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ABSTRACT

This guide, for use at the junior high level, is aimed at helping our youth become more knowledgeable concerning the environment and associated problems, thus making them aware of how to solve these problems and motivating them to work toward their solution. Among the subjects discussed are art in nature, erosion, body pollution, water pollution, finding edible plants for food, outdoor cooking, noise pollution, television and the ecology image, cemeteries, watersheds, recycling, natural dyes, and aesthetics. Each learning activity includes behavioral objectives, directions to the teacher and students, materials needed, references, and a listing of related audiovisual materials. This guide is designed to help teachers effectively implement environmental education into the classroom. (BT)

Laramie County School District Number One

ENVIRONMENTAL ACTIVITIES

JUNIOR HIGH SCHOOL

Funded by

ESEA TITLE III, SEC. 306

1973

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and

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INTRODUCTION FOR JUNIOR HIGH BOOK

The environmental education activites in this manual have been prepared by teachers from Laramie County School District Number One of Cheyenne, Wyoming. They were written for the Eco-Curriculum Development and Learning Laboratory and funded by the United States Office of Education under Title III, Section 306 of the Elementary-Secondary Education Act of 1965. An identification of the author(s) has been made at the beginning of each activity.

If we are to bring man to a fuller understanding of his environment, we must embark on a comprehensive environmental educational program. This program should be aimed at: helping our youth to become more knowledgeable concerning the environment and associated problems, making them aware of how to solve these problems, and motivating them to work toward their solution.

One of the challenges to education today is to develop an effective method of implementing environmental education into our classrooms.

It is hoped that this booklet of activities may help the teacher to accomplish this goal.

The cover was designed by Kathy Montez, Johnson Junior High School.

Junior High

Submitted by Margaret L. Albert

"A TREE IS BORN"
Cartoon Interpretation of Tree Life Cycle

Behavioral Objectives:

1. The student will be able to define or identify cartooning.
2. The student will be able to sketch the structural image of a tree at various stages of cartooning.
3. The student will be able to change or modify true image of a tree into cartoons of at least two stages of growth or change.
4. The student will be able to differentiate a tree into at least eight growth stages.
5. The student will be able to reconstruct cartoons on acetate transparancies.
6. The student will be able to judge the value of the art work on the criteria of:
   a. appeal of cartoon characters or symbols
   b. animation
   c. color attention
7. The student may express a desire for follow up cartoons on another ecological or environmental subject.
8. The student will be able to draw an accurate reproduction of a tree with the degree of accuracy expected on average junior high school level.

Directions to the teacher:

Consideration should be given to acquainting students with how an overhead projector works and the use of permanent ink on acetate. Illustrations on this activity have been left out purposely so the student would not be restricted creatively.

Directions to the students:

You will need the following materials: lead pencils, several values; white drawing paper; crayons, colored pencils; felt tip markers, various size tips.

You should consider these things while working; orginality of ideas; humor; action poses and positions; unusual situations regarding tree growth.

Materials:

Any good book on the drawing of cartoons.
MacBean, John C. and others, Trees
Reston, Richard J. Jr., Rocky Mountain Trees
_____, Trees, MacDonald Junior Reference Library

Junior High Submitted by Margaret L. Albert

PROFESSIONAL ARTISTS - A STUDENTS INTERPRETATION OF POLLUTION THROUGH THE EYES OF THE ARTIST

Behavioral Objectives:

1. The student will be able to identify the styles of at least three famous artists.
2. The student will be able to distinguish and explain characterists dominate of the artist he chooses to imitate.
3. The student will be able to apply characteristics to his own interpretive sketch.
4. The student will be able to analyze the compositional structure of his sketch and relate it to the style of the choosen artist.
5. The student will be able to create and reconstruct an original sketch into a finished value drawing.
6. The student will be able to conduct a self critic within his peer group and justify his artistic interpretation.
7. The student will be able to understand and accept his own strengths and limitations regarding copying of famous artists styles.
8. The student will be able to expand small muscle and eye-hand coordination through manipulation of brush and pencil draftmanship.

Directions to the teacher:

Become acquainted with three artists mentioned in additional information or three of your own choice. Obtain several prints of work done by the artists. Suggest student research. Provide adequate materials such as drawing paper, erasers, and various values in sketching pencils. Paints, markers, colored pencils, ink, and others could be used as various substitute media.

Directions to the students:

The student will choose an artist whose work he likes. He then should give a lot of thought and observation to the environmental problem he would like to represent in his drawing. Then make a rough sketch of the problem he plans to represent as an artist. He should study closely the things noticed the most in the artists paintings such as colors, symbols, lines and size changes. Also strive for detail if needed, strong value and neatness.

Additional information that may help: destruction of natural resources as Rousseau may have viewed the environment, extinction of wildlife as viewed by James Audubon and crowded living space, noise as viewed by Andy Warhol.

Suggested artists might include Matisse, Paul Klee, Picasso, Renoir, Dali, Michelangelo, van Gogh, and Deuer.

Junior High Submitted by Clinton M. Brown

ART IN NATURE - ART DESIGNS FROM NATURE SLIDES

Behavioral Objectives:

1. The student will be able to describe the characteristics of a specific plant through art.
2. The student will be able to distinguish the characteristics of one plant from those of another by his representation of them in his selected media.
3. The student will be able to construct meaningful works using nature's lines and mass in his own creative interpretation.
4. The student will be able to select those qualities from the natural object that best portray the object in the student's style.
5. The student will be able to rearrange and thus create his own work of art based on nature.
6. The student will be able to conclude that art and nature are interrelated.
7. The student will be able to appreciate the forms found in nature as elements of design.
8. The student will be able to create a design that interprets the lines and forms found in nature.

Directions to the teacher:

The role of the instructor is to direct and guide the students as they combine nature slides with self expression. The instructor will point out interesting shapes and lines in nature. He must also teach beauty and guide the students toward an aesthetic experience.

The instructor may chose the medium or let the students select their own. The instructor should stress the abstract.

Directions to the students:

The students will take pictures from nature. If this is impossible, they may react to slides. The students should study these slides and find interesting lines and shapes that motivate them in the development of an abstract composition.

Materials:

Nature slides, camera, film, projector, chalk, paint, ink, pencil, paper, scissors and mounting boards.

References:

Film: "Art in Motion" and "Art in Nature"

Junior High

Submitted by Clinton M. Brown

CREATIVE REACTION TO "CRY OF THE MARSH"

Behavioral Objectives:

1. The student will be able to identify ecology through the impact of the film, "Cry of the Marsh".
2. The student will be able to reproduce the emotion felt during the viewing of the film.
3. The student will be able to explain and extend his feelings of the film experience through art.
4. The student will be able to solve the problem the film portrays in the way that best serves ecological practices.
5. The student will be able to recognize the fallacy that man must progress through environmental destruction.
6. The student will be able to further an expression through the universal language of art as observed by honesty in his work.
7. The student will be able to express two concerns for the welfare of this total environment.
8. The student will be able to react by creating a two-dimensional statement of the film experience.

