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"Classroom Ecosystems: Windows on our Environment"

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Introduction

In my unit this year, I would like to help my students develop an understanding of their relationship with their environment, and a respect for how the everyday things they do affect that environment. I am a middle school special education teacher in the Hill area of New Haven, and as such I am constantly being challenged to find new ways to motivate my students in learning about the various aspects of science while still being considerate of students' limitations. These students always are most attentive to, and thus learn the most from, hands-on learning situations. Whereas they often have limited reading and mathematical ability and will rarely experience the excitement of sitting and reading to themselves a book on topics of interest to them, there is vast potential for developing a unit on ecosystems where students can experience nature first-hand while learning about it. This unit is created to be taught in parts, with each section taught during the corresponding season so that students will have the best opportunity of relating what they are learning directly to what is happening in their neighborhood. One of the very important things which I feel that I can foster in my students is respect and concern for their environment. I hope to encourage them to think about the fact that each of us plays an active role in what is happening in our environment, good or bad, and that not making conscious choices is in itself a choice. Students in my classes are often caught up in a daily struggle to hold their own personal lives together, and they tend not to think about issues such as environmental impact. However, I think that it would be healthy and productive for them to be exposed to environmental education and I believe that it will have some impact on them, with the amount varying from student to student.

Many people today seem to have lost hope in the future, feeling helpless and paralyzed to do anything to affect it. I believe that, in part, this comes from viewing nature and ecology at a distance, and feeling that the "important issues" are global, too distant and overwhelming for the common person to do anything about. Others I have spoken with seem to feel that the earth is so powerful and magnificent that it can take in stride anything that mere men could do to it and still manage to right itself. I am hopeful that by involving students in a study of our earth on a personal level, they will begin to realize that each person can have an impact on changing the future, for better or worse.

Objectives

1. Introduce the concepts of ecology, environment, and ecosystems and the interconnectedness of living things and the world around them.
2. Expose students to the idea of a Web of Life, and explore this concept as it applies in their personal environment.
3. Create a classroom environment which allows students to interact first-hand with their environment.
4. Increase students' knowledge of vocabulary for understanding ecology.
5. Provide opportunities for students to predict, observe and discuss changes in their personal environment.
6. Encourage students to photograph, chart and artistically depict their environment under various conditions.
7. Demonstrate how each student can affect ecological cycles around her/him.
8. Discuss and, where possible, observe cycles occurring naturally in nature.
9. Provide opportunity for students to demonstrate and talk about what they have learned, including expression through art forms including art, music and dance.

Strategies

Fall Component

Ecology Defined and Explained

The word *ecology* has its origins in the Greek words "oikos" meaning a dwelling place, and "logos" meaning the study of. Ecology is the study of plants, animals and their biological and physical environments, how they interact and influence each other. Ecology views the world or a particular ecosystem as a whole, but does not consider conditions specifically as good or bad. Earth is, in effect, our "house" and the interrelatedness of its many parts is ongoing. In studying ecology, we will try to look at *what is happening* in a particular environment, not just what is *there* . We have to recognize that man is not an isolated creature, that his existence depends upon the many billions of organisms that share the earth's surface with him. The oxygen man breathes is produced by plants, the food he eats is derived from animals and plants, and plants have a definitive influence on the drainage of water from the land and thus affect the water cycle and his supply and quality of drinking water. Many years ago, man began to realize that he not only needed "nature", but also that there were ways he could change and control it, to make it fit his idea of a better way of life. As a result, changes such as factories, electricity, automobiles, synthetics and such came about. People were pleased with the conveniences and improved way of life they gained, but sometimes forgot that with these kinds of changes must come an understanding of their impact on our environment and nature. With an easier way of life often came an attitude favoring disposable, throw-away containers with little concern for their environmental impact. It's important now that we step back and look at the fact that all living things depend upon one another, and that we need to consider things like litter, stripping the earth, causing excessive soil erosion, and other major consequences when we make the choices for our actions. I would hope that an outcome of this unit will be for students to see that by beginning to be more aware of how we treat our own environment, we can help to save the earth. Each and every person in this world can make a difference.

