Appendix 1 — Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

This is a compilation of schoolyard investigations and other activities that were used successfully with teachers in SYE Institutes. These are presented as reproducible write-ups for leaders to hand-out directly to teachers, as appropriate. While not designed with this in mind, many teachers used these activities, either modified or as is, with their students. Where possible, we've included sample results of the inquiry, comments from leaders and/or teachers who did the activity, suggested readings - relevant ecology research papers and review articles - for each inquiry, and blank data sheets. However, this segment of the Handbook is still under construction, so many of the descriptions are not complete. We look forward to hearing more about each activity from YOU! and will update these write-ups accordingly. Included are a number of "inquiry idea starters" for engaging teachers in guided or open inquiry, and a collection of other activities for reflecting on teaching and learning, and for assessing teacher attainment of science process and content goals. Other reproducible handouts, such as evaluation forms and checklists, are included in appendix 2.

Inquiry Idea Starters:

- Color Bugs: SYEFEST project to discover what colors different kinds of insects are attracted to and why.
- Dandelion Determinations: Estimate the number of dandelions in a schoolyard lawn.
- Tree Transects: Compare how the tree species vary from the edge to the interior of a forest by sampling tree saplings and adults along a transect.
- Bagged Branches: In this study you will have a chance to investigate first hand the process of transpiration, or the loss of water from plants via evaporation.
- Ant Cafeteria: What foods do ants prefer and why?
- School Traffic: Discover the effects of human traffic on the soil communities in your schoolyard.
- Nature Preserves: This exercise introduces students to the measurement of biological diversity.
- Beat Sampling: Compare how the insect species vary from the edge to the interior of a forest by beat sampling tree saplings along a transect.
- Quadrats: This field study is designed to build confidence in conducting the initial parts of the inquiry process in schoolyard ecosystems.
- Tree Key: Learn how to make your own tree key.
- Giving Up Density: Ask questions about how giving up density changes in different habitats.

Other activities:

- Schoolyard Wonders ... Right Before Your Eyes: A guided "Treasure Hunt" by ecology themes
  - Plant Structures
  - Habitats
  - Adaptations
  - Plant-Animal Interactions
  - Diversity

- Assessing Student Learning: Observing and assessing student knowledge.
- Assessing Teachers' Understanding of Community Ecology: **missing**
- Schoolyard Ecology Teaching Resources Treasure Hunt: An activity intended to guide you in searching the school-yard for good teaching resources.
- Reflection: Reflective thinking for teachers.
- Assessment Activity Plan: Schoolyard Ecology - Summer Institute Worksheet

Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

SYEFEST Activity: Color Bugs

Hope College, 1994
Holland, Michigan
Contributor: Kathy Winnett-Murray

Starter Question: What colors are different kinds of insects attracted to and why might this be so?

Elementary Curriculum Objectives: For Michigan Essential Goals and Objectives for Science Education (K-12): Constructing New and Reflecting on Scientific Knowledge; Using Scientific Knowledge - Life Science - Organization of Living Things, Evolution, and Ecosystems.

Ecology Themes: Perception and Scale; Interactions between Individuals and their Environment.

Grade Level: All. Older children can handle the Tanglefoot smearing on their own, but teachers should plan to pre-smear sticky traps for children K-2.

Materials:

(1) Tanglefoot, available in nurseries or the garden section of most larger department stores. The spray is easiest and cleanest and goes on smoothly (1-2 cans) Or if spray is not available, Tanglefoot spread (has the consistency of spun honey) (1 or 2 tubs). If the students will spread Tanglefoot themselves, divide the spread into 1 container (margarine tubs)/group with just a few tablespoons in each container.
(2) 1 plastic knife inside one recycled plastic bag/group (if students are spreading the Tanglefoot themselves).
(3) Poster paper in various colors (white, red, yellow, green, blue, brown, your choice) cut into strips about 10" long x 5" wide. The exact dimensions are not important as long as they are all the same size. You will need either one paper strip of each color/group (if each group will investigate all colors) OR one strip in one color/group (if each group will investigate one color).
(4) Plastic wrap - 1 roll.
(5) Staplers - up to 1 stapler per group.
(6) Data sheets or classroom data chart.
(7) Hand magnifiers - 1/group or more.
(8) Insect identification guides or handouts OR have the children invent names for different kinds of insects.

Procedure:

(1) Assign each group of students a color or a set of colors to investigate.

(2) Ask your class to predict what color of sticky trap will attract the most insects and WHY they think so. If appropriate for your grade level, ask the students if different colors will attract different kinds of insects and WHY they think so.

(3) Prepare sticky traps after marking one side (the white side if colored on only one side) with the group name. First, ROLL the rectangle into a short tube with the marked side on the inside and staple the ends closed, overlapping about 1 inch on the end. Next, have each group select a location where they will hang their trap over a tree branch or other structure where it will be secure enough to not blow away. The traps should all be placed at about the same height and in about the same kind of habitat. Third, use the plastic knives to smear a THIN, EVEN layer of Tanglefoot on the colored side of the poster paper rectangle while holding the stapled section. LEAVE ABOUT ONE INCH BARE ON THE STAPLED END TO HOLD ON TO so your fingers don't get sticky!

(4) Hang up the traps and leave in place for 24 hours. This is not a good activity to do if rain is expected overnight.

(5) Sticky plastic knives go back in the bags and discarded.

(6) At the time of retrieval, each group removes their color trap, holding the uncoated & stapled edge. Gently OPEN the trap at the staples to form a flat rectangle once again.

(7) Cover each trap with a layer of plastic wrap; staplers can be used around the edges to keep the plastic wrap in place as needed.

(8) Each group counts the number of insects of each variety on their sticky trap and records this information on a data sheet AND/OR the classroom data chart.

(9) Compare and discuss the similarities and differences between the students' predictions and the actual data, and the possible reasons for different color preferences in different insects.

Follow-up:

Using sticky traps all of one color (perhaps the one determined to be the most popular in the above exercise), compare the variety of insects that are captured in different portions of the schoolyard and under different environmental conditions. E.g. Which sticky traps catch more insects, and why: Traps high on branches vs. traps on the ground? Traps in windy areas vs. traps in calm areas? Traps in thick vegetation vs. traps in open areas? Traps placed in different kinds of trees? During what season or what weather conditions are the most insects captured on sticky traps, and why do you think so? At what time of day are most insects captured on sticky traps and why do you think so? Select one insect species, research its natural history FIRST, and then try to predict what color sticky trap will attract the most individuals of that species.

References:

Dr. Kathy Winnett-Murray; Department of Biology; Hope College. For help in insect identification: Dr. Harvey Blankespoor and Dr. Allen Brady (Hope College Biology Department); Gordon VanWoerkem (Birder's World, Holland, MI).

Please post any questions or comments in our Color Bugs forum. We'd love to hear from you!

SYEFEST Activity: Dandelion Determinations

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Question: What is the population of dandelions in the schoolyard lawn?

