Schoolyard Investigation Plan

Title: Comparative study on the rates of decomposition in the bamboo forest and the hardwood forest in the campus of Brenau University

Age Group: 9-12

Duration of Investigation: 6 weeks

Lesson Goals

A healthy ecosystem is sustained by the recycling of nutrients. Without the process of decomposition, nutrient cycling processes will be halted, dead organisms will accumulate, and many parts of the Earth will eventually be depleted of spaces for other organisms to pile up. A world deluged with heaping dead organisms is unimaginable!

The primary purpose of the study is to investigate which site has a higher rate of decomposition using the litterbag technique. Throughout the duration of this investigative study, students will be able to achieve the following goals:

- Determine which area has a higher rate of decomposition: bamboo forest or hardwood forest.
- Clearly understand the definitions of these words: *invertebrates*, *decomposition*, *decomposers*, *biotic factors*, *abiotic factors*, *nutrient cycling*.
- Recognize the role and importance of decomposers in the recycling processes.
- Cite how we benefit from forests.

The investigation also meets the following Georgia Performance Standards, Biology/Environmental Science Curricula:

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.
SCSh3. Students will identify and investigate problems scientifically.
SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.
SCSh6. Students will communicate scientific investigations and information clearly.
SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.
SEV1. Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society.

Materials (per group)
12 Flags (4 sets of bags labeled 1-3)
12 Litter bags
Digital weighing balance
Leaf samples: bamboo leaves; and red maple or oak leaves
Masking tape
Newspapers

Record notebook
Shovel

Investigation Setup

Engaging students

Prior to the onset of investigation, the students will play *Journey of the Carbon Atom,* a good role-playing exercise that will teach the students about carbon cycle between biotic and abiotic components of the ecosystem.

The whole class will need the following materials: *Tennis balls marked with C (carbon), permanent markers, index cards as name plates*.

Procedure

1. The class will be divided into seven groups to represent the following: *Atmosphere, water, aquatic plants, aquatic animals, sediments and rocks, land plants, land animals.* Each member of a team will have to wear her IDs (index cards) to identify her with the group.
2. Allow rooms for these areas: *Atmosphere, land and ocean*. The students will position themselves in the appropriate areas, depending on their roles.
3. Allow brainstorming time for the teams to decide on the appropriate movements of their carbon atoms. For instance, carbon from the atmosphere has the option to move to land plants or to water.
4. Each member in a team will have one tennis ball, which will represent the carbon atom.
5. Each group will have to "give up" a carbon atom to another team, one at a time, and must always leave at least one carbon. Remind the students to be mindful where their carbon is going. Before a student tosses a ball to another group, she must verbalize how her carbon is lost to another team. The receiver, once she catches the carbon, will state how she is going to use the carbon.
6. When students have mastered their roles, simultaneous carbon movement may now be done without each student explaining the carbon movement.

After the activity, students will be encouraged to share what they have learned from the journey of the carbon atom. When everyone finish taking her part in the assessment of the exercise, students will be prompted to answer the following question:

1. Why is carbon cycle important?
2. How does carbon end up in the atmosphere?
3. How does carbon end up in soil?

Following the question-and-answer section, the investigation will be introduced. Background of the studies will be provided to give the students a picture of what they are about to investigate. Afterwards, the students will have opportunities to raise questions. Given the overview of the investigation, the following student-driven questions may arise:

1. How does decomposition happen?
2. What factors contribute to the rate of decomposition?

3. What decomposers are present in each sampling site?
4. How are the two sampling sites different in terms of their biotic and abiotic factors?

Sample hypothesis
The rate of decomposition will be faster in the hardwood forest than in the bamboo forest.

Methodology
Experimental designs

Day 1: For every sampling site, there will be three litter bags for bamboo leaves, and three litter bags for red maple (or oak leaves). A group will have six litter bags in one site. All in all, one group will use 12 bags for both sampling sites.

When collecting leaf samples, the following should be considered:

1. Samples must come from one location. For instance, bamboo leaves must be collected from the bamboo forest designated as a sampling site.
2. Samples must be mature leaves that have fallen off their trees, not picked from the tree.
3. Good quality samples must be collected. Leaves that are fully intact are ideal samples.

To flatten the samples for a day, newspapers or used books will be used.

Day 2: The petioles will be cut off the leaves before drying the leaves in the oven at 30^0 C for 24 hours.

Day 3: Before storing the samples, each litter bag must be labeled with the name of the species of leaves that it will hold, sampling site, date of sampling, and group number. Every litter bag will have to contain approximately five grams of one species of leaf samples. Initial mass of each sample must be recorded accurately. For instance, the weight of the sample is 4.95, then the numbers must be indicated in the record notebook.

Students will proceed to the sampling sites, and identify the sunny and moist areas. They will then dig out ground with a depth enough to shelter a litter bag for six weeks. To easily locate these areas later on, flags will be erected on top of the areas where the litter bags are buried.

Six weeks later: Samples will be collected, and the leaves will be carefully taken out of the litter bag. The leaves will be dried again by placing them in the oven at 30^0 C for 24 hours.

Day 1 (after six weeks): Final mass of the leaf samples will be collected.

Data to collect:
Initial mass (*in grams*)
Final mass (*in grams*)
Percent mass loss= Initial mass- Final mass/Initial mass * 100
Decomposition rate (daily) = Percent mass loss/ Length of incubation (in days)

Sample table

Leaf sample	**Bamboo**				**Hardwood**			
Red maple (for example)	**1**	**2**	**3**	**Average**	**1**	**2**	**3**	**Average**
Initial mass								
Final mass								
% Mass lost								
Decomp. Rate(daily)								

Team assignment: Prior to the investigation, students will be randomly assigned to groups.

Safety precautions: Students will be required to use sunscreen and bug spray. Also, students will be reminded about the presence of poison ivy plants, particularly in the hardwood forest. A student allergic to poison ivy will have to inform the teacher about her allergies prior to checking the sampling site. Wearing of appropriate clothings is required (Long pants and long-sleeved shirts are ideal).

Sampling sites

The two sampling sites, which are the bamboo forest and the hardwood forest, are located within the proximity of Brenau University's property in Gainesville. The city is positioned northeast to the city Atlanta.

In terms of area, the bamboo forest is a smaller zone compared with the hardwood forest in the campus. Growing in the forest are bamboos with approximately more than half a foot in diameter and a towering height of about 50 feet. An article posted on the Internet claimed that the forest has been surviving for more than 75 years. The bamboo trees have served as

canopies to a few tiny plants on the ground layers. Some of the trees grow on higher elevated areas, and other trees are upraised on slopes. Compared with the temperature of other areas close to the bamboo forest, with the exception of the deciduous forest nearby, the bamboo forest has a lower temperature.

The deciduous forest, on the other hand, is a very lush area that is rich with trees such as loblollies, oaks, red maples, and other perennial or deciduous trees. It is a more diverse and wider environment than the bamboo forest.

Prediction

If the rate of decomposition is faster in the hardwood forest than in the bamboo forest, then the leaf samples buried in the hardwood forest will decompose more than those samples buried in the bamboo forest.

Analysis and communication

Students will compare the data of leaf samples that are tested for decomposition in both sites. They will especially note the percent mass lost in each set of leaf samples and the leaf samples' daily rate of decomposition. Whichever site has a bigger value for the average percent mass lost

and average daily rate decomposition will be identified to be the area with a faster rate than the other sampling site. To compare with other groups' results, students will present all their data and conclusions to the class.

Resources
Any Environmental Science or Ecology books; Internet: Galileo, OIEE, Education Resources Information Center; *Death is Natural* by Laurence Pringle

Budget
Mesh bags are sold at least $3.33 a piece on E-bay. For ten bags and their shipping ($10.49, shipping rate from the seller), the total cost $43.79. A box of marking flags costs $40.49. These are the only items that require purchase. Total cost for needed materials is **$84.28**.

Extensions
- Comparative study on the relative abundance and diversity of soil invertebrates in the bamboo forest and deciduous forest
- Comparative study on the abiotic factors in the bamboo forest and deciduous forest

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