Living organisms are widely varied and abundant on earth and are reliant on each other; they are not totally

independent, distinct entities. They may share a common ancestry, they do share a common habitat in our biosphere, and they compete for the same sources of energy and materials. Living organisms are especially organized parts of the biosphere that interact constantly with one another and also with the nonliving components of the biosphere. They are regarded as a *web of life* in which all of the parts are intricately interwoven. As plants and animals solve the problem of finding energy sources, they affect each other. Sometimes the way these organisms affect one another are easy to see, sometimes they are impossible to observe, but all living things do affect one another directly or indirectly.

Scientists since Darwin have been concerned with the organization of living and nonliving things, and "biological community" is a phrase they have used to describe the distinctive organization of plants and animals in a given area they are studying. This concept tended to focus on the organisms occupying a given area, rather than the processes going on there. Ecologists are now interested in understanding how biological communities function. The term *ecosystem* was coined for this purpose in the 1930s, but did not become widely used and understood until the 1960s.

Theoretically, there are an unlimited number of ecosystems for any situation being studied. Students will be encouraged to brainstorm names of the ecosystems of which they are a part, ranging from the earth as a whole to the United States to New Haven, Connecticut, to our school, to our class, to their family, etc. At this point they will not be asked to analyze these ecosystem as much as to recognize the many ways there are to look at our place in the environment. I intend to use activities like this to reinforce constantly the fact that every person has an impact on the environment, no matter how distanced he may feel from major problems.

Although I intend to focus my unit on the local environment, I will briefly expose students at this time to the fact that ecologists tend in general to look at a limited number of ecosystems when they are looking at the earth as a whole, and that these generally are divisions of large units of nonmarine earth space called *biomes* . Biomes are almost all named for the principal physical aspect of the vegetation. In general, the recognized classification of the world's biomes includes:

Tropical Rainforest	Tropical Cloud Forest
Tropical Deciduous Forest	Tropical Scrub Forest
Tropical Savanna	Mangrove Forest
Mediterranean Woodland and Shrub	Oceans
Middle Latitude Grasslands	Lakes
Middle Latitude Marshlands	Rivers
Middle Latitude Deciduous Forest	Coniferous Forest
Tundra	

Cycles in Nature

At this point in my unit I would like to reinforce in my students the concept of cycles in nature. There are times when nature surprises us with an unexpected event, some of which can have tremendous impact in our lives: such things as earthquakes, tornadoes, monsoons, etc. And there are times nature surprises us in small ways that delight us, such as a rare warm, sunny day in the midst of a cold, gloomy February or a cool, breezy day in the middle of a roasting, steamy August. However, there is a general order to many things in nature. Each 24 hours here in New Haven, night follows day. The length of each may vary, but night follows day, over and over again. In September, when we start school, it is always technically Fall or Autumn. The season following that will always be Winter, followed by Spring, and then Summer. Despite variations from the traditional

expectations which may occur in each, these things follow cycles: they start at any given point, change in an established order, and eventually come back to the starting point. We are so used to the changing of the seasons that we do not pay much more attention to it than our complaints or compliments about the weather, rarely thinking about the fact that they are a response to the fact that the earth circles around the sun. (Even in this area many people are able to distance themselves from nature by using mechanical processes to keep their homes perpetually at the temperature of the desired season.) Changes from season to season and how these support each other will be discussed.

In illustrating this, students will begin their hands on experiments with ecosystems. We will go out to the area around the school and collect soil samples to be used. Back in the classroom, students will create their own bottle ecosystems by placing soil samples into clean, recycled plastic soda bottles (two or three liter) and sealing them. These will be their individual sealed ecosystems. Students will be encouraged to comment on what they found out about the environment around their school and to make notes of the components they find in their soil, including such things as rocks, bugs, glass, bits of asphalt, etc. (At this point I will remove any objects which might be dangerous to students, including glass. If a student feels that she/he wants this to be part of their ecosystem as an experiment, I will personally see if there is a way to include it.) They will be encouraged to predict what will happen within their ecosystems. Preliminary findings on soil, procedures, and students' predictions will be charted and displayed in the classroom. Throughout this unit I will stress with the students that there are no "right" or "wrong" answers. They may find very different results at any time from the same procedures, but it will hopefully reinforce that there is no guarantee of results where so many factors of nature are involved. Our bottle ecosystems will then be placed in varying conditions around the room to be observed in future days. Students will be encouraged to experiment with conditions where they place their bottles, including putting them inside a cabinet or dark place which would simulate the low light conditions we generally experience in New Haven in winter. Bottles will be checked periodically and observations recorded on our charts.