Overview: Estimate the number of dandelions by sub-sampling a study area using ½ square meter circular plots at randomly identified locations

Background: All of the organisms of a species that live in a given place are considered a population. We might be express the size of a population as the total number in an area (e.g., the number of people in Poughkeepsie) or in the population density (e.g., the number of people per city block in downtown Poughkeepsie). Measuring population size is a necessary step in addressing on of the BIG QUESTIONS in ecology: What factors determine the population size of a species in a given place?

One of the big challenges in learning about populations is that it usually is too hard to count all of the individuals that make them up. Dandelions are no exception. While dandelion flowers are quite conspicuous in lawns, the plants themselves are harder to see. Most lawn areas have far too many dandelions - much to the chagrin of grassy lawn purists - to count. In this study you will use a point-centered circular plot technique to estimate dandelion plant density. By examining a number of plots located randomly within the study area, you will determine a mean density which, multiplied by the area, will give you an estimate of the total number of dandelions.

Materials:
1. Measuring tapes at 15m long for marking the study plot
2. 2 metal stakes, one for the study plot and one for marking the center of the sampling plot
3. 1 1m measuring tape with "eyelet" at the end
4. Field guides for dandelions
5. Data sheet on clipboard or piece of firm cardboard
6. Random numbers table

Procedure:
(1) Layout a 10m x 10m study plot

- Choose the part of the schoolyard lawn you want to study.
- Mark the lower left corner with one of the metal stakes, running it through the metal tab of the first meter tape.
- Run the tape along one of the sides of the plot to just beyond 10m.
- Run the second meter tape out in a roughly perpendicular direction and use the second stake to mark the 10m point along this side.

- Square the plot corners by using the second meter tape and measuring 14m 14cm from the 10m point on first tape to this stake and adjusting the stake accordingly.
- Go back and lay the second tape out from the first corner stake to this point, and you have two sides of a perfectly square 10m x 10m study plot.

(2) Identify random locations for sampling

- Use the random numbers table to pick random coordinates for 10 sample points. Record these coordinates on the data sheet.
- Go to each sample point by proceeding to the appropriate point along one of the measuring tapes, then moving into the plot until you're adjacent to the appropriate point on the other tape.

(3) Sample dandelions

- Place the metal stake at the randomly-located point in the study area.
- Make a 0.5 m2 circular plot by placing the eyelet of the 1 m tape over the stake and holding the tape at the 40 cm mark. NOTE: a circle with a radius of 40 cm is almost exactly 0.5 m2 in area!
- Carefully examine the entire area within the circular plot for dandelions. Only count plants whose center is inside the circular plot.
- Record the total number of dandelion plants you see.
- Repeat these procedures at all 10 spots.

(4) Making sense of the dandelion determinations

- What is your best estimate of dandelion density? Calculate the average number of dandelions per circular plot and multiply this by 2 to get the average density of dandelions per m2 . How reliable is your estimate?
- Did dandelion density vary from place to place within the study plot? What might account for these differences?
- Calculate the total number of dandelions in the entire study plot by multiplying your estimate of average density by the area of the plot (i.e., 100 m2). Impressed or surprised?

[SHERRY: INSERT Dandelion Determinations Data Diary/grid.]

Please post any questions or comments in our Dandelion Determinations forum. We'd love to hear from you!

SYEFEST Activity: Tree Transects

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Questions:

- Do different tree species occur along the edge versus the interior of a forest?
- Does the total number of tree species differ in different parts of a forest stand?
- Does the mix of young versus old trees differ from edge to interior?

Overview: Compare how the tree species vary from the edge to the interior of a forest by sampling tree saplings and adults along a transect.

Background: A plant community includes all of the plants living in a given place. One of the most obvious patterns evident in most schoolyards is the dramatic difference (at least in appearance) between the open meadow and lawn communities and the closed forest communities. However, are these forests themselves homogeneous, or are there interesting patterns of variation within them? There are many interesting things to study about forest communities. One concerns changes in the forest community that might occur while going from the edge to the middle of a patch of forest. Forest edges are receiving a lot of attention these days, in large part because human activity has created so many edges and small patches where there used to be larger expanses of contiguous forest. Are there species that require conditions found only in the interior of an intact forest. If so, how big does a patch need to be for these species to escape the "edge effect"?

Materials:
1. 1 measuring tapes at least 5m long
2. 1 12m long transect rope or string with marks at 1m, 6m and 11m
3. 1 meter stick
4. flexible measuring tape for measuring tree circumference (optional)
5. tree and shrub identification books and keys
6. stakes for anchoring transect
7. data sheets and clip boards

Procedure:
1. Locating and running transects

- Locate the starting point for your transects randomly.
- Each transect should start approx. 2m into the forest, and then will run 12m in a straight line as perpendicular to the forest edge as possible.
- Run the 12m transect rope or string from a stake at the starting point into the forest. You will be sampling a the 1m, 6m and 11m points along the transect.

2. Collecting data at each sampling point
   - Think of each point as the center of a "plus" sign. The transect line is one part and an imaginary line through the sampling point at right angles to the tape is the other. This identifies four "quadrants" for sampling. You can lay the meter stick perpendicular across the transect line to help you visualize the quadrants.
   - Find and identify the adult (dbh more than 10cm) and the sapling tree (dbh less than 10cm) closest to the sampling point in each of the four quadrants. NOTE: dbh means diameter at breast height, or 4.5' above the ground.
   - Record the distance from the sampling point to each tree in meters.
   - Repeat this procedure at each sampling point along the transect.
3. Interpreting your data
   - Calculate the average distance from the sampling point to the four adult and the four sapling trees. Then, square this distance to get the average amount of space (in square meters) per tree in that part of the forest. The inverse of this number is the average number of trees per square meter in this part of the forest!
   - Record the diversity or species richness of adult and sapling trees in each of the three parts of the forest. This is simply the number of different species you recorded at each spot.
   - Compare the species composition of each type of tree in each part of the forest, and for adult versus sapling trees. This could be the proportion or percentage of each species, etc.

Please post any questions or comments in our Tree Transects forum. We'd love to hear from you!

SYEFEST Activity: Bagged Branches

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Questions:

- What factors determine how much water plants lose through transpiration?
- How do two species differ in the amount of transpiration that takes place from their leaves over the course of 1 week?

Overview: Leaves are the "food factories" of plants. Unfortunately, studying photosynthesis directly requires fancy equipment that is not easily available to school teachers. However, making sugars through photosynthesis is not the only way leaves interact with the environment. In this study you will have a chance to investigate first hand the process of transpiration, or the loss of water from plants via evaporation.

What do you wonder about transpiration? Brainstorm for a minute with your teammates and then decide on a question you'd like to answer. You'll have enough materials to compare water loss from the leaves on several twigs between now and next week. You might want to compare leaves in different micro-environments, (e.g., sunny vs. shaded) of two kinds of plant (e.g., oak vs. maple). You also will have to consider how many replicates you will need so that you will have confidence in your results.

