Who All is There?

Robert Morgan

Target Group: Grades 6-12: No more than 5 students per group

Duration: 90 minute blocks

- Observations of both sites and class discussion…….....1 day
- Brainstorming of questions, class discussion to narrow question, making of Berlese funnels, writing hypothesis and prediction……...1 day
- Collecting leaf litter from one site and placing in funnels……....1 day
- Attempting to identify, count specimens collected and chart data of class..1 day
- Collecting leaf liter from other site and placing in funnels……...…...1 day
- Attempting to identify, count specimens collected and chart data of class..1 day
- Organizing, charting, analysis of data, and drawing conclusion……..1 day
- Writing report……homework

Lesson Goals: To investigate the similarities and differences in biodiversity and species richness of microinvertebrates living in and under the leaf litter in a pine forest on a steep slope versus that of microinvertebrates living in and under the leaf liter in a pine forest with no slope.

After completing the unit on relationships between the biosphere, ecosystem, community, population and organisms, this investigation can link all the factors that influence communities and populations. It can demonstrate how various populations can coexist in the same habitat. Not only are the abiotic factors measured, it reinforces lessons learned from biology concerning adaptations. It can also introduce concepts such as competition, mutualism, commensalism, and possibly predation. With a little work, this could lead into methods of estimating populations, and discussions on carrying capacity and how that is associated with the factors measured. You may also want to investigate if there is a difference in microinvertebrates of the leaf liter between fall and summer. Does temperature influence the microinvertebrates?

Georgia Performance Standards addressed:

SEV3a,d,e. Students will describe stability and change in ecosystems.

a. Describe interconnections between abiotic and biotic factors, including normal cyclic fluctuations and changes associated with climatic change.
d. Explain how biotic and abiotic factors influence populations.
e. Describe interactions between individuals (*i.e.* mutualism, commensalisms, parasitism, predation, and competition).

SCSh3c,d,e. Students will identify and investigate problems scientifically.

c. Collect, organize and record appropriate data.
d. Graphically compare and analyze data points and/or summary statistics.
e. Develop reasonable conclusions based on data collected.

SCSh4a,b. 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.

SCSh6a,c. Students will communicate scientific investigations and information clearly.

a. Write clear, coherent laboratory reports related to scientific investigations.
c. Use data as evidence to support scientific arguments and claims in written or oral presentations.

Materials:

- Quart size baggies ……..4 per group
- Berlese funnels……..4 per group*
- Garden trowels……..1 per group
- Incandescent light source for funnels……....1 per funnel
- Key and/or pictures for identifying specimens……..…1 per group
- Stereo scopes for identifying specimens……....1 per group

Setting Up The Investigation: How is a sloped pine forest different from a flat pine forest? What kind of adaptations has been made to help organisms survive?

There is quite a bit of talk among scientist about conserving biodiversity. But what is biodiversity? It is two words put together; biological and diversity. The term has come to mean the variety of all living things. Because there is still so much about our world that has yet to be discovered, conservation and protecting all live has become a priority. We cannot learn from things we do not know of or have not studied. How do you know if you like a song unless you have listened to it? Some say if I have never heard it, then I am not missing anything. But such is not the case with biodiversity. There are many reasons to preserve and study varieties of life. Some are ecologic, esthetic, and economic. And it is human nature to ask, so, what is in it for me? What's in it is that many medicines have ingredients that come from plants and some from animals. How many things do you use that has Velcro? Velcro was discovered by examining how and why a little green seed stuck to the clothes of a man walking through a field (he became rich beyond all dreams). Many plants and animals have adaptations that help them survive in an ecosystem. Some of these adaptations could be useful to humans. Microinvertebrates fill a niche in a forest ecosystem. Many help break down organic material and start the process of recycling nutrients for use by plant life. Because of the abiotic factors that influence their ecosystem, many have evolved adaptations that help them survive.

Having introduced abiotic and biotic factors, cycling of nutrients and compounds, and possibly succession, walk the students to one of the sites and while in their groups, have them make as many observations (both general and detailed) as possible. Have one student per group act as a recorder for their group. Move to next area and make observations as before. Move to a quite

area or back to the classroom and have students brainstorm questions based on the observations they made. Conduct a class discussion on the observations made by each group and write a running list of observations stated. Interject ideas or observations that students did not state to try and focus on learning goals. Allow groups to add to their observations as needed. Switch discussion to the questions the groups wrote. Again, state questions that may have been omitted and guide students towards questions that align with goals. Decide on a question as a class that supports learning objectives. Have groups compose their hypothesis based on the question and make a prediction.

