Conservation Education Curriculum

A series of Classroom Activities
for Grades K - 12

Produced for Educators in Carlton County and
South St. Louis County

in cooperation with
Carlton County Soil and Water Conservation District
South St. Louis County Soil and Water Conservation District and the Minnesota's Lake Superior Coastal Program

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Table of Contents

WATER LESSONS

WATER POLLUTION

WATER MAGIC

THE WATER CYCLE

MINGLE, MINGLE

MARBLEIZED PAPER

GYOKU (FISH PRINTS)

TITLE: I AM WATER!

WATER POLLUTION RESEARCH

WATER & SOIL EROSION

DON'T CRY OVER SPILLED OIL

WATER QUALITY FOR FRESHWATER ORGANISMS

WE ALL LIVE DOWNSTREAM

WHERE DOES ALL THE WATER GO?

POND LIFE MAGNIFIED

ACID RAIN LABORATORY ACTIVITIES

SOIL LESSONS

DIRT

EROSION

EDIBLE EARTH PARFAITS

MOUNTAIN BUILDING

LET'S PEEK UNDER THE SOD

LET'S TALK DIRT

LEAD IN THE SOILS

WHERE DOES ALL THE WATER GO?

FORESTRY LESSONS

FOREST IN A JAR

TREE ACTIVITIES AND CRAFTS

THE WOODS AND POND

TITLE: TREES, TREES, TREES!!!!

BOTTLE HABITAT

OBSERVING GROWING GRASS SEEDS

THE IMPORTANCE OF TREES IN THE RURAL AREA: PLANTING A SNOWFENCE

LEAF PRINTING

CONSERVATION LESSONS

WETLANDS MIGRATION

GYOKU (FISH PRINTS)

ENVIRONMENTAL PROBLEM-SOLVING USING THE WEB

CREATING BUILT ENVIRONMENTS

STUDYING THE ABC'S OF THE ENVIRONMENT

LOCAL RESOURCES

WEB SITES

What is the Soil and Water Conservation District?

The first Soil and Water Conservation Districts (SWCDs) in Minnesota were formed in 1938, SWCDs are a subdivision of state government, created by the Minnesota State Legislature under MN Statute Chapter 103C. This law governs the formation and operation of Soil and Water Conservation District. The Water Law of the state of Minnesota contains Soil and Water Conservation Law and soil and Water Conservation Policy. This policy is Minnesota's statement on soil and water conservation. A power granted to Minnesota SWCDs is to implement this policy

Soil and Water Conservation Policy

"Improper land use practices have caused serious wind and water erosion of the land of this state, the runoff of polluting materials, increased costs to maintain agricultural productivity, increased energy costs and increased flood damage. Land occupiers have the responsibility to implement practices to correct these conditions and conserve the soil and water resources of the state. It is the policy of the state to encourage land occupiers to conserve soil and water resources through the implementation of practices that effectively reduce or prevent erosion, sedimentation, siltation and agriculturally related pollution in order to preserve natural resources, ensure continued soil productivity, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife, protect the tax base, and protect public lands."

A board of five (5) supervisors, elected in the general election, governs the District. The term of office is four (4) years. Support and funding for District operations comes from federal state and county government.

Within the scope of soil and water conservation policy, Districts assist landowners with soil and water conservation practice implementation. Engineering design assistance is available to land occupiers through t the SWCD. Once designed the SWCD often has financial assistance available in the form of grants or loans to help land occupiers afford to implement the practices. These programs help SWCDs address existing soil and water conservation issues. Through education program, the SWCDs hope to prevent some of the future issues that would need to be addressed. This education effort is different according to the needs of the District but often includes programs like Conservation Education Field Days for 5th graders, the Envirothon competition for High School students an d school visits a requested.

Water Lessons

WATER POLLUTION

Grade Level: K-6.

OVERVIEW: There are a wide variety of pollutants that can affect water and the plants and animals that live in the water. This pollution can be divided into three groups: chemical pollution, thermal pollution, and ecological pollution. Since not all pollution is human produced students need to understand that there are sometimes "natural" reasons for some pollution.

PURPOSE: These activities will help students' understanding of water pollution and its potential effects on human and wildlife habitats.

OBJECTIVES: Students will be able to:
1. Identify 2 or more pollutants in a bog, marsh, stream or other wetland area.
2. Relate a pollution prevention message through words and art.
3. Understand that some pollutants cannot be seen.

ACTIVITIES:
1. Taking student a wetland area helps them become more aware of the water around them. Take with you paper, pencils, clipboards, rubber gloves, plastic garbage bags and extra adults. When you get to your wetland site divide students into groups of 3 or 4. Each group is to look around the wetland area and find as many sources/types of pollution as possible. On their paper a designated recorder for each group will record the different types of pollution found. After 5-7 minutes, come together as a whole group and discuss the pollution that is seen. Since the visible pollution is often in the form of litter, discuss with your students the pollution that may be present, but not seen. When the group discussion is over, pass out gloves and bags. Divide students into groups and assign an adult to each group. Then have the students pick up the litter pollution and take it back to school and put in dumpsters. Repeat throughout the year.
2. For this activity you will need paper, crayons, markers, crayon pastels and other art supplies. Review with the students the types of pollution that they know about. Talk about the ways people can help prevent certain kinds of water pollution. List them on the chalkboard. Have students draw a picture showing how to prevent pollution of a wetland of other water source. Encourage students to think about the source of the pollution and ways to either prevent or ways to dispose of some pollutants.
3. To help students understand that clear water isn't necessarily free of pollutants, place 5 clear liquids in portion cups. Things to include should have a definite taste that students would recognize. Use sugar water, 5 drops of white vinegar, salt water, water mixed with 5 drops of lemon juice, and tap

water. Using cotton swabs, have students taste each liquid (dispose of swab after each taste) and record what they taste after each. After students have all had a chance to taste, discuss that some kinds of pollution can't be seen. If you have local creeks, streams, or other waterways that are unsafe for human use, this is a good jumping off point to discuss the problems these bodies of water have.

RESOURCES/MATERIALS NEEDED: All resources are available in most areas. (paper, pencils, clipboards, rubber gloves, plastic garbage bags, crayons, markers, crayon pastels, portion cups, cotton swabs, sugar, water, white vinegar, lemon juice, salt.)

TYING IT ALL TOGETHER: Environment concerns can be understood by even the youngest school children. Providing them with a background of information and an opportunity to actively use that information, they will begin to develop a feeling of stewardship for their world. Using activities that develop environmental stewardship in students will hopefully become a basis for action in their future lives.

TITLE: WATER MAGIC

GRADE LEVEL: K - 4,

OVERVIEW: This activity will introduce new vocabulary and will serve as a building block to future lessons on the water cycle. Students will use experiences from their everyday lives to practice the above skills.

PURPOSE: This activity is designed to help students understand that water picks up natural and man-made substances as it moves over and through the earth. Students will observe and experiment with water in three physical forms.

OBJECTIVES: Participants will be able to:
1) observe water in different physical forms
2) theorize what happens in the evaporation process, and
3) observe residues left after water evaporates.

RESOURCES/MATERIALS: Refrigerator, small plastic glasses or a jar, water source, rulers, balance scale, tea kettle, hot plate and mirror.

ACTIVITIES AND PROCEDURES:
1. Show the student an ice cube, or provide each student with an ice cube in a cup.
2. Ask the students what the cube is made of and ask them to put them in the glass and observe what happens.
3. When the ice has melted, discuss the difference between the solid form of water and the liquid form.
4. Have the students leave their glasses of water on a shelf and ask then what they think might happen.
5. When the water has evaporated, discuss with them what has happened and compare this to their answers to what they thought would happen in step 4.
6. Observe the sides and bottom of the glasses and, if necessary, compare them to a new glass. 7. Discuss with them where the film came from that is left on the sides and bottom of the glass.
7. Heat water in the tea kettle and, when boiling, hold the mirror over the opening in the spout and observe what happens.
8. Discuss with them how water becomes steam and is able to move into the air.

TYING IT ALL TOGETHER: Have the students draw the things that they observed. Have student describe the three physical forms of water and compare and contrast them. Test students knowledge of the following vocabulary words: Solid, Liquid, Gas, Vapor, Absorb, Evaporation.

The Water Cycle

GRADE LEVEL: 2-4

OVERVIEW: The water cycle explains the sun heating the earth's surface water so that it evaporates. This vapor gathers in clouds which rise to the cold air. When those clouds become too heavy to float, they release their moisture as precipitation. The precipitation collects in lakes or oceans after siphoning through soil or running down rivers. It then evaporates and repeats the cycle once again.

OBJECTIVE(s): Students will be able to:
1. Explain how the water cycle recycles the earth's water supply.
2. Make use of the knowledge of landforms learned in social studies.
3. Form a hypothesis on how/why the water cycle works.
4. Use language arts skills of writing and drawing to explain how the cycle works.

RESOURCES/MATERIALS:

soil
water
small margarine bowl
large, clear plastic container or an old aquarium
plastic wrap
plastic trees, animals, boat, etc. are optional
tape or large elastic band
bag of ice (optional)
heat lamp (optional)

ACTIVITIES AND PROCEDURES:

1. Arrange the soil in the container to make mountains, plateaus, hills, etc., and a lake basin. Place the margarine bowl in the lake basin. Fill the bowl with water. The plastic toys may be added to appeal to the children's imaginations. Cover the container tightly with plastic wrap and secure it by means of tape or the band.
2. Discuss what is expected to happen in the container.
3. Depending on the amount of sun, the project may take 1-3 days. In order to speed the process, a bag of ice may be placed on one end of the covered container, while a heat lamp is focused on the other.
4. Watch for condensation on the plastic "sky" of the container. When enough moisture collects, it will fall onto the landforms as precipitation.
5. Compare the hypothesis to actual results by discussion.
6. Encourage the students to draw the water cycle using arrows to show the flow.
7. Ask the students to write a paragraph explaining their picture. A word bank might be used if needed.

Possible words for the bank are: condenses (cools), vapor, clouds, evaporate, precipitation (rain/snow), heavy, soil, oceans, lakes. Try to elicit these words from the students.

Mingle, Mingle

Grade Level: 2 - 4

Objective: After completing this activity, the student will be able to describe how oil and water do not mix.

Materials:
-cut out circles from blue and black paper
-string (optional)
-one cup of water
-1/4 cup vegetable oil with a drop of food coloring

Teacher Information: Oil spills are a serious threat to water environments. The idea that oil and water do not mix is very abstract for a young student. This game may help the student visualize the mixing of oil and water and understand that oil spills do not generally go away by themselves. The game will also serve to "energize" the students.

Procedure:
Give about 2/3 of the students in the class at least one blue circle. Give the rest of the students at least one black circle. These will identify who is going to be oil and who is water. Then the students should pin or stick their circle on with tape. If you prefer, you can give each student five or six circles of the same color along with a length of string. Have the students make necklaces.

Have the students walk around the room, snap their fingers and say, "Mingle, Mingle." The teacher calls out a part of the body that he/she wants the students to touch on each other.

Students in the oil group can touch only each other and the same for the water group because oil and water do not mix. Examples of such calls might be: "Elbow to Elbow" or "Wrist to Wrist". The students with the same color should touch the body parts called out by the teacher. It is not necessary and really not desirable for all of the blue circles to be in one group and all of the black circles in another. Group sizes can vary from 2 on up.

If an "oil" person ends up touching a "water" person, they are out of the game. You might let them call the next body part to be touched. After all connections are made, continue the game by beginning the "Mingle, Mingle" chant again until the next body part is called. The game continues until the class is "energized".

Evaluation:
If 90% of the students have linked correctly with other students, then the activity has been successful.

An actual demonstration of oil and water mixing would be most appropriate. Use a clear bottle with a top on it. Put a quantity of water and oil in the bottle and close it. Use motor oil or vegetable oil with a drop of food coloring added. The separation of oil and water should be easily observed.

Shake the bottle to try to get the oil and water to mix and then let it sit still for a moment and see what happens.

Marbleized Paper

GRADE LEVEL: K-6

Objective: Students will investigate the properties of oil and water in creating marbleized paper.

Materials:
-4 large tubs
-water
-oil paints
-white vinegar
-plastic spoons
-many sheets of light colored paper
-newspaper

Procedure:
1. Teacher will elicit discussion of how water repels oil and will wash up on other surfaces. Elicit examples oil slick.

2. Teacher will demonstrate the process of marbleizing paper.

3. Students will gather around 1 gallon tubs of water.

4. Students will add to water 1 tablespoon of vinegar, more if needed.

5. Students will add 2-3 dabs of different oil paints into water and mix with spoon.

6. Once paint has dispersed into water, students can swirl paints around into different designs.

7. Students will lay paper down on top of the water, then lift off.

8. Students will put name on paper and set on newspaper to dry.

Evaluation:
1. Are paint and oil properly mixed?

2. Did paint adhere to paper?

Gyoku (Fish Prints)

GRADE LEVEL: 4-8

Objective: Students will examine different fish species and create gyoku or Japanese fish prints.

Materials:
-several raw fish
-tempera paint
-spoons
-printing paper or t-shirts
-newspaper

Procedure:
1. Teacher will discuss with students different types of fish, different kinds of water habitats.

2. Teacher will talk to students about the art of Japanese fish printing techniques or gyoku.

3. Teacher will demonstrate fish printing process for students.

4. Students will get paper and find a fish they want to pull prints from.

5. Students will spoon paint onto fish, one or more colors, and smooth it on.

6. Students will lay paper onto fish and press down firmly.

7. Students will lift paper from fish, put name on it and let dry.

8. Teacher will put dried prints up for students to examine, discuss results, details and differences.

Evaluation:
1. How well is image of fish printed on paper?

2. Are details apparent?

3. Color and clarity?

4. Placement of print on paper?

5. Craftsmanship?

Title: I am Water!

GRADE LEVEL: 4-6

OVERVIEW: Students will use guided imagery to experience the water cycle. This activity allow young students to use their imagination to form mental pictures of the different stages in the water cycle

OBJECTIVES: The students will:
1. Experience the water cycle through an imagination activity.
2. Be able to describe their own understanding of the journey of water through the water cycle.
3. Express their mental images of the water cycle by drawing pictures.

RESOURCES/MATERIALS: blue construction paper, markers or crayons, scissors, string or yarn, 1 piece per students, writing paper and glue.

ACTIVITIES:
1. Allow the students to get into a comfortable position. To begin, sing a song about water, such as "Eensy Weensy Spider" or listen to a tape of rain falling. This is a time for relaxing, changing the pace, and calling on the right hemisphere of the brain.

