Natural Inquirer Lesson Plan

Schoolyard Tree Inventory and Biodiversity Project

Adapted from Web Site: Virginia Tech Biodiversity Study: http://www.cnr.vt.edu/dendro/forsite/si4.htm

Subjects Covered
Science: Biology, Ecology
Math: Addition, multiplication, division, solving equations
Reading: Comprehension

Science Skills: Observing, comparing, recording, classifying, analyzing
Science Education Standards Addressed: Abilities necessary to do scientific inquiry, Populations and ecosystems, Diversity and adaptations of organisms, Science as a human endeavor, Nature of science

Objectives:
1. Students will be able to observe, identify, measure, transform, and record data associated with trees.
2. Students will be able to analyze and synthesize collected data.
3. Students will be able to compare results and discuss results with peers.

Estimated Time for Lesson: 5 Class Periods

Materials:
Day 1: Plastic tags, wire, and permanent markers (You will need enough tags and wire to tag all of the trees and samples from each tree). Plastic bags for samples.

Day 2-3: Tree identification book. Pencils and sheets of paper to record tree identification information. Or visit http://www.oplin.org/tree/.

Day 4: Pencils and identification sheets prepared from Days 2-3. Extra paper.

Day 5: Pencils, paper, and calculators (optional).

Procedures
Day 1
1. Introduce the topic of biological diversity and discuss why diversity is important in natural systems.* Explain that the project will involve an inventory of all trees on the school grounds (or other area), followed by a calculation of the measure of biological diversity represented by those trees.

2. Divide the school ground or other area into two sections. Assign two for each section. Tag and number sequentially all of the trees in each section of the school grounds or other area. Alternatively, one team can inventory the school grounds, and another can inventory an adjacent area. From each tree, take a few samples of branches with leaves. (Take enough so that students can identify whether the leaves are opposite or alternating, and simple or compound.) Put the samples in plastic bags that are numbered sequentially to match the tree from which they came.

Day 2: 1. Have each student guess which area they think has more tree diversity. Have each student record their guess.

2. Identify the trees using the samples and a tree identification book (or a Web-based tree identification key).

3. Record each tree's name (common and biological) on a sheet of paper according to the sequential tag numbering.

Day 3: Using a sample from each tree species, do leaf rubbings or have students draw each leaf on a sheet of paper, along with the common and biological name and the location of the tree. Other characteristics of the tree may be noted on the sheet as well. These characteristics should come from direct observation of the tree and from the tree identification book. For example, is the tree native to the area? Does it produce nuts? Each student should have a collection of sheets showing all of the trees inventoried in their area.

Day 4: 1. Count the total number of trees growing on the school grounds (or other area). This should equal the total number of samples collected. This number will be identified as N. (N=the total number of trees of all species.)

2. Count the number of each individual tree species identified on the school grounds. This number will be identified as n. (n=the total number of trees of each species.)

Day 5: 1. Calculate the amount of diversity using Simpson's Index. Simpson's Index is calculated using this equation:

$$D = \frac{\sum n(n-1)}{N(N-1)}$$

D=Diversity. In this equation, the value of D ranges between 0 and 1.

Now, to calculate Simpson's Index of Diversity, subtract the value of D from 1.

Simpson's Index of Diversity also ranges between 0 and 1. 1=infinite diversity and 0=no diversity.

For example—

Species	Number (n)	n (n-1)
Red maple	4	4X3=12
White oak	2	2X1=2
Holly	9	9X8=72
TOTAL (N)	15	86

N (–1) = 15 (14) = 210
D = 86/210
D = .4095 or .41
Simpson's Index of Diversity = 1-D 1-.41 =.59

2. Now compare Simpson's Index of Diversity between the two areas. Which area is more diverse? How many students had guessed correctly about which area is more diverse?

3. Hold a class discussion about biological diversity as represented by the diversity of tree species.

4. Have students put their own leaf rubbings and information sheets into a notebook or on a poster. Any additional information learned could be added to demonstrate the biological diversity (or lack of it) of the area that they studied.

Do not forget to remove the sequential tags from the trees when you have finished with the project!

Assessment—

Formal assessment: Create a rubric for the student notebooks or posters. You could require the student projects to clearly display the leaf specimen, common and biological names, and location. You could require students to identify what they know about that species within the area they studied. For example, how many trees from that species were found in the area? How much additional information did they add? You should also require correct spelling and punctuation.

Informal assessment can be done through class

discussions, observations of group interactions, and participation.

Modification:

- Students that have difficulty reading or doing the other tasks can be paired with a partner or the educator may want to assist the student.
- Students that need an extra challenge can go to http://www.cnr.vt.edu/dendro/forsite/si4.htm. At that Web site, they can learn how to measure the trunk diameter and height of the trees in their area. They can measure the trunk diameter and the height of trees in their area, and add this information to their poster or notebooks.

* What is biological diversity? Scientists use the word biological diversity to describe the variety of life on Earth. Over the past 550 million years, the diversity of life has increased, meaning that more different kinds of organisms exist today than when the first multicellular animals appeared.

Species diversity is important. Recent ecological research shows that an area of land with many plant species is more productive and resistant to drought, pests, and other stresses than a comparable area with only a few species.

The diversity of genes, cells, organisms, and ecosystems is a hallmark of life on Earth and one of the reasons that life has survived and prospered despite periodic catastrophes.

Biological diversity is measured in different ways. The two main factors are richness and evenness. Richness is the number of different species in an area. Evenness is the abundance of individuals within a species. In this project, students will assess the richness and evenness of the tree species growing on the school grounds or in another area.