Materials:
1. 1-qt or 1-gal clear plastic bags (at least 4 per group)
2. masking tape for sealing bags on twigs
   - twist ties or masking tape for marking twigs
   - permanent marker for marking twigs
   - ruler for measuring leaves and twigs
3. graph paper for tracing and measuring leaf area
4. graduated cylinder or marked beaker (for final day only)
5. hand lopping sheers or strong scissors (for final day only)

Procedure:
1. Decide on what comparison you want to make, then select and bag branches.

- Select areas, species, and branches etc. to study based upon your question, e.g., if your question "How does transpiration from leaves differ in sunny versus shaded conditions?", then find branches from the same species that have similar leaves (number, size, etc.). Or if your question is, "How do two species differ in the amount of water loss that takes place over the course of 1 week?", then find twigs from two species that are similar in all other respects (e.g., exposure to sun, size of leaves, etc.)
- Choose at least two branches approximately 15cm long (as replicates) in each of the two+ situations you've decided to focus on. All branches should be as similar as possible, and each should be able to fit into the

plastic bag.

- Mark each branch with a twist tie or tape, and label them in some way (e.g., 1 to 4). Record which number corresponds to which branch.
- Carefully place the branch with all its leaves in the bag and seal the bag onto the branch at tightly as you can without damaging it.

2. Collecting data about transpiration.
   - Carefully remove the plastic bag from the branch, making sure you don't spill any water.
   - Pour the water into a marked beaker or graduated cylinder to determine the volume of water that was lost from the twig. Record this amount.
   - Repeat this procedure for each branch.
   - Calculate the amount of water that transpired per square cm of leaf:

     (1) Clip the part of the branch that was in the bag, or just its leaves.
     (2) Lay the clear cm grid over each leaf and estimate its area.
     (3) Add up the areas of all of the leaves to get a total amount of leaf area that was in each bag.
     (4) Divide the volume of water by the total leaf area to express transpiration as ml water per square cm of leaf.

Teacher's Study Plan

Question
1. Write the question you will answer with your study.

Hypotheses
2. Write the "null" hypothesis you are testing.
3. Write an alternative hypothesis you are testing.

Methods
4. Describe how you will address your question. Give specific details about your methods.
5. Draw a map showing the location of your sampling sites and/or a diagram showing what your sampling scheme looks like.

Anticipated Results
6. What do you expect to find? You might want to draw a graph of your predictions on the back of this sheet.

Please post any questions or comments in our Bagged Branches forum. We'd love your input!

SYEFEST Activity: Ant Cafeteria

Hope College, 1994
Holland, Michigan
Contributor: Gail VanGenderen

Starter Question: What foods do ants prefer and why might this be so?

Elementary Curriculum Objectives: For Michigan Essential Goals and Objectives for Science Education (K-12): Constructing New and Reflecting on Scientific Knowledge; Using Scientific Knowledge - Life Science: Organization of Living Things, Evolution, and Ecosystems.

Ecology Themes: Perception and Scale; Interactions between Individuals and their Environment.

Grade Level: All.

Materials:

(1) One sheet of plain poster paper, cut into rectangular strips about 1" x 6" long. You will need one paper strip per group of students.

(2) One data sheet/student group and one clipboard/group (optional, but much easier!).

(3) Assorted food items (5 different kinds) in a dispensing container, plus spoons, swabs, eyedroppers - whatever is needed to dispense your food items into small samples. You may want to ask your students to suggest food items to test on the day before the experiment. Good possibilities to start might include honey or a sugar solution, bird seed, vegetable oil or animal fat shortening, tuna packed in oil, crackers or cookies, etc.

(4) Magnifying lenses - 1/group (optional).

Procedure:

(1) Assign groups of students and have each group prepare the paper strip "ant cafeteria trays" by cutting to size (or pre-cut the strips and distribute), then have the students draw 5 evenly-spaced circles of about 1/2" diameter lengthwise along the "tray."

(2) Draw a sample cafeteria tray on a class chart to show how the food items will be arranged (one food item/circle). You may choose to leave one circle empty or including only tap water as a "control."

(3) Ask each group to predict which food item will be preferred by the ants and WHY they think so. Compile the different group's predictions on a class chart. Discuss HOW "preference" for a particular food item will be

measured.

(4) In the schoolyard, help your student groups locate a sufficient number of ant colonies that each group can observe a different colony. Ask your teams to observe the ant colonies for a few minutes while you distribute the food items onto the cafeteria trays. USE ONLY A VERY SMALL AMOUNT OF EACH FOOD ITEM - ABOUT THE AREA EQUIVALENT OF YOUR PINKY FINGERNAIL. Then have the students place the tray lengthwise alongside the entrance to the ant colony, about 2 inches away. Caution the students against disturbing the colony itself or they may find that the ants spend all of their time repairing the damage rather than looking for food!

(5) Specify a time period for food preference observations (at least 30 minutes). It may take the ants 10-20 minutes to discover the new food source!

(6) At the end of the investigation, each group should tally their results and report to the class. Display the compiled "actual results" alongside the initial predictions. Did the ants behave as predicted? Why or why not? Can the students propose reasons (nutritional or otherwise) for food preferences of the ants? Ask the students to generate new spin-off questions and proposals for answering those questions!

Follow-up:

Do ant food preferences differ for different species of ants? Do ant food preferences differ with time of day, weather conditions, or season? If many kinds of food were tested, can you begin to define the characteristics of foods that are attractive to your ants (e.g. sweet foods, salty foods, oily foods)?
Challenge your students to write a recipe for their own mixture of Ant Superfood (one that is more preferred than any other tested food type) and provide a rationale for their proposed recipes....then, hold an Ant Superfood Contest!

References:

For additional activities with ant colonies, refer to "Ants", prepared by OBIS, and published by Delta Education, 5 Hudson Park Drive, Hudson, New Hampshire 03051. (603) 889-8899.

For related activities, see "Ant Detective" and "An Ant's Amazing World", pp. 38-39, 42, and 44 in: Braus, J. (ed.) 1988. Incredible Insects. National Wildlife Federation. 1400 16th St., NW, Washington, DC 20036-2266.

For additional ideas on other kinds of ants, contact Gail Van Genderen, West Ottawa Public Schools.

Please post any questions or comments in our Ant Cafeteria forum. We'd love to hear from you!

SYEFEST Activity: Impacts of Schoolyard Traffic

Hope College, 1994
Holland, Michigan
Contributor: K. Winnett-Murray

Starter Question: What are some of the effects of human traffic on the soil communities in your schoolyard?

Elementary Curriculum Objectives: For Michigan Essential Goals and Objectives for Science Education (K-12): Constructing New and Reflecting on Scientific Knowledge; Using Scientific Knowledge - Life Science: Organization of Living Things, Evolution, and Ecosystems.

Ecology Themes: Scale; Interactions between Organisms and their Environment; Communities and Human Impacts on Communities

Grade Level: All.