Directions to the teacher:

The role of the instructor in the activity is to initiate thinking among the students on the subject of man's destruction on this environment. The instructor will speak briefly to the class about environment and what man has done to better or destroy his environment. The film, "Cry of the Marsh", will be shown. A brief discussion lead by the instructor will follow on expectations of the students. If the students desire, the film may be shown a second time to help them form ideas on expression of reaction. The students will select a media to express reactions to the film. After reactions are completed, the instructor will initiate a discussion on what one individual can do to stop this never ending destruction of the environment.

Directions to the students:

The student will watch the film, "Cry of the Marsh", and will react creatively. He will work in an abstract style to express his feelings. He will participate in a discussion on what he can do, as an individual, to help the environment and what can be done to stop the destruction of the environment.

Materials:

Film, "Cry of the Marsh"; projector and screen; paper for chalk; paint and ink; paint; crayon; chalk; pencils; scissors; glue; collage materials; and illustration board.

Junior High

Submitted by Clinton M. Brown

"NATURE AND POLLUTION" COLLAGE, PHOTAGE COMBINATION

Behavioral Objectives:

1. The student will be able to define the terms collage and photage.
2. The student will be able to explain through the use of collage and photage the concept that man's lack of interest is destroying nature.
3. The student will be able to relate the devastation of nature with destruction around his own home.
4. The student will be able to select those items that best show his feelings of man and his disregard for nature.
5. The student's work will be evaluated by the instructor on the basis of good design and statement of the problem.
6. The student will be able to create a design that shows his understanding of the need for concern for nature as well as basis of good design.
7. The student will be able to complete a collage or photage that shows his concern for the environment.
8. The student will be able to create a composition that follows the principles of good design.

Directions to the teacher:

The role of the teacher in this unit is to direct and guide the students with their creative expression of nature and its destruction. The instructor will guide the students in the selection of a specific area and in the use of materials for their creative expression. This unit will combine photage and collage.

Directions to the students:

The students will select an area that they wish to explore through art. The students will select photographs that show both the beauty and the destruction of their environment. They will combine sections of the photographs and materials from nature such as leaves, weeds, and seeds.

Materials:

Photographic equipment or photographs taken by others, collection of objects from nature, rubber cement, ink, paint, brushes, mounting board, and glue.

References:

Films: "Art in Nature" and "Art in Motion"

Junior High Submitted by Mary Connin

EROSION--OR WHERE HAS ALL THE SOIL GONE?

Behavioral Objectives:

1. The student will be able to select three pictures from a group of six that show erosion.
2. The student will be able to give two examples of erosion in the school community.
3. The student will be able to predict, through a classroom experiment, the amount of erosion on a dirt plot which is sixteen inches by twelve inches.
4. The student will be able to infer the quantity of runoff on an acre plot of dirt both grassed and without cover.
5. The student will be able to summarize what has happened and what could be done to prevent erosion.
6. The student will be able to criticize past practices which caused erosion and conclude how this could be corrected in the future.
7. The student will be able to seek ways to correct erosion around the school.
8. The student will be able to correct erosion problems around the school by erecting fences, using plants and installing signs.

Directions to the teacher:

Discuss different types of erosion with the class and encourage them to contribute their understanding of the problem. Show at least six pictures to the students, three of which show erosion under various conditions. Take the class on a field trip around the school to note evidences of erosion and probable causes. Build 12 x 16 boxes (page 12, Soil and Water Conservation Activities for Boy Scouts) to demonstrate how crop cover affects soil loss. Students should be encouraged to relate this to the school situation and motivated to correct their school environment.

Directions to the students:

The students should collect pictures of soil erosion. Each will then start his own notebook. This notebook will be used to record all information gathered during the activity.

Materials:

Boxes for experiment and fences for controlling erosion

caused by traffic. Fences and boxes could be made by shop boys. A forester could come to help with plantings around the school.

References:

_____, Our American Land, Agriculture Information Bulletin 321, Soil Conservation Service, Department of Agriculture 386-057.

_____, Soil and Water Conservation Activities for Boy Scouts, U.S. Department of Agriculture, Soil Conservation Service, PA 348.

_____, Teaching Soil and Water Conservation - a classroom and field guide, U.S. Department of Agriculture, Soil Conservation Service, PA 341.

Junior High Submitted by Mary Connin

IS WATER USED WISELY IN CHEYENNE?

Behavioral Objectives:

1. The student will be able to list at least three water sources in Cheyenne.
2. The student will be able to give two examples of how water is purified for use by the City of Cheyenne.
3. The student will be able to make charts showing water sources, the percentage of water furnished by each source and the cost per gallon of getting water to the consumer.
4. The student will be able to evaluate and state at least three improvements when the new facilities are completed.
5. The student will be able to explain the new water facilities including one reason for and one advantage in future plans through charts and speeches.
6. The student will be able to compare water consumption in Cheyenne with another city of similar size and circumstances at a minmum to include: 1) total gallons per day, 2) distance water travels to city, 3) consumption per day per season.
7. The student will be able to practice water conservation by using less water for domestic consumption over a two week period.
8. The student will be able to shut off all dripping faucets and will see to repairing them, if necessary, in his home.

Directions to the teacher:

Discuss the use of water and why it is important. Emphasize the fact that water will become critical by the end of the decade. Request students to make estimates of how much water is used per person per day. With the class, construct a workable chart which they could use to establish the quantity of water that each student uses.

Develop a satisfactory chart which could be duplicated and distributed to the students. The students should familiarize themselves with the charts and the aspects of water usage that they represent. Divide the class into groups and distribute questions to be discussed by each group. Each pupil should keep his own tally.

Schedule a guest speaker from the water department. Be sure he has received a list of the questions to be asked before he comes to class. Develop an interest in the subject so your students may freely ask questions.

Career education is an excellent by-product if a field trip to the water department could be planned. Also a plumber could be invited to explain his job to the students and demonstrate how to repair a faucet.

Suggested list of questions to stimulate student thought and basis for study: How much water does Cheyenne use? Where does it come from? How is it purified? What is the cost per 1,000 gallons to purify? How much water is used in the average bath? How much water is used when flushing a toilet? How much water is used while brushing teeth? How much water is used by the dishwasher? How much water is used by the clothes washer? How much water is used to water the lawn for one hour? What is the percent of water used by industry as compared to domestic consumption? How much waste is lost in one day by a dripping faucet?

Directions to the students:

Plan a chart to measure individual water consumption.

Materials:

You might invite the water department superintendent or a plumber to visit the the class. A field trip to the water plant would be beneficial.

Comments:

Encourage students to estimate answers to questions and then find out more accurate answers by figuring, measuring or research. Don't overlook the opportunities to include career education in this project.

	SUN.	MON.	TUE.	WED.	THUR.	FRI.	SAT.	TOTAL
Bath								
Toilet								
Drinks								
Teeth								
Wash								
Cook								
Etc.								
TOTAL								

Junior High

Submitted by Mary Connin

YOU ARE WHAT YOU EAT--BODY POLLUTION

Behavioral Objectives:

1. The student will be able to identify at least five fun foods with nutritional value.
2. The student will be able to give two examples of how some foods pollute our bodies.
3. The student will be able to show on a chart the proportion of useful and useless food in two selected fun foods.
4. The student will be able to devise a system of advertising two foods that will clearly identify nutrients as well as calories.
5. The student will be able to distinguish on a food label the additives and preservatives that have been added to food.
6. The student will be able to describe how corn flakes or other comparable foods are made and conclude how much nutritional value is taken out in the process.
7. The student will be able to assist in obtaining ingredients to make "Granola", a new kind of cereal.
8. The student will help make the cereal and share it with the class.