At this point, I would like to involve students in thinking about the soil they have collected as a product of both nature and man. After telling students that soil is partly made up of rock particles, I would encourage them to think of a rocky area they know. (West Rock and East Rock are certainly good examples for students in New Haven who believe they cannot think of an individual area.) I would ask the students to think about what weather conditions the seasons bring to the area, and we would do a prediction chart: What effects do you think certain seasons might have on rocks? (For all prediction sessions to be most productive, I believe the teacher should accept and record all given answers nonjudgementally.) If possible, this would be a great time to plan a field trip to the beach, where many of the concepts about to be covered could be demonstrated.

After predicting, I will ask students to think about the bare rock, and to picture hot sun shining down on it in the summer; rain, hail, and wind pounding against it and snow covering the rocky area in winter, and ice freezing in its cracks. Then think about the rain coming again in the Spring. I would try to elicit from them the response that after many years of this treatment a rock would begin to split and crumble. At this point I would ask them to think about the possibility of seeds being deposited there by natural causes, such as wind or birds. Hopefully I will engage them in thinking about roots growing into the rock, making tiny tunnels. I will give them information on rain seeping in next to the roots and ask how this would contribute to further splitting and cracking. This discussion will continue, encompassing the fact that the rock will eventually crumble into various sized pieces, and how these contribute to our soil.

Soil is made up of more than rock particles, and my next topic with students would be humus. In the Fall, leaves fall from the trees. Birds who have been flying around a neighborhood leave their droppings, and now

and then a feather. Animal droppings are also left on the soil. Bits of fur may also brush off the animals as they walk about. These are added to the multitude of other things which may be on the soil: butterfly wings, old cocoons, bits of food, garbage created by people but spread by animals, dead roots and twigs, and many other things. Students will be encouraged to add information to the discussion from their own findings in their soil samples. All of the things which have ever lived and died from insects, to plants, to animals—become part of the earth when they die. They stay in the ground year after year in all of the cycles of weather and, like the rocks we talked about, they eventually break down. In addition to the process we discussed with rocks, animals also decay. Millions of bacteria and molds exist in the soil, so small that we cannot see them, but in their daily life cycle they produce chemicals that take apart and change the materials around them. This is how *humus* is made in a process called decay. The process of making humus also involves many tiny plants, and insects and worms who loosen and mix the soil as they tunnel about, and by microscopic animals. Humus mixes with sand and clay that has been made by the weathering of rocks.

In looking at the season of Fall or Autumn, it would be appropriate to have students comment on the changes they see happening in their neighborhood and to take a trip to nearby Edgewood Park to observe changes and to take pictures for a display project on seasonal changes. If possible, a Park Ranger would accompany the group for this trip. In addition to walking and talking about what they observe, students will be provided with a worksheet and possibly a list for a fall scavenger hunt containing such items as dried seed pods, colorful leaves, etc. Back in the classroom, we will discuss changes in plants which occur in Fall and what effect they have on the environment. We will also look at and chart temperature and weather changes. Discussion will include the fact that the changes we are observing are a gradual preparation by nature for the onset of winter, a cold and difficult season for the environment.

Winter Component

Some Major Cycles in Nature

Since winter has a great deal less observable change going on than some of the other seasons, this will be a time when I will teach students about some of the major cycles in nature. We will continue observing bottle ecosystems and charting data, including noting any differences between bottles in light and those in darker settings. We will record data and weather conditions periodically and hang the chart next to the one with our Fall data for comparison. Students will again be given the opportunity to take pictures of their neighborhood in winter for a display. Discussion will also center around dormancy in plants and animals during the winter. Earlier in this unit I talked about the interrelatedness of things in nature. At this point, in order to prepare for a discussion of the major cycles, I would ask students to consider this: “As a living being, you are part of the biosphere. Each time you breathe, eat, drink, read, etc. you are interacting with other living and nonliving parts of nature. As you breathe, you are exchanging gases with the atmosphere. The paper you are writing on, or the chair you are sitting on, or the floor you are walking on may be made from wood, which came from a living tree, which was another part of the biosphere. The biosphere influences the environment, and is influenced by it. Living parts of the environment use other living parts and nonliving parts to survive, and are affected by them. At the same time their lives and actions affect the rest of the living and nonliving parts. All living and nonliving parts of nature are interrelated.”