2. Use this script or create a similar story outline that allows your students to fill in the details. "..." indicates a pause to allow students to form their mental pictures. "In a few moments, I am going to tell you an adventure story. I will tell you a very simple story, and you can make up the rest in your mind. Now get comfortable, close your eyes, and try to imagine the things I tell you about." "Pretend, in your mind, that you are a raindrop ... You are way up in the clouds. Imagine the clouds around you... Now you are getting bigger and bigger. You begin to fall toward the earth... Suddenly, you land somewhere, on something." "Now you slide or trickle down to the soil. Imagine what the soil is like... You begin to move down into the soil, going deeper and deeper into the ground. Imagine what you see along the way...For a long time you keep moving down." "You find that there are many drops of water underground, moving through the earth... Now, you are moving sideways instead of down. Imagine what the earth is like, with the water moving through it sideways..." "After a long time, you begin to move a little faster. You come out of the ground and end up...somewhere. Imagine where you are now..." "The sun is shining. You are getting warmer, in fact, so warm that you're coming apart. All the tiny little pieces of water that formed you as a raindrop come apart and float up into the air...Imagine yourself broken into pieces...The pieces go higher and higher, lifted by the warm air. Finally they reach the clouds and come together again to form you...a raindrop." "Now

remember your adventure from cloud to earth, down underground, up to the surface of the earth and back to the clouds... Take a few moments to go back over it in your mind. Remember as much as you can about your adventure...(Long pause)...Then, when you've gone back over the whole journey in your mind, become a person again and open your eyes."

3. After the story is finished, allow students who want to share their adventures to do so without correction. As questions such as: What was it like in the cloud? How did it feel to fall? What things did you pass in your journey underground Did you like coming back to earth's surface again? Encourage description and creativity. Emotions may enter into the descriptions along with sounds, textures, temperatures, and smells. These descriptions can give you indication of how completely your students understand the water cycle and groundwater. They also give the students a chance to verbalize their experience, which will help to make their mental images more concrete.

Have each child cut blue paper in the shape of a raindrop. On the raindrop, children can share their raindrop stories through pictures. Encourage your students to include as much detail as possible. Punch a hole in the top of the raindrop and run the piece of string or yarn through it. Hang raindrops from the ceiling or on a larger raindrop outline on the wall or chalkboard. Older students can write short descriptions of their drawings on lined paper, and then glue them to the back of the raindrop.

Evaluation:
Students will draw a generalized water cycle, showing precipitation, run-off or infiltration, groundwater movement, evaporation, and condensation.

Extensions: Use this technique to develop storytelling with your students. The richer the mental images, the more interesting the story can be.

-Read **The Magic Schoolbus at the Waterworks** by Joanna Cole. 1986. Scholastic, Inc., New York,
Where Does Water Come From? by C Vance Cast.
1992.Barron's Educational Series, Inc. Hauppauge, NY, and
Henry Goes Underground, by Patricia A. Chilton-Stringham,
1992, Kalamazoo Cooperative Extension Service, Kalamazoo, MI

Water Pollution Research

Grade Level: 4 - 12

Objectives

Information gathered by students will be combined to create a database on water purity and pollution; its causes, costs, incidence, health problems and possible solutions. This will be used as a basis for class discussion; analysis of actual water samples and examination, through field trips, of local examples of water pollution. The purpose here is to create a tool. After completing the lesson, the student should be able to gather and organize data for analysis using standard reference tools.

Activities

The class will be divided in to groups. Each group will investigate an aspect of water composition and pollution in the library. The actual number in each group and the actual number of groups will vary, but there should be one group investigating the nature of unpolluted, naturally occurring water. Another should consider water which has been through treatment centers. At least one should investigate disease organisms and their sources. Others should study industrial and agricultural pollution. The groups should record their data in a pre-prepared chart for later transfer to a spreadsheet. Data on clean and polluted waters should fit into this chart. That will facilitate comparisons. It should also make clear the difference between immediate, short term disasters like oil spills and the long term problems which can result from improper waste disposal. It would also be easy to modify the chart to include data of other sorts such as the effect of pollution on fish and other forms of wildlife.

Suggested headings are:

- Water Source
- Substance or organism
- Concentration
- Health problems
- Cleanup costs
- Information source

One problem which students will have to deal with is translating data from one scale to another. Chemical concentrations are often given in parts per million. That is not always the case in the sources, which the students will be investigating. They will need to keep track of the actual numbers and quantities reported and arrive at a standard to use. This will also be true when dealing with the issues of costs. The spreadsheet could be constructed to yield a ratio of concentration to cleanup costs and health costs or one could have the students do the same manually. It might be valuable to do both, since adding the formulas to the spreadsheet will not be onerous.

Resources

Encyclopedias and books; will usually include the vertical file, Readers'Guide to Periodicals, access to magazines and interlibrary loans, chemistry and general science reference books; and may include access to the computerized Magazine Index and online services like Dialog.

Evaluation

At the end of this project, we should have a better idea of what the issues regarding water and water pollution are. It will provide a conceptual base for moving on to the consideration of real water. I would schedule the library for a week and plan on three days. If the kids run into problems and need more time, they'll have it. Hopefully you will be able to devote class time at the end of the week to the presentation and discussion of the data. If possible, have each group be responsible for the entering of its' own research into the spreadsheet. If several classes work on this project, you should end up with a massive database even after removing duplications. Publish results for the students in two forms: hour-by-hour and consolidated. Consider offering individuals an opportunity at a written analysis. I would base grades on qualitative and quantitative issues.

Water & Soil Erosion

Grade Level: 4 - 8

OVERVIEW: This lesson plan deals with giving students hands-on experience with viewing the effects of water erosion and also provides students with a computer based cooperative group activity on soil erosion.

OBJECTIVES: Student will be able to:
1. verbally state the meaning of erosion.
2. state where erosion takes place.
3. list 2 examples of water erosion.
4. list and describe 2 ways to prevent water erosion.

RESOURCES/MATERIALS: Apple, Paper cups , Sand, Small bowls, Tissue

ACTIVITIES AND PROCEDURE:
Review the layers of the earth by using an apple.
Cut the apple in half across the core.
Explain that the skin represents the crust, the heart represents the mantle, the seed coat represents the outer core and the seed represents the inner core.

Crust 6-40 miles.
Mantle 1,800 miles
Outer core 1.375 miles
Inner core 1,750 miles

Explain that the apple skin (crust) is smooth and even but the earth crust is uneven, varying in thickness from 6 to 40 miles deep.
Review the physical features of the earth's surface.
Explain how the Grand Canyon was formed by water erosion.
Have students divide into groups of three. Distribute materials to each group.
Have each student in the group perform one part of the main hands on 3-step experiment.

Sand Plain
1. Fill the small bowl with sand.
2. Smooth the sand flat so it fills the whole pan to form a "plain".
3. Use a toothpick to make 10 small holes is the bottom of one paper cup.
4. Fill the second cup with water.
5. One student holds the cup with holes 12 inches above the "plain".
6. Another student gently pours the water from the other cup into the cup with holes.
7. Watch what happens and record the observation on the worksheet.

Sand Mountain without Grass
1. Fill the small bowl with sand.
2. Shape a pile of sand into a "mountain".
3. Re-use the paper cup with holes.

4. Fill the second cup with water.
5. One student holds the cup with holes 12 inches above the center of the "mountain".
6. Another student gently pours the water from the other cup into the cup with holes.
7. Watch what happens and record the observations on the work sheet.

Sand Mountain with Grass

1. Fill the small bowl with sand.
2. Shape a pile of sand into a "mountain".
3. Pretend to grow grass all over "mountain" by covering it with a tissue.
4. Pat the tissue down lightly so that it is touching the sand everywhere.
5. Re-use the paper cup with holes.
6. Fill the second cup with water.
7. One student holds the cup with holes 12 inches above the center of the "mountain".
8. Another student gently pours the water from the other cup into the cup with holes.
9. Watch what happens and record the observations on the work sheet.

Closure:

Discuss the student's results.
Have students explain why they think the "mountain with grass" has less erosion than the "mountain without grass and the plain.
Discuss what characteristics of grass that would make the soil not slide.
Discuss the importance of conserving soil by planting trees and grasses.

Computer Enrichment: Following the above lesson, students will acquire further comprehension on the process and effects of erosion researching the Internet. Have students go to the National Soil Erosion Research Lab Web site. (http://topsoil.nserl.purdue.edu/nserlweb) At this web site have students locate the search window, at the lower left hand side of the page and type in elementary soil erosion. At this point students will select the *Soil Erosion* category. Have cooperative groups of students view and read the selections on soil erosion, deposits, natural and accelerated erosion. While viewing each selection have students collectively answer the questions on the work sheet.
When students have completed this section, have them go back to the category list and select water erosion. Have students once again work in collaborative groups to view, read and answer worksheet questions on the topics of water erosion, sediment transportation and deposition, precipitation, surface run off and other water erosion control practices.
When students have completed this section have a whole group discussion relating to all the topics on the worksheet. During this time further clarify and answer any questions on the worksheet topics. During the discussion list on the blackboard what the students think are the most important points relating to erosion.

Assessment:

Evaluation will be based on the student's ability to define and list examples of water erosion and ways to prevent it.
Worksheets will be reviewed to assess and determine understanding of the topics.

Don't Cry Over Spilled Oil

Grade level: 6th -12th

Objectives:

The students will be able to:

1. Investigate the Exxon Valdez oil spill
2. Evaluate oil spill clean up procedures
3. Understand long term effects of an oil spill on an ecosystem

Background:

While pollution of the world's oceans by oil is not a new problem, conferences were held as early as 1926, the growth of world production has increased the incidents of oil spills. While oil tanker accidents and offshore well blowouts often grab the headlines, more petroleum is lost in the routine operation of oil tankers.

Sources of Oil Pollution:

- 9.8% natural seepage
- 21.8% tanker operations
- 3.3% tanker accidents
- 9.8% other transportation activities
- 9.8% atomospheric fallout
- 1.3% offshore petroleum production
- 12.3% coastal facilities (sewage plants, refineries, etc)
- 31.1% river and urban runoff

Because oil is less dense than water and floats, it can quickly coat anything in the water. By cutting off the exchange of gas, organisms that live in the water column and require oxygen quickly die. This damage is particularly damaging in the tidal zone and near-shore environments. Not only does this zone support aquatic life, but also a variety of predators that feed on aquatic organisms. Birds and aquatic mammals can be most severely effected. A coating of oil on feathers reduces the birds' ability to fly and the feathers can no longer help the bird retain body heat. Oil on the fur of sea mammals, such as otters and seals, reduces the animals' ability to stay warm. The ingestion of oiled water and prey will further weaken the animals.

While most of the volatile components of the oil quickly escape into the atmosphere, other more stable components can remain in the water column for many years. Some will disperse into the water, some are oxidized by sunlight, some are consumed by microorganisms and the remaining will be deposited as sediment.

Many methods of clean up have been employed in the aftermath of a major oil spill, including the use of microorganisms to "eat" the oil. Detergents have been used to disperse the oil, but have actually been found to do more damage than the oil itself. Burning the oil is ineffective due to the fact that the more volatile

components quickly escape. Barriers and booms are often used to contain the spill while the oil is absorbed or siphoned off. Most attempts to clean up a spill have proven to be ineffective.

In the aftermath of the Exxon Valdez accident of 1989 there have been efforts to clean up Prince William Sound. In support of their efforts, Exxon has produced a video, Scientists and the Alaska Oil Spill. The video examines some of the methods currently employed in worldwide oil spill clean ups. The scenes of cleaning otters and birds as well as the shoreline will point out to students the magnitude of cleaning up a spill of this size.

Materials:

- 500 ml saltwater
- disposable containers for oceans (plastic or aluminum pans)
- shrub clippings
- small rocks
- 50 ml clean motor oil
- balance
- play money
- expenditure worksheet
- paper bathroom cup
- plastic zipper bag
- fur scraps
- feathers
- clean up materials: tweezers, styrofoam peanuts, string, cotton balls, paper towel strips, medicine dropper, liquid detergent

Procedure:

Part One-Teacher preparation

1. Bundle the money so that each group will have $15,000,000
2. Package the clean-up materials in bundles so that they can be easily distributed
    - Cut the paper towels into 25-1" strips stapled together
    - Cut the string to 12" lengths
    - Fill sandwich bags with styrofoam peanuts
    - Sandwich bags with 25 cotton balls
    - cups with small amounts of detergent
3. Set up one station with a pan of water and paper towels and label as the "Wildlife Rehabilitation Center." This station will only be used by one member of each team to clean any wildlife that becomes oil soaked. While at the center they can use any of the materials, but they cannot take them back to the spill sight to help with the shoreline clean-up.
4. Fake fur pieces can be found at craft stores or garage sales. Cut into small pieces.
5. Set up an example of an oil spill so that you can demonstrate how each of the clean-up materials are to be used.

Part Two-Day One-Student preparation of their oceans

1. Students fill their containers about 2/3 full of saltwater. A little blue food coloring will increase visibility.
2. Build a beach of rocks and gravel and add sprigs of leaves to simulate trees. Place feathers and /or fur scraps to simulate wildlife.
3. Pour a small amount of motor oil into the paper cup and place in the center of the ocean. This is the oil tanker.
4. To simulate the spill, poke a hole in the cup below the water line or slowly lay the cup on its side. Leave the cup in place, remember the tanker continued to leak oil for several days before it could be stopped.
5. Observe how the oil spreads over the surface of the water. Do not disturb the ocean set-up until the next day.
6. Inform the students that their oil company has been allotted $15,000,000 to clean up the spill. At this time it may be helpful to demonstrate how each of the clean-up materials are to be used. Clean up material restrictions:
    - each group must purchase at least one set of tweezers
    - cotton balls, paper towels and styrofoam peanuts cannot be touched with the fingers, only tweezers
    - purchase of detergent allows one student the use of the "Wildlife Rehabilitation Center"
    - One large zipper bag will be provided to dispose of all materials.
7. Allow each group to discuss how they will spend their money. Once the money has been spent on Day two, they cannot get a refund.

Part Three- Teacher prep for day two

(Remember: the students were told not to disturb their oceans and to be careful with them) During the night there is going to be a storm and the wildlife is going to get hungry. Shake up the trays and push the feathers and /or fur scraps into the water!!

Part Four-Day Two-Students return to find the effects of the surprise storm

1. The students will probably be upset when they see the condition of their spills. Remind them that nature doesn't stop just because there has been a spill.
2. Pass out money to each group and allow students to begin purchasing clean up materials from different areas of the room. Point out that clean up materials and equipment are seldom near the sight of an accident and may have to be transported from far parts of the world before the clean up can begin.
3. All used materials and oil should be placed in the large zipper bag.

Assessment:

After the students have cleaned as much as possible, line the oceans up with the bag of waste material in front. Let each group judge who was the most

successful in their efforts. Discuss the most successful methods and the problems encountered.

Enrichment:

Due to the fact that no one group will be able to purchase all methods of clean-up, some groups may want to share. Allow them to set up a consortium to share their resources or pool their remaining money.

Sample Expenditure Worksheet

MATERIALS	COST	QUANTITY	TOTAL
styrofoam	$7,500,000		
string	$1,000,000		
paper towels	$5,000,000		
cotton balls	$7,500,000		
medicine dropper	$10,000,000		
tweezers (each)	$1,000,000		
detergent	$2,500,000		

WATER QUALITY FOR FRESHWATER ORGANISMS

Grade Level: 8-12.