Directions to the teacher:

Explain that not only can the air, water, and earth be polluted but this can also happen to our bodies. Encourage the students to discover which foods are desirable and which are not.

Have the students bring empty labeled food containers to school including fun foods, breakfast cereal boxes and fruit juice and fruit drink cans. Study the labels so additives and preservatives can be determined.

The ingredients for the following recipe can be gathered.

GRANOLA

Preheat oven to 225 F.

6 C uncooked rolled oats
3 C dry shredded coconut
1 C raw wheat germ
3/4 C honey
½ C soy or safflower oil
1 C cold water
1 C slivered blanched almonds
1 C unsulphured raisins (optional)

In a large bowl toss first three ingredients together and mix thoroughly. Combine honey and oil and add to dry ingredients. Add cold water a little at a time. Spread mixture evenly in large heavy oiled shallow baking pan. Place on middle rack of a preheated oven and bake for two hours, stirring every fifteen minutes. Add almonds and continue to bake for another thirty minutes or until mixture is thoroughly dry and light brown in color. Cereal should feel crisp to touch. Remove cereal from oven, cool and store in a tightly covered container. Store in a cool dry place. Serve with fresh fruit or plain as a snack. Yield: 10 cups

Directions to the students:

Bring empty labeled food containers to school. Study the labels so you can identify useful and useless ingredients. Assist in getting materials to make Granola.

Comments:

This could precede or follow a study in organic gardening. A field trip to a health foods store would be beneficial. Many other associated activities are listed in The Organic Classroom.

Reference:

Rodale Press Education Services Division, 1972, The Organic Classroom, Rodale Press, Inc., Emmaus, Pennsylvania, 18049.

Junior High

Submitted by Jean E. Cooper

ADAPTABILITY OF A FRESH-WATER MICROORGANISM TO VARIOUS CONCENTRATIONS OF THE MINERAL SALT FOUND IN HIGHEST CONCENTRATION IN LOCAL TAP WATER

Behavioral Objectives:

1. The student will be able to identify the organisms used in the study when he sees them at a later time.
2. The student will be able to compute percentage concentrations of chemicals obtained by serial dilution.
3. The student will be able to predict what will happen to a population of the test protist if concentrations of chemicals in water suddenly change.
4. The student will be able to recognize the importance of the "control" in a scientific experiment.
5. The student will be able to interpret the results of observations on a protist population in terms of the effect of potential changes in concentrations of the studied chemical on fish, aquatic insects in streams and lakes.
6. The student will be able to explain the importance of the application of the results of this study in terms of long range environmental changes, man-made and natural.
7. The student will be able to effectively use the compound microscope.
8. The student will be able to efficiently prepare temporary, water mount microscope slides.
9. The student will find enjoyment in close observation of materials that can be seen with the aid of the microscope, biological and non-biological.

Directions to the teacher:

Select microorganisms which are easily obtained in quantity from available water sources, i.e. aquaria, ponds or lakes, and streams. They may also be purchased from biological supply houses. Ciliates such as Paramecian sp. or Vorticella sp. are excellent. These are large and active and it is generally easy to maintain large populations.

Cultures should be started at least a week before the study is to begin. Students should be given ample chance to get acquainted with the test organism before starting the study and to become proficient in the preparation of temporary microscope slides.

It is presumed that students will have learned to operate the compound microscope.

Obtain in the average concentrations of the mineral salts in local water supplies from the water department or whatever agency checks water quality.

Solution preparation: The control solution should be aged tap water. Concentrations of experimental salt may be prepared by serial dilution of a stock solution of known concentration. Students should be taught to make their own dilutions.

One salt concentration should be distilled water -- 0 conc. Other experimental concentrations might be: 100 x tap water, 50 x tap water, or 25 x tap water. No more than five different culture solutions should be used including the control.

Students should work in teams of two with each team observing and counting numbers of organisms in one culture unit. This allows for more counts of each unit and reduces variations in counting procedures.

It may be necessary to use a protozoan quieting compound as Protoslo or methyl cellulose. This will make it easier to observe and count the protists.

Directions to the students:

On the first day each team should, using a 10ml pipette, pipette 10ml of stock culture into 90ml of one of the four experimental culture solutions and control solution. Each team should immediately make at least ten sample slides (use one drop per slide) of their culture. Five teams will thus be able to count all the experimental concentrations plus the control.

Using the scanning objective (4x) of the microscope, count and record the number of organisms found on each slide made. This record is to be a personal record of each day's count of ten slides. Keep this record carefully so the data will be available at the end of the study to use in compiling a class record.

After completing the counts, add ten grains of dry yeast (or an equivalent weight of yeast prepared by the teacher) to the culture you are responsible for. Put an aluminum foil cap or lid over the container of solution and place it in the area designated by the teacher for the use of your class.

On days two through ten, count and record the number of test organisms on at least ten sample slides each day.

At the end of the study average the ten counts made each day and record this average on the class data table. Then graph the average counts per culture for the ten day period.

As you count the organisms, record any changes you observe in your culture.

Comments:

After completion of the laboratory activity, discussions of the meaning of the results should be conducted in terms of man-made and natural changes in the chemistry of water, why ten slides per day instead of one slide, the importance of a "control", and the mathematics of serial dilutions.

Students may see protist that are dividing, feeding, or the contractile vacuoles in action. These observations may be used to bring out the rapid rate of reproduction among protists and the ways used to reproduce in these organisms as well as the effect of water conditions on reproduction and other cell activities.

It is presumed that a Life-Science classroom will have a microscope for each two students.

The teacher should adjust the material in this activity to fit the abilities and grade level of the students.

References:

Lab. manual and text, Biological Science: An Inquiry into Life, BSCS, Harcourt, Brace and World.

Film Loop: Paramecium aurellia, Part I, regular 8 minute available from Central Science Co.

Morholt, Brandwein and Joseph, A Source Book for the Biological Sciences, 2nd ed. Harcourt, Brace and World.

Junior High

Submitted by Jean E. Cooper

EFFECT OF LIGHT ON THE GERMINATION OF "WEED SEEDS" AS COMPARED WITH GERMINATION OF SELECTED GARDEN SEEDS

Behavioral Objectives:

1. The student will be able to identify at least three different "weed" seeds and three different garden plant seeds.
2. The student will be able to recognize the importance of keeping all the conditions except the test situation as nearly the same as possible.
3. The student will be able to determine and organize the criteria to be used in determining whether or not germination has occurred.
4. The student will be able to compute the percentage of germination of the seeds.
5. The student will be able to write a paragraph about the survival value to "weed" seeds of being able to germinate in light.
6. The student will be able to explain the possible relationship between size of seed and ability to germinate in light only, dark only or in either light or dark.
7. The student will be able to follow laboratory instructions efficiently, asking questions about any procedure that is not clear.
8. The student will be able to appreciate the importance of understanding the differing environmental requirements of plants if he is to be successful in growing garden plants and reducing growth of "weeds".