Everything that surrounds and touches us is composed of molecules of matter. Some of these compounds of matter may be newly produced, while others are years or centuries old. Regardless of the age of the particular compound, they are all composed of elements that have existed since the beginning of the earth. Although they may have changed form throughout that time, most of the elements exist in the same quantity they did when the earth began. Life on earth exists and flourishes because of the use and reuse of these elements.

Since there is no new source of these elements, their cycling is critical to life. Plants and animals need at least thirty to forty chemical elements for their growth and development. Three elements—oxygen, carbon and hydrogen—make up ninety-three per cent of the human body, but people also need other elements.

The cycles we'll be discussing are called "biogeochemical cycles", "bio" meaning life, "geo" referring to rocks, soils, water and air, and "chemical" referring to the changes that occur as the elements go through these cycles. There are two main types of these cycles: gaseous and sedimentary. In a gaseous cycle, the element is mainly stored in the earth's atmosphere where it exists as a gas. Carbon and nitrogen are gaseous biogeochemical cycles. Sedimentary cycles have the earth's crust as the main storage area for their elements, as demonstrated by phosphorus and sulfur. [2]

The *carbon cycle* is an important gaseous cycle. Most of the carbon in our world is stored as carbon dioxide, in either the atmosphere or dissolved in the ocean. Plants need carbon dioxide to carry on *photosynthesis* , a process where the carbon atoms become part of molecules of simple carbohydrates (sugars) and may later be changed to fats, proteins and DNA or more complex carbohydrates. The carbon becomes part of the energy system for ecosystems, since fats and carbohydrates are forms of stored energy. The carbon atoms travel through food chains, with decomposers at any step of the way. To fuel their bodies living things take in oxygen from their environment and use it to oxidize carbohydrates to release energy, the reverse process of photosynthesis. The process in which this energy is made available for growth and other activities is called *respiration* , and produces carbon dioxide which must be excreted from the body, usually through lungs, gills or leaves.

The process of respiration makes carbon dioxide available for photosynthesis. Many living things build shells of calcium carbonate (a combination of carbon, calcium and oxygen) and when they shed them in growth or when they die these shells may accumulate and build up into rocks. The White Cliffs of Dover is a famous example of this. Carbon in animals might stay in its bones until the bone decays after the animal's death, or might leave an animal's body relatively quickly with waste matter. Some carbon in dead bodies of plants or animals becomes trapped and fossilized before decomposure is complete, and can form materials such as peat, coal or oil. [3]

The *nitrogen cycle* involves the earth's atmosphere, which is about 78 per cent nitrogen. Nitrogen is of no use by itself to most living things, and we breathe it in and back out again. However, nitrogen is vital to life when combined with other elements. The nitrogen cycle is largely dependent on bacteria, fungi and blue-green algae which convert the nitrogen from the air into nitrogen compounds. These nitrogen-fixing organisms may live in the soil or on the roots of plants. The nitrogen compounds they generate may be given off into the soil or become available when the nitrogen-fixing organisms die, at which point the nitrogen compounds move through food chains. [4] Nitrogen is returned to circulation when the bodies of dead plants and animals disintegrate, and when animals excrete uric acid after breaking down proteins in their food. The excreted matter is eventually converted to nitrates after complex bacterial action. [5] Nitrogen compounds can thus cycle from the soil to plants to bacteria and back to the soil again and again without returning to the atmosphere. However, denitrifying bacteria and fungi break down nitrogen compounds and release nitrogen gas into the atmosphere.

The nitrogen cycle also has a component affected by humans. Industrialists have learned how to take nitrogen gas from the air and "fix" it in compounds that are an important part of fertilizers. It is significant to note that the amount of nitrogen treated this way has been doubling every six years. Since large amounts of these nitrogen compounds tend to wash from the lands where they are used into the waters of our streams, lakes

and rivers, they are having an effect the size of which is still being studied. When these waters become highly nitrogen enriched, there is too much plant growth and a loss of oxygen which can result in the death of fish and other animals.

