Activity: Schoolyard Ecology

An ecosystem is usually too large to study in detail. Therefore, dividing the ecosystem into plots provides a reasonable sample of the area. However, for most class situations, a plot is too large of an area for our student(s) to study. Breaking the plot into quadrants makes the area manageable. Before taking your students into the field, assess the schoolyard, field, empty lot, and adjoining park for an appropriate area. In an urban setting the grassy strip between the sidewalk and street is usable and often offers a surprising amount of diversity.

Materials:

- Measuring tape (at least 10 meters long)
- Stakes (wooden or metal - enough to make enough quadrats for all your students)
- Hammer
- Cord, heavy string or marking tape (these come in very bright colors and are easy to see)
- Graph paper and pencils (plain and colored)
- Clipboards
- Field Guides
- Pruning shears (if you do the Biomass activity)
- Fabric sacks (if you do the Biomass activity)

Vocabulary and Formulas:

- Abundance Number of Target plant/Total number of all plants (not including grass)
  X 100% = the % of abundance of target plant.
  Biomass Grams Dry Weight/meter2
- Density Number/meter2
- Diversity Total number of different types of plants per plot.
- Vegetation structure Type of vegetation (grassland or field) and the average height

Selecting a Sampling Scheme:
In fields/grasslands you can work with 1 meter X 1 meter sampling plots. This can be done either by plotting the squares using stakes and string or using "Hula-Hoop Ecology." A standard Whammo Hula-Hoop has an interior diameter of 77 cm, so it will give you a good sampling of a meter square plot. If you choose the standard sampling scheme, measure the area and place the stakes at 1 meter intervals for roping off or marking. Each student or group will then follow the procedures within their quadrant.

Hula-Hoop Ecology: If you are using hula-hoops your students should measure the interior diameter of their hula-hoop. This will be important when converting your figures into square meters.

Procedure:

1. Before you begin your survey, have students prepare a map of the total sample area. This map should be drawn to scale on graph paper. Divide the sample area so each student, or group of students, has a specific area to take their sample. Within that area, have the students lay down their hula-hoop. This will ensure all sample sizes are of equal size. Have students tack down their hula-hoops using 3 or 4 stiff wires, such as metal clothes hangers, bent into a U shape. These can also be purchased already made at a gardening store. If the hula-hoops cannot be left on the ground for a few days, use a non-toxic spray paint or some other form of mark so that students can reposition their hula-hoops.

2. Once students have their quadrat laid out, have them count the diversity (the number of different types of plants) they find. Students should list their observations in their notebook or field journal. Students can also identify the vegetation structure of the plants they find. In order to do this, plant height measurements are needed in order to calculate an average height.

You will need to decide how in depth you want their identifications to be, depending on the age and ability of the students. Field guides are a necessity for this step. Although there are many, one of the best for working with a field or empty lot is the Golden Guide pocket book Weeds.

3. Density counts are a great way to integrate more math. The formula for density is the total number of plants within a meter squared. If you are using the hula-hoop technique, this gives you a wonderful opportunity to have your students hone up on their math skills to make the conversion from your circular area to a meter squared. Another alternative for students would be to establish the density of a target plant or specific type of plant. (ex. Dandelions; although you might want to eliminate grass).

4. Next, the students will measure the abundance of the plants in their quadrat. A chart to figure out the relative abundance for each plant in their quadrat is provided. You could also choose to have them calculate an abundance figure based on the actual count of their chosen plant compared to all of the other plants in their quadrat.

5. The exploration of your plot could easily end here, or you can do a final activity to calculate the biomass of your quadrat. It is suggested that you only assess above ground biomass, as many plants will regrow or regenerate if their roots are left undisturbed. Biomass is important when relating it to trophic levels in the food pyramid. It also shows the relationship between the energy of each level and the number of organisms it can support. In most plants the basic energy value is 4 kcal/g. Establish the amount of available above ground biomass. Then estimate of how much life can be supported on the trophic levels above the plant (which are the producers). Students can also design flow charts showing the relationships and values estimated using the biomass figures.

To estimate the biomass in a plot the students should use clippers to cut off the above ground vegetation and place into collection sacks. These should be dried in an oven at 80

to 105 degrees centigrade. If you air-dry the vegetation first, it will take less time to oven dry. Do not stop drying the material until the weight remains constant for a couple of days. (According to Brewer & McCann it will take several days to dry a large amount of green vegetation, but only one or two days if it has been air-dried first.) To calculate final biomass weight the oven-dried material in the bag. Then empty it and weight the bag itself. Subtract the weight of the bag from the total. Use the formula of weight in grams/meter(s) squared. All of the dried material should be combined to represent the entire plot. This provides the figures to use when estimating life support capability of the plot.