Directions to the teacher:

Students should collect their own weed seeds whenever possible. Even in winter some plants will still have seeds. Wild sunflower, sheep sorrel, peppergrass, wild mustards, chickweed, shepherds-purse, Russian thistle or Canadian thistle might be investigated.

University botany departments and schools of agriculture should be able to help in the identification of seed types if the teacher is unskilled in this area.

Use of the stereomicroscope to show surface variations could be used to interest students and as a means of helping in the identification.

Plastic petri dishes will work well in this activity. They are inexpensive and can be reused a good many times if care is taken.

Many students either use too much water or let their seeds dry out in this type of activity. A major problem often is also the heating affect of the light.

If several classes are trying this study, number of seeds being tested by each team may have to be limited. If different teams use different seeds then combined data at the end of the study, good results may be obtained.

Directions to the students:

Work in teams of two or three. Collect at least 100 seeds of each kind of seed you are going to test. Weed seeds--dandelion, thistle, sheep-sorrel, chickweed, shepherds-purse, mustard, peppergrass, wild sunflower are all usable. Garden plant seeds that are convenient are tomato, pansy, snapdragon, sweet corn, radish, and marigold.

Cut circles from paper towels or blotting paper to fit the bottom of four petri dishes per seed type being used by a team. Place the circles in the bottom of the dishes and soak them thoroughly with tap water for ten to twenty minutes. Pour off the excess water and distribute at least 25 seeds of one kind in a dish. Try to use the same number of seeds in each dish. Use four dishes for each kind of seed.

Place a strip of masking tape on the bottom of each dish and label it as to kind of seed, team number and whether it is dish number 1, 2, 3, or 4. Dish 1 - Seeds will be kept in the dark throughout the study. Dish 2 - Expose seeds to continous light (24 hours per day). Dish 3 - Expose to light one hour per day. Dish 4 - Expose to light during daylight hours only. (Control)

When some seeds in dish 4 have germinated, complete the study and count germinated seeds in all the dishes and calculate percentages of germination under different light conditions.

Compare the percentages of germination among all the seeds studied under the four light conditions.

As you do this activity be thinking about answers to the following questions: 1. Did the "weed" seeds germinate better in partial light, 24 hour light or total darkness? 2. Which seeds seemed unaffected by light conditions? 3. How might seeds' response to light affect the survival ability of the species? 4. How might seed size be related to the need of a seed for light during germination?

Comments:

Some lettuce seed is light sensitive. Seeds of corn and beans show no light sensitivity.

Very few studies have been done on the sensitivity of "weed" seeds to light during germination, so it is nearly impossible to give answers to questions about what will happen or whether the seeds are doing what they are supposed to do.

Junior High

Submitted by Jean E. Cooper

POLLUTANTS IN OUR WATER

Behavioral Objectives:

1. The student will be able to identify the protist Paramecium sp. as well as other microorganisms found in fresh water ponds and streams when they see them at a later time.
2. The student will be able to make serial dilutions of a stock solution to obtain known concentrations of experimental chemicals.
3. The student will be able to recognize "controls" in experiments.
4. The student will be able to predict possible effects of the chemicals in washing compounds on fresh water organisms especially phosphate effect.
5. The student will be able to discriminate between the effect of phosphates as such and the effect of concentration of phosphate and other chemicals on fresh water organisms.
6. The student will be able to explain problems that will arise if major changes are made in the nature of washing compounds.
7. The student will be able to conduct additional studies with other types of organisms and the effects of the same and other chemical materials on these organisms.
8. The student will be able to use the compound microscope with speed and efficiency.

Directions to the teacher:

Paramecium sp. may be obtained from pond water maintained in the classrrom which came from most fresh water streams and lakes. More nearly pure cultures may be purchased from biological supply houses. However, these protists do not live as pure cultures in nature so a better control of source is the pond water.

Most detergent-producing companies have reduced phosphate content in their products, but it is possible that the substitute whitening agents may be more harmful than the phosphate excess. A question the students should be considering is "Which situation is worse--the improved growth of plants due to high phosphate levels or the destruction of organisms in water due to the substitute materials in washing compounds?"

Percentages of phosphate in some wasning compounds are known by means of independent analyses and others can be found on packages. Following are some easily obtained products.

*Calgon-75% phosphate; *SalSoda-1.0% phosphate; *Ivory-1.0% phosphate; *Brown soap-1.0% phosphate; Cheer (all temperatures)-12.3% (label); All-8.7% biodegradeable phosphrous compounds (label); Trend-no phosphate (label).

The pond water should be decanted off the soil residue so the water will be fairly clear. Do not filter.

A good culture size is 100ml of water with ten grains of dry yeast or equivalent weight added as a food supply. Different experimental cultures would be made of possibly 1ml experimental solution per 99ml of pond water culture.

Each team (in the interests of time) should use a different cleaning agent in perhaps three concentrations, 1.0%; .5%; .25%. Also each team should use a control culture.

* Analyses by University of Toronto Laboratories, report in pamphlet by Kalamazoo Nature Center Environmental Education Service, 1970.

Directions to the students:

Set up the three experimental culture solutions and a control. Make two slides of each culture per team and, using the 4x objective on your microscope, count the number of paramecia on the slides. Use one drop of culture per slide. Record the counts on the slides in a personal data record for the study. After completing the counts, add ten grains of dry yeast or equivalent weight to the cultures.

Each day for at least four days and longer if time permits, count two slides from each culture as in above instructions. After completing the laboratory work, average the two counts per culture. Try to see if there are any observable growth patterns.

Not only should the student note changes in numbers of paramecia but also note changes in kinds and number of other microorganisms in the cultures.

Each team should record the average counts in a class table which will show the effects of the experimental cleaning agents and effects of concentration of the chemicals as observed in this activity.

Comments:

There has been much talk about phosphates in washing compounds. It is known that phosphates do increase alga growth in fresh water. Little is reported on the effects of phosphates on protozoan life.

Since the late 1960's most companies making washing compounds claim to have reduced their phosphate content. Detergents and soap residues go into streams and lakes. What effect will these residues have on the protist population?

Junior High

Submitted by Jacqueline Esquibel

EMERGENCY SURVIVAL - FINDING EDIBLE PLANTS FOR FOODS

Behavioral Objectives:

1. The student will be able to describe common edible plants.
2. The student will be able to distinguish the differences between poisonous and edible foods.
3. The student will be able to demonstrate a test for determining the edibility of an unknown food.
4. The student will be able to select two common edible plants found in his own particular area.
5. The student will be able to categorize and make mounts of two edible and poisonous plants.
6. The student will be able to relate his knowledge to a mock situation.
7. The student will voluntarily discuss three ways of preparing plants.
8. The student will collect, prepare and eat an edible plant.

Directions to the teacher:

The teacher should have a good background in this area or read a handbook before presenting this activity. Introduce the activity and discuss in class. Have members of the class determine what projects they wish to work on and assign a deadline.

Directions to the students:

The student should become acquainted with plants around his home and double check on whether they are edible or not. The students should have specimens and record what they find before presenting unit to class. If necessary they should get help from some person experienced with plants in his region.