The water cycle is different from the other two cycles we will talk about, because of the fact that water can exist in all three forms of matter: solid, liquid and gas. It can exist naturally at all of the temperatures which occur on earth, and can easily change from one form into another. Interestingly enough, if water did not change form it would all exist today in the oceans or deep in the lithosphere since it responds to the pull of gravity pulling it downward.

When water is in contact with the atmosphere it evaporates, with the rate of evaporation depending on such things as air temperature, water temperature, wind speed and humidity of the air. The amount of water vapor in the air is called the relative humidity and for any given temperature there is a set amount of water that the air can hold. In general, the warmer the air is, the more water it can hold. Relative humidity is an expression of the percentage of water in the air at a given temperature as compared to what it could hold.

As water evaporates it moves upward on currents of warm air until it reaches a temperature where the temperature is low enough that it cannot hold any more water. At this level the water vapor condenses and form clouds. Droplets of the water in the clouds condense on dust particles until they are too large to withstand the force of gravity's pull and they drop to earth. This precipitation may fall on a place far from the land area where the water initially evaporated, due to wind movement, and so water forms all over the earth are constantly being replenished.

Lakes or oceans are not the only sources from which water enters the air. Water evaporates from everything that is wet. Clothes drying on the line, a swimming pool, puddles after a rainshower, a steamy bathroom after your shower, all of these are sources of water for evaporation. Perhaps the easiest way to observe water evaporation is to boil water in a pan or tea kettle and watch the process. It should be stressed with students that most normal processes of evaporation are not readily observable; there may be evaporation going on in the room around them at the very moment they are talking about it, but normally they will not see anything. They will however see the results: a saucer of water which has dried up after being left out for some time, or the drying of their skin as they calm down to a cooler temperature after running around the track for gym on a hot day.

At this point I would encourage students to pay close attention to the next rain or snowfall. What happens to the water/snow after it is on the ground? This could lead to talking about the water which seeps back into the ground and eventually back to the nearest underground water flow, or to the nearest storm drain, which may take it under city streets to the ocean or another destination. At the same time, students should explore the absorption of water by plants and its expulsion into the air through respiration. And, of course, discussion should include man's use of water and the way he returns it to his environment.

Spring Component

The Spring portion of this unit will include activities which are hands— on and personal observation activities. This is a time when we will again chart predictions about that we think the season will bring and take pictures of what is actually happening to our environment. Bottles ecosystems will be taken from their places around the room or school and opened to observe changes to the soil inside. Bottles should be opened carefully, in case there might be any gas buildup inside. After that, however, I will cut the bottles at midpoint and remove the top half. Students will be encouraged to look through what remains in their bottles (wearing rubber gloves

for protection against any possible hazards) and comment on what they find. Is it exactly the same? Have things grown and died? Are there changes in the soil itself? Are there things they did not observe upon setting up the bottle, such as worms or bugs? Again, charts will be updated. At this point students will be given the chance to again use their soil for planting. Although the resulting plants should not be eaten, something like radishes or beans grows very rapidly and would give students a chance to observe the growth process. Such flower seeds as marigolds or pansy seeds may also be used, as can small plants previously started.

At this time of the year I will also have students think about some of the ways man pollutes his environment and what effect they think these have. In addition to looking at the effect of the world in general, I will again ask students to personalize the assignment. What things do they observe in their neighborhood? What have they personally done that might cause pollution? They will have a chance to take photographs of examples of the pollution they observe, at the same time that they are taking pictures of Spring for their display. I will encourage the students to get involved in the New Haven clean-up activities such as Park Friends and Clean Sweep, and perhaps we can have a school clean-up day with everyone or volunteers getting involved. Students will also be encouraged to start new bottle ecosystems and experiment with different pollutants, to observe and chart results.

Summer Component

Although students will not be in school during the summer, they will end the school year with three activities designed to help give them closure on the unit. One will be an open house at which they will have the chance to display and talk about all of the charts, picture displays, murals, ecosystems, and other work that they have been involved with during the year. Parents, administrators, and if possible other classes will be invited. If students are interested, it would be fun to make a videotape of them talking about their experiences. At the end of the tape, students could talk about how they think what they have learned will affect their interaction with their environment in the future. The second closing activity I will use for this unit is a project to make self-watering planters from soda bottles in which students can plant flowering plants (small plants will probably be more effective than seeds because it will be easier to observe flowering sooner). The purpose of this activity will be to help students to focus not only on the dangers of pollution and neglect of our environment, but to allow them to focus also on the beauty in the world around us and to help them feel the joy that can come from nurturing living things and watching them grow and blossom. Along with this project we will talk about summer being the time when so many living things experience their strongest growth cycle, and make predictions about what they expect to see happening around them.

Finally, students will be asked to do some written work for me. I will devise a form where students will : 1. answer questions on specific things they have learned, 2. generalize some of the ideas they have learned about their environment, and 3. discuss what their feelings have been in doing this unit and explain what effect (if any) it may have on the way they interact with their own environment in the future.

Lesson Plans

Lesson Plan #1 (Ongoing)

This is an ongoing lesson, which provides that during the course of this unit students will be encouraged to produce at least one, but potentially many of the following products in response to the materials presented in

the unit. The realm of choices encourages students who may not be good at one skill (i.e. writing) to still become fully involved by using a skill in which they feel more confident (i.e. art).

Possible Student Activities

1. Take pictures of your neighborhood during the different seasons and mount them on posterboard.
2. Think about the changes that occur in our neighborhood during the different seasons and write them down. Print them out on our computers to be mounted with our photographs.
3. Draw a mural of any of the seasons, or divide your picture to show all of the seasons in one mural.
4. Collect samples of brightly colored leaves in the fall and mount them in a collage or make a see-through window by mounting them between sheets of waxed paper and adding a bright construction paper border.
5. Read the poem “Trees” by Joyce Kilmer and draw a picture to go with it. Or volunteer to recite it to the class. Or share it with a friend on your own.
6. Keep a journal during this ecology unit. Record your feelings about the things you do and learn.
7. Draw a diagram representing the water, carbon or nitrogen cycle. Hang it up in our room.
8. Create a bottle ecosystem and take notes on what happens.
9. Predict the weather for a two week period in general terms based on the season. Write your predictions on a chart. Then chart the real weather as it happens. Compare results.
10. Make a list of five things you saw on your way to or from school that were related to the season.
11. Think of a way you can observe evaporation. Write down what you will do and then do it. Write down what observations follow. If you like, draw pictures or take photographs to show your ideas. You might like to talk to the class about what you have done. If that makes you uncomfortable, you might make a tape recording to accompany your display at our open house.
12. Write a short story illustrating a food chain.
13. Plant seeds in several containers and observe the results. Keep a chart of their growth measurements.
14. Change the growing conditions for your seeds by putting them in different lighting, giving differing amounts of water, or in some other way varying their environment. Keep track of the results. Think about the differences and/or similarities and try to explain why they might be there.
15. Name some ways in which the four seasons are the same. Then name ways they differ from each other.
16. Help generate a list and then take part in a scavenger hunt in which you have to find objects connected with nature.
17. Demonstrate your ability to learn new vocabulary words connected with ecology by learning our list and then taking part in a “vocabulary bee” (like a spelling bee) where you give the meaning and/or spell the word.
18. Talk to a person you know who is younger than you and teach them something about ecology that you have learned from this unit.
19. Choose a book that is connected with ecology (fiction or non-fiction) and do a book report on it. Your report can be written, drawn or painted, or made of clay models.
20. Make a diorama in a shoebox depicting one of the seasons or one of the cycles we have studied.
21. Think about and present ideas to the Principal or the Student Council of ways to improve our school environment.
22. Take part in an Open House to present projects to your parents and friends.
23. Write your teacher a letter telling her your feelings about this unit. Did you like it? Did you learn anything? Was it interesting? What would you like to know more about?
24. As you walk to and from school, notice examples of pollution in our environment. Write them down along with possible ways we can help clean them up.

25. In the Fall, find seeds in the environment around you. Plant some in soil in the classroom or at home, and dry some to plant in the Spring. Record your observations of what happens.
26. In Spring, find seeds in your neighborhood and plant them. Record observations.
27. Write a letter to someone you feel can help clean up our environment. State what you are concerned about and what you would like them to do.
28. Use music you like to make up a dance about one or more of the seasons showing themes you connect with that season. Present your project to the class and/or open house.
29. Make up a rap about what you have learned about the seasonal changes in our environment and share it with the class and open house.
29. Create your own rap about ecology and ecosystems and share it with people you know.
30. Write a simple play about new ideas you have learned in this unit and ask your classmates for help presenting it.
31. Help the class to put together a show for the elementary schools which includes many of the above projects, and which will help teach younger children what you have learned.

Lesson #2

Give students the following vocabulary list and have them work on it as the unit progresses. Compare vocabulary meanings periodically to be sure students are on the right track. Use the words for "vocabulary bees" (like spelling bees), classroom jeopardy games, etc.

Suggested Vocabulary List

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adaptation
atmosphere
biome
biosphere
climate
community
compost
consumers
cycle
deciduous
decomposers
ecology
ecosystem
environment
evaporation
food chain
germinate
habitat
herbivore
hydrologic (water) cycle
nutrient
omnivore
organism
pollution
population
predator
producers
scavenger
territory

Lesson Plan #3

In addition to the many themes of environment and seasons presented thus far, I would like to have my students do a project which would make them aware of the local marine environment at the same time that they are studying their local land environment to ensure that they do not think of ecosystems as relating only to land environments. In order to demonstrate this, I will set up a Long Island Sound aquarium with my class. I

will obtain a 20 gallon or larger aquarium and the underground filter required to keep it functioning effectively. (Tag sales are highly recommended as a source of these materials. Also, you may want to spread the word among parents of your students in case any of them are looking to get rid of stored tanks.) Students will take a field trip to the dock at Schooner, Inc. to take water from Long Island Sound which will be taken back to the classroom for the aquarium. While there students will be encouraged to scout around the area and make observations about what they see and find. (If a trip is taken to a local beach in connection with the study of how soil is created, this theme can be expanded upon.) Careful supervision may be necessary, since there is sometimes dangerous debris along the shoreline area.

Upon return to the classroom, students will add the water they have taken from the Sound to the aquarium. Schooner, Inc. will attempt to provide living specimens taken from Long Island Sound upon request, but students may also wish to contribute those they have personally found in the Sound.

From here on, possibilities are enormous for classroom participation. Students can chart facts about animals in the aquarium: how they grow, how they interact with each other, what they eat, etc. They can make graphs of the water temperature (which does not need to be controlled by a heater since the Sound varies greatly in temperature). We may want to keep a classroom log of who contributes to the aquarium in any way: adding more water when needed, feeding fish, measuring water for evaporation, and so on.

Students may want to volunteer, or could be assigned, to do reports on various organisms living in the aquarium. Again, the whole idea would be to personalize this experience for the children in terms of organisms living in their environment. Charts, raps, dance,and pictures could all be examples of how students could tell about the animal they've studied.

Further lessons could focus on pollution which can/is happening in our area and how it affects the animals in our aquarium.

Notes

1. Al Gore, *Earth in the Balance* , p. 31.
2. Laurence Pringle, *Ecology Science of Survival* , pp. 84-85.
3. John Oates, *Web of Life* , p.47.
4. Pringle, p.91.
5. Oates, p. 47.

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This book explores the cycles observable in nature.

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A middle-level book which explores the meaning of environment, pollution, and the effect man has on his environment.

Carson, Rachel. *The Sense of Wonder* . Harper and Row, New York, 1965.

A book to inspire adults and children to maintain and encourage a sense of wonder about the environment. Photographs, largely black and white, are an important part of the format.

Gates, Richard. *Conservation* . Children's Press, Chicago, 1959.

An easy-to-read book designed to introduce low level readers to the concepts of ecology and conservation.

Greene, Carla. *Our Living Earth* . Bobbs-Merrill Co., U.S.A., 1974.

A good book on history of our earth in simplified form. Deals with pollution and things you can do.

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Miles, Betty. *Save The Earth! An Ecology Handbook for Kids* . Alfred A. Knopf, New York, 1974.

Ecology text presented in a very interesting format for students. Short selections feature poems, illustrations, photographs and lots of group or individual projects.

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Five interconnected visual stories (almost no reading involved) depicting life and death in a watershed comprising five neighboring ecosystems. Excellent illustration of foodchains and cycling in nature.

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A solid, easily understood ecology text. Good explanations of patterns and cycles in nature.

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Basic text explaining physical, chemical and biological science concepts in ecology.