Questions that can be addressed in this study:

- Is there a difference in the type of animals (microinvertebrates) between a sloped versus a flat forest?
- Are some types of microinvertebrates only found in one forest area or the other?
- Are there more of a particular type of microinvertebrate in one forest versus the other?
- How do the abiotic factors differ between sloped forest and flat forest?
- Which forest understory receives more sunlight?
- Are there more microinvertebrates in a flat area than on a slope?
- Are there more microinveterbrates in the fall than in the summer?

Expected student questions:

- What kind of animals lives in the pine forest?
- Why are pine trees tall and skinny?
- Why are pine needles skinny?
- Why are the branches of a pine tree only near the top?
- Why is the pine tree bark different from other trees?
- Why don’t pine trees lose their needles every fall like hardwoods?

Hypothesis: Guide students to try and write/select a hypothesis based on the learning goals. Possible hypothesis may include:

- There is more biodiversity of microinvetebrates in the flat area of a pine forest than in a sloped area of a pine forest.
- There are more numbers of all types of microinvetebrates found in a flat area of a pine forest than a sloped area of a pine forest (species richness).
- There is no difference in the type of microinvetebrates found in a sloped area of a pine forest and a flat area of a pine forest.
- Because the flat area of a pine forest is more moist, there will be more microinvetebrates in the flat area of a pine forest than in a sloped area of a pine forest.

The hypothesis selected will lead to a prediction of the outcome once the experiment or test of the hypothesis has been designed.

Methodology:

1. Select one area each of a sloped and flat pine forest. Insure that the areas have enough space for each group to operate without being too close together. The areas should be as similar as possible to reduce variables. Examples are; both receive about the same amount of sun/shade, both areas near water/away from water, and as little human impact as possible/the same amount of human impact.
2. Each group will take at least four samples from each site.
3. Students should take temperature of sample sites (within the leaf liter).
4. Moisture test should be completed for each sample. (Use humidity probe on a CBL or make general observations using a soil "pinch" or clump test).
5. The students will use their sampling bags as the outline for the area for each sampling site.
6. Each sample from each group will be taken from similar areas (sun-vs-shade, etc…).
7. Only the leaf liter will be collected (no dirt). Organisms living in the soil can be done as a different investigation.
8. A description of each site will be written on an index card and placed in the sample bag.
9. Samples from each group may be combined to accommodate funnels.
10. The alcohol reservoir will be prepared.
11. Samples will be placed in the prepared Berlese funnels and placed under the lights.
12. Samples will remain under the lights for 24 hours.
13. The next day attempt to identify the samples using the stereo scopes and pictures/keys of organisms.
14. Each group will conduct a data table containing the type of organism and the number of each type found.
15. A class data table will also be constructed so to record each group's data for overall forest data.
16. Each group will construct a chart or graph of their data.
17. A class chart or graph will also be made.
18. Repeat steps 2—15 for the other type of forest to be sampled.

Safety Considerations:

- Try and insure sites do not have nests of bees in sampling area.
- Inform students of poison ivy/oak
- Talk over actions to be taken if a student is bitten by an organism.

- How to identify ticks and what to do if performing investigation in spring/summer months.

Possible predictions based on hypothesis:

- If there is more biodiversity of microinvetebrates in a flat area of a pine forest, then there will be a greater number of types of microinvertebrates in the flat area than the sloped area.
- If there are more numbers of all types of microinvetebrates in a flat area of a pine forest, then there will be more individuals of each type of organism found in the flat area of the forest.
- If there is no difference in the type of microinvetebrates found in a flat area of a pine forest, then the same type of each organism will be found in both areas of the forest.
- If the flat area of a pine forest is more moist, then there will be more microinvetebrates in the flat area of a pine forest than in a more dry sloped area of a pine forest.

Analysis and Communication:

Within the groups students will look and compare the number of different types/groups of organisms and the number of individuals in each type/group. Each group will organize and show raw data collected and calculate the percentage each captured group represents of total types/groups found. Groups will utilize technology to construct graphs/charts to represent data. A group presentation, both oral and written will be made with each group member responsible for a portion of the presentation. In addition, each student will write a lab report restating the question, hypothesis, prediction, and methodology utilized. Each student will state whether they accept or reject the hypothesis and provide sound reasoning based on the data analyzed. Students should use critical analysis to describe possible flaws in the investigation and state how they would correct the flaws or what should be done differently. Finally, students will suggest extensions of this investigation for further study.

References:

Global Litter Invertebrate Decomposition Experiment
http://www.nrel.colostate.edu/projects/glide/references.html

Swift, M.J., O.W. Heal, and J.M. Anderson. 1979. Decomposition in terrestrial ecosystems. University of California Press, Berkeley, CA