References:

Boy Scout Handbook

Girl Scout Handbook

Harrington, H. E., Edible Native Plants of the Rocky Mountains, p. 4.

Junior High Submitted by Jacqueline Esquibel

FIREBUILDING ACTIVITY

Behavioral Objectives:

1. The student will be able to select the best types of wood for cooking and heat.
2. The student will explain the proper cutting and gathering of firewood.
3. The student will be able to demonstrate one way to properly construct a fire for cooking and heat.
4. The student will be able to differentiate between the proper and improper way to extinquish a camp fire.
5. The student will be able to combine the mechanics of a man-made stove, camp stove and a campwood.
6. The student will be able to reach a conclusion as to the type of wood and the method of fire building best for him and the area in which he lives.
7. The student will voluntarily discuss two kinds of wood and their fire building properties.
8. The student will start a fire using matches and then using glass and sun.

Directions to the teacher:

Acquaint yourself with two or three outdoor methods of building a fire. Prior to introducing the activity, discuss camping and the various activities that are an integral part of camping. Divide the students into study groups and assign or have them volunteer for a specific project. Encourage students to use the library, parents, agencies to enlarge their store of information.

Directions to the students:

Collect wood and build a fire. Start the fire by using matches or magnifying glass and sun. Extinguish the fire using the improper way. Bring two samples of wood that are not condusive to fire building; explain what the properties are that keep it from burning. Ask an outdoor resource person to speak and demonstrate two ways of extinguishing a small area fire.

Materials:

Boy Scout Handbook, Girl Scout Handbook, Colorado Teachers' Curriculum Guide to Conservation.

Junior High Submitted by Jacqueline Esquibel

OUTDOOR COOKING

Behavioral Objectives:

1. The student will be able to list three common camping utensils.
2. The student will be able to create a meal without utensils.
3. The student will be able to d... ...ate a method for purifying water.
4. The student will be able to explain two effects of altitude on cooking.
5. The student will be able to determine four types of food easily adaptable for outdoor cooking.
6. The student will be able to identify at least three differences between outdoor cooking and indoor cooking.
7. The student will discuss outdoor menu planning with his peers.
8. The student will prepare processed food using utensils and using no utensils.

Directions to the teacher:

The teacher should become acquainted with various aspects of outdoor cooking in order to guide the students in setting up their own objectives.

The teacher should have resource materials readily available in the classroom and names of resource people and agencies that may be contacted on outdoor cooking.

Introduce activity to the students. Direct and guide discussion and help the students formulate objectives. Divide students into working groups and assign them an activity.

Give students free time to go to the library or work in class. Set a deadline for completion of reports, projects and speakers.

Directions to the students:

Discuss activity in class. Become familiar with your assigned project before presenting to the class.

References:

Boy Scout Handbook
Girl Scout Handbook
Harrinton, H. D. Edible Native Plants of the Rocky Mountains.

Junior High

Submitted by Linda Fleming

AESTHETICS THROUGH PHOTOGRAPHY

Behavioral Objectives:

1. The student will be able to define the following terms: aesthetic, photography, and values.
2. The student will be able to give five examples of aesthetical factors in our environment.
3. The student will be able to take five or more photographs of aesthetical factors in our environment.
4. The student will be able to select five photographs from many photographs to be used in a class display or presentation.
5. The student will be able to arrange five photographs in a sequence and then place the five photographs in a sequence established by the class.
6. The student will be able to justify in words why the five photographs should be included in the class sequence exhibit.
7. The student will be able to appreciate the aesthetic values of our environment by continuing to photograph and gather pictures of our environment.
8. The student will be able to operate a camera skillfully after reading the instructions and practicing.

Directions to the teacher:

The teacher should introduce the activity with a film showing aesthetical qualities. An example of such a film might be Our Environment 3 Aesthetics, Gerald Madigan, by E.M.C. Corporation, St. Paul, Minn. This film and record is available at the Eco-Lab.

The students should be grouped in as small a number as possible. This will depend on the availability of the cameras and film. The class sequence can be slide show, black and white print show or Polaroid show.

Directions to the students:

The student should view an introductory film concerning the activity. The student should read and learn to operate the camera from the directions.

Materials:

The necessary materials would include cameras, film, projector, and pictures already made.

References:

Contright, Edgar M., 1968, Exploring Space With a Camera, Office of Technology Utilization, National Aeronautics and Space Administration, Washington, D. C.

_____, Photography, 1969, MacDonald Junior Reference Library.

_____, Photography For Kids, Environmental Science Center, 5400 Glenwood Avenue, Golden Valley, Minnesota 55422.

Films and filmstrips

All the Difference, Eastman Kodak Co., Free loan from Kodak Colorado Division, Windsor, Colorado 80550.

Man and His Environment: In Harmony and In Conflict, 1971, Humanities, Inc., White Plains, New York 10603. The above is a filmstrip series and is available from Laramie County School District Number One film library.

Our Environment 3 Aesthetics, Gerald Madigan, by EMC Corporation, St. Paul, Minn. The Eco-Lab has a copy of this film and record.

Junior High Submitted by Linda Fleming

MICRO-ENVIRONMENT WATCH

Behavioral Objectives:

1. The student will be able to define the following terms: environment, troposphere, hydrosphere, biosphere.
2. The student will be able to estimate four observable changes on the environmental study plot.
3. The student will be able to subdivide the environmental study plot into four physical factors and variables and two biological factors and variables.
4. The student will be able to reconstruct the changes in the environmental study plot that were observable by his senses and by measurements.
5. The student will be able to explain why accurate, precise measurements are important in detecting physical and biological factors and variables in environmental changes.
6. The student will be able to work in a cooperative spirit while studying the environmental study plot by contributing one idea to a fellow student and receiving one idea from the student.
7. The student will be able to locate the same unmarked environmental study plot each observation time by using string and meter stick.

Directions to the teacher:

The teacher should decide on the grouping of the students. It is suggested they work in teams of two. He should locate an area near the school premises to use for the study plots. A recording sheet should also be prepared.

The teacher should decide on the time limit for the lab. It is suggested recordings be made every two months or every season. Too frequent recordings may cause the lesson to become routine.

The teacher should prepare a pre-lab to include discussion of the reporting form, use of terms and techniques necessary for a successful observation.

The findings of each group should be discussed with the entire class at a post-lab period. The reporting sheets should be kept as this is a long term activity.

The instructions for making a light meter and the methods for collecting animals in the soil can be found in Couchman, J. Kenneth, Mini-Climates.

Directions to the students:

The student should attend the pre-lab session concerning this activity. He will work within his group to find and locate a plot area.

The student must find an acceptable reporting form to use for the post-lab presentations. Suggested methods might include graphs, written reports, booklets, charts, etc.

Materials:

Necessary materials would include meter stick per group; meter or longer piece of string per group; thermometer per group; small jar per group; copy of Beaufort Scale of Winds per group (can be found in most encyclopedias); one reporting sheet per group; several light meters (can be shared by groups); and several light sources can be shared by groups.

References:

Couchman, J. Kenneth, 1971, Mini-Climates, Mine Publications Inc., Minneapolis, Minn., Holt, Rinehart & Winston of Canada, Limited.