Materials:

(1) For the "super soil" OBIS component; see list in OBIS handout.
(2) For the percolation test, each group of students will need a soup can with both ends removed, a water source, and a container to measure water with.
(3) For the survey of soil animals, each group should have a magnifier, a data sheet, and a clipboard.
(4) Soil temperature may also be measured; each group of students will need a thermometer.

Procedure:

(1) Each group should select 2 areas on the schoolyard to be compared with respect to physical features associated with schoolyard traffic. Select one area with heavy kid traffic and one area with little or no kid traffic, but try to keep the general habitat the same. For example, a path through a section of woods edge and an area just off the trail would be ideal. OR, use an area of a grassy playground that is heavily trodden (e.g. soccer field goals!) vs. spots in the same area with little traffic (perhaps just behind the goal). Have the children PREDICT which location will have more soil organisms and/or a greater variety (diversity) of living things than the other and WHY this may be the case. Most children will probably predict that the disturbed areas will have less - make sure they back up their reasons for WHY because the point of this exercise will be to discover some of the physical features associated with "disturbance/traffic" that may impact the living communities. Conduct each of the following measurements (or any subset the teacher selects) at BOTH sites.

(2) "Super Soil," an OBIS activity. Have the children describe (in writing) the characteristics of the soil at the 2 sites - color, texture, odor, graininess, lumpiness, etc. Secondly, conduct an ALUM test at each site to determine the amount of ORGANIC material present in the soil. Which site has a higher organic content? Make sure the

children record their results. A quantitative way to report the results would be to measure the depth of the organic layer in the tube by measuring it with a cm ruler.

(3) Percolation: Percolation here will be used as an indication of how compacted the soil is and how much water runoff might be expected in the two areas. Insert the soup can about 2 cm into the ground at the site to be measured by twisting. Try not to disturb the soil on the inside of the can. Pour 50 ml of water into the can and time how long it take for all of the water to percolate into the soil. Record this time. For areas that have a LONG percolation time (water sits in the can), we would associate slow percolation of water into the soil and high surface runoff during rain, watering, etc. What is the significance of high surface runoff? EROSION!

(4) Temperature: Measure the temperature just beneath the surface of the soil at each site by inserting the bottom red bulb of the thermometer into the soil until the entire bulb is just covered.

(5) Ground Creatures. You may elect to have the children to census only animals or only plants or both. In either case, select a plot size that will be consistent from group to group. Stretched coat hangers or large embroidery hoops, or circles of string about 20 cm in diameter are all possibilities. Have the children count and record each variety of organism and the number of each on their data sheet. Remember that the number of different kinds (= biodiversity) is every bit as important as how many creatures.

Follow-up:

(1) Do this exercise in combination with the Decomposers on Jello exercise beginning on page 196 of Eco-Inquiry by Kathleen Hogan. Have the children predict before-hand where there will be fewer vs. greater microbes that decompose dead plant and animal bodies. Also see the extensions listed in this exercise for growing funguses in baggies - again - the two areas could be contrasted for decomposer activity in this way.
(2) See the follow-through extensions listed in the Super Soil Obis handout. (3) If you have a hill on your schoolyard, measure the amount of erosion that occurs when water runs down a trampled part of the hill vs. a vegetated/grassy part of the hill. All you need is a mound such as the one at Van Raalte Elementary! See OBIS: "Hold-a-Hill."

References:

1. Hogan, Kathleen. 1994. **Eco-Inquiry: A Guide to Ecological Learning Experiences for the Upper Elementary/Middle Grades.** Kendall/Hunt Publishing Co. Dubuque, Iowa.
2. **"Super Soil." Outdoor Biology Instructional Strategies.** Published by Delta Education, 5 Hudson Park Drive, Hudson, New Hampshire, 03051.

Please post any questions or comments in our Schoolyard Traffic forum. We'd love to hear from you!

SYEFEST Activity: Nature Preserves: Is Bigger Better?

Hope College, 1994
Holland, Michigan
Contributor: Kathy Winnett-Murray

Starter Question: What is the effect of "nature preserve" size on the diversity and abundance of organisms protected within the preserve?

Elementary Curriculum Objectives: For Michigan Essential Goals and Objectives for Science Education (K-12): Constructing New and Reflecting on Scientific Knowledge; Using Scientific Knowledge - Life Science: Organization of Living Things, Evolution, and Ecosystems.

Ecology Themes: Scale, Communities and Human Impacts on Communities.

Grade Level: All.

Background:

A practical question confronting conservation biologists, politicians, and the voting public is the design and management of nature preserves - national parks, wilderness areas, wildlife refuges - any chunk of habitat that has been set aside with at least one of the intentions being the preservation of biological diversity. Biological diversity, or "biodiversity" can be measured at various levels of biological organization, the two most common being: a) species diversity, that is the number of different kinds of species and their relative abundances, and b) genetic diversity (the genetic variety present within a given species, as well as among different kinds of species). Both kinds of variety are critical for the maintenance of a healthy, viable population of organisms and for the long-term health of an entire ecosystem (why?).

This exercise introduces students to the measurement of biological diversity, the relationship between sampling effort and species diversity (optional), also known as the "species-area curve relationship", and (most importantly!) the relationship between habitat patch size and species diversity. These relationships provide a model from which we will draw conclusions about the design of nature preserves (habitat patches, if you will).

How big should a nature preserve be? Most of us would reply intuitively that "bigger is better" - but can we provide sound ecological reasons why bigger is better? Challenge your students to think of some of these reasons. All else being equal, a big preserve can hold more individuals than a small one, on average. Much less obvious is the prediction that a large preserve will also contain a greater variety of organisms, on average, than a small one. Why might this be so?

Materials:

(1) Hula hoops - about 80 cm diameter, 1 per group of students.

(2) Embroidery hoops - about 16 cm in diameter, 1 per group of students..
(3) Hand magnifiers (optional) if very small animals are to be included in the census.
(4) Data sheets and clipboards - 1 set per student group.