Follow up activities:

1. Research the economic value of the chosen plant. For example, if a student is studying the dandelion, point out that dandelion greens are often included in the very expensive salad greens sold in specialty stores, health food stores and upscale markets. Have the student find out how much is charged for these salad greens and estimate the actual monetary value of their plant in their quadrat.

2. Study the concept of succession and disturbance by having the students determine the stage of succession of your plot. Determine the amount and cause of disturbance in the plot. If the area is relatively new, conduct some research to determine what the plot looked like before the disturbance (before your school was built, before a building was torn down, before a structure was erected etc.)

3. Collect the invertebrates in the quadrant. Test the biomass projections using the actual biomass figures generated by the invertebrates.

Activity: Becoming A Weed Expert

While waiting for the plant specimens to dry out in the plant press, students (as individuals or in pairs) will investigate one common schoolyard weed. The investigation should lead to further inquiry of the plant.

To begin this investigation, lead a discussion with the students about the importance of becoming an expert in a particular area and sharing the knowledge they gain. Each student will become an expert with one plant that has been discussed in class. Depending on the ability level of your students and the time you want to spend on this portion, you may choose to assign each plant to one student or a pair of students. Students may choose their own plant; however, it is suggested that you have the students pull the plant name from a hat.

Explain the required sections each paper must contain. At this time a grading rubric should be presented to the students so they are aware of the requirements for this assignment. The recommended sections of the paper are as follows:

The Paper

- The common name, scientific name, plant family, range, habitat and origin of the plant can be featured as bulleted points of interest in the paper. Or you may choose to have that information written out within the body of the paper.
- Description: The student should include a detailed description of the plant in his/her research paper. This description should include his/her observations of the plant as well as information they found in various resources (see previous section). The information from the additional resources will not only contain some information the student may have missed upon first examination, it will allow the student to familiarize him/herself with the scientific terms associated with plants and plant parts.
- Scientific Drawing: The research paper should contain a drawing of the plant in its natural habitat. It should be noted that this is not an art activity; it is a way of collecting scientific data. By creating detailed drawings of the plant, the student will notice more characteristics of the plant. Only accept precise drawings. Remind the students that drawing organisms in their natural surrounding is a profession.
- Reproductive Biology: This section of the paper should explain the reproductive process of the plant including methods of pollination.
- Cultural Relevance: What significance does the plant have in a particular society's culture?
- Ecology: Describe the habitat of the plant including the soil type, the climate, and organisms found on or near the plant.
- Traditional uses: Are there any traditional uses (ceremonial, food, medicine, craft) associated with the plant? This would be an appropriate area for the student to interview a family member or a person of an older generation about any traditional uses of the plant.
- Current Scientific Research: It is important for the student to find information regarding science surrounding their plant. Does the scientific information support the traditional use of the plant? For example, does current scientific research support or deny herbal medicines.
- Further Point of Inquiry: The student should end the paper by discussing a further point of inquiry. After learning about his/her plant, the student should develop a question that can be tested using the scientific method.

After gathering all the information and synthesizing it into a coherent paper, the student should present their information to the class. This can be done in a variety of ways; a five-minute show and tell, a power point presentation, a poster, etc. However, it may be advantageous to have the students delve into their inquiry projects. Then the plant research information would be presented along with the inquiry project results.

Some suggested inquiry projects are:

- Why do some dandelions have bigger leaves than others?
- Does ginger have antibacterial qualities?

- Which pollinators regularly visit the plant?
- A photo essay of the plant throughout its life cycle could be constructed.
- Which components of the plant allow it to be a pioneer species?
- A comparison of seed dispersal between two of the same plants.

Assessing the inquiry projects
The students could present their projects in a variety of ways. A simple lab report may serve your needs, however, you may consider a poster, powerpoint presentation, or any other creative mode of communication the student develops. Use a rubric to assess the content of the presentation.

Identify that Plant!

Name_____

Date_____

Period_____

Directions: For the following ten plants that we've been studying, please observe each specimen carefully. Note the number posted by the specimen correlates to the number on this sheet. For each specimen, record the information in the space provided.

1.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

2.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

3.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

4.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

5.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

6.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

7.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

8.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

9.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant:

10.
Scientific Name: _____
Common Name: _____
Areas where you might find this plant:

At least one traditional use, and/or myth about this plant: