of their seeds.

Characteristics of Mosses
Mosses lack true leaves, stems and roots. Instead of specialized structures, these plants obtain moisture and nutrients from the environment by direct absorption through their tissues. They are anchored onto the surfaces on which they are found by thin filaments. Because water greatly facilitates this absorption process, mosses thrive in moist conditions, although many are adapted to surviving periods of dryness.
Another prime characteristic of mosses are the structures they produce to disseminate their spores. These spore capsules are suspended on thin stalks. They eventually dry and break open, allowing the mature spores to be dispersed by the wind.



Characteristics of Grasses and other Monocots
Other than palms, the majority of monocots are herbaceous (fleshy) rather than woody plants. They get their name from the structures surrounding their seeds, called "cotyledons." In *mono*cots, these cotyledons comprise a *single* sheaf surrounding the plant embryo. Monocots generally have inconspicuous flowers, with structures such as leaves, stamens and sepals that can be divided into three parts. Usually, monocot veins run parallel though the leaves, and their vascular tubes are arranged in bundles in the stem of the plant. In the case of grass-like plants, roots are often fibrous clumps, and a taproot is lacking. Many important food plants such as corn, wheat, and oats are monocots.

Characteristics of Dicots
The largest group of flowering plants is the dicots. This group includes many common garden plants and wildflowers, fruits and vegetables, hardwood trees and ornamental shrubs. In contrast to dicots, monocots have seed coats (cotyledons) that can be split down the middle into two sections. Their flower parts come in groups of fours and fives, and their veins are netted. Dicots often have taproots, although there are many that do not. The vascular bundles in dicot stems are arranged in a ring within the stem of the plant.



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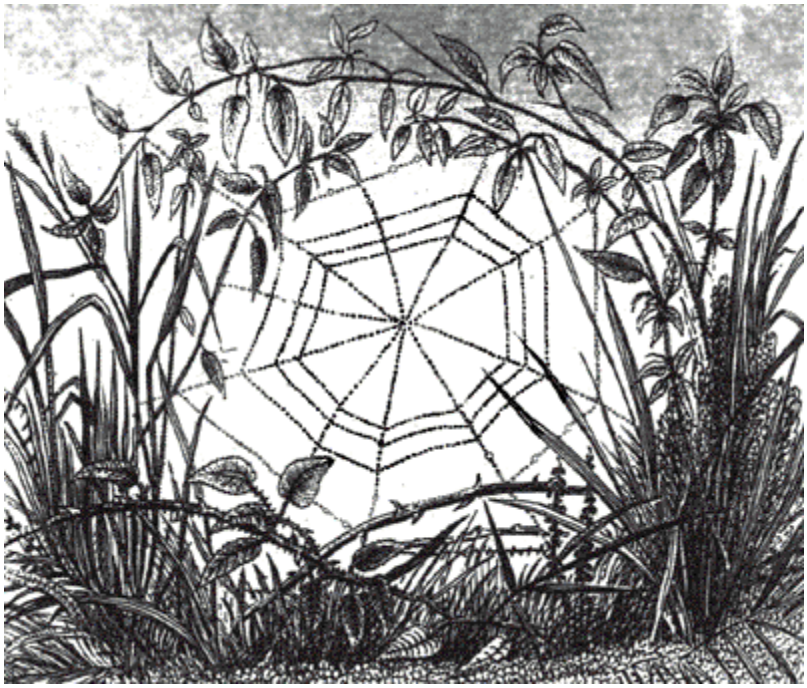
Appendix B
Copy Masters for Middle School Level Soil Microhabitats Field Study

Copy Masters for:

Cover Page
Soil Profile Microhabitat Data Sheet
Analyze Soil Characteristics Microhabitat Data Sheet
Organisms in the Soil Microhabitat Data Sheet
Soil Characteristics Reference Tables
Soil pH Quick Reference
Plant Identification Quick Reference
Soil Creatures Key
Examples of How to Present Data