Procedure:

(1) Locate a schoolyard habitat such as a patchy lawn or a weedy area. Divide the class into groups and distribute the hoola hoops and embroidery hoops. If the 80cm and 16 cm varieties are chosen, then you will have big preserves 5 times the size of small ones and that's convenient for later analysis.
(2) Each group throws the hoola hoop at random (throwers CLOSE EYES) and censuses all living things inside by recording the type of organism and how many of each. If you have a particularly diverse area, restrict the census to just plants or just animals.
(3) Each group does the same thing with the embroidery hoop.
(4) It is not necessary to correctly identify all species but it is very important that **different groups choose consistent name for the same creatures so that they are recorded under the same name on everybody's data sheet.**
(5)Tally the class results.
(6) Compare the total number of living things in big vs. little, the number of different kinds of things in big vs. little, and the number in each population. Discuss what a "viable" population might be for various organisms, (e.g., if you have just one caterpillar in a reserve is that likely to sustain the population over a length of time or are more caterpillars (in more preserves) needed?
(7) For advanced students: Plot the cumulative number of species types found on the y axis, and the number of plots sampled on the x axis. This is called a species-area curve. It shows the importance of sample size, among other things. If you get a graph that goes up, then levels off, this means that at the corresponding number of samples, you are no longer picking up new species even though you take more samples. This way, you know how many samples it takes to get a very good notion of how many different critters/plants are in the entire area. How many hoola hoop samples does it take to reach this point? How many embroidery hoop throws? What would you predict? This relationships reinforces the concept that bigger will hold more variety, on average.
(8) Still more advanced, sort of: What if the conservationists and other citizens are faced with the choice below:

These two preserve "designs" have equivalent area, but one has the area broken into 5 small chunks and the other has all of the area contained in one large chunk. Which preserve system would contain the greatest variety of species? Based on our mathematical intuition alone, we might conclude that the sum of the species types found in preserve system 1 should equal the number of species sampled in preserve system 2. However, in the real world, the answer is: it depends. And what it depends on most, apparently is a more complex understanding of the ecological ties in the habitats involved. For example, if the big preserve, by virtue of being big, contains a greater variety of landscape features (rivers, low areas, high areas, wet areas, dry areas), then more species may be found there. On the other hand, depending upon how spread apart the little preserves are, they may encompass more different types of terrain.

Still, you are left with the problem of smaller populations that can be sustained in each of the smaller chunks. Get the picture? The answer may be complex and depends a lot on the particular situation. Try it on your schoolyard and see what happens. If your school had $500 to buy wildlife preserves, would you spend that money in one big chunk and carefully select it (where would you put it on your schoolyard?) or would you buy 5 small pieces where would you put those?) Here is a good reason for having the hoola hoop measure 5 times the diameter of the embroidery hoop!

Follow-up:

The same exercise can be done sampling bird species in a neighborhood. This exercise uses the same 5:1 ratio for area sampled as the hoola/embroidery hoop technique. A single "yard" can count for one small preserve and 5 yards constitute a big preserve. Have groups of students count and identify all of the bird species present in several large and small preserves. (When I did this I enforced a rule of all census-takers remaining on the front sidewalk - no walking into backyards, although they were allowed to count birds that could be seen anywhere in the preserve). Also, this is more scientific if you make a rule for when to sample large and small - don't leave it up to the census takers. For example, Yard 1 = first small, skip 2 houses, next 5 yards = large preserve , skip 2 houses, then second small preserve, and so on.

References:

K. Winnett-Murray, Biology Dept., Hope College.

Please post any questions or comments in our Nature Preserves forum. We welcome your input.

SYEFEST Activity: Beat Sampling

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Questions:

- Do different insect species occur along the edge versus the interior of a forest?
- Does the total number of insect species differ in different parts of a forest stand?

Overview: Compare how the insect species vary from the edge to the interior of a forest by beat sampling tree saplings along a transect.

Background: An insect community includes all of the insects living in a given place. One of the most obvious patterns evident in most schoolyards is the dramatic difference (at least in appearance) between the open meadow and lawn communities and the closed forest communities. However, are these forests themselves homogeneous, or are there interesting patterns of variation within them? There are many interesting things to study about forest communities. One concerns changes in communities that might occur while going from the edge to the middle of a patch of forest. Forest edges are receiving a lot of attention these days, in large part because human activity has created so many edges and small patches where there used to be larger expanses of contiguous forest. Are there species that require conditions found only in the interior of an intact forest. If so, how big does a patch need to be for these species to escape the "edge effect?"

Materials:

(1) 1 white sheet
(2) a rigid object to strike or beat saplings
(3) 1 meter stick
(4) insect identification books and keys
(5) materials for laying transect (see Tree transects)

Procedure:

1. Locating and running transects
2. Collecting data at each sampling point
   - For each sapling tree you sample during this study, collect insect community data.
   - Lay the sheet down on the ground directly beneath the sapling.
3. Firmly beat the sapling for a predetermined amount of time or with a predetermined number of strikes.
4. Immediately examine the insects that fall onto the sheet. Your goal is to "name" as many species as possible, so that you can get an idea about the total number of species present (i.e., species richness or diversity) and what the major species are (i.e., the species composition).

5. Record your results on the data sheet.
6. If possible, repeat this procedure for each sapling tree at each of the three sampling points along the transect.

[PUT INSECT COMMUNITY DATE TABLE HERE]

Please post any questions or comments in our Online Forum. We welcome your input.

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Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

SYEFEST Activity: Quadrats & Questions

Institute of Ecosystem Studies
Millbrook, New York
Contributors: Peter Feinsinger and other ecologists in OTS (the Organization of Tropical Studies), Steward T.A. Picket and Alan R. Berkowitz, IES

Objective: This field study is designed to build confidence in conducting the initial parts of the inquiry process (sometimes called the scientific method) in schoolyard ecosystems. Most non-scientists' experiences are limited to the "back end" of the process, having been restricted to data acquisition, processing, analysis and interpretation. Yet gaining facility at initiating the process is one of the real keys to becoming scientifically literate. The initiation of the inquiry process involves going from reflections and observations, to questions and hypotheses.

Tactics:

Part I - Asking Questions

- Examine the quadrat your team was assigned.
- Observe the organisms and physical environment in your quadrat. You might want to sketch the quadrat as a way of getting started.
- Write down all the questions you come up with as rapidly as you can for at least 20-30 minutes. Write as many questions as you can.
- Do not filter your questions. Do not reject any questions whether you know the answer or don't have a clue how you would answer the question, or feel that the question is stupid or trivial.
- Make sure at least some of your questions address the central theme or topic presented at the beginning of the exercise, but do not limit yourselves to such questions.

Part II - Examining Questions

- In a quiet spot in the schoolyard, or back inside, look over your questions. What kinds of questions did you ask? One classification is a) informational ("what is it?"), b) functional ("how does it work?"), and c) evolutionary ("why is it that way?").
- Reconvene with the whole group and discuss: How do your questions reflect your background and prior knowledge? What makes questions interesting? How do the questions relate to the central theme or topic set out at the beginning of the exercise?
- Consider how to proceed from a brainstorm list of questions to questions that can be answered through your own investigations. What makes question answerable? What other criteria characterize "good" questions for ecological studies in the schoolyard?

Part III - Questions to Investigations

(Note: A hypothesis is, simply stated, a testable proposition or statement. One of the core parts of scientific inquiry is the rigorous comparison of your proposition with some aspect of reality (e.g., results of observations, experiments, etc.)

For any question, there necessarily are at least two hypotheses, e.g., "Does more moss grow on the north or the south side of trees?" For example: H1 - More moss grows on north sides of trees than on other sides, or H2 - Moss growth does not differ on different sides of trees.)