Earth Science Curriculum Project, 1967, Teacher's Guide-Investigating the Earth, Houghton Mifflin Co., Boston.

Thurder, Walter A. and Robert E. Kilburn, 1966, Exploring Life Science, Allyn & Bacon, Inc., p. 9-16.

ANALYSIS SHEET

Physical Factors

Name_____ Locality _____

Class Period _____ Date _____

Observation Date _____ Time _____

Temp. Ground Level _____ Temp 1 Meter Above Ground _____

Light Meter Reading _____ Evidence of Mosture on Soil____

Amount of Litter on Top of Soil _____

Type of Litter _____ Is Sod Present?_____

Depth of Sod _____ Wind Direction_____

Soil Characteristices _____

Biological Factors

Observation Date _____Time _____

Number of Different Kinds of Plants _____

Number of Each Kind of Plants _____

Name of Plants, if known _____

_____

Number of Different Kind of Animals Observable in Soil_____

Number of Animals in 10 cm^2 of Soil _____

Name of Animals, if known _____

_____

Junior High Submitted by Linda Fleming

NOISE POLLUTION

Behavioral Objectives:

1. The student will be able to define the following terms: sound, noise, decibel, pitch, loudness, and irregularity.
2. The student will be able to give ten examples of noise pollution in the approximate decibel readings from his local environment.
3. The student will demonstrate the use of a tape recorder or a decibelmeter or an audiometer to measure the volume of a sound.
4. The student will be able to discriminate between noise and sound.
5. The student will be able to summarize the effects of ten noises on humans and wildlife.
6. The student will be able to contrast economical, industrial, and recreational noise values with medical and aesthetic noise values.
7. The student will do additional projects concerning this topic such as control devises, guitars, snowmachines, motorcycles and be able to compose a workable plan to present to school and/or city and/or state officials to control the limits of noise pollution.
8. The student will be able to operate a tape recorder and/or an audiometer or a decibelmeter skillfully.

Directions to the teacher:

The teacher should allow the students to group themselves. The number of groups will depend upon the number of recorders available. He should present an opportunity for the students to record sounds on a tape recorder. As students re-play the tape, the teacher should lead a discussion using and defining the terms necessary for the understanding of sound and noise.

The teacher should explain how a tape recorder can be used to get approximate decibel readings. Instructions can be found in Pollution, 1971, Danie F. Wentworth, et al. Students should again be allowed to make recordings and readings of sounds. The teacher should allow for class presentation on their group findings.

Directions to the students:

The student should find a group to participate with during the activity. The student should learn to operate the equipment by reading the instructions. He should construct a report to present to the class summarizing the effects of noise on humans and wildlife and constrasting economic and aesthetic noise values.

Materials:

Necessary materials include a tape recorder for each group and audiometer or decibel meter if possible.

References:

O'Donnell, Patrick A. and Charles W. Lavaroni, 1971, Noise Pollution, Addison-Wesley Publishing Co., Inc., Menlo Park, California

_____, 1972, Survival Kit-Ecology and Social Action, Harper and Row, Publishers, Inc.

Wentworth, Danie F. et al, 1971, Pollution, Mine Publications Inc. Minneapolis, Minn., Holt, Rinehart & Winston of Canada, Limited.

Junior High Submitted by Sally Lowe

COINING NEW WORDS FOR ENVIRONMENTAL ATTITUDES

Behavioral Objectives:

1. The student will be able to name several common Greek and Latin prefixes and suffixes.
2. The student will be able to explain the meaning of the words prefix, suffix and root.
3. The student will be able to show how progress in one area of environmental preservation is related to attitudinal change.
4. The student will be able to distinguish a root word from a common prefix.
5. The student will be able to combine a common suffix and/or prefix with a new root to coin a new word.
6. The student will be able to explain his newly coined word to others, giving examples of the word's usage.
7. The student will relate specific human attitudes and their environmental results.
8. The student will construct a word which relates attitude and environmental results of that attitude.

Directions to the teacher:

The study can begin with the introduction of Latin and Greek suffixes and prefixes to the class. An explanation of the word suffix, prefix and root should ensue. Root words can be suggested by students and prefixes and suffixes attached to these root words to change their meaning. Common Latin and Greek roots and prefixes are listed at the end of the explanation of this activity.

The pamphlet, LIFE PASS IT ON: How You Can Help, can be introduced. This pamphlet lists various things that the average individual can do to help the environment. Students can be asked to name the bad habits which correspond to each suggestion for improvement. For example, the suggestion "Water at night and only as much as necessary to avoid evaporation" suggests as its other extreme the habit of turning on the sprinkler at midday and forgetting it, allowing water to run off into the gutter.

Ask each student to write a short paper defining a common problem of waste of resources which they have observed, and proposed solutions to that problem.

Now students are ready to coin a new word. They may use their problem or a problem they have read about in the pamphlet. Using the prefixes, suffixes and roots they have studied they can combine familiar and unfamiliar parts of a word to make a new term which describes the attitude behind the problem. For example, the problem described

above might be defined by the new term: "hydrounthink" which actually describes the attitude behind the problem.

As students begin to search for terms to combine, a short lesson in etymology may be necessary, showing them how to find the roots for words and the derivation of words in the dictionary.

Now students are ready to present their words to the class and to see if the class can guess the problem each word relates to. The words can later be put on posters as cartoons or definitions, with a specific example for each words meaning provided. If a school newspaper exists, the words could be submitted as a weekly feature with an accompanying cartoon or definition.

Directions to the students:

Have a clear picture in your mind of an everyday action which illustrates the word you are going to coin. The class may have suggestions for improving your coined word. Can you find a picture or draw a cartoon which illustrates your word?

Materials:

LIFE PASS IT ON: How You Can Help This pamphlet can be obtained by writing to the U.S. Environmental Protection Agency, Rocky Mountain Prairie Region, P. O. Box 2999, Denver, CO. 80210

Dictionary

Source for common roots and prefixes is Warriner's English Grammar and Compostion by John E. Warriner (Harcourt, Brace & World, Inc., 1963). See the chapter on "Enlarging Your Vocabulary".

Poster board or construction paper, if desired.

The following examples of prefixes and roots were taken from Warriner's English Grammar and Composition.

Latin Prefixes

ab,a	from
ad	to
bi	two
circum	around
com, con	together, with
contra	against
de	from
di, dis	away, from
e, ex	out, of
in, im	in, into, not
inter	between, among
intra	within
non	not

per	through
post	after
pre	before
pro	before
re	back, again
retro	back
semi	half
sub	under
super	above
trans	across

Greek Prefixes

anti	against
hyper	over, above
em, en	in
hemi	half
hypo	under
para	beside
pro	before
syn	together

Latin Roots

cid	kill
cur	run
miss	send
vis	see
fac, fact	do, make
junct	join
vert, vers	turn

Greek Roots

chron	time
anthrop	man
gen	birth
geo	earth
hetero	different
homo	same

Junior High Submitted by Sally Lowe

NATURAL SOUNDS AND RHYTHMS IN POETRY

Behavioral Objectives:

1. The student will be able to define onomatopoeia.
2. The student will be able to explain one way in which rhythm contributes to the meaning of a poem.
3. The student will be able to use sounds to change the meaning of a sentence.
4. The student will be able to identify onomatopoeia in a poem.
5. The student will be able to rearrange sounds to produce different meanings.
6. The student will be able to describe the sounds and rhythms of a natural phenomenon and to relate these sounds to a main idea.
7. The student will identify rhythm and sound as an essential part of natural phenomena, and will look for ways to include a natural sound or rhythm in his poetry.
8. The student will be able to assemble natural sounds into a poem, to make a poem using natural sounds and rhythms.

Directions to the teacher:

Introductory Exercises

Have students close their eyes for several minutes and listen. Then they can write down words that describe the sounds they hear. Ask students to describe common nature sounds such as rain, wind, ocean with words or words in rhythm. Ask students to suggest words which sound like the things they are: whisper, growl, zoom, hush, croon, sneak, rock-a-bye, ocean, echo, whoosh, bang, whippoorwill and bark.

Discuss the difference between whispering tree and stout tree. What different sounds do students hear? How does this difference in sound change the meaning of what they hear. Ask students to draw an imaginary malumba and an imaginary tikiti, after listening to and repeating the sound of the words several times. Malumba is usally produced as a round, full soft shape. Tikiti is sharp, angular, smaller and more complex. Discuss with students how the sound of a word affects what we imagine.

Main Exercises

Introduce the concepts of rhythm (measure or beat) and onomatopoeia (the coining or use of words that imitate the sound of a thing.) Relate these words to the introductory exercises.

Introduce a poem such as "Cheers". Ask students to pick out onomatopoeia as it occurs in the poem. Introduce a poem such as "Seal", with certain words left out. Ask students to think of words to describe the sounds that are occurring in the poem and to fill in the blanks with these words. Students can then compare their inventions with the words the author used in the poem.

Final Exercises

Ask students to think of or to make up words which could describe a cow, hippo or other large slow animal with a low sound. Write these words on the chalkboard under the name of the animal. Ask students to choose sounds and words for a bird and make another list on the blackboard. What kind of rhythms would students associate with each kind of animal? Slow or fast? Simple or complicated? Students can then write a four line poem about one of the animals using the words on the board. Point out that students are using sounds and rhythms in the poems to reinforce their main ideas about the animals.

Now reverse the animals' names above each list. Students will see the humorous effect of using heavy sounds to describe a light animal and so on. Do sounds affect our mood when we think about things? Now is the time for a humorous short poem about one of the animals, using the words that are now below the animal's name.

A visit out-of-doors is in order now: to a zoo, a park or the Eco-Lab. Students can collect words and rhythms that describe natural sounds. Later they can write short poems using some of the natural sounds they have heard.

Materials:

Pencil, paper, chalkboard, and poems such as "Jabberwocky" by Lewis Carrol, "The Skater of Ghost Lake" by William Rose Benet or "hist shist" by e.e. cummings which use natural sounds and rhythms to reinforce meaning. Songs which use rhythm and sounds of nature to express meaning, such as, "Blow Wind Blow" by the Kingston Trio or "Summer Breeze" by Seal and Crofts.

Comments:

An album called "Country Loving Folk" by Mystic Moods can bring some natural sounds into the classroom. Students can then make up words to imitate the sounds.

Both poems, "Cheers" and "Seal", are taken from REFLECTIONS ON A GIFT OF WATERMELON PICKLE ..., compiled by Stephen Dunning, Edward Lueders and Hugh Smith (Scott Foresman and Company, 1966).

Cheers

by Eve Merriam

The frogs and the serpents each had a football team,
and I heard their cheerleaders in my dream:

"Bilgewater, bilgewater," called the frog,
"Bilgewater, bilgewater,
Sis, boom, bog!
Roll 'em off the log,
Slog 'em in the sog,
Swamp 'em, swamp 'em,
Muck mire quash!"

"Sisyphus, Sisyphus," hissed the snake,
"Sibilant, syllabub,
Syllable-loo-ba-lay.
Scylla and Charybdis,
Sumac, asphodel,
How do you spell Success?
With an S-S-S!"

Seal

by William Jay Smith

See how he dives
From the rocks with a (zoom!)
See how he (darts)
Through his watery room
Past crabs and eels
And green seaweed,
Past fluffs of sandy
Minnow feed!
See how he swims
With a (swerve) and a twist,
A flip of the flipper,
A (flick) of the wrist!
Quicksilver-quick,
Softer than spray,
Down he (plunges)
And sweeps away;
Before you can think,
Before you can utter
Words like "Dill pickle"
Or "Apple butter",
Back up he swims
Past sting-ray and shark,
Out with a zoom,
A whoop, a (bark);
Before you can say
Whatever you wish,
He (plops) at your side
With a mouthful of fish!

Junior High

Submitted by Sally Lowe

SUPERMARKET DICTIONARY

Behavioral Objectives:

1. The student will be able to define the word additive, and he will be able to name several common additives.
2. The student will be able to distinguish between natural food and foods containing chemicals and additives.
3. The student will discover some products which do not list ingredients.
4. The student will differentiate between advertising words and words which describe actual food value.
5. The student will compile a vocabulary list of words from the supermarket and their definitions.
6. The student will compare advertising terms humorously by using the "Measure for Measure" device.
7. The student will be aware of and look for the hidden costs and ingredients of food.
8. The student will assemble, in cooperation with other students, a supermarket dictionary.

Directions to the teacher:

A short pretest can be given or a discussion can be held about terms commonly used in describing food, such as: saccharine, staple, synthetic, additive, caffeine, choice (meat), gram. Students can add words they have heard or seen in relation to food and which they do not understand.

Before making the trip to the supermarket, separate the vocabulary investigation into three areas: (1) terms of measurement or quality, (2) ingredients, (3) advertising words. Ask the students to discuss the difference between these areas. Select a product and give examples of each area in relation to the product. Each student will then choose one area as his area of investigation. Students should make a note next to each new word they find about where they saw the word used.

Each student should be able to find a substantial list of unfamiliar words at the supermarket. Next, the student will attempt to define his words. A lesson on the requirements of a good definition is in order here. Sources could be books on nutrition, general dictionaries, science dictionaries, news articles, and other teachers should be made available to students during this period.

The student should find and write a definition which pertains to food products and should then write a sentence which contains a concrete example from his own experience of the word's use.

There will be a natural division of students into groups by the area they have chosen to investigate, and students can work in groups while defining their word lists and assembling these lists into a dictionary if this is desirable. In this case, the end product will be a three-part dictionary with a separate section for each area of investigation. Or groups can be set up to assemble the dictionary with each group taking a section of the alphabet.

Directions to the students:

At the supermarket today, you will be making a list of words you see which describe food products. Later, you will try to find information about these words and to write a definition for each word. The class will put together a dictionary using the words we have found. The dictionary will be useful tool when shopping; it will give a better idea of what we are buying.

While you are hunting for your words, be on the lookout for some other answers. Do you notice any packaged foods which do not list ingredients? If a food, such as fruit or meat, does not list any ingredients, does this mean that there are no additives? You might want to ask the store clerk or manager. Does the package always give you a fair impression of what is inside? Which products do you find that have the longest list of ingredients.