OVERVIEW: In modern day society there are many types and sources of pollution which directly affect the environment. One such type of pollution, which is becoming even more predominate through the construction of nuclear power plants, is that of thermal pollution. Power plants use vast amounts of water which are converted to steam by the thermonuclear reaction. This steam is used to turn the blades of the turbines which turns the generators producing the electricity. The hot water resulting from condensed steam is partially cooled in specially designed towers before it is released again into the environment by means of a reservoir or stream. The temperature of the return water is great enough to raise the temperature of the body of water several degrees. Such increases in temperature could greatly affect the organisms living in the water.

PURPOSE: The purpose of this activity is to demonstrate to students the effect increased water temperature has on the amount of dissolved oxygen found in water and in turn upon the gill beat rate of fish.

OBJECTIVES: Students will be able to:
1. Describe the proper procedure for observing and recording data.
2. Describe how to use the Winkler method for O2 determination in water.
3. Demonstrate how to graph and interpret data.
4. Discuss what effect increased temperature has on the amount of dissolved oxygen in water and in turn upon the gill beat rate of fish.

ACTIVITIES: Equipment needed (for each lab group): cold aerated pond water, 800 ml beaker, minnow, hot plate, Celsius thermometer, ring stand, cork, stirring rod, Hach Dissolved Oxygen test kit, data table, graph paper.
Day 1:
Step #1 - Place 600 ml. of cold (50C.), well aerated pond water into a 600 ml beaker. Step #2 - Place minnow into beaker and set on hot plate.
Step #3 - Suspend Celsius thermometer by means of a ring stand and cork in center of beaker.
Step #4 - Allow minnow to quiet down and take the gill beat rate by counting the movement (beat) of the operculum which covers the gills. Take the count for 30 sec. and multiply by 2 to obtain rate per minute and then record count in table of results on work sheet. (By taking the average of 2 or 3 counts you may be more accurate.)
Step #5 - Turn on hot plate and heat water slowly while gently stirring. Take a count of the next gill beat rate when the temperature is at 100C. and record data.

(You will need to stop the stirring when the beat rate is taken. A double beaker with surrounding water may be used if water heats too quickly.)
Step #6 - Repeat steps 4 and 5 at 15, 20, 25, and 30 degrees Celsius, recording your data each time. If the minnow begins to float at the surface or wildly thrash about immediately return to cold water as we do not intend for it to die.
Step #7 - Take the recorded data and plot on graph: Gill Beat Rate vs. Water Temperature.
Day 2:
Step #1 - Same as step #1 above.
Step #2 - Without placing minnow into beaker use the cold water sample and your Hach water test kit to determine the amount of dissolved oxygen in parts per million (ppm). Instructions are contained within each kit. All data will need to be recorded on your worksheet.
Step #3 - Return the amount of water lost from testing to beaker. Place beaker on hot plate, stir gently, and remove sample for testing when it reaches 100C.
Step #4 - Repeat Step #3 and test the amount of dissolved oxygen at 15, 20, 25, and 30 degrees Celsius. (If test kits are in short supply or you do not have enough time to make a test at each 5 degree interval, each lab group may be assigned only a few and the data taken and averaged for the entire class.)
Step #5 - Make a graph of Dissolved Oxygen (ppm) vs. Water Temperature.
Step #6 - Study each of the graphs which you have made and from your analysis write your conclusion.
RESOURCES/MATERIALS NEEDED: All explained above.

TYING IT ALL TOGETHER: The balance of nature, as we often hear, is a very delicate one. Each organism has its own specific tolerance levels to many different environmental and human imposed factors. The oxygen level of water is but one of many factors that will determine what species will be present of survive in a freshwater ecosystem. In today's society we need to be more aware of how we effect that balance of nature and weigh carefully the results of our actions and decisions.

WE ALL LIVE DOWNSTREAM

GRADE LEVEL: 8 - 12

OVERVIEW:
Developing waterfront property impacts the land and water environment, not only at the development site but downstream. Students will research and present waterfront development projects and discuss their impact on the land, water and life.

Objective:
To understand how humans and land use affect water quality.

RESOURCES/MATERIALS
Prepare 10 sections of a river. Include straight sections, some with islands in the middle, some wide sections, some narrow, end of the stream, etc. Some can have trees already shown, some not. Make up your own or use a plat book. Markers, colored pencils, crayons, tape

ACTIVITES/PROCEDURES:
1. Copy the sections of the river.
2. Distribute one section per student group.
3. Students will visually represent how this riverfront property will be used if given one million dollars.
4. Write an essay to describe the property, the land use, and an explanation of why the property was developed the way it was. Predict how their property will affect their neighbors.
5. Read and explain the visual representation to the class.
6. Determine any water quality problems caused from the land use in the watershed.
7. After students have made their section, tape all 10 sections together from upstream to downstream.
8. Have students present their section.
9. Discuss the results.
10. Each group is to observe the completed river front developments and write a brief paper on the impact of all the developments combined and the impact each other.

Evaluation:
4 - Watershed section is visually represented with extra enhancement, monetary guidelines are meet, essay was complete using all writing standards, a prediction of effect on neighbors was included, and oral presentation meet all guidelines.
3 - Watershed section is visually represented, monetary guidelines are almost meet, essay was complete using nearly all writing standards, a prediction of effect on neighbors was included, and oral presentation meet nearly all guidelines.
2 - Watershed section is visually represented, monetary guidelines are only exceeded by a modest amount, essay was complete using most writing standards, a prediction of effect on neighbors was included, and oral presentation meet at least half the guidelines.
1 - Watershed section is visually represented, monetary guidelines are exceeded by a huge amount, essay was incomplete and/or doesn't use writing standards, a prediction of effect on neighbors was not included, and oral presentation did not meet the guidelines.

WHERE DOES ALL THE WATER GO?

GRADE LEVEL: 9 - 12

MATERIALS/RESOURCES:

- topographic map of the area surrounding your school, or other appropriate maps that show topography of the area
- tracing papers
- surveying equipment (optional depending on desired outcome of lesson)
- graph or chart paper (optional depending on desired outcome of lesson)

ACTIVITY:

The purpose of this activity is to have students determine where the water run-off from the school actually ends up. This activity obviously works better in areas with open drainage ditches to the final destination of the water (river, bay, lake, etc.). The students will spread out the map of the area and locate the school. Using the elevation contour lines they can follow the route of the water from the source (school) to its final destination. Depending on where your school is located in relationship to the nearest major body of water, this can be a lengthy project. The students will carefully lay tracing paper over the map and trace the route.

Extension activities could include:

- take all the final tracings and lay them on top of each other to see if everybody agrees where the water goes
- work with a math teacher or drafting teacher to develop a contour cross section map to determine how fast the water drops in elevation
- use surveying equipment to follow the drop of water in elevation
- don't use topographic maps at all, just have the students use surveying equipment to determine the elevation from the school to the final destination (this can be a real challenge in some areas)
- if it is close enough to walk the route of the drainage, have students follow the water and make observations about the the speed of the water flow and other data
- measure the area of your school's roof, determine the annual rainfall for your area, and calculate the total water run-off from your school in one year (don't forget the parking lots also)
- perform a soil analysis on the soil in the drainage ditch to possibly determine if the school is adding to stream pollutants
- good creative writing/geography lesson: have the student pretend to be a drop of rain water from your roof that flows all the way to the ocean and describe what they would see along the way

Pond Life Magnified

GRADE LEVEL: ALL GRADES

OVERVIEW: Displays of living organisms are a great way to generate student interest and enthusiasm in the science classroom. This display is easy to set up and maintain, inexpensive, and guaranteed to fascinate your students.

RESOURCES/MATERIALS
Gravel, aquarium, aerator and air pump, tubing

ACTIVITES/PROCEDURES
Setting up your tank
Before collecting your insects, place your aquarium in a location that is out of direct sunlight but receives indirect light. This location should also be near an electrical outlet. The back of a laboratory bench that receives light from an under-cabinet fixture is ideal. Rinse the gravel thoroughly and place it in the bottom of the aquarium. Three kilograms of gravel should be enough to create a 5 cm-deep bed in a 10-gallon aquarium. Assemble the aerator, connect it to the air pump with tubing, and place it in one of the back corners of the tank.

Gathering your specimens
When gathering your specimens, keep in mind that *shredders* and *gathering collectors* are easiest to maintain. (See *An Introduction to the Aquatic Insects of North America* in the Resources list for a detailed description of these insects.) Shredders are those macroinvertebrates that eat leaf litter, ingesting the leaf as well as associated fungi and bacteria. Their eating process produces smaller particles that are the food base for gathering collectors. These two groups include caddisflies, isopods, numerous mayflies, and aquatic earthworms.

Begin your collection by visiting a nearby pond or other still body of water. Organisms from still water environments adapt more easily to aquarium life than organisms collected from moving water such as streams. Start by examining leaves in the water near the edge of the pond for caddisfly larvae cases and place them in a container. The larvae produce the cases by secreting a silk that they use to glue together sticks, leaves, and other small materials. They use these cases for protection. The larvae look like small caterpillars with a few hairs. If your are not sure what to look for, take along a guidebook. Next, use a dip net to collect aquatic vegetation or fallen leaves from the pond. Place this material in a pan that contains pond water. Examine the plant material for macroinvertebrates, and sort them into a separate container with a few leaves and some pondwater.

Before you leave, gather up a few sticks and rocks for the aquarium. Also, fill some jugs with pond water to provide a water supply for your aquarium and

gather a few handfuls of leaves from the pond. Some of the leaves will be used to create a layer at the bottom of the tank to provide food and building material for the macroinvertebrates. The rest will be air dried and added to the tank over time to replenish the food supply. Only leaves that have been underwater for a period of time are conditioned and ready for use by macroinvertebrates.

From pond to tank

The key to successfully transplanting a part of a pond to an aquarium is to allow the pond water and organisms to slowly warm up to room temperature. To prepare the tank for the transfer of the water and organisms, place your rocks and a few thicker sticks at the bottom of the tank. Next, fill the tank two-thirds of the way to the top by slowly pouring it over the rocks to prevent the gravel from being disturbed. The thick sticks should float free. Finally, anchor the twiggy sticks in the gravel so that the upper ends protrude about 10 cm above the water. Do the same with any aquatic green plants you may have collected from the pond. If none were available, substitute watercress shoots from the supermarket.

You are now ready to add the macroinvertebrates to your tank. Turn on your aerator and then carefully transfer your organisms from the container to the tank. Once they are in, secure the top with a piece of vinyl window screening. If available, place a magnifier in front of the aquarium or set out a few hand lenses to help students view the smaller invertebrates. When replacing water evaporated from the tank, be sure that it has warmed to room temperature. Pond water is preferable, but you can use chlorinated tap water, if it has been allowed to stand for a week.

A tank full of benefits

Many lessons can be tied into this display.

- the distinction between the complete lifecycle exhibited by the caddisfly (similar to butterflies) and the incomplete lifecycle exhibited by mayflies (similar to grasshoppers);
- adaptations to aquatic life that pond or stream macroinvertebrates have developed, such as gills, suction cups, stream-lined, or flattened bodies;
- food webs (leaves, herbivores, predators);
- environmental niches (aquatic earthworms are found at the bottom of the tank, caddisflies are found on plants); and
- insect camouflage and building skills, focusing on how caddisflies use silk to glue materials together when making cases.

Although a field trip to a pond is a wonderful learning experience, an aquarium in the classroom has its advantages. Safety issues and transportation of the class to a pond site are avoided. The miniature pond can be observed everyday. The possibility of setting up two aquaria, one with clean water and the other with polluted water (containing only midge fly larvae and aquatic earthworms) could prove valuable in the classroom. For extension ideas, such as setting up aquaria for aquatic predators or cages for terrestrial invertebrates, see *Culture Methods for Invertebrate Animals* in the Resources section.

Acid Rain Laboratory Activities

GRADE LEVEL: 9 - 12

OBJECTIVES: The student will:
1. Obtain comparative data on the pH of natural bodies of water at different locations.
2. Compare data to other locations nationally as it relates to the problem of acid rainfall and the acidification of natural bodies of water.
3. Assess the effects of acid rain on aquatic ecosystems.
4. Acidify and neutralize distilled water with commonly available substances

RESOURCES/MATERIALS:
1. pHydrion paper (Dual Range Jumbo, see vendors in Resource section).
2. Red cabbage water home-made pH paper (see recipe in Resource section)
3. Beckman portable digital pH meter (Optional).
4. Seeds: Early Scarlet Globe Radish, White Tip Sparkler Radish, Alfalfa, Mung Beans, Poppy Seed, Mustard Seed

ACTIVITIES AND PROCEDURES

I. DATABASE GENERATING ACTIVITIES
Observing Acid Rain and Acid Waters
Activity One: Participants will be provided with sample bottles and requested, at the initial session, to obtain a water sample from either a natural body of water or from a rainfall (weather permitting). The water will be tested using the following methods:
1. pHydrion paper
2.Red cabbage water homemade pH paper
3. Beckman portable digital pH meter. This will yield comparative data on the pH of natural bodies of water at different locations. This can be compared to other locations nationally as it relates to the problem of acid rainfall and the acidification of natural bodies of water. The "raw" data will be statistically manipulatable and graphically presentable. The data leads into the effects of acid rain on aquatic ecosystems.

Differential Germination: Acid Rain and Terrestrial Ecosystems
Activity Two: Participants will divide up into 3 working groups. Each group will be given three packets of seeds from the following group:
1. Early Scarlet Globe Radish
2. White Tip Sparkler Radish
3. Alfalfa
4. Mung Beans
5. Poppy Seed
6. Mustard Seed

They will count out and place 10 seeds of each type in four separate petri dishes (or appropriate containers) along with some filter paper. Each group will be responsible for eight petri dishes. Each petri dish will then be wetted (approximately 3.0 ml) with one of the water solutions acidified to differing pH's ranging from pH 3.0 to pH 7.0. On day three the % germination for each seed type and each pH will be determined by counting the germinated seedlings in each dish. The data yield will be % germination by species and % germination by pH. This data will be statistically manipulatable and graphically presentable by itself. It relates into the differential effects of acid rainfall in terrestrial ecosystems. Changing the species composition of terrestrial ecosystems through its effects on germination in addition to the effects on soil cations and on existing plant life.

II. OBSERVATIONAL AND PARTICIPATORY ACTIVITIES NOT UNDERTAKEN FOR THE PURPOSE OF GENERATING A DATABASE

Acidification/Neutralization of Water

Activity Three: Participants will be able to acidify and neutralize distilled water with commonly available substances. Measuring the changes in pH with either pH tape, a pH meter, the Cabbage water pH indicator

Acid Rain and Our Cultural Heritage

Activity Four: Participants will be able to view the effect of various concentrations of acid sprayed (HCl, lemon juice, vinegar) on marble chips. Short reading material with pictures about the disintegration of famous monuments will accompany the marblechips. Participants will be able to spray solutions on the chips.

Freshwater Aquarium: Aquatic Invertebrates

Activity Five: An aerated aquatic aquarium with common aquatic invertebrates (freshly collected) from an eutrophic body of water will be displayed. The participants will be able to view common aquatic insect larvae/adults in the aquaria and with a dissecting microscope. Material on pH indicator species and species composition changes with increasing acidity will accompany the exhibit. Additional age appropriate activities will be provided in a handout and the facilitators will be available to advise regarding longer term projects/experiments. All materials, with the exception of HCl, the microscope, pH paper and the Beckman pH meter, are those that are available in most grocery stores.

Collecting Soil Samples

Several approaches to collecting soil samples are detailed below. In all cases, collect several handfuls of each type of soil in a large ziploc bag or plastic bucket. Label the bag for future reference, describing where you collected the soil. Try as much as possible to preserve the collecting area, and carefully fill in the small hole your sampling will leave.

The Ideal Way

Ideally, it would be best for you to have soils with a variety of pH's and buffering capacities. This helps demonstrate the natural range of lake acidity, and the range of different effects that acid rain can have on lakes. While you might well arrive at a suitable collection of soils with the easier collection methods described below, you will not be fully assured that the soils you collect will have a range of pH and buffering capacities.

NOTE: *Soils whose pH changes very little after the addition of acid solution are referred to as having a natural buffering capacity. The less the soil's pH changes, the greater its buffering capacity.*

It would be most advantageous to include a rock-like or granite sample to simulate high mountain lakes with little or no buffering capacity, a soil sample high in carbonate such as limestone to demonstrate soils with a high level of natural buffering capacity, and several other soils, such as: rich garden loam, pine forest floor, soil from a burned area, maple woods, oak woods, redwood forest, ocean beach, eucalyptus woods, and so on.

Note: *It is ironic that soils high in carbonate (buffer) are found in arid regions, places that receive little rain (and, therefore, little acid rain). These soils are high in carbonate because it has not been leached (washed) out of the soil by water.* If you do not have access to a forest of a certain kind of tree, get a sample from directly under a tree or small grove of that type of tree. If you live in the prairie, desert, or in a region with low diversity of environments, a phone call to you local Soil Conservation Service Officer or a conversation with an earth science teacher at your school, or in your school district, should help you locate soil samples of different pH and with high and low buffering capacities. Soils from burned areas usually have high buffering capacity. If there is not an area near you (forest or grassland) that was burned within the last several months, you can simulate a burned soil. Collect soil from under an older tree and leaf litter from around the tree. Place the soil in your fireplace, scatter the dried litter on top and burn the litter. Another way to make "homemade burn" is to mix residual wood ash from a fire into soil. Though not as authentic as they could be, either of these methods will assure a soil that is both quite basic and has a high buffering capacity. You can quickly test the pH of soil samples while collecting them. Shake a teaspoon of soil thoroughly with distilled water, filter the mixture through a coffee filter into a container and test the liquid with a few drops of Universal Indicator solution.

The Easy Way

Perhaps the simplest approach to collecting soil samples is to look for dramatic differences in environment. Collect a soil that is affected by a variable, and one that is not affected by that variable. Following are some suggested quick strategies for finding soils of differing pH:

Soils of different wetness: from a very wet area, from a continuously dry area, and from a somewhat moist area.

Soils affected by different plants: under perennial plants, under annual plants (collect these two soils at the same measured depth from the surface); soil under

a deciduous tree, under a coniferous tree, soil that has no large plants growing on it.
Soil from beneath a very young tree, soil from beneath an older tree.
Soil that is under a post in or a yard that neighborhood dogs frequent soil that is not affected by dog urine.
Soils affected by human use: in a fertilized field, in a fallow field, in a range land, in a uncultivated field, in an area built on fill transported from another area; soil near a parking lot, garage, or other area where internal combustion engine exhaust would settle.
Soils on very different slopes: at the apex of a hill, at the backslope, at the toeslope.
Potting soils, sand from sandboxes, kitty litter, vermiculite from packing. Call companies listed under "Soils" in the Yellow Pages. They may have different soils or fill dirt available.

Soil Histories
Many of the quick strategies for obtaining different types of soil mentioned above are based on finding soils with a variety of soil histories. A brief summary of how soil histories vary many be helpful to you. Soil histories can differ due to variations in these soil-forming factors: parent material, climate,organisms, topography, and time. These factors act in concert to form any given soil. To find soils with different pH's, locate distinct variations in these factors.

Parent material is the geologic deposit from which a soil is weathered. Examples of different geologic deposits are: volcanic ash, volcanic rock, deposits of sediments via wind or water, glacial deposits, or bedrock. Soils weathered from different parent material can differ widely in pH. For example, a soil weathered from a sedimentary sandstone rock has a markedly different acidity than a soil weathered from a limestone rock.

Climate refers to the average of cyclical differences in temperature and the amount and patterns of precipitation. To find soils affected by changes in climatic temperature, look for a soil in an open, sunny field and one under the cool shade of a building or a tree. To find soils subjected to different patterns of precipitation, look for soils on the dry and moist sides of a hill.

Organisms are the people, other animals, and plants that live in and on the soil environment. Organisms add some material to the soil and take other away from it, thereby cycling nutrients. By cycling nutrients, organisms affect the soil pH. Likewise, organisms are affected by the pH of the soil around them. When looking for samples with different pH's, due to the action of soil organisms, try: soils found under different plants, such as agricultural crops, tree roots, shrubs, grasses, or flowers; soils found in a wild field and soil found in a rangeland, soil in a lawn or park and soil found in an empty lot.

Topography is the lay of the land; how flat or hilly it is. Topography will affect the water table and erosion. A soil at a hill crest will have a different water table that one found in a creek bed or river bed, and so is likely to have a different pH.

Time is how long the soil has been forming, how long it has been undergoing chemical and physical changes. If a soil has been in place for a long time, it will have different properties than one that has been there for less time. An older soil tends to have smaller particles than one that is younger soil (an indication of how much clay there is). Often, older soils also have a reddish color. Soils on a shoulder slope have not been in place as long as soils at a toeslope, and so may have different acidities.

Soil Lessons

Dirt

GRADE LEVEL: 2-3

OVERVIEW:
This lesson gives students the opportunity to explore and discover uses for soil with the use of this floppy disk program and also hands on learning centers. During their exploration, the students will discover uses for dirt including habitants of dirt.

OBJECTIVES:
1. Students will be able to tell what dirt is made of and identify different types of dirt.
2. Students will be able to name uses for dirt.
3. Students will be able to name different types of dirt habitants.
4. Students will be able to learn how dirt changes forms, moves and erodes.
5. Students will learn the importance that recycling has on dirt and how recycling improves the soil.

RESOURCES/MATERIALS:
Macintosh Computers, above-mentioned software, "The Amazing Dirt Book" by Paulette Bourgeois, "Explorations in Science: Level Three, Teacher's Ed" by D. Herridge and N. Moore. The Banana Slug String Band presents "Dirt Made My Lunch".

ACTIVITIES:
Introductory Activity: Read the "I Love Dirt", as a class from the "Earthcare Interactive" software.

Day 1 - Different Types of Dirt
Center 1: In small cooperative groups look at different types of dirt and record differences. Discuss and identify the different types of dirt: humus, clay, silt, sand, and gravel.
Center 2: In a small cooperative group, make a dirt jar. Put a handful of dirt into a jar. Fill with water and shake. When settled, describe results. Pour water through coffee filter, describe results. Can students identify different types of dirt?
Center 3: With your small group, collect dirt samples.

Day 2 - Inhabitants of Soil
Center 1: Brainstorm in small cooperative group the uses of dirt. Record on poster board and hang up around the room.
Center 2: Small group exploration: making mud pies. What is the best recipe for each type of soil? Record. (Explorations in Science p. 70-71)
Center 3: Have students in small cooperative groups make bricks. (The Amazing Dirt Book, p. 68)
Center 4: Have students draw pictures of animals that live in dirt. Also students

could draw homes that are made out of dirt. (i.e. Southwestern adobe)
Center 5: Dirt tray. Students will explore dirt tray.

Day 3 - Learning Centers: Growing in Dirt
Print Idea Box from page 3 of "I Love Dirt" from "Earthcare Interactive".
Center 1: All students will grow bean plants using different types of soil.
Center 2: Students will make predictions of which type of soil will produce the largest bean plants.
Center 3: Have students set up graphs to record the bean growth.
Center 4: Have students listen to "Dirt Made My Lunch".
Center 5: Have students taste foods that are grown in dirt: carrots, radishes, potatoes, turnips, and green onions.

Day 4 - How Dirt Changes Form, Erodes, and Moves.
Go on a field trip to a beach or silted bay to view erosion. Look at cliffs, how were they formed? Have the students build sand castles, so that the water could wash them away. After the field trip, as a class, list the ways the dirt changes form, erodes, or moves.

Day 5 - Recycling: How to help our soil.
Have a class discussion on what is biodegradable, what happens to trash and how trash affects the earth.

Set up a long term project: A Compost Box (The Amazing Dirt Book, p. 39).
Learning Center
1: Make predictions of what would happen to the items in the compost box. Record predictions. Graph results.
Learning Center
2: Have small groups make recycled paper (Explorations in Science, p. 263).
Learning Center
3: Set up a recycling center for the whole school. Have parents in the class volunteer to take the items to the recycling center for additional money for field trips. Have students design posters and flyers for the whole school.

EROSION

Grade Level: K-4.

OVERVIEW: No matter where you look, the land you see is a battleground. On one side of the battle are the forces beneath the surface. These forces cause the crust to be faulted, folded, tilted, and lifted. On the other side of the battle are the natural processes of weathering and erosion. Once rock has been broken up by weathering the small pieces can be moved by water, ice, wind, or gravity. Everything that happens to cause rocks to be carried away is called erosion.

PURPOSE: The following activities will demonstrate to students various types of erosion. The purpose of these activities is to increase students awareness to the point where they can make intelligent decisions on proper land use.

OBJECTIVES: Students will be able to:

1. Identify the different types of erosion.

2. Identify the effect of ice on land.

3. Identify the effect of wind on land.

4. Identify the effect if water on landforms.

ACTIVITIES:

1. Sand Dunes: How do sand dunes form? Place sand in a pile and blow gently from one side. Observe what happens. What happens when you blow on the sand? Could you make the whole pile move if you blew long enough?

2. Windblown Deposits: Collect the following: newspaper, dry sand in jar with lid, box lid, spoon, water, paper, and pencil. Place the box lid on the center of the paper. Remove the lid from the sand and place it inside the box lid near the center. Blow gently on the sand, increase the strength of your breath until sand is being thrown from the lid. Continue blowing for 5 to 10 seconds at this rate. Examine the material in the paper by rubbing your finger over it. Do the same to the material trapped in the box lid. Which is finer? Why?

3. Water Weight Erosion: How does the weight of water affect the earth? Find a spot of bare dry earth. Pour a cupful of water on it. Repeat on the same spot, but this time hold the cup from as high a distance as possible. Observe, how did the earth change when you poured your first cupful of water? How did it change when you poured the second cupful from a greater height? Can

you relate this to changes caused by the weight of water in various places around the earth?

4. Glaciers and Erosion: How does the movement of glaciers cause erosion? Take a 12 inch square piece of aluminum foil and form it into a box shape with edges about 2 inches high. Put it in a freezer overnight. Remove the block. Rub over some clay. What did the block of ice feel like? What happened when you rubbed it over clay? How can you relate this to glaciers?

5. Glacial Erosion: Collect the following materials: ice cube, sand (about 1 spoonful), modeling clay, paper towel, pencil, and paper. Press the ice cube lightly on the flat surface of the modeling clay. Move it back and forth several times. Does anything happen to the clay? To the ice? Place a small pile on the surface of the clay. Place the ice cube over the sand on the clay. Let it sit for about one minute. Pick up the ice cube and look at the surface that had been on the sand. Describe what you see. Place the ice cube back in the same position and move the ice back and forth on the sandy surface of the clay a few times. Remove the ice cube and gently wipe the excess sand off the surface of the clay. Describe the surface of the clay when it was rubbed by the sand and ice. How would this compare with the surface of the land when rock and other materials are dragged over it by a glacier?

6. Landslides: Why do hills and mountains that seem very solid in dry weather develop major landslides after prolonged rains? Build a sand castle. After you have it shaped firmly, pour some water on it. Pour the water slowly and gently. Keep pouring until the sand can absorb no more water. What happened at first? What happened finally? How can you compare this to rainfall and mountains?

RESOURCES/MATERIALS NEEDED: All listed above.

TYING IT ALL TOGETHER: The natural process of erosion works slowly but surely. In hundreds of thousands of years, erosion can wear away a mountain until it is level with the plain. The more that students know about the causes and preventions of erosion, the more they can do to wisely use the land and not destroy and/or misuse it.

Edible Earth Parfaits

OVERVIEW: This activity is a fun and easy way to understand the geology of an aquifer. You will build your own edible aquifer, learn about confining layers, contamination, recharge and water tables.

GRADE LEVEL: 4 - 8

MATERIALS NEEDED:

- Blue or red food coloring
- Vanilla ice cream
- Clear soda pop
- Crushed ice
- Variety of colored cake decoration sprinkles and sugars
- Drinking straws
- Clear plastic cups

OBJECTIVE:

To teach about the geologic formations in an aquifer, how pollution can get into groundwater and how pumping can cause a decline in the water table.

ACTIVITIES AND PROCEDURES

1. Begin to construct your edible aquifer by filling a clear plastic cup 1/3 full with crushed ice (represents gravels and soils)
2. Add enough soda to just cover the ice.
3. Add a layer of ice cream to serve as a "confining layer" over the water-filled aquifer.
4. Then add more crushed ice on top of the "confining layer."
5. Colored sugars and sprinkles represent soils and should be sprinkled over the top to create the porous top layer.
6. Now add the food coloring to the soda. The food coloring represents contamination. Watch what happens when it is poured on the top of the "aquifer." Keep in mind that the same thing happens when contaminants are spilled on the earth's surface.
7. Using your straw, drill a well into the center of your aquifer.
8. Slowly begin to pump the well by sucking on the straw. Watch the decline in the water table.
9. Notice how the contaminants can get sucked into the well area and end up in the groundwater by leaking through the confining layer.
10. Now recharge your aquifer by adding more soda, which represents a rain shower.
11. Review what you have learned as you enjoy eating your edible aquifer.

Edible Earth Parfaits was adapted from *Making A Bigger Splash*, co-published by The Groundwater Foundation and the US EPA, Region VII. You can contact The Groundwater Foundation at **1-800-858-4844**.

Mountain Building

GRADE LEVEL: 4 - 12

OVERVIEW: This activity was a part of a series of lessons in a continuing study of Change. It was designed to give the students hands-on experience manipulating and controlling some of the variables in one type of Change, soil erosion.

OBJECTIVES:
1) The learners will identify variables that influence rates of change.
2) The learners will, through group consensus and using the assigned materials, design and build what they believe to be the strongest mountain possible.

RESOURCES/MATERIALS: dish pans, potting soil, rocks, sand, water, watering can, building plan sheets.

ACTIVITIES AND PROCEDURES:
The teacher will begin by dividing the class into seven groups. (For the sake of saving time the terrarium study groups may be used.) The teacher will explain to the class as a whole that their task will be to build a mountain in their dish pan that can withstand the effects of having a watering can emptied out on it. Two groups must use sand as their building medium, two groups must use potting soil as their building medium, two groups must use rocks as their building medium and the last group will be allowed to use any combination of materials that they see fit. All the groups may use creative extras to complete their mountains but the main structure must be made from their assigned materials. The groups should be allowed 10-15 minutes to come up with a building plan before they begin. When all groups are finished they will gather with their mountains and under go the erosion test. The teacher will fill a watering can and pour it over each mountain in turn. During the erosion testing each group should share their building strategies and theories with the rest of the class. The activity will end with a discussion and group planning session to design the ultimate, ever-lasting mountain.

Questions to think about:
"Why did some of the mountains erode more than others?"
"What are the variables involved in the structure of a mountain?"
"How can these variables affect the rate of mountain erosion?"
"Can people change the erosion rate of a real mountain?"
"How?" "How did our mountains change during the erosion?"
"What ways did they stay the same?"

LET'S PEEK UNDER THE SOD

GRADE LEVEL: 7 - 12

OBJECTIVE:
Students will be able to evaluate difficulties that can occur in attempting to separate various materials.

MATERIALS/RESOURCES:

- Thermometer
- Coffee cans or piece of PVC pipe
- Gallon jugs of water brought to site
- Level
- Meter (or yard) stick
- 12" x 8" grid paper
- Pencils
- Clipboard

ACTIVITY:
Site analysis:

1. Collect soil samples from school, neighborhood, and other city areas. Place in plastic bags and label.
2. At each location run the following test (known as a perk test): Use a cylindrical object such as a coffee can with both ends removed or a piece of PVC pipe. Pound into ground, leaving half of the height exposed. Pour 1 gallon of water into the can/pipe, remembering to keep liquid in pipe at all times until the gallon is used up. Time the interval from when you start to pour until the last amount of water is absorbed into ground. Perform test at each site. Record data.
3. Determine soil temperature by making a hole with a pencil in the soil and immediately placing a thermometer into the hole. Wait 2 to 3 minutes and read.
4. Collect wind velocity and directional data. Have students design a manometer to record direction of wind. Get velocity data from weather service or manometer.
5. Measure the angle and direction of the slope at that location. Use a level and meter stick and refer to Figure 1 below, to determine the slope in the mapping area.
6. Measure the percent canopy cover for the site as described for Figure 2 below.
7. Identify the use for the land at this site.

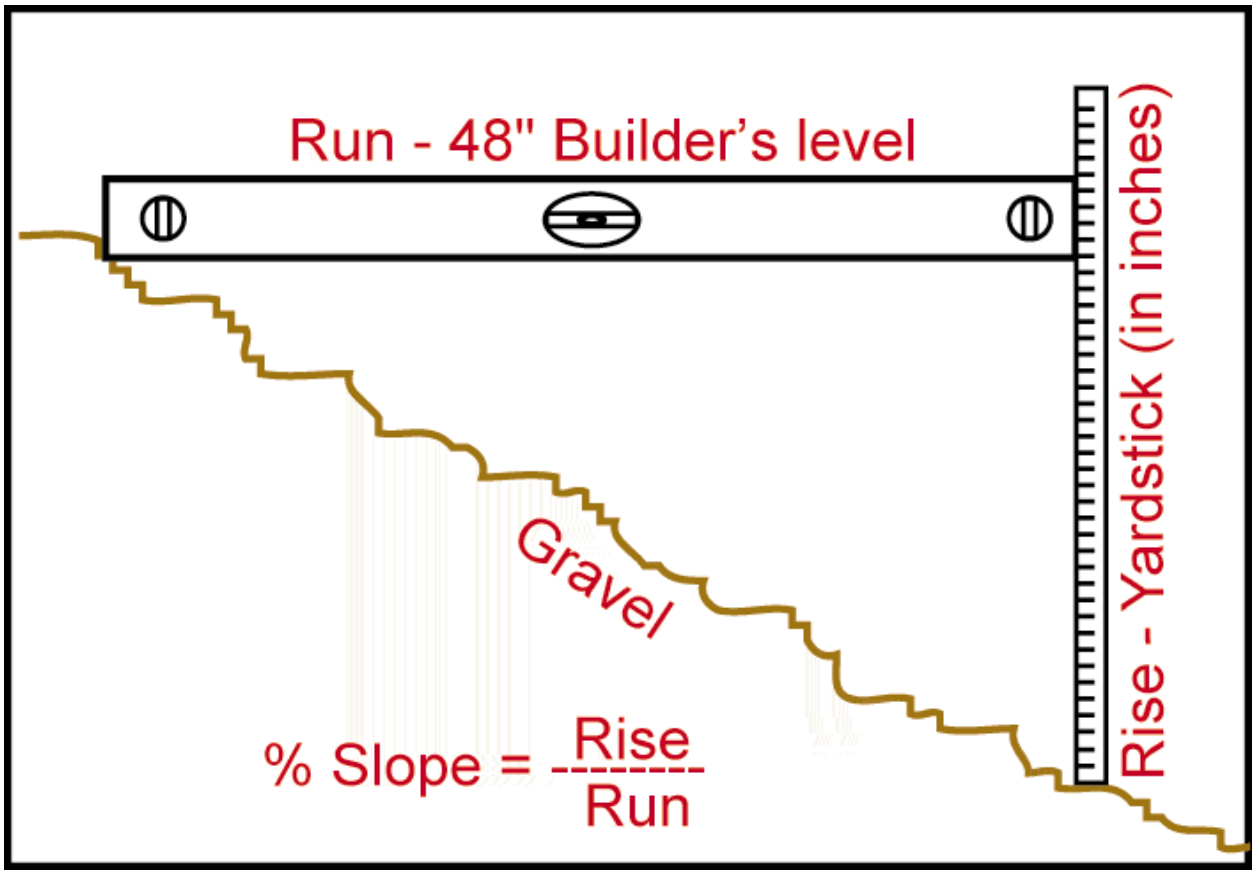
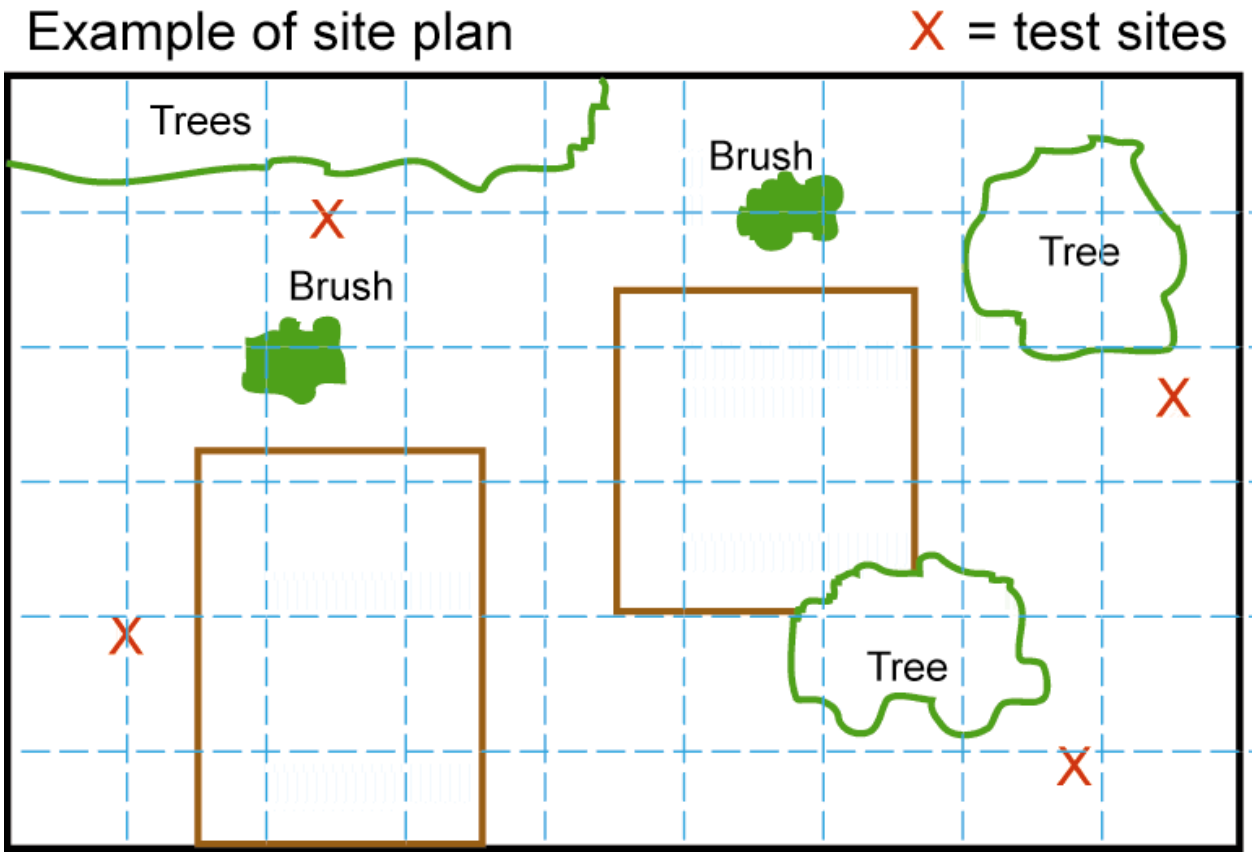


Figure 1: Calculating Angle and Slope

Figure 2 Note: To measure the percent of canopy cover: draw area on grid paper. Map the trees and the canopy (shade) as projected on the ground (at or near noon). Determine the area covered by canopy, then divide by total area. This figure is the percent of canopy cover.



LET'S TALK DIRT

GRADE LEVEL: 7-12

OBJECTIVE:
The student will take a sample of soil, determine the percentage of the different types of soil particles it contains and identify the soil, using the Ternary Chart and/or the Color identification chart.

MATERIALS
Trowels, shovels or augers
Ternary diagram of soil composition, from the USDA Soil Conservation Service Soil Classification System
Glass jars for sample and water, with lid
Metric rulers
Gloves, safety glasses
4-5 Ziploc bags

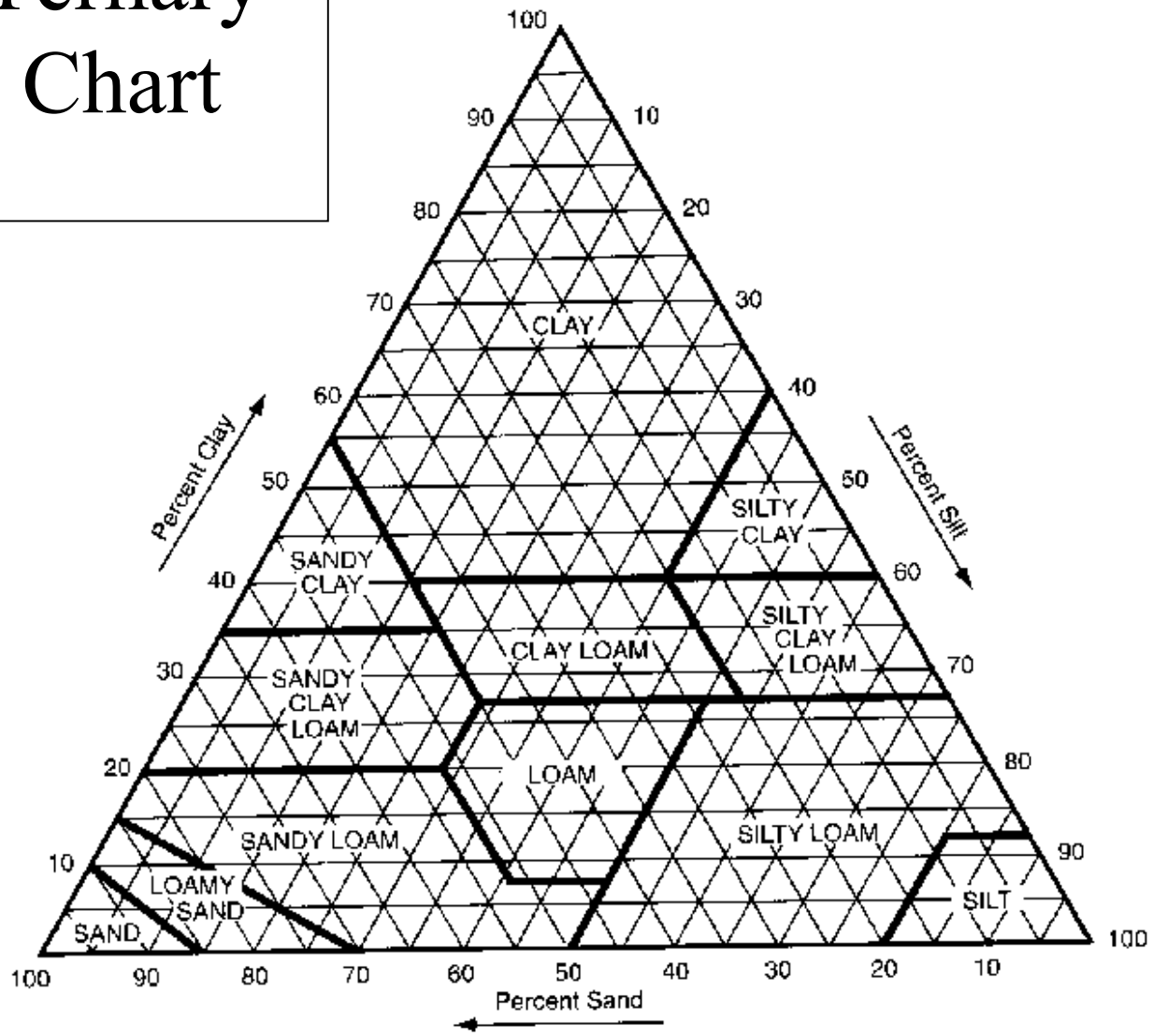
PROCEDURE:

1. Each student should bring a small zip-loc bag of soil from their backyard and a glass jar with a lid. Soil samples should be taken from approximately from 2, 4, 6, 8, or 12 inches under the surface, this measurement should be recorded.
2. In the classroom, use gloves and goggles when transferring soil, the student will place a measured amount of soil into the glass jar using a trowel and fill with at least double the amount of water. The volume of soil should be recorded.
3. After closing the lid the soil and water sample should be agitated vigorously for 30 to 60 seconds. The jar should be allowed to sit undisturbed for 20 minutes.
4. While waiting for the particles to settle, the leftover soil should be characterized by identifying the texture or moisture content and differences in color
5. Samples of soil from six to 12 inches under the surface should be compared with other from 2 to 4 inches under the surface.
6. Using the Ternary Chart for soil classification, the student should determine the percentage of the different soil particles which are found in their sample. Using a ruler, students can mark off the three distinct layers of soil particles. (Note some samples do not have all three types of soil particles. Soil particles are sands, the heaviest, silts and clay (the lightest).
7. Answer the following question: What percentage of the entire sample is made up of sand? of silt? of clay? When these are determined, use the Ternary Chart to name the type of soil the sample represents. Read the

Chart by marking the percentage of the soil particle indicated on each side of the triangle, follow each percentage to a point of intersection on the chart which indicates the kind of soil.

8. Students should construct a chart of soils in the class samples, noting differences in moisture, particles, color and soil type.
9. Discuss the different kinds of soils which were found in the samples taken by the class. Locate on a map where these samples were taken. Predict what their water samples will look like after one day of settling, after one week, after one month of sampling.
10. Students should discuss the importance of soil, conservation of soil, handling of contaminated soil and the use of soil.
11. Alternative Activity: Combine all of the individual class soil samples into one bucket. Using this combined sample which has been mixed, take representative samples. Analyze these samples according to moisture, texture, color and percentage of particles as done previously. Chart this representative sample and compare to the individual samples

Ternary Chart



U.S. Department of Agriculture Textural Chart

LEAD IN THE SOILS

GRADE LEVEL: 9 - 12

MATERIALS/RESOURCES
Soil samples, common glassware, Hach test kits for lead in soils (see resources).

ACTIVITY:
Studies have shown/suggested that the soils near older highways contain higher levels of lead than soils father from such highways. It would be interesting to sample soils from apron areas of older highways (make sure that the soils have not been recently disturbed).

Take samples, perhaps right next to the road (as well as a sample some distance from the highway for comparison), then every 1 - 2 feet down into the ditches on both sides of the road. These samples should be taken back to the lab and analyzed using Hach testing materials for lead in soils.

This info could be graphed.

Students should make hypothesis about the results - where did the lead come from, why do the concentrations change with distance, etc.
This activity could also move into biological applications of lead poisoning.

WHERE DOES ALL THE WATER GO?

GRADE LEVEL: 9 - 12

MATERIALS/RESOURCES:

- topographic map of the area surrounding your school, or other appropriate maps that show topography of the area
- tracing papers
- surveying equipment (optional depending on desired outcome of lesson)
- graph or chart paper (optional depending on desired outcome of lesson)

ACTIVITY:

The purpose of this activity is to have students determine where the water run-off from the school actually ends up. This activity obviously works better in areas with open drainage ditches to the final destination of the water (river, bay, lake, etc.). The students will spread out the map of the area and locate the school. Using the elevation contour lines they can follow the route of the water from the source (school) to its final destination. Depending on where your school is located in relationship to the nearest major body of water, this can be a lengthy project. The students will carefully lay tracing paper over the map and trace the route.

Extension activities could include:

- take all the final tracings and lay them on top of each other to see if everybody agrees where the water goes
- work with a math teacher or drafting teacher to develop a contour cross section map to determine how fast the water drops in elevation
- use surveying equipment to follow the drop of water in elevation
- don't use topographic maps at all, just have the students use surveying equipment to determine the elevation from the school to the final destination (this can be a real challenge in some areas)
- if it is close enough to walk the route of the drainage, have students follow the water and make observations about the the speed of the water flow and other data
- measure the area of your school's roof, determine the annual rainfall for your area, and calculate the total water run-off from your school in one year (don't forget the parking lots also)
- perform a soil analysis on the soil in the drainage ditch to possibly determine if the school is adding to stream pollutants
- good creative writing/geography lesson: have the student pretend to be a drop of rain water from your roof that flows all the way to the ocean and describe what they would see along the way

Forestry Lessons

FOREST IN A JAR

Grade Level(s): K - 6

OVERVIEW:
Succession is a term used to describe the ever- changing environment and the gradual process by which one habitat is replaced by another. In this activity, students will be able to see in miniature how a swampy area can be succeeded by a forested habitat.

OBJECTIVES:
Students will be able to: 1) observe and describe succession; and 2) summarize what they have learned about how environments can change.

RESOURCES/MATERIALS:
Pint or quart jars (one per student or small groups of students, or one for the entire class), water, soil, aquatic plants (one per jar), two cups bird seed.

ACTIVITIES AND PROCEDURES:
1. Place two inches of soil and three inches of water in a jar. Place the jar at a window, without a lid, and allow it to settle overnight.
2. Plant an aquatic plant in the jar. It should grow well in this environment. If your classroom has no windows, substitute a grow-light.
3. Do not replace the water that evaporates from the jar.
4. Once or twice a week, have students add three or four bird seeds to the jar. While there is water in the jar, the seeds should germinate and then rot. Continue adding seeds even after the water evaporates.
5. As the water evaporates down to the soil, the aquatic plant will die. The bird seeds will now find the environment suitable for successful growth. Sunflower seeds, which grow large, can be added to represent forest trees. You will now need to add water, as a substitute for rainfall, to keep the soil damp to keep things growing.
6. Have each student make a poster, drawing, or other visual representation of what they saw happen to their "pond." Ask them to talk about what they have learned about how environments can change. Introduce the term, "succession," to older students.
7. OPTIONAL: Take a field trip to a pond. What plants are growing in the water? What plants are growing on the shore? What parallels are there between this real pond and the "pond" in the jar? Make a second drawing of this real pond. Compare the similarities and differences between the two.

TYING IT ALL TOGETHER:
Describe three changes you saw happen to what was inside the jar.

TREE ACTIVITIES AND CRAFTS

GRADE LEVEL: K-6

OVERVIEW: Seed collecting is fun. Have the children collect a large variety of tree seeds. The wings of maples, the paddles of the basswoods, nuts, acorns, seeds of cherry and others.

OBJECTIVES/UNDERSTANDINGS: Trees grow from seeds. Seeds are not all the same. Some seeds are large. Some seeds are hard. Seeds from some trees are called nuts. Continue concepts on sight observations comparing one seed to another. Excellent activities for ***touching***: feeling the differences in size and shape and texture.

RESOURCES/MATERIALS: A large variety of seeds, glue, string, wire, heavy needles, piece of wood, flower pots with soil.

ACTIVITIES/PROCEDURES:

1. Children should plant a seed from each collection. Some will germinate quickly, others may take months, some will not germinate at all. When planting, conditions for growth should always be discussed.

2. Glue the various types of dried seeds to piece of cardboard or plywood for wall hangings and designs. Students can create hundreds of beautiful designs suitable for gifts. Mix dried and pressed leaves in with the seeds for creations. If twigs and other items are used, students are making “Nature Collages.” An excellent rainy day camp activity.

3. With acorns students can create jewelry and figures. Simply string acorns on wire or heavy string. If acorns are hard, a brace and bit with a tiny drill size works well. A student can hold the acorn tightly with a pair of pliers while another drills the holes. Acorn men are especially fun for young children.

THE WOODS AND POND

Grade Level: 1-2.

OVERVIEW: In today's world of high consumption it is important to keep people in touch with the earth and its diverse life forms. As long as one's senses are involved, much can be learned by even the youngest child. If we allow children the opportunity to experience nature, and let them see our own enthusiasm, they will be on their way to a lifelong appreciation of our natural surroundings. If we give them direction in their observations, they may become the natural scientists and caretakers of tomorrow's world.

PURPOSE: The purpose of this woods and pond unit is to involve children with nature in a living, experiencing way. The activities are designed to give children a hands-on approach to learning about their natural surroundings. Following the seasons through a multitude of changes throughout three quarters of the year gives continuity to the unit and increases their awareness of the important part that nature plays in our lives. Children who have the opportunity to be involved in this way gain knowledge and show their appreciation for the multitude of life forms in their care for the area in which they are encountered.

OBJECTIVES: After completion of the activities in this unit, children will be able to demonstrate the following skills and understandings:

1. Recognize that the pond/woods environments are ecosystems and state some of the differences in the two ecosystems.
2. Identify three of the trees in the area by their leaves and bark characteristics.
3. Recognize three shrubs by their growing manner and fruit.
4. Identify by common name three animals and plants in or near the pond.
5. Identify three changes in the two ecosystems over a span months.

ACTIVITIES: These activities are only a few, which can be used to involve children in nature in a real way. Instead of teaching an ecosystem unit, plant unit, or animal unit in isolation, the use of a local natural area ties all of these things together in a meaningful way for the children. It also gives the science curriculum continuity over time. Hopefully they will spark your imagination and you will come up with lots of other ideas for involving children with our natural world.

1. Take the children on many pond and woods walks to the same area to observe and identify plants and animals spanning the seasons. Do drawing and writing activities with the children both in the field and back in the classroom. Keep an ecosystem book.
2. After the children observe small pond creatures, bring back a few to the classroom for further observation. Be sure to bring back the pond water with them. Have the students observe some pond water under a microscope the first day, second day, and fourth day after bringing into a warm building. They make comparisons and note differences in both kind and number of organisms. Using prepared, colored slides of tiny pond creatures, have

children look through the microscope and then on a four inch circle, draw what they observe through the microscope. Mounted all together, this is a very effective display.

3. On at least one woods walk, do hug-a-tree activities. In this activity children are blindfolded and led to a tree by another child and returned to a starting point after careful use of their sense of touch. Free of the blindfold, they are to find the tree they have hugged. Gather leaves and make leaf prints with the students after comparisons as to size, color, smell and feel. In a tall mature forest, ask the children to lie on the ground on their backs. With eyes shut, they are to be very still and just feel and hear the woods around them. With eyes open, but still on their backs, they look up to the tops of the trees and quietly observe. (A breezy day is very effective for this activity.)
4. Invite you local Forest Service or Greenhouse person to come with samples of seedling trees to talk to your children. Most will give each child a seedling to take home and plant.

TYING IT ALL TOGETHER: This unit involves children in learning activities that require the use of all their senses. Taking them out into nature is the most likely way to insure their learning and appreciation of this wonderful world, our earth. Collect their art, writing and record keeping and display it at your school's science fare, hang it in the hallways, decorate you classroom with it. The children's new knowledge will show up in creative art and writing projects, and all across the curriculum.

TITLE: TREES, TREES, TREES!!!!

GRADE LEVEL: 2-5.

OVERVIEW: The environment is an issue of great importance. The more knowledgeable a person is about the world around them, the better prepared they are to maintain it.

PURPOSE: The purpose of this activity is designed to increase students' awareness and knowledge of trees. They will be involved within the world around them at home and at school and hopefully will become caretakers of their environment.

OBJECTIVES: As a result of this activity, the students will:

1. Adopt and identify a specific tree of choice.
2. Take a bark rubbing, draw a picture, read, and research about a particular tree.
3. Each student will write an original piece about their tree to include at least three facts. It can be a story, poem, song, play, acrostic, etc.
4. Document changes throughout the year on their adopted tree.
5. Learn the difference between deciduous and coniferous trees.

RESOURCES/MATERIALS:

Teacher materials: Several literature books about trees. Resource books for identification about trees. Any other materials you might already have concerning trees. Project Learning Tree and Project Wild books are a great source. Student materials: construction paper, paper for the bark rubbing, crayons, pencil, notebook paper.

ACTIVITIES AND PROCEDURES:

1. At the end of a class period, with no rationale, ask students to take a piece of paper and draw a tree or trees. Don't ask for a particular type of tree or size, etc. Give them a good amount of time, at least 15 minutes. They can keep the paper.
2. The next class period, take the students on a nature walk. Walk around and observe the trees in the area surrounding your school(if possible). Ask the students to describe the trees to you. Ask them to be specific about what they see. Notice differences and similarities.
3. Return to the classroom and give the students a piece of paper and ask them to draw a tree or trees. Give them a good amount of time, at least 15 minutes. Then have the students compare the two sets of drawings and discuss what they see. Were the second drawings more detailed? Were they more aware of the shape of the trees, etc.?
4. Read the book The First Forest by John Gile, The Giving Tree by Shel Sylverstein and or other pieces of literature about trees. Discuss some of the

specifics about trees, using vocabulary and identifying parts of the tree. Discuss the difference between confiferous and deciduous trees.

5. Then take the students outside a second time and allow them to adopt a tree. The students will take a bark rubbing, a leaf, and draw a picture of their tree. When they return to the class the students will use reference books and each other to try to identify their tree.
6. When the students have researched a little about their tree, they will write three facts about their tree in any form they wish. They can write a story, a poem, a song, a play, an acrostic, etc.
7. Take all of the information from each student in the class and put together a class scrapbook.

TYING IT ALL TOGETHER:

1. Put the students materials together into a scrapbook. I put the picture with the name of the tree, the bark rubbing, and leaf on the first page. Then I put the original piece the student created on the second page. I faced each students work toward each other.
2. To draw in their parents, ask the students to go home and see if they happen to have the same type of tree on their property at home. When they return with the results, tally everyone's information and graph it. The students can compare each of the classes and see if students happened to choose a particular tree because it was familiar or not.
3. When the scrapbook is finished allow the children to take the book home for their families to see and allow their families to write comments about the book in the back of the book on a comment page.
4. 4. After the families have viewed the scrapbooks, have them available in the library for viewing and check out.
5. You could also have other grades look at the scrapbook and then pair up students and take the visiting grade on a nature walk and show them your tree.
6. You could also make a map of the campus and try to identify where your tree is on the map.
7. If you choose to do this activity in the fall, have the students watch their tree throughout the year and have them document the changes that occur as the seasons change. This is fun for the students to see their tree change. They learn a lot.
8. If you feel like this would be too difficult for one student, pair students together and have them work in groups.

Bottle Habitat

GRADE LEVEL: 4 - 8

OVERVIEW: Students will construct an aquatic ecosystem in a two-liter pop bottle. The stock organisms will be: water plants, snails, and fish. Students will record data concerning the observations they make over a four-week period.

PURPOSE: Students will exercise important early scientific skills, like observing, measuring, classifying, communicating data, inferring, and predicting.

OBJECTIVES:

1. Students will, in groups of four, construct aquatic habitats in pop bottles.
2. Students will create charts to record data from observations.
3. Students will observe the habitats over a period of four weeks, and record what they see--changes in population, plant growth, water quality, and animal growth.
4. At the end of the observation period, students will graph their data.
5. Students will write explanations for what they observe. Also, questions will be posed with specific questions, such as: "What would happen to your plant population if you added more snails?" or "What environmental factors do you think influenced the growth of your fish/snails/plants?" or "What do you think would happen if the fish population doubled? Quadrupled?"

MATERIALS;

1. 2 two-liter pop bottles for each group
2. water source
3. light source
4. guppies
5. elodea
6. duckweed
7. water snails
8. sand
9. scissors
10. graph paper

ACTIVITES AND PROCEDURES:

1. Cut The top off one bottle, at the shoulder (where it tapers). Cut the base off another bottle and score it with holes. This is the cover.
2. Fill bottom of bottle with sand, two inches deep.
3. Add water--slowly, to minimize sand displacement--and then root three ten-centimeter elodea stalks firmly in the sand. Sprinkle a small amount of duckweed onto the water's surface.
4. Let the aquaria stand overnight to let the sand settle, and to allow chlorine from water to dissipate (if tapwater is used).
5. Add two guppies and two snails.

Over a four-week period, have the students record daily observations in journals. Suggest certain things for them to be watching for, like plant growth or population changes. Ask for quantitative measurements (exactly how many? exactly what size? how many days?) as well as qualitative (what color? what shape? slow or quick movement?).
During the observation period, have students research pond ecology and the organisms involved in the project.
At the end of the observation period, have the students graph the information they've obtained through observation. At this time, they should write hypotheses to explain some of the things they've seen.

ASSESSMENT:
Are the aquaria appropriately stocked? Have they been well-maintained? Are observations recorded at regular intervals? Are graphs drawn correctly? Are hypotheses based in fact?
Useful Reference:
Information about bottle aquaria taken from Bottle Biology, copyright 1993, by the Bottle Biology Project, University of Wisconsin--Madison.
http://www.fastplants.org/teachingmaterials/Manuals_body.htm

OBSERVING GROWING GRASS SEEDS

GRADE LEVEL: 5-8

OVERVIEW: Grass seed is planted. Germination and growth is observed as grass seed matures. Plant parts observed as they germinate and grow.
Seeds germinate and grow into plants. Seeds store energy within them to start growth. When the growing plant uses up the food energy stored in a seed the plant must find nutrients and manufacture its own food or die.

RESOURCES/MATERIALS: Two small plastic dishes (one pound plastic butter tubs), a sponge cut to fit the bottom of the container, large pinecone, grass seed (rye works best), a hand lens; water.

ACTIVITIES/PROCEDURES:
PART 1:
1. Place the sponge in the small dish.
2. Place the pinecone in the other container.
3. Add enough water to each container to get the sponge and pine cone wet.
4. Sprinkle the seed on the wet sponge and pine cone.
5. Keep the sponge and cone wet.

EVALUATION: The grass seed will soon germinate. The plants will grow until all the food in the seed is used. The plants will not be able to obtain nutrients from the water. They will grow for a period of time and die.
PART 2:
1. Carefully remove several of the growing plants from the sponge or pine cone.
2. Place the plants on a flat surface (A piece of clear plastic or wax paper is fine).
3. In good light, examine the tiny plant.
4. Look for root hairs that take in water and nutrients that may be dissolved in it.
5. Use the hand lens for close examination of plant parts. Note the veins in the leaves where nutrients are moved throughout the plants.

FOLLOW-UP ACTIVITIES: (Optional)
- Try a sponge with seeds and no water. Why won't the seed germinate?
- Try a sponge in water with a layer of soil over the sponge before the seeds are placed on it. Do the seeds that germinate and grow on the sponge with soil produce a plant that appears bigger, greener and lives longer?
- Try several sponge gardens with different types of soil and compare the results.

EVALUATION: Compare the results of germination and growth on the different sponges. When nutrients are available for seed germination and plant growth what are the differences in the plant? How can this information be transferred to gardens and houseplants?

The Importance of Trees in the Rural Area: Planting a Snowfence

GRADE LEVEL/SUBJECT: 5-12

OVERVIEW: Trees can play an important role in rural areas. As a living snowfence, trees can protect roads and highways as well as provide habitat cover for wildlife and protection for livestock. This activity gives students hands-on experience in planting trees as well as being involved in area projects.

PURPOSE: The purpose of this activity is to demonstrate the importance of trees in rural areas through the planting of a living snowfence.

OBJECTIVES: Students will be able to:
1. Explain the importance of a living snowfence in a rural setting.
2. Sequence the steps in planting trees for a living snowfence.
3. Exhibit the ability to work in a group.
4. Demonstrate the proper way to plant a living snowfence.

RESOURCE/MATERIALS: "Contact your local County Extension agent or your state department of agriculture for pamphlets, slides, etc. on trees and tree planting. Trees, shovels, etc.

ACTIVITIES AND PROCEDURES:
1. Have the students brainstorm ways trees can be useful in rural areas.
2. Invite an extension agent or person from the forest service to talk about the importance of trees in rural areas.
3. Use slides to illustrate the use of trees as a living snowfence.
4. Use math activities to figure how many trees it will take for the project. Figure how far from the highway the trees will need to be planted to keep the snow off the road. Predict the percentage of trees that will survive.
5. Take a class field trip to the area that the living snowfence is to be planted. Using the team approach actually plant the trees.
6. After returning to the classroom, use writing activities to highlight the experience.

TYING IT ALL TOGETHER: This activity has sparked interest in the students as to how trees can be of importance to our school playground. It has been an excellent way to work with area ranchers, farmers and county officials. One student developed an interest in what it takes to become a "tree city USA.

Leaf Printing

GRADE LEVEL: All ages

RESOURCES/MATERIALS:
A variety of different leaves, paint, brushes, fabric paint, paper or fabric, and newspaper

ACTIVITIES AND PROCEDURES:

1. Collect different kinds of leaves. It's best to do this in the fall, when the leaves are on the ground and not in use by the trees. Try to collect leaves that are clean. They'll work better.

2. Squirt fabric paint into a small container. Dip brushes in paint
3. Paint one side of the leaf. The imprint will show up better if you paint the bottom side of the leaf where the veins are more pronounced.

4. Put newspaper under the fabric or between the fabric layers if you're painting on a T-shirt. Lay the painted leaf on the fabric (cotton works well) or paper and apply equal pressure to all parts of the leaf. This method is called pressure printing. With a little practice you'll discover how hard to press the leaf and how much paint to apply.

5. A rolling pin sometimes makes this process easier. A closet rod, cut into 12 inch lengths makes an inexpensive set of rolling pins. You can also use a caress printing technique. Lay your printed leaf down, paint side up, and lay the material to be printed on top of the leaf. In one motion firmly press down on the material and leaf.

6. If you're printing on fabric, you'll need to waterproof your design.

7. Once it's dry, you can heat-set or waterproof your design by putting it in a dryer on low for 10-15 minutes. Ironing also works. Read the paint manufacturer's directions for more information.

8. Once it's dry, you can heat-set or waterproof your design by putting it in a dryer on low for 10-15 minutes. Ironing also works. Read the paint manufacturer's directions for more information

Conservation Lessons

Wetlands Migration

Grade Level: 2 - 8

Objectives:

Students will be able to operationally define migration
Students will be able to visualize the dependence of wetlands for Migrating birds.

Purpose:

To increase awareness for the need to protect our nation's wetlands.

Description:

Students will be able to operationally define migration and they will be able to visualize the dependence of wetlands for migrating birds.

Background:

Coastal wetlands are an important factor to insure the success of bird migration. Ponds, lakes and marshes provide food and shelter for traveling birds . Without the wetlands birds would not have the energy to make the trek from areas as far south as Panama in the case of the Belted Kingfisher. At the time of the European settlement of the United States there were 215 million acres of wetlands. Today there are less than 100 million. Besides providing habitats for waterfowl, wetlands help relieve flooding, filter pollutants and are an integral part of the biosphere. Through increased education of their importance and beauty children will become responsible stewards of the remaining 100 million acres of wetlands.

Activities and Procedures:

1. This activity will be best accomplished on a sandy section of the playground or a parking lot. The teacher will draw a large sized hopscotch course. The course can be drawn on the pavement with chalk or drawn on the sand/dirt with a stick The squares should be approximately 3'x3'. The hopscotch course should contain 10 squares.
2. Have the students line up at the beginning of the course. Tell the students that they are birds starting there journey northward. Tell the students that each of the squares represents a wetland between Florida and Maine (it will be more dramatic using a migration path that includes your state. Specific migration patterns and bird species can be obtained from a bird field guide.). Students are then challenged to migrate northward on the course. They do not have to step on every square, however they must not go outside the course.
3. All students should be successful in the first migration. Now, tell the students you are a developer. You will destroy 2 wetland areas in order to build condos. Put an "X" on two of the squares. Tell students to make the migration once again. The students may not set foot on the destroyed

wetlands. If they do, they die and thus may not participate in any further migrations. After all students have run through destroy two more and repeat the procedure. Repeat this until all students fail to make the migration. Try to "X" off the squares in such a way that not all are destroyed but are so far apart students can not make the jump. This will help with the debriefing.

Materials:

chalk or a stick.

Evaluation:

At the end of the activity ask students the following questions:

1. Explain why some birds died earlier than others?
2. Why did the rest of the birds die?
3. Explain how this game represents migration.
4. Why did the birds die even though some wetlands remained at the end of the game?
5. Why is it important to save wetlands in all states?
6. How do migrating birds depend on wetlands during migration?

Extension:

Have students investigate any developments in their community that threaten wetlands.

Have students use field guides to investigate birds that migrate to and from their community.

Gyoku (Fish Prints)

GRADE LEVEL: 4-8

Objective: Students will examine different fish species and create gyoku or Japanese fish prints.

Materials:
-several raw fish
-tempera paint
-spoons
-printing paper or t-shirts
-newspaper

Procedure:
1. Teacher will discuss with students different types of fish, different kinds of water habitats.

2. Teacher will talk to students about the art of Japanese fish printing techniques or gyoku.

3. Teacher will demonstrate fish printing process for students.

4. Students will get paper and find a fish they want to pull prints from.

5. Students will spoon paint onto fish, one or more colors, and smooth it on.

6. Students will lay paper onto fish and press down firmly.

7. Students will lift paper from fish, put name on it and let dry.

8. Teacher will put dried prints up for students to examine, discuss results, details and differences.

Evaluation:
1. How well is image of fish printed on paper?

2. Are details apparent?

3. Color and clarity?

4. Placement of print on paper?

5. Craftsmanship?

Environmental Problem-Solving Using the Web

GRADE LEVEL: 5 - 8

OVERVIEW

This lesson is appropriate for use in an upper elementary or middle school language arts or science course. It is directly related to the eighth grade language arts curriculum. The goal of the lesson is to have students articulate an opinion on a current environmental issue and to use techniques of argument to express and defend their opinion in writing and to persuade an appropriate audience to their point of view. This lesson would best be used toward the middle or end of a course in composition, after students have had some experience writing argumentative pieces and after they have practiced researching both sides of an issue. It is most appropriate near Earth Day, and it will meet science objectives involving environmental education and current topics in science.

OBJECTIVES:

The learning objectives of this lesson are:

1. Students will work collaboratively on a written product that expresses a response to an experience.
2. Students will identify, collect, or select information and ideas.
3. Students will manage resources needed to complete writing tasks.
4. Students will revise vocabulary, organization, and tone as appropriate for audience and purpose.
5. Students will choose organization and layout appropriate for audience.
6. Students will use literary devices and design elements as appropriate to describe, support an opinion, or persuade an audience.
7. Students will assess the validity and accuracy of information and ideas.
8. Students will determine the value of information and ideas.
9. Students will respond to personal situations and events.
10. Students will respond critically and creatively to personal experiences.
11. Students will demonstrate knowledge of current societal/environmental issues in science.

Resources

The learning resources needed for this lesson are:

1. One or more computers with Internet and e-mail access
2. CD-ROM research tools such as NewsBank or SIRS, current print journals covering environmental issues, or newspapers
3. A tool to evaluate World Wide Web sites (see Kathy Schrock's Guide for Educators, http://www.capecod.net/schrockguide/eval.htm)
4. Student-friendly Web publishing software such as Microsoft® FrontPage® or Sunburst's Web Workshop

It might be helpful to have a display device attached to one of the computers with Internet access to demonstrate search and evaluation techniques. This lesson would also be enhanced by collaboration with the school library media specialist.

Pre-Assessment Activities

To complete this lesson successfully, students should be able to recognize an author's bias and should be able to identify characteristics of argumentative writing. Students should have practiced writing argumentative pieces that have coherent, logical, and organized structure and that provide sufficiently elaborated reasoning to persuade an audience. Students should have experience using print and non-print resources and documenting sources for research and problem-solving writing tasks.

Teaching/Learning Strategies

The lesson will begin with a demonstration leading to the assignment. The teacher will begin a discussion concerning environmental issues that have currently been in the news. The teacher might use a student's suggestion for a topic or, say, knowing that a controversy has been brewing over wolf populations in Yellowstone Park and Idaho, could use this topic to demonstrate the assignment. Using a computer with Internet access and a display device, students will be shown a search for "Yellowstone wolves" using a search engine. (I used MetaCrawler at http://www.metacrawler.com.) Several appropriate Web sites should be returned. The last time I performed this search, the first hit I received was the Total Yellowstone Page at http://www.yellowstone-natl-park.com, which is a good page to use for introducing students to the issue. If the page contains a brief description of the problem, then, as a class, read it. After reading the rest of the page on their own, students will be asked to provide their opinion on the reliability and validity of the information on the page. The Web page evaluation tool used in this lesson is from Kathy Schrock's Guide for Educators at http://www.capecod.net/schrockguide/eval.htm.

Once this has been accomplished, students will be asked to make suggestions for other sources which might have more information on this issue. Students will then be asked to suggest where opposing points of view might be found. Students will evaluate each Web site visited and make a judgment on the reliability and validity of the information on each page and comment on the author bias, if any is apparent.

The teacher will then make the following assignment:

> Students are to work in groups of twos and threes to research and report on a current, controversial environmental issue.

As a suggestion for places to find topics, the teacher or media specialist will point the Web browser to the Yahoo! directory at http://www.yahoo.com and choose the topic **Environment** under the heading **Society and Culture.** Students should have no problem finding information on such environmental issues as: global warming, ozone depletion, endangered wildlife species, animal rights, mining issues, pollution, acid rain, and oil spills, as well as many others.

Students can also use NewsBank or SIRS, print journals, and newspapers to research issues, if they are available.
Students will be asked to evaluate any Web sites they use and report on all sides of their issue.
Students will present their reports orally before the class, using charts, graphs, photographs and other visual aids. At the end of each presentation, the teacher will ask the students in the group if they have formed a personal opinion about this issue.
Students will be allowed to share their opinion and will be asked to justify it with facts and other reasons. After all the groups have given their presentations, students will be given a second assignment to complete:

> Each student will be asked to choose one of the issues presented that he or she feels strongly about. Then the student must state his or her opinion and defend it in writing.

In their writing, students will be encouraged to include possible solutions to the problem. Afterward, they will be asked to brainstorm ways to make their opinions heard in the real world. The list should include some of the following:

- E-Mail politicians who vote on laws.
- Write letters to politicians who vote on laws.
- Write to local or national newspapers or journals.
- Talk to friends to inform them about the issue and get them involved.
- Take personal action, such as orgainizing and taking part in cleanups and recycling projects clean-ups.
- Make posters to inform other students.
- Speak to groups about the issue.
- Go to town council meetings and bring up the issue.
- Publish your own Web page educating people on the issue.

As a third part of this unit, students will be asked to complete three of the ideas on the brainstorming list, with a requirement that one of them be to publish a Web page educating others about their issue and the stance they have chosen to take. All students who have chosen the same stance on a particular issue will work together to design and publish their page. Students will describe the chosen issue from all sides and use the papers previously written to defend their stance.
Students will be allowed to include original artwork or photographs on their page. If they choose to use graphics from other sources, they will first have to get permission to use the images in order to comply with copyright law.
Students may link to other Web pages on their topic if they have written to the Webmaster of that page and been given permission to link. All student pages will be linked to the school's and/or class's Web page. All Web pages will include a counter to inform students how many hits their site has received.
Students will be free to choose the other two activities they take part in to express their positions on the issue. Students will be asked to write a brief paragraph on the activities they chose and the outcome of their actions.

Post-Assessment Strategies
Students' success in meeting the objectives for this lesson can be verified by checking their documented sources in the research presented orally to the class. Students will also be evaluated by their knowledge of the subject presented and the persuasiveness of their arguments.
Students' opinions should be reinforced with fact as well as feeling. Web pages will be evaluated by other class members using the evaluation techniques applied earlier in the research stage.
Students will also do a self-evaluation of the impact of their Web pages by using the counter to assess the number of hits their page receives.

For articles, maps, or other media pertaining to this topic, look up the following in Encarta® Encyclopedia:
Ecology
Environment
Pollution
Global Warming

For additional online information and media, view the following Encarta articles:
Ecology
Environment
Pollution
Global Warming

For additional relevant information, visit the following Web sites:
The EnviroLink Network
http://www.envirolink.org/index1.html
This pro-environment site has an environmental library, an online marketplace, and links to related sites on the Internet.

Creating Built Environments

GRADE LEVEL: 7-12

OVERVIEW Students learn about land use planning, built environments, and cooperative living habitats.

PURPOSE: As a result of this community design activity, students will understand the following: the concepts of land use planning and cooperative living habitats, the process of creating a built environment, and the characteristics of built environments which meet the needs of Man and Nature.

OBJECTIVES:

1. Students will read and write about built environments, which create cooperative living habitats.
2. Students will view audiovisual presentations that focus on built environments, which create cooperative living habitats.
3. Students will meet with community resource people to discuss characteristics of built environments, which create cooperative living habitats.
4. Students will meet with community resource people to discuss land use planning strategies.
5. Students will tour the local community and/or communities in the region to study characteristics of built environments and land use planning schemes.
6. Students will create visual displays and tabletop dioramas (models) of built environments.
7. Students will make reports and presentations to the class.

RESOURCES/MATERIALS:

- community resource people as guest speakers in classrooms, and as site guides
- community-at-large and specific resource sites in the community
- reference materials (print/non-print and software)
- Internet sites
- audiovisual presentations (films, filmstrips, slides, videos)
- motion picture/still photography cameras and video tape equipment used to collect field-based data
- butcher paper or large sheets of construction paper on which students will draw maps of the local community
- tourism brochures from several communities, domestic and foreign, which relate to land use planning and resources management
- atlases, maps, and globes

ACTIVITIES AND PROCEDURES: Engaged in designing built (human-made) environments which promote the creation and maintenance of cooperative living

habitats (geographical contexts within which Man and Nature mutually coexist and mutually benefit from their associations), students use the Internet to collect and read relevant news articles from www.cnn.com , www.foxnews.com , www.abcnews.com (etc.); view a variety of audiovisual presentations (films, filmstrips, videos) that depict human-made environments (cities, manufacturing facilities, highway systems, etc.) and their impact upon the surrounding natural environments; meet with community resource people at selected sites to observe and learn about Man's impact upon Nature in the local community/area; and display their knowledge of built environments by creating visual displays (bulletin boards, tabletop dioramas, slide/tape presentations, PowerPoint presentations) and presenting oral reports -- the basis for whole-class discussion and debate.

ASSESSMENT: In addition to writing reflective essays, term papers, poetry, and short stories, students will exhibit their understandings, perceptions, and value systems (as related to cooperative living habitats) by engaging in a series of meetings with elected and appointed community leaders to discuss the positive and negative impact of human-made environments upon Nature -- nearby/close to home, by creating and presenting a community-awareness campaign to local/regional inhabitants (articles to the editor of local/area newspapers, posters, a rally, a community 'clean-up' day -- involving public school students/church groups/social clubs & organizations, a student-made audiovisual presentation), and by proposing a site adoption activity -- involving students in an effort to create and maintain a model cooperative living habitat area in the local community for all to see and learn from, re: the maintenance of a lifespace environment that benefits Man and Nature.

Useful Internet Resources:
* Environmental Protection Agency
http://www.epa.gov
* Simple Living Network
http://www.simpleliving.net
* The Institute for Policy Studies
http://www.ips-dc.org

STUDYING THE ABC's OF THE ENVIRONMENT

Grade Level: All Grades

OVERVIEW: This project will promote an awareness of environmental issues and ways in which each student can help to improve our earth. Research will be done by students on a variety of topics and students will create a big book about the environment which includes an index.

PURPOSES:
1. to make students aware of the condition of our environment and what they can do to help improve it.
2. to practice research skills, emphasizing the use of an index.
3. to follow the writing process to produce a finished informative article.
4. to assemble an index for a book produced by students
5. to create an ABC Class Big Book of ways to save our Earth.

OBJECTIVES:
1. The students will demonstrate an interest in the environment and discuss ways to save it.
2. The students will complete research on at least one topic with the beginning letter which they select and write an informative article.
3. The student will contribute to the development of an index for the book and demonstrate a knowledge of it's working.
4. The student will complete a picture to illustrate the items discussed in his article.
5. The student will follow the writing process to draft, conference, edit work, and publish

RESOURCES/MATERIALS: -stencils of large letters -blank big book with 30 pages -writing paper -art supplies/construction paper
Literature books read to create the set.

Baylor, *Celebrations*
Baylor, *Desert Voices*
Burton, *Little House*
Siebert, *Mohave*
Siebert, *Sierra*
Van Allsburg, *Just A Dream*

Some of the resources made available:

Commoner, Making *Peace with the Planet*
Ehrlich, *Facing American Trash*
Heloise, *Hints for a Healthy Planet*
Jones, *Pollution: the balance of nature*
Lamb, *Two Minutes a day for a Greener Planet*
Nobile, *The Complete Ecological Fact Book*

ACTIVITIES AND PROCEDURES:

1. Students will listen to and discuss literature read by the teacher to develop a set to think about.
2. Students will select a letter to research for the book and brainstorm topics to write about.
3. Students will use materials available in the room or seek additional sources of information for their articles.
4. Students will write an informative article on their selected topic.
5. Students will select important facts form their articles to be listed in the index.
6. Illustrations will be created by the students to be used with their article in a book format.
7. Each student will be responsible for laying out and gluing in their book page which will include a large letter, an article, and illustrations.
8.

TYING IT ALL TOGETHER:

1. As a culminating activity the book is bound and each student has the opportunity to share their article with the entire class.
2. This book can be put on display in the library and might be used by other classes as a starting point for their ecology projects.
3. Have the students check the index to see how many articles discuss the same important topics; ie, demonstrate the usefulness of an index.
4. This project was timed to coincide with Earth Day.

Local Resources

Local Resources

Speakers, Videos, Educational Displays

Carlton County Soil and Water Conservation District
PO Box 29
115 5th St. South
Carlton., MN 55718
218 384-3891
E-mail: ccswcd@myexcel.com
Web Site: www.carltonswcd.org

South St. Louis Soil and Water Conservation District
215 North 1st Avenue East
Room 110
Duluth, MN 55802
218-723-4867
218-723-4731
E-mail: info@southstlouisswcd.org
Web Site: www.southstlouisswcd.org

Envirothon Coordinators
Mary Kay Anderson
103 Fire Monument Rd
PO Box 267
Hinckley, MN 55037
320-384-7431

University of Minnesota Extension Service
Carlton County Extension Service
310 Chestnut Street
PO Box 307
Carlton, MN 55718-0307
218 384-3511
E-mail*: carlton@extension.umn.edu*
Web Site:www.extension.umn.edu/county/carlton/

St. Louis County Extension Service
St. Louis - (Duluth) County Extension Service
Central Admin Bldg RM 113
215 N 1st Ave E
Duluth, MN 55802-2058
Phone: (218) 733-2870
E-mail: duluth.stlouis@extension.umn.edu
Web Site:www.extension.umn.edu/county/stlouis/

Minnesota Seagrant
2305 East 5th Street
Duluth, MN 55812-1445
218-726-6191

Environmental Protection Agency - Duluth office
6201 Congdon Blvd
Duluth, MN 55804
218-529-5075
http://www.epa.gov/med

Western Lake Superior Sanitary District
2626 Courtland Street
Duluth, MN 55806
218 722-333
Web Site: www.wlssd.duluth.mn.us

Carlton County Planning and Zoning Office
Carlton County Courthouse
Carlton, MN 55718
218-384-9176

Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4040
651 296-6157 or 888 MINNDNR
E-mail: info@dnr.state.mn.us
Web Site: www.dnr.state.mn.us

Cloquet Forestry Center
175 University Road
Cloquet, MN 55720-9594
218-879-0850 x.116
E-mail: cfc@umn.edu
Web Site: www.cnr.umn.edu/cfc

Minnesota Pollution Control Agency - Duluth office
525 Lake Avenue South
Suite 400
Duluth, MN 55802
218-723-4660
Web Site: www.pca.state.mn.us
Environmental Guide for Students: http://www.pca.state.mn.us/kids/students.html

St. Louis River Watch
Fon du lac Technical Community College
2101 14th Street,
Cloquet, MN 55720,
(218) 879-0789,
E-mail: krezanka@ezigaa.fdl.cc.mn.us

Minnesota Office of Environmental Assistance - Duluth office
Palucci Building
525 Lake Ave S Ste 400
Duluth, MN 55802
218-529-6265

Minnesota State Parks
Web Site: www.dnr.state.mn.us/state_parks/
Jay Cook State Park
500 Highway 210 East
Carlton, Minnesota 55718
218 384-4610

SEEK
Sharing Environmental Education Knowledge
525 S. Lake Ave., Ste. 400
Duluth, MN 55802
Phone: 218-529-6258
Toll Free: 1-888-668-3224
Email: seek@moea.state.mn

Other Resources

Board of Water and Soil Resources
One West Water Street, Suite 200
Saint Paul, MN 55107
(651) 296-3767;
Fax (651) 297-5615;
TTY (800) 627-3529
Web Site: www.bwsr.state.mn.us

United States Department of Agriculture
Natural Resources Conservation Service
375 Jackson Street, Suite 600
Saint Paul, Minnesota 55101-1854
Phone: (651) 602-7900
E-mail: webmaster@mn.usda.gov
Web Site: http://mn.nrcs.usda.gov/

Minnesota Department of Agriculture
90 West Plato Boulevard
St. Paul, MN 55107
651-296-6688
E-mail: alan.withers@state.mn.us

Minnesota Association of Soil and Water Conservation Districts
790 Cleveland Avenue So. Suite 201
St. Paul, MN 55116
(651) 690-9028
Fax (651) 690-9065
E-mail: maswcd@maswcd.org
Web Site: www.maswcd.org

Scientific Equipment Companies

Flinn Scientific, Inc.
P.O. Box 219
Batavia, IL 60510
Call: 800 - 452-1261
Fax: 866 - 452-1436
E-mail: flinn@flinnsci.com
Web Site: www.flinnsci.com

Carolina Biological Supply Company
2700 York Road
Burlington, NC 27215-3398
Call: 800-334-5551
Fax: 800-222-7112
E-Mail: carolina@carolina.com
Web Site: www.carolina.com

Web Sites

Web Sites

Resources on the Internet

Carlton County Soil and Water Conservation District
http://www.carltonswcd.org

South Saint Louis County Soil and Water Conservation District
http://www.southstlouisswcd.org

U.S. Geological Survey's (USGS) Water Science Web Site
http://water.usgs.gov/droplet/

North American Association for Environmental Education
http://www.naaee.org

Minnesota DNR Private Forest Management Assistance
http://www.dnr.state.mn.us/forestry/forpriv.html

Minnesota DNR Forestry
http://www.dnr.state.mn.us/forestry

Minnesota Forest Resources Council
http://www.frc.state.mn.us

Minnesota Forestry Association
http://www.mnforest.com

Cloquet Forestry Center
http://www.cnr.umn.edu/cfc

Board of Water and Soil Resources
http://www.bwsr.state.mn.us/

Natural Resources Conservation Service
http://mn.nrcs.usda.gov/

Minnesota Pollution Control Agency
http://www.pca.state.mn.us/

Minnesota Association of Soil and Water Conservation Districts
http://www.maswcd.org/

Minnesota Office of Environmental Assistance
http://www.moea.state.mn.us

Web Sites

Resources on the Internet

Arbor Day Foundation
http://www.arborday.org/trees

Project Wild
http://www.dnr.state.mn.us/projectwild
http://www.projectwild.org

Natural Resources Conservation Services (soil descriptions)
http:// soils.usda.gov

Ecology Center
http://www.ecocenter.org

Environmental Media Corporation
http://www.envmedia.com

Seagrant
http://seagrant.umn.edu

Habitat Stewards Program
http://www.nwf.org/habitats

National Tree Trust (trees for school plantings)
http://www.nationaltreetrust.org

Web Sites

Environmental Education Sites for additional lesson plans

Environmental Education on the Internet
http://eelink.net

ERIC - Educational Resources Information Center -- Environmental Lesson Plans
http://www.ericse.org/elessons.html

Chicago Academy of Sciences - Environmental Issues Forum
http://www.chias.org/www/edu/ecocit/eif.html

Central Michigan University - list of lesson plan web sites
http://www.personal.cmich.edu/~franc1m/es-geo-e.htm

Collaborative Lesson Plan Archive
http://www.faldo.atmos.uiuc.edu/CLA

Texas Natural Resources Conservation Commission
http://www.tnrcc.state.tx.us/exec/sbea/tes/lessons99/subjectlist/html

Forest Stewardship Web Site
http://www.foreststeward.org

US Environmental Protection Agency - Teachers Page
http://www.epa.gov/teachers/

Wisconsin DNR - Teachers Page
http://www.dnr.state.wi.us/org/caer/ce/eek/teacher/index.htm

Give Water a Hand - Action Guide
http://www.uwex.edu/erc/gwah/

The Groundwater Foundation
http://www.groundwater.org/GWBasics/gwbasics.htm

Web Sites

Student Activity Sites

Watershed Academy 2000 Self Test
What's wrong with this picture?
http://www.epa.gov/owow/watershed/wacademy/frans/fran.htm

Nonpoint Source Pollution
What's wrong with this picture?
http://www.epa.gov/OWOW/NPS/kids/whatwrng.htm

What on Earth? Water, Soil and Land Quiz (NASA)
http://gaia.hq.nasa.gov/quiz/quiz_start-template.cfm

The Groundwater Foundation
http://www.groundwater.org/KidsCorner/festival.htm