Questions:

1. In groups of 6 (3 pairs), explore the entire "schoolyard."
2. After brainstorming questions, try to come up with a favorite question that is: a) interesting, b) amenable to direct investigation in the schoolyard, and c) can be answered, at least in part, by your team in the time allotted.
3. Record the actual questions you will address and state at least 2 hypotheses for your question.
4. Design a study for the schoolyard to address your question and test your hypotheses.
5. Carry out your study.
6. Present your results to your peers. Also consider how this study might be implemented with children in a school setting.

Please post any questions or comments in our Quadrats & Questions forum. We welcome your input.

SYEFEST Activity: Making Your Own Tree Key

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Overview: Create a key to trees sampled from around the schoolyard. Use only features that are clearly visible and consistent between the different specimens you have that are from the same species. Make the key as simple (i.e., the fewest steps) and as user-friendly (i.e., the fewest new terms or hard choices) as possible. This is a fun way to gain direct familiarity with the idea of a dichotomous (branching in two parts) key. You can create keys to lots of everyday things - children in your classroom, types of silverware, seeds, toys, art supplies, tools, etc. Eventually, students can create and continue build and refine their own keys to the organisms they observe and describe in their schoolyard studies - leaves, branches, fruits, insect, etc.

Materials: At least 2 twigs from each of 2-10 different species of local trees

Procedure - Making a key to the trees whose branches you have:

1. Look through the branches with your group. Decide which are from the same and which are from different species before proceeding.
2. Plan as a group what features you can use to distinguish between different species. Consider: how the leaves are attached to the stem (opposite or alternate), whether leaves are simple or compound, the nature of leaf lobes, and the texture of leaf edges.
3. Write the key as a series of "either-or" choices, unless it is absolutely necessary to have three choices (not ideal except as the last set of choices before identifying the individual):

    1 - Big nose (more than 2") - go to 2.
    1 - Small nose (less than 2") - go to 5.
    2 - Really big nose (more than 3") - Pinocchio
    2 - Not really big - go to 3.
    3 - Bloodshot eyes - Sneezey
    3 - Not bloodshot eyes - go to 4.
    4 - Eyes blue - Santa Claus
    4 - Eyes brown - Sleeping Beauty
    4 - Eyes green - Dolly Parton
    5 - .... etc.

4. You have 30 minutes to write your key.
5. Pick one of your samples to be the mystery species.
6. Invite a stranger to identify the mystery tree using the key.

Please post any questions or comments in our Tree Key forum. We'd love to hear from you!

SYEFEST Activity: Giving Up Density

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Questions:

- Which food stations are utilized most?
- Which animals are likely to visit the food stations?
- How does giving up density change in different habitats?
- What environmental, physical, or biological factors may encourage animals to feed at a site?

Overview: Many animals are active all year round and have to adapt to their environment throughout the changing seasons. Every action the animal makes has both benefits and costs. For example, when animals forage they may be exposed to predation or inclement weather. These are risks, or costs, associated with foraging at a particular site. The benefit of a food patch is primarily determined by the nutrition value and density of food in an area. A high density of food may encourage an animal to take greater risks whilst feeding. However, as an animal feeds, there is a critical point at which the density of food available no longer out ways the cost of feeding at that site. This is called **the giving up density.** When the giving up density of a food patch is reached, the animal will leave the site and forage somewhere else. Winter is a time when resources are particularly limited so behavioral decisions are very critical. To survive, an animal has to adapt its behavior so that the balance of its actions result in a net benefit.

This study will allow you to ask questions about how giving up density changes in different habitats. Further investigation may indicate some of the physical and environmental factors that affect giving up density at each site and so allow an unique insight into the decision making processes of foraging animals.

Materials:

(1)Aluminum baking trays
(2) Striped sunflower seeds
(3) Sand
(4) Sieves to separate sand and sunflower seeds
(5) Pans to sieve sand into
(6) Flagging
(7) Data sheets and clipboards

Procedure:

(1) Prepare food stations
a. Half fill aluminum baking trays with dry sand.

b. Count sunflower seeds and place them in each baking tray. The number of seeds depends on how long trays will be left outside, the habitats in which the trays will be placed, and the number of foraging animals in the area. Start with 100 seeds per tray left outside for 2 nights. Run some trials before starting the main project to see if this is a good number.
c. Mix the seeds into the sand to make your food station.

(2) Choose site locations
a. Choose sites where food stations can be located in 2 different habitats (plots). For instance, in brush and in the open.
b. Locate 2 or more food stations in each habitat. Having a number of food stations at each plot will help the results show the real effect different habitats have on giving up density as opposed to results being influenced by chance or random factors.
c. Mark your plots with flagging or tape so they can be found easily. In this study, at each site plot 1 is in a covered area and plot 2 is in the open.

(3) Running the experiment
a. Place the food stations at each site for two or more days. This gives animals time to find the food and get used to the new objects in their environment.

(4) Collecting data
a. After two or more days, collect each food station and count the number of whole seeds that remain. Don't count empty shells, since some animals are just messy eaters and leave these behind after their meal. b. Calculate the number of seeds eaten: Number of seeds eaten = 100 - number seeds remaining
c. Enter the information from each site in the table on this page.

(5) Extending the activity
a. There are many ways to investigate the differences in giving up density in different habitats. Perhaps temperature or light intensity could be measured.
b. Animal antifreeze is a suggested follow-up activity.

Click here to view a Sample Worksheet for your "Giving Up Density" activity. Please post any questions or comments in our Giving Up Density forum. We'd love to hear from you!

Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

Schoolyard Wonders: Plant Structures

Schoolyard Wonders ... Right Before Your Eyes!

Sometimes the best way to get familiar with the ecology of an area is to just put your senses to work and explore! Your group will be assigned one of the following ecology themes (Plant Structures, Plant-Animal Interactions, Diversity, Habitats, or Adaptations). Your challenge is to use the clues listed below to locate the items for your ecology theme. Observe carefully, and be prepared to share your findings with other groups.

PLANT STRUCTURES

- ❑ Find a leaf that is wider than it is long.
- ❑ Find a leaf that isn't green.
- ❑ Find the largest leaf/flower you can.
- ❑ Find tree with the smoothest bark.
- ❑ Find a leaf with a jagged edge.
- ❑ Find a plant that has a square stem.
- ❑ Find a plant that has the largest seeds.
- ❑ Find a flower that looks better than it smells.
- ❑ Find a tree that you can put your arms around.
- ❑ Find a plant that has a seed cluster or head with more than 20 seeds.

By: Chris Brown, Science Coordinator
Ferguson-Flourrissant School District
St. Louis, MO 1994

Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

Schoolyard Wonders: Habitats

Schoolyard Wonders ... Right Before Your Eyes!

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HABITATS

- ❑ Find something living in a place that is always shady.
- ❑ Look for an area with the wettest soil.
- ❑ Find a tree (or tree part) that is used as an animal home.
- ❑ Find a place where plants grow poorly.
- ❑ Look for an animal home attached to a building or structure.
- ❑ Find a critter living under something.
- ❑ Find something living in a crack in the sidewalk or parking lot.
- ❑ Find a place where ants have set up housekeeping.
- ❑ Find something that is living in an area that is always sunny.
- ❑ Locate the rockiest area you can find. Any critters living there?

By: Chris Brown, Science Coordinator
Ferguson-Flourrissant School District
St. Louis, MO 1994

Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

Schoolyard Wonders: Adaptations

Schoolyard Wonders ... Right Before Your Eyes!

Sometimes the best way to get familiar with the ecology of an area is to just put your senses to work and explore! Your group will be assigned one of the following ecology themes (Plant Structures, Plant-Animal Interactions, Diversity, Habitats, or Adaptations). Your challenge is to use the clues listed below to locate the items for your ecology theme. Observe carefully, and be prepared to share your findings with other groups.

ADAPTATIONS

- ❑ Two different seeds that travel at least 3 ft. when you blow on them.
- ❑ Look for a seed that can stick to hair or fur.
- ❑ Find a plant that has thorns or spines to protect itself.
- ❑ Find a plant whose roots have penetrated a crack or crevice.
- ❑ Find an insect that you would be afraid to pick up.
- ❑ Find an insect whose COLOR or SHAPE blends in with its surroundings.
- ❑ Find a leathery or waxy leaf that holds moisture in.
- ❑ Find a leaf that makes a good "sun collector."
- ❑ Find a vine growing up a fence, tree, or building.
- ❑ Find a flower that you think would make a good butterfly restaurant.

By: Chris Brown, Science Coordinator
Ferguson-Flourrissant School District
St. Louis, MO 1994

Appendix 1 Schoolyard Ecology Leaders' Handbook

Sample activities & inquiry ideas

Schoolyard Wonders: Plant-Animal Interactions

Schoolyard Wonders ... Right Before Your Eyes!

Sometimes the best way to get familiar with the ecology of an area is to just put your senses to work and explore! Your group will be assigned one of the following ecology themes (Plant Structures, Plant-Animal Interactions, Diversity, Habitats, or Adaptations). Your challenge is to use the clues listed below to locate the items for your ecology theme. Observe carefully, and be prepared to share your findings with other groups.

PLANT-ANIMAL INTERACTIONS

- ❑ Find a leaf that has been chewed.
- ❑ Look for a plant that is a home to an animal.
- ❑ Find a plant growing on another plant.
- ❑ Find a plant shaded by another plant while shading another plant.
- ❑ Find a plant damaged by humans.
- ❑ Look for a plant that has a gall (or bumpy growths) on it.
- ❑ Find a seed that looks good enough to eat.
- ❑ Find a flower (or flowers) being visited by insects.
- ❑ Find a tree that has lichens growing on it.
- ❑ Look under (or within) a rotten log or decayed leaves for signs of life.

By: Chris Brown, Science Coordinator
Ferguson-Flourrissant School District
St. Louis, MO 1994

Schoolyard Wonders: Diversity

Schoolyard Wonders ... Right Before Your Eyes!

Sometimes the best way to get familiar with the ecology of an area is to just put your senses to work and explore! Your group will be assigned one of the following ecology themes (Plant Structures, Plant-Animal Interactions, Diversity, Habitats, or Adaptations). Your challenge is to use the clues listed below to locate the items for your ecology theme. Observe carefully, and be prepared to share your findings with other groups.

DIVERSITY

- ❑ Look for a mushroom or other fungus among us.
- ❑ Find a worm.
- ❑ Find a tree trunk that you can put your first finger and thumb around.
- ❑ Find a flower with five petals.
- ❑ Find a spider web.
- ❑ Find a moss.
- ❑ Find a spot that has the greatest variety of plants in the smallest area.
- ❑ Find a flying insect.
- ❑ Find a plant that is "evergreen."
- ❑ Find a bird's nest.

By: Chris Brown, Science Coordinator
Ferguson-Flourrissant School District
St. Louis, MO 1994

Syefest Activity: Assessing Student Learning

Institute of Ecosystem Studies
Millbrook, New York
Contributor: Alan Berkowitz

Starter Questions:

- What do you know about plant community ecology?
- What science process skills and habits of mind can you demonstrate in the field of plant community ecology?
- How can you assess the scientific knowledge, process skills and habits of mind of students?

Overview: Teams of participants design, administer, and evaluate performance assessment activities in plant community ecology for each other. The whole group then discusses strategies and challenges for assessing student learning.

Background: Student knowledge, skills and habits of mind in schoolyard ecology can be assessed by **performance events.** These are tasks requiring 30-90 minutes and can include use of manipulatives or tools, designing investigations, making predictions, data collection and interpretation, and/or drawing inferences and conclusions based on data. They usually start with a standardized and engaging assignment that motivates and focuses the work of the participants.For example: (A) Assign the group to address the question, "Design a study to test how food webs relate to relative humidity on the four sides of the school building." The class is directed to produce a short proposal for their study that would include observations of the actual site that could be made during the specified time period. Or, (B) Assign the group to design and plan the installation and maintenance of a native plant garden for the schoolyard.

The assessment would be based on some combination of (1) observation of specific behaviors or factors by the group as they carry out the task, (2) specific features of the final product, and (3) self assessment by the participants. For each item of interest, the assessment plan should include a rubric facilitating evaluation of attainment. .

Materials:

(1) Worksheet for assessment activity plan
(2) Field research materials specified by each team in their plan
(3) Clip boards, paper and pencil for teams to record observations during performance assessment activity

Procedure:

(1) Assign teachers to create a performance assessment activity.

a. At least one day in advance, form two (or more) groups and give them the following assignment:
Two groups plan an activity to assess the science knowledge, process skills and habits of mind in the field of community ecology of the members of the other group. This is to be a performance assessment lasting up to 1 ½ hours, with at least part if not all of the activity taking place outside. Tomorrow you will actually "administer" your activity, be a "student" in the other group's activity, and have a chance to reflect on the entire process.

- Make sure we have a list of the supplies you will need us to provide for your use tomorrow.
- Complete the Worksheet - Assessment Activity Plan.
- Prepare the handouts and other materials you will need, either by the end of today or first thing in the morning for duplication.
- Devise a rubric for how you will assess the other group's knowledge, skills and habits of mind.

b. Help teacher teams prepare and plan their activities.

c. Collect Worksheets and assemble requisite materials.

(2) Conduct assessment activities at school site.

a. One group directs the other in conducting the assessment activity it devised.
b. The second group directs the first in conducting the assessment activity it devised.
c. Each group then meets to complete its assessment of the other group's performance.
d. If time is available, each group shares its observations of the other group's knowledge, skills and habits of mind with respect to plant community ecology.

(3) Reflecting on assessing student learning.

a. Journal writing: What did it feel like to have your science process skills assessed? What were the strengths and weakness of the techniques you used to assess the other groups' skills?
b. Jigsaw groups so that each new group has members from each old group. Then discuss the effectiveness of their assessment activity.
c. Group discussion of strategies for assessing learning in SYE.

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Schoolyard Ecology Teaching Resources

Schoolyard: ______________________________

Your Name(s): ______________________________

This activity is intended to guide you in searching the school-yard for good teaching resources. By resources we mean habitats, environments, organisms, communities, or other features of the schoolyard landscape that can be used to teach ecology. If you have questions or comments, please post them in our Resource Forum. In searching for useful teaching resources, remember:

- There must be adequate room for an entire class broken into small groups to work.
- There must be enough of the resource so that it can be sustained indefinitely with the kind of use you envision.

The list is drawn from many ecology curriculum and activity guides. Earlier versions were tested by ecologists and teachers in the Schoolyard Ecology for Elementary School Teachers (SYEFEST) project over the past 3 years.

What to do: See how many items you can check off. Make sure you explain or describe what you find next to each item.

A. Neat Natural Patterns

___ 1. A plant species that grows in clumps rather than spread out. ____________________

____

___ 2. A plant species that grows along an environmental gradient (e.g., a slope). ___________

____

___ 3. Signs of an animal that might be territorial. ______________________________

___ 4. Signs of an animal species with an interesting distribution. ______________________

___ 5. Two plants with different branching patterns. _____________________________

___ 6. A spot that will change a lot with the seasons. ____________________________

___ 7. An organism with easy-to-study life cycles. ______________________________

___ 8. One other natural pattern that's neat. Describe: ___________________________

____

____

B. Dazzlingly Different Places

___ 1. Two (or more) areas where the same plant species are growing. ______________________

____

___ 2. Two areas where plant diversity might be different. ________________________________

____

___ 3. Two areas were soil organisms might be different. _________________________________

____

___ 4. Two areas where insect diversity might be different. ________________________________

____

___ 5. Two areas where baits might disappear at different rates. ____________________________

____

___ 6. A tree or shrub species some growing alone and others in clumps. _____________________

____

___ 7. Slopes or sides of the building with northern versus southern exposure. ________________

____

___ 8. One other dazzlingly different pair of places. Describe: _______________________________

____

C. Scintillating Sampling Subjects.

___ 1. A promising spot for insect sweeping. ____

___ 2. An area to sample using pitfall traps (for sampling soil surface beetles, etc.). ______________

____

___ 3. A source of litter for decomposers. ____

___ 4. A place for a bird feeder. ____

___ 5. A live tree to core to look at tree rings. ____

___ 6. A dead tree to cut to look at tree rings. ____

___ 7. A tree or shrub with clear end-bud scars on the twigs for studying growth. _______________

____

___ 8. A tree or shrub with branches within reach to shake over a sheet to collect insects. _________

____

___ 9. A damp area for finding animal tracks. ____

___ 10. A good spot to study the effects of mowing. _______________________________________

___ 11. A spot for placing out boards or carpet strips on the ground. ________________________

____

D. Charismatic Creatures for Schoolyard Ecology Studies.

___ 1. Ants ____

___ 2. Grasshoppers ____

___ 3. Leafhoppers ____

___ 4. Gnats ____

___ 5. Spiders ____

___ 6. Plants with burred seeds ____

___ 7. Plants with sun & shade leaves ____

___ 8. Plants on walls ____

___ 9. Lichens ____

___ 10. Milkweeds ____

___ 11. Spittle bugs ____

___ 12. Dandelions ____

___ 13. Robins ____

___ 14. Worms ____

___ 15. Oaks and acorns ____

___ 16. Bees ____

___ 17. Goldenrod ____

___ 18. Galls ____

___ 19. Nests ____

___ 20. One other charismatic creature: ____

Environmental Issues Teaching Resources.

___ 1. A sign of air pollution. ____

___ 2. The parts of the schoolyard with the lowest and highest biodiversity. ____________________

____

___ 3. The densest population of an easy-to-study species. ________________________________

____

___ 4. A place to study recycling in nature. ____

___ 5. Exotic plant species (e.g., Ailanthus, honeysuckle, barberry, purple loosestrife, dandelion, etc.). ____

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SYEFEST Activity: Reflective Thinking for Teachers

Logan, Utah, SYEFEST
Contributor: Steve Archibald

MAKE QUOTES IN GRAPHIC FORM/"FLOWERY" STYLE/NOT SAME AS CH. QUOTES?

"Students are thinking all the time, but experience teaches us that, without reflection on what we do, we are not likely to benefit from our good thinking."

(Author Unknown)

"Our thoughts are the epochs of our life; all else is but as a journal of the winds that blew while we were here…"

(Henry David Thoreau)

In our fast paced society, perhaps one of the greatest missing ingredients is the act of REFLECTION, of SLOWING DOWN, of being DELIBERATE THINKERS.

(Henry David Thoreau)

Activity 1: Learning to Reflect **Objectives:**

- To plant the suggestion that there is need for reflective thinking.
- To help us explore the idea that time spent in reflection is not wasted time but is rather time well spent.
- To give participants theory and others' words on the topic which might encourage them to action.

Materials:

(1) Reflective Thinking Handout
(2) A copy of *Mountain Time* by Paul Schullery

Procedure:

(1) Engage: Relate the story of the 10-year-old bike rider who sees his surroundings for the first time one day. Amazement! The mountains were out there all the time!

(2) Explore: Take the next 60 seconds to think about an incident in your life which changed the way you look at the world.

(3) Explain: How would you define the word **reflective?** (Serious, thoughtful, with careful consideration). The quotations on this page are great starting points to understand the need to slow down and to reflect on what surrounds us and waits for us to see and understand.

(4) Elaborate: Brain Research suggests that reflection allows the brain to organize and make meaning of sensory inputs.**This is important for classroom teachers!** We give so much sensory input whether we're inside or outside with our students, but do we give them time to organize and make meaning of it?

(5) Read from *Mountain Time* (pp xiii - xiv).

(6) Go on to the **Recipe for Reflective Thinking** activity below.

(7) Evaluate: Journal prompt and reflection time offered; sharing.

Activity 2: Recipe for Reflective Thinking

Objective: Taking time to reflect.

Procedure:

(1) Determine a need to reflect. Ask yourself: Do I (or my students) need more time to think about what’s going on around me/us?

(2) Find a place where you can be undisturbed during the reflective experience.

(3) Attempt to **slow down** while you are reflecting. This takes practice because slowing down is mental as well as physical.

(4) It’s OK to be unproductive in the traditional sense for a while. Perhaps **less really is more.** Sometimes you should be deliberate about your think time and other times let your mind take you wherever it goes. A focus at time can be of great value.

Please post any questions or comments in our Reflection Strategies forum. We'd love to hear from you!

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Schoolyard Ecology: Summer Institute Worksheet

Assessment Activity Plan

Names:

Focus Topic

General Outcome

Task Description (for students)

Time Frame (for students)

Procedures and Time Frame (for teacher)

Scoring Rubric

Criteria	Scoring Scale			
	High Quality 1	Meets Objective 2	Falls Short 3	Not Done 0
I. Knowledge				
II. Skills				
III. Habits of Mind				
IV. Products				

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