Start your list with the word additive. This is a word that we all need to know. Try to gather as many words as you can. Remember to write next to each word where you saw the word, what product it was telling about. Stick to your area of investigation.

Materials:

Some stores can provide pamphlets and other materials about food terms. Essential materials include paper, pencils, good dictionaries, an encyclopedia, and some science reference books and books about nutrition.

Bethel, May, 1968, How to Live in Our Polluted World, Pyramid Books, pp. 7-18, gives a good introduction to food and drink additives, simply written.

Comments:

The Measure for Measure exercise shown below can be used as an optional follow-up exercise. Students can compose their own Measure for Measure scales using the terms for measurement or quality and especially the advertising words.

It is a good idea to enlist a chemistry or science teacher to visit the class and to answer questions about chemical terms.

Another optional follow-up exercise would be to discuss alternatives to buying prepared foods. The class could become involved in research on growing their own food or could visit a food cooperative or a health food store.

MEASURE FOR MEASURE

By Joe Ecclesine

Political Opponent's Measure

2 nincompoops equal 1 fathead
2 fatheads equal 1 incompetent
3 incompetents equal 1 opportunist
2 opportunists equal 1 machiavelli

Historical Invective Scale

2 scamps equal 1 rascal
3 rascals equal 1 knave
2 knaves equal 1 varlet
4 varlets equal 1 scoundrel
2 scoundrels equal 1 charlatan

Junior High

Submitted by Julie Luhr

CEMETERIES AND THEIR VOICES FROM THE PAST

Behavioral Objectives:

1. The student will be able to define "cemetery" and "epitaph" and identify correctly the markings used on tombstones.
2. The student will be able to paraphrase at least one epitaph and interpret at least one set of facts on a tombstone.
3. The student will be able to predict and relate historical facts of significance from at least three tombstones.
4. The student will be able to select a family or person on which to base an original, creative composition.
5. The student will be able to write a creative composition.
6. The student will be able to judge the adequacy with which conclusions have been drawn in his composition and at least one other student composition.
7. The student will be able to read additional information concerning local population growth or environmental conditions voluntarily.
8. The student will be able to write in an acceptable manner.

Directions to the teacher:

The teacher should be familiar with the particular cemetery to be visited as well as the historical make-up of the area. Also prepare a map of the points of interest to be covered in the visit.

Directions to the students:

You are to imagine what life would be like for a particular person whose tombstone you find in the cemetery. Write an original composition in which you describe and narrate, using either first person or third person point of view, the main concerns, problems facing the person. Concentrate on how the individual views and feels about his surroundings and environment.

Junior High

Submitted by Julie Luhr

TELEVISION AND THE ECOLOGY IMAGE

Behavioral Objectives:

1. The student will be able to identify the following basic genres of television shows: the soap opera, situation comedy, and dramatic series.
2. The student will be able to give at least one example of a current television program for each TV genre.
3. The student will be able to, from observation, discover conscious or unconscious ecological misuse on at least one of the genres of TV programs.
4. The student will be able to point out the likely consequences of the conscious or unconscious action seen on the television program.
5. The student will be able to rewrite the script involving the ecological misuse in such a way as to make it ecologically beneficial.
6. The student will be able to explain why his alternate method follows sound ecological practices.
7. The student will be able to write a letter to the network carrying the program and relate to the network his observation and his suggestion for correction.
8. The student will be able to write in an acceptable manner.

Directions to the teacher:

If a television is available for classroom use, watch a program and discuss as a class ecological actions--both conscious and unconscious. Stress that what is seen was not likely intentionally written into the script, but that nonetheless we, as viewers, are influenced directly and indirectly by what we watch.

Directions to the students:

Select and view either a soap opera, situation comedy show, or a dramatic televison series. Watch for such things as how waste is disposed of, fuel and electricity is consumed, automobiles and other vehicles are used--actions that can be traced to water, land, air, or noise pollution. Generally what you view will be unconsciously written into the script. Your job is to rewrite the scene, changing (be subtle) the negative ecological action to a postive action.

Junior High

Submitted by Frances Mosher

THE JUNKED CAR

Behavioral Objectives:

1. The student will be able to define the following words: renewable, nonrenewable, reclaimable, and recycle.
2. The student will be able to give two examples of how he would benefit by the alleviation of junked car pollution in our city.
3. The student will be able to demonstrate, either orally, visually, or both, one method of recycling a resource from junked cars.
4. The student will be able to illustrate at least six of seven materials a representative junked car contains that can be recycled and the proportion of each substance.
5. The student will be able to propose or revise a plan for salvaging junked cars in Cheyenne.
6. The student will be able to criticize the method(s) Cheyenne uses in either alleviating junked cars or recycling junked cars and propose a solution.
7. The student will be able to volunteer to plot locations of junked cars on a classroom map of Cheyenne.
8. The student will be able to locate junked cars on a individual map of the city.

Directions to the teacher:

This would be a good section to use to reinforce any unit on recycling since it is an immediate problem in our area. These activities could be used to meet the above objectives.

To learn the basic terms concerned with recycling resources, read and discuss pp. 130-140 and pp. 147-152 in Interaction of Man and the Biosphere. The "Recycling Resources" kit shows the basis of recycling all resources, including those found in automobiles. The second filmstrip and the game make this point.

Have the students find the location of junked cars. Plot this on an individual map of the city. City maps can be obtained from the Chamber of Commerce, funeral homes or printing companies. Then have groups of four students compile a group map. Plot the class data on the large wall map of Cheyenne.

Have resource people come to class to discuss the problems of junked cars, the useful materials found in them how they are taken care of, and some possible solutions. Allow a question and answer period. The presentation of the resource person could be video-taped so other classes could benefit. Some suggestions for resource people are the

mayor, a council member, or a junked car dealer. Follow with a class discussion.

Have a variety of pamphlets on recycling materials about automobiles available so that the students can read, discuss, and briefly report to the class orally, visually, or both on the topic they studied.

Have groups of four students discuss and criticize methods of dealing with junked cars in Cheyenne. Discuss how cars can be salvaged and propose or revise a plan for salvaging junked cars. Make a chart or poster showing or telling of the plan. Display all the class plans.

Directions to the students:

Read in Interaction of Man and the Biosphere, pp. 130-140 and pp. 147-152, and be able to orally discuss what you have read.

The following filmstrip shows why we need to be concerned about recycling our natural resources. Watch the filmstrip. Do not take notes, but be prepared to discuss the importance of recycling.

You have been given a map of Cheyenne and the surrounding area. You are to find the location of junked cars and plot that location on the map by marking an "x". A "j" will represent a junked car lot. Now form groups of four and compile your information and make a group map. At least one volunteer from each group can plot the data on the classroom map.

Mr. Resource Person has come to our class to discuss the problems of junked cars, what materials junked cars contain, how they are taken care of here, and some possible solutions. You will have time to ask him some related questions. We will have a class discussion on the main points.

Here are pamphlets concerning some phase of recycling materials in automobiles. You are to form groups and choose a pamphlet to read, discuss and give a brief report to the class orally, visually, or both.

In groups of four, criticize methods of dealing