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ABSTRACT

This activity is used to introduce students to biology in general and the significance of environmental studies. The focus of the ecosystem survey is to examine the effects humans have on the environment. After completing a series of investigations, students develop their own hypothesis about human impact on the environment, and then test this on a site they had not previously examined--including the identification of exotic plants and animals on and around the site. Analysis and discussion of the results of the three initial surveys allows the students to develop a theory about the effects of humans upon biodiversity. Students also are introduced to experimental design, use of statistics to determine whether to accept or reject a hypothesis, and the significance of taxonomy. (Author)

Surveying an Ecosystem

An Exercise for High School Biology Students

Grade: High School

Target audience:

- Biology
- Integrated science
- Environmental studies
- Special Education

Background information:

Time:

Approximately 13-15 class days.

Teacher notes:

The teacher should select and check out four sites before the class. The sites should pose few or no obstacles. Students on crutches and in wheel chairs can do many of the activities if the site is well selected. One site should show little or low human impact. A second site should show moderate human impact and a third should show high human impact. (This site can be run in the parking lot, lawn, or football field). A fourth site is where the students will check their predictions. It can have any level of impact you wish. Try to have a plant taxonomist help check your sites because you will sample the plants and you don't wish to remove rare species. **You also should identify poisonous species -- such as poison ivy, poison oak, or poison sumac -- and the existence of any *exotic* (non-native) species of plants or animals.** You probably will be surprised at what you have locally. If possible, teachers should run their own biodiversity survey in two other sites first just to gain the feel of what the students will run into.

Students:

Students should practice (dry lab) the procedures for counting the biodiversity in the classroom. Review procedures with the student teams at the end of the practice. Students will be crawling on the ground collecting samples, so appropriate clothing is essential.

Preparation time: (1 Hr.= 1 class period)

- Equipment organization (teacher time) = 3/4 Hr.
- Student survey sampling & instruction = 1 Hr. (class time)
- Class time: (Performing Survey and post lab discussion) 1 Hr.
- Surveying 3 terrestrial sites = 3 Hrs.
- Data analysis = 2 Hrs.
- Classroom identification = 2 Hrs.
- Hypothesis development, experimental design = 1-2 Hrs.
- Survey of final terrestrial site = 1 Hr.
- Data analysis and discussion of acceptance or rejection = 3 Hrs.
- *Total* - Approximately 16 Hrs.

Florida Department of Environmental Protection

Surveying an Ecosystem

Abstract

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Materials:

- 1 plant press per class
- 1 note book per team
- 3 or 4 10 m tape measures
- Arthropod/insect ID book or taxonomic key
- Plant/shrub ID book or taxonomic key
- Animal tracks/scat ID book

Procedure:

Opening exercise - setting the stage

Engage students in a cooperative learning exercise on the importance of their own environment. Move into the concept of *diversity*. Model diversity within the classroom, and repeat until the students can tell each other or in written form, what diversity is. (In many schools you may be able to use the students themselves to demonstrate the diversity of *human* communities.) Expand the concept to ***bio***diversity. Each student should state what he or she thinks biodiversity means and why it is or isn't significant. Discuss how biodiversity might be measured.

Demonstrate on the board, floor or field how to run a line survey. There are other names for the same procedure. (See also the Department of Environmental Protection Booklet: *Classroom and Field Experiments for Florida's Environmental Resources* - Experiment 14, for a detailed description of several sampling procedures. Experiment 4 of this booklet describes a similar process.)

Sampling with line surveys

Form student teams of five persons (1 recorder, 2 animal surveyors, 2 plant samplers). Three to Four sites will be needed for the survey in order to see patterns. One site should show little or low human impact. A second site should show moderate human impact and a third should show high human impact. (This site can be run in the parking lot, lawn, or football field). A fourth site is where the students will check their predictions. It can have any level of impact you wish. A site is selected and a base point is chosen (see box), from which a straight line will be measured. Several line surveys may be run per site.