Soil MicroHabitats



Field Study Log Book

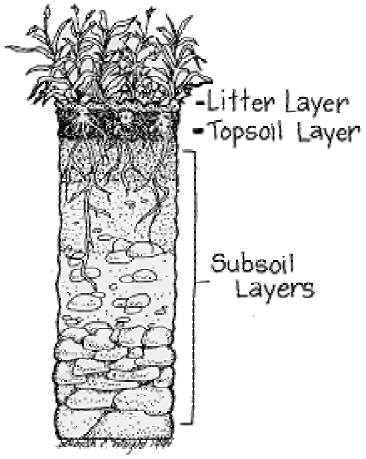
Name: _____

School: _____

Grade: _____ Date: _____

Soil Profile

Microhabitat Data Sheet



	Picture	Description
3 inches (8 cm)		
6 inches (16 cm)	Picture	Description
1 foot (30 cm)	Picture	Description

Organisms in the Soil

Microfauna Data Sheet

Select an area about 2 or 3 feet square on the ground and sift through the top 3 inches, recording the evidence of plants and animals you observe. Replace the ground in as near original condition as possible.

Name, picture or description of organism in the soil	Quantity	Possible Effect on Soil

Analyze Soil Characteristics

Microhabitat Data Sheet

Work in small groups. Using the information provided in the soil data tables, complete the following:

1.What is the soil's color in layer A?

☐ **Dark** ☐ **Moderately Dark** ☐ **Light**

Based on the soil's *COLOR*, complete the following (Refer to Table 1a and 1b):

The topsoil, or **A Layer**:

Amount of organic material _____

Erosion factor _____

Fertility _____

2. What is the soil's color in layer B?

☐ **Dull Grey** ☐ **Yellow/red-brown/ Black** ☐ **Mottled Grey**

Based on the soil's*TEXTURE*, complete the following (Refer to Table 2a and 2b):

Layer horizon	Sandy, Silty or Clayey	Soil Drainage
Top soil A		
Subsoil B		

The drainage in the subsurface or **B Layer** is _____

3. Based on the soil's *STRUCTURE*, complete the following (Refer to Table 3);

Layer horizon	Type of Soil Structure	Drainage	Aeration
Top soil A			
Subsoil B			

Analyze Soil Characteristics – Continued

4. What is the pH of the soil? _____

Based on the *pH* ranges, complete the following (Refer to Table 4):

Some plants could grow here, based on the soil pH plant chart	Some plants actually observed growing here

5. The terms: *litter*, *duff*, and *humus*, are used to describe organic matter at the top of the soil. From your study above, complete the following chart.

Term and definition	Describe the characteristics, e.g., feel, smell, color	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter)		
Humus (almost completely decomposed non-identifiable organic matter)		

6. Soil temperature:

A Topsoil layer: _____

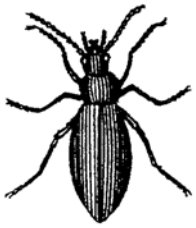
B Subsoil layers: _____

7. Soil nutrient content:

Nitrogen: _____

Potassium: _____

Phosphorous: _____



Additional Notes:

Soil Characteristics Reference Tables

TABLE 1a.
Topsoil (A Layer)

Condition	Topsoil color		
	Dark (dark grey, brown to black)	***Moderately dark (brown to yellow-brown)***	***Light (pale brown to yellow)***
Amount of organic material	High	Medium	Low
Erosion factor	Low	Medium	High
Aeration	High	Medium	Low
Available Nitrogen	High	Medium	Low
Fertility	High	Medium	Low

TABLE 1b.
Subsurface Soil (B Layer)

Subsurface soil color	Condition
Dull grey (if in low rainfall soils, 0-2 inches of rain)	Water-logged soils, poor aeration
Yellow, red-brown, black (if in forest soils)	Well drained soils
Mottled grey (if in humid soils)	Somewhat poorly to poorly drained soils

TABLE 2a.
Common Soil Textures

Particle Size	Feel	Air Space	Water Availability
Clay (.002 mm)	Sticky	Few, tiny	Slow movement of water; may result in low availability
Silt (.002-.05 mm)	Smooth	Many, small	Good
Sand (.05-2.0mm)	Gritty	Many, large	Low

TABLE 2b.
Some effects of texture on soil conditions

Texture	Water holding capacity	Looseness of soil
Sandy	Poor	Good
Loamy	Good to excellent	Good
Clayey	High (water held too tightly for plant use)	Poor

Soil Characteristics Reference Tables

TABLE 3.
Some effects of structure on soil conditions

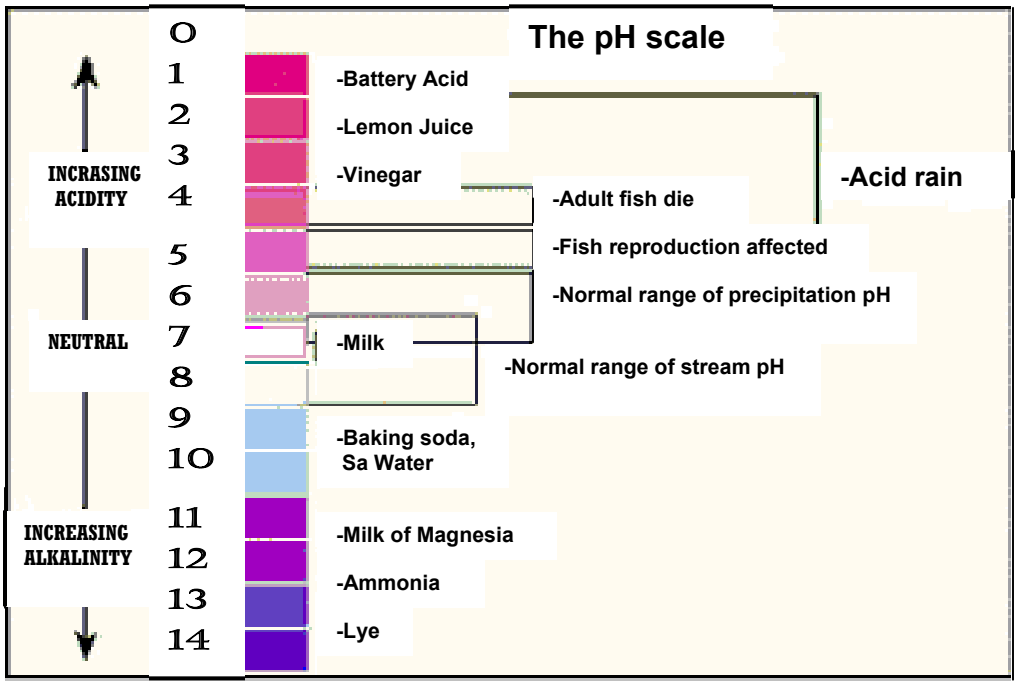
Type	Penetration of water	Drainage	Aeration
 ***Columns***	Good	Good	Good
 ***Blocky***	Good	Moderate	Moderate
 ***Granular***	Good	Best	Best
 ***Platey***	Moderate	Moderate	Moderate

TABLE 4.
Relationship of soil pH to plant species

Tree Species Suitable for Soil Conditions based on pH and Drainage

pH	Poorly Drained (Wet)	Well Drained (Moist)	Excessively Drained (Dry)
7.0 – 8.0	Beech		
5.5 – 7.0	European Alder Green Ash Pin Oak Sycamore Willow Silver Maple	Sugar Maple Basswood Tuliptree Black Walnut Aspen Red Oak	Red Pine Pitch Pine
4.0 – 5.5	Swamp White Oak Eastern Hemlock Yellow Birch Red Cedar	White Pine White Oak Scarlet Oak Rhododendron Azaleas Ferns Blueberries	Chestnut Oak Virginia Pine

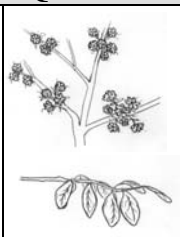
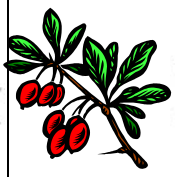
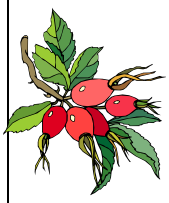
Soil pH Quick Reference



How to Measure Soil pH

1. Have students measure 1 tablespoon of soil and place into a petri dish, or any similar glass or plastic container. Wet the soil sample with 5 drops of distilled water (from an eyedropper). Allow to set for 3 to 5 minutes.
2. Place one piece of pH paper on the soil sample. (Use pH paper with a range from at least 5-10.)
3. Determine the approximate pH or acid/base level of your soil.

Plant Identification Quick Reference

Woody Plant Quick Identification						
Shrubs	 Tartarian Honeysuckle	 Blackberry Bramble	 Spicebush	 Sumac	 Barberry	 Russian Olive
Vines	 Poison Ivy	 Virginia Creeper	 Greenbriar	 Grape	 Multiflora Rose	 Japanese Honeysuckle
Grasses	 Crabgrass	 Bluegrass	 Quackgrass	 Wild Onion	 Foxtail	 Timothy
Fern and Moss Quick Identification Guide						
Ferns	 Ostrich fern	 Christmas Fern	 Bracken Fern	 Sensitive Fern	 Interrupted Fern	 Cinnamon Fern
Mosses	 Sphagnum	 Pincushion Moss	 Common Haircap	 Tree Moss		

Soil Creatures Key

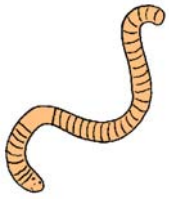
1A. Animals with no legs . . . . . Go to 2

1B. Animals with legs . . . . . Go to 5

2A. Animals with a worm-like, tube shaped body . . . . . Go to 3

2B. Animals with a flat squishy body, head with tentacles . . . . . Go to 4

3A. Body is segmented, (divided up into many rings) . . . . . EARTHWORMS



3B. Body is hair-like and not segmented (looks clear under a magnifier) . . ROUNDWORMS

4A. Coiled shell present . . . . . SNAIL

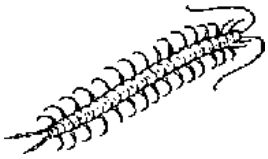
4B. Snail-like but without shell . . . . . SLUG

5A. Animals with more than seven pairs of legs . . . . . Go to 6

5B. Animals with seven or less pairs of legs . . . . . Go to 7

6A. 2 pairs of legs attached to each body segment . . . . . MILLIPEDES

6B. 1 pair of legs attached to each body segment . . . . . CENTIPEDES



7A. Animals with seven pairs of legs, oval shaped body - - - - - - - - - SOWBUGS

7B. ANIMALS WITH THREE OR FOUR PAIRS OF LEGS . . . . . Go to 8

8A. Animals with three pairs of legs (6 legs TOTAL) . . . . . INSECTS

8B. Animals with four pairs of legs (8 legs TOTAL) . . . . . Go to 9

9A. Animals with a narrow waist dividing the body into two regions . . . . . SPIDERS

9B. Body not clearly divided - - - - . . . . . Go to 10

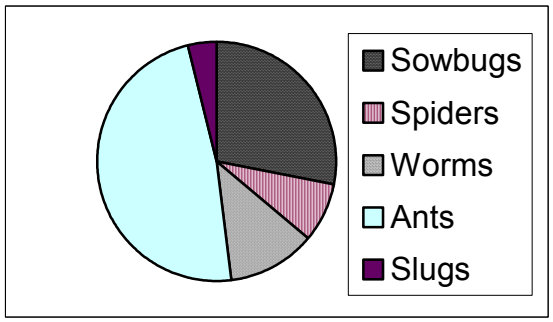
10A. Without pincers - - - - - MITES

10B. With pincers . . . . . PSEUDOSCORPIONS

Examples of How to Present Soil Microhabitat Data

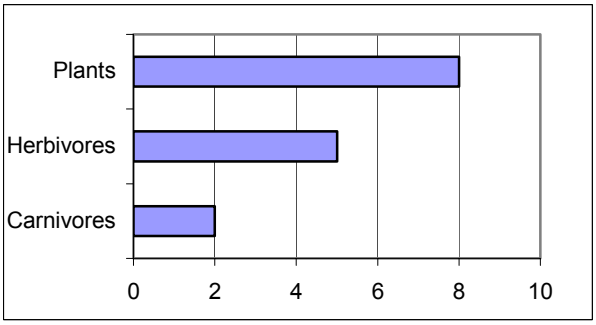
Create a pie chart

Invertebrate Distribution in a Grassy Meadow

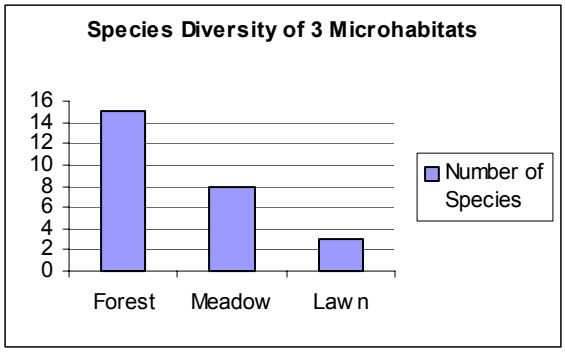


Create a Food Pyramid

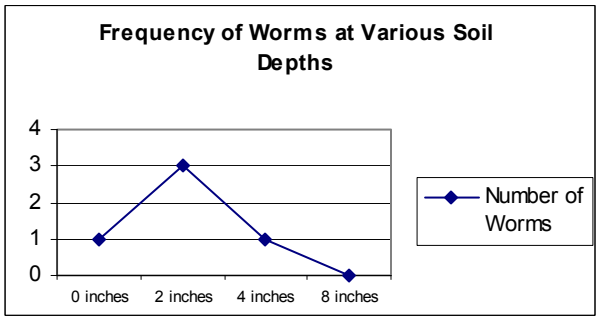
Trophic Levels in a Lawn Ecosystem



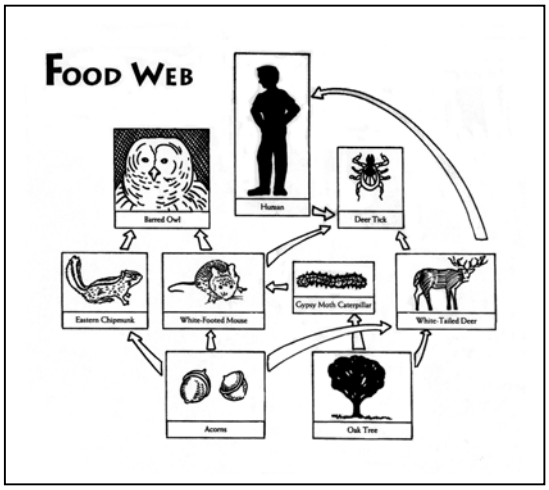
Create a Bar Graph



Create a X/Y Table



Create a Food Web



Appendix C
Copy Masters for Elementary Level Soil Microhabitats Field Study

Copy Masters for:

Field Study Log Book Pages for 3rd-5th Grade

Cover Page/Back Page
Field Study Instructions/Equipment Checklist
Zoologist/Field Study Question F
Botanist/Field Study Question E
Geologist/Field Study Question D
Cartographer/Field Study Question C
Field Study Question A/Field Study Question B

MUHLENBERG
COLLEGE

Soil Micro Habitats

Field Study Log Book

Name:_____

School:_____

Grade:_____**Year:**_____

Equipment Checklist

- ☐ Beaufort wind scale
- ☐ Birds
- ☐ Bug Box
- ☐ Calculator
- ☐ Celsius thermometer
- ☐ Clipboards
- ☐ Compass
- ☐ Fahrenheit thermometer
- ☐ Flags
- ☐ Forceps – 2 pair
- ☐ Hand lenses – 2
- ☐ Insect key
- ☐ Insects – Golden Guide
- ☐ OBIS Lawn Guide
- ☐ Pennies - 6
- ☐ Petri dish and lid
- ☐ PH paper
- ☐ Plant press
- ☐ Ruler
- ☐ Soil creatures key
- ☐ Soil thermometer
- ☐ Spiders – Golden Guide
- ☐ Trees – Peterson First Guide
- ☐ Trowel
- ☐ Weeds – Golden Guide
- ☐ White plastic trays
- ☐ White spoon
- ☐ Wildflowers – Peterson First Guide

Field Study Instructions

1. **Read through all the instructions**

2. **Gather all the materials**

3. **Place the hula-hoop over the ground in a study area where you won't be bumping into things.**

4. **Toss four coins into the study area.**
   a. The places where the coins land are where you will take a sample of the soil and identify the plants.
   b. DO NOT move the coins after they land.
   c. If two coins land in the same place, toss one of the coins again.

5. **Identify the plants growing around the coins.**
   a. Record your information in the columns on the botany page. List mosses in the moss column, monocots in the monocot column, and dicots in the dicot column.
   b. If you can find the plants in the field guide, write down their names
   c. If you cannot find the plants in the field guide and don't know their names, write a description or draw a picture. Be sure to observe all the details of the stem, roots, seeds, flower, and leaf shape. Draw as much as you can see.
   d. If there is more than one of the same kind of plant, write the number in the column next to the name or description of the plant

6. **Look for any invertebrates on the ground or on the plants near the coins.**
   a. Turn over rocks and logs and look for invertebrates hiding there. Make sure you put the rock or log back after you are finished looking.

7. **Use the trowel to take a sample of the soil from your study site**
   a. Put the soil on the white paper plates and use the forceps and spoons to sift through the soil looking for any small critters
   b. When you find a critter, record this information in your log book on the zoologist page. Put the mollusks in the mollusk column and the arthropods in the arthropod column, and the worms in the worm column.
   c. Write down the kind of arthropods you find—insects, spiders, millipedes, centipedes, and sowbugs. If you can find the animal in the field guide, write down the name. If you don't know what kind of animal it is, write a description or draw a picture.

8. **Draw a map of your study site.**

Zoologist

Name:_____

Molluscs 	Arthropods 	Worms 

Notes and Observations:

F. Use the information you have gathered from your field study to answer the following questions.

How many of these types of animals do you have in your study site—

Worms:

Molluscs:

Arthropods:

Is one type more common than another?

Why?

E. Use the information you have gathered from your field study to answer the following questions.

Observe the mouthparts of the organisms you collected. Look at the plants you collected them on or near. See if you can figure out what they eat. What is the most common type of food that these animals eat? Explain your answer.

What are some other types of food that the animals you collected eat? Explain your answer.

Name: _____

Botanist

Moss	**Grasses** (Monocots)	**Trees, Shrubs Weeds** (Dicots)
		

Notes and Observations:

Name:_____

Soil Color:

☐ Lt Bown ☐ Yellow/ Orange ☐ Green/ Gray ☐ Olive Gray ☐ Lt Gray ☐ Dark Gray

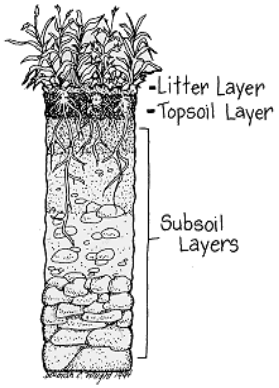
Soil Texture:

☐ **Mostly Clay** (soil clumps hold their shape) ☐ **Mostly Sand** ☐ **Mixture of Clay and Sand**

Soil Temperature: _____

Depth of A Layer: _____

Depth of B Layer: _____



Contents of Litter Layer:

Soil pH: _____

☐ ☐ ☐

D. Use the information you have gathered from your field study to answer the following questions.

Where did you find the most animals in your study site?

Why do they like that environment best? Do they like the soil? Do they like the plants? Do they like the food or shelter or water? (Give a detailed explanation for your answer.)

C. Use the information you have gathered from your field study to answer the following questions.

What kind of plant is most common in your study site, mosses, monocots or dicots?

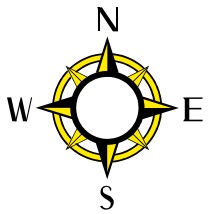
Why is it most common?

How do the animals affect the plants in your microhabitat—do they help them or hurt them?

Why do you think the animals in your study site help or hurt the plants?

Name:_____ Cartographer

Draw a Map of Your Study Site



Suggested Field Study Questions

A. Use the information you have gathered from your field study to answer the following questions.

What is the most common type of animal in your microhabitat?

Why is it the most common?

How do the soil and the plants affect the animals in your microhabitat—do they help them or hurt them?

B. Use the information you have gathered from your field study to answer the following questions.

Some examples of physical adaptations are camouflage, warning coloration, stingers, protective body coverings, feelers, etc. Which ones do your animals have?

Are there any that were not listed that your animals have?

Describe how these adaptations help the animals survive.

Some examples of behavior adaptations are weaving webs, running away quickly, staying still so not to be noticed, curling up in a ball, etc. Which ones do your animals have?

Are there any that were not listed that your animals have?

Describe how these adaptations help the animals survive.