Life in the Trenches:
Biodiversity Present in Leaf Litter

This lesson will allow students to view the components of an ecosystem found near the school and will help them to develop an understanding of the interdependence of all life forms on earth.

HYPOTHESIS:
The earth is made up of a variety of interrelated systems; even the tiniest of soil samples contains entire communities.

Primary Learning Outcome:
Students will examine the basic components of an ecosystem and will learn about the factors affecting the communities there.
- *What is species diversity?*
- *What is species richness?*
- *Why does biodiversity matter?*
- *Consider differing habitats. What factors affect biodiversity in each?*
- *What biotic and abiotic factors are influencing the system?*
- *What community interactions may be occurring?*

Assessed GPS:

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism
in science.
a. Exhibit the above traits in their own scientific activities.
b. Recognize that different explanations often can be given for the same evidence.
c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh3. Students will identify and investigate problems scientifically.
a. Suggest reasonable hypotheses for identified problems.
c. Collect, organize and record appropriate data.
d. Graphically compare and analyze data points and/or summary statistics.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.
a. Develop and use systematic procedures for recording and organizing information.
b. Use technology to produce tables and graphs.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.
a. Trace the source on any large disparity between estimated and calculated answers to problems.
b. Consider possible effects of measurement errors on calculations.
c. Recognize the relationship between accuracy and precision.

d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
e. Solve scientific problems by substituting quantitative values, using dimensional analysis and/or simple algebraic formulas as appropriate.

SCSh6. Students will communicate scientific investigations and information clearly.
a. Write clear, coherent laboratory reports related to scientific investigations.
b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
d. Participate in group discussions of scientific investigation and current scientific issues.

SCSh8. Students will understand important features of the process of scientific inquiry.
Students will apply the following to inquiry learning practices:
a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.
c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.

SCSh9. Students will enhance reading in all curriculum areas by:
• Read technical texts related to various subject areas.
• Respond to a variety of texts in multiple modes of discourse.
• Relate messages and themes from one subject area to messages and themes in another area.
• Recognize the features of disciplinary texts.
c. Building vocabulary knowledge
• Demonstrate an understanding of contextual vocabulary in various subjects.
• Use content vocabulary in writing and speaking.
• Explore understanding of new words found in subject area texts.
d. Establishing context
• Determine strategies for finding content and contextual meaning for unknown words

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.
a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.
c. Relate environmental conditions to successional changes in ecosystems.
d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.
e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.
f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

Total Duration:
1 hour lecture (compare and contrast biodiversity with species richness, why biodiversity is important, factors affecting biodiversity, introduction of laboratory)
Lab time:
- **One hour** to obtain samples
- **5 days** to wait for samples to process
- **2 hours** to examine and sort processed material

Materials and Equipment:
- Several soil sieves of different sizes
- Gardening gloves (optional)
- Several Berlese-type funnels (can be ordered from Bioquip)
- Pillowcases (for carrying samples back to lab)
- 75% ethanol
- Baby food jars or some other glass container to be placed underneath the funnels
- Light/heat source for funnels
- Microscopes or magnifying glasses
- Forceps

Procedures:
Step One
Students should work in groups or pairs. Using gardening gloves (if desired) students should obtain several leaf litter samples. For best results, do not use dry, top-layer leaves; instead, seek damp leaves that are in various stages of decomposition. The more variety the students can collect, the better the lab will be. Mushrooms and other fungi work really well for this activity, also. Handfuls of leaves (or fungus) should be placed into the sieves, using the largest sieve first then progressing to the smallest. Sieved samples should be collected in a pillowcase and taken back to the lab. Samples will keep for several days if refrigerated, so immediate processing in the funnel is not necessary.

Estimated Time:
One hour

Step Two
Once back at the lab, Berlese funnels should be set up and the leaf litter samples poured in.   The samples should remain in the funnels for several days in order for the maximum number of organisms to be extracted from the leaf litter.

Step Three
Students will observe the life found in the samples they collected and document relative numbers of each type of animal, noting the differences between the relative diversity of the sample versus the relative numbers of one species, i.e., richness. Students should also note the differences in life present for different types of samples and should attempt to identify the organisms present; specificity is optional. For example, comparisons could be as general as differentiating between insects and arachnids or as specific as comparing different insect orders or families.

Web Links
The following URL is a helpful link to assist students with more advanced identifications:
http://www.missouri.edu/~bioscish/index.shtml

Other references:
Borror, D. J., Triplehorn, C. A., and Johnson, N. F. (1989). An Introduction to the Study of
      Insects. (6th Edition) Saunders College Publishing. Philadelphia, PA.

Assessment:
Laboratory notebooks should be mandatory for this project and should include all information
relative to the field data, such as daily recordings of outside temperature, rainfall, and humidity.
Notebooks should contain rough sketches of the types of organisms differentiated from the
samples. Students should be able to apply some identification to the organisms found, e.g.,
insect or spider, etc. Students can also be tested on the concepts of biodiversity and species
richness and asked to apply these definitions to their own observations in the lab.

Extension:
Have the students design an experiment to test whether or not the results of the previous
experiment may differ depending upon the environment. How would results differ in spring as
opposed to fall? How would unusually heavy rainfall or drought impact the experiment?