Surveying an Ecosystem

Base point: ☐ Student movement: ➳➳➳➳➳ End: ✪

☐ ➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳➳ ✪

A line, 10 meters long, 1 meter wide

- Students first OBSERVE over the site any organisms that cross an imaginary straight line. Organisms may fly, crawl, or otherwise move across the line. Do for 5 minutes and record all observations and time of day (some animals are active only at particular times of day). If possible, do this at different times of day -- and in the evening.

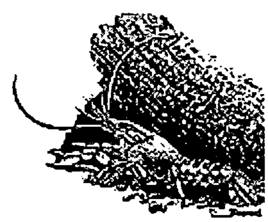
- Shoulder to shoulder the two *animal* surveyors crawl the 10 meter line and call out every single sign or type of animal . . . as long as they can tell they are different. This might be foot prints, scat, soda pop cans (sign of humans), animal burrows, trails, the different insects, rodents, birds, other arthropods. Lift up all leaves, branches, rocks . . . everything. The Recorder notes the data. We want the number of different TYPES. You can expand the study to include the number of each type as well.

- After the animal survey, the *plant* samplers go in and collect one of each kind of plant. All they need to do is be able to tell one plant is different from another. Collect the plants properly, by including the root system. Place properly in a plant press. These may be used for later plant taxonomy. Again, we're trying to survey the number of different types, but you may wish to know how many of each type there are. If there are a large number of leaves on the ground, look around the site to see what trees are growing nearby, or take samples of the leaves and identify the tree or shrub from the leaf.

- Repeat for the other two sites.

Analysis of data:

Chart the data for each site, showing how many types of organisms (be sure to keep a record of the different categories of organisms). You may also chart how many of each kind as well. Compare the data from each site. Note and discuss trends.



Hypothesis development and experiment design:

Based upon the data, have students individually or in teams develop a hypothesis about the effects of humans on the enviornment and biodiversity. The hypothesis will be tested through an experiment of their own. The hypothesis must be measurable. Keep it simple. Have students design their procedure for testing their hypothesis. Other students are used to check to make certain it is understandable.

Review and discuss as needed. Be encouraging, this may be the first time they've ever designed their own experiment. Discuss how they will know if their hypothesis should be accepted or rejected. Avoid use of "we prove," "We don't prove," "we suggest." Use the school's math teachers to help introduce the ideas of sample sizes, significance and how math is used to decide what we accept or reject. This could easily launch into other discussions about how "good or poor" a theory is.

Surveying an Ecosystem

Run the Student Experiments:

Have the students run their experiments and analyze the data. Present the data in a lab report and chart and display for class discussion. Did they support their hypothesis? How can we check it mathematically?

Evaluation

Evaluation of the lab is through a series of reflection and conclusion activities that are performed individually, collaboratively, and cooperatively. These are usually completed in a written form, although they may be extensively discussed. The procedures of inquiry, reflection and the biological principles found in biodiversity are repeatedly used throughout the remainder of the year with all other organisms. Reinforcement is frequent.

Reflections and conclusions: (individually, collaboratively, cooperatively)

Typical Questions:

- Did any patterns emerge in the biodiversity? What might they mean?
- Can we use these patterns to predict biodiversity in other places in the country or world?
- Check the pattern (theory) for another place in the world or country. Was it confirmed? Why or Why not? What might influence the theory? Does that mean its wrong?
- Do we find variables?
- What did we learn about:
  - the environment?
  - scientific method, sampling, hypothesis and theories?
  - biodiversity?
  - working as a team?
  - need for taxonomy?
  - human impact locally, regionally, globally?
- What can they, as students, do differently in:
  - the environment?
  - the test design?
  - in reading, interpreting other tests or experiments?

Taken and adapted slightly from:
http://www.gene.com/ae/AE/AEC/AEF/1995/schenck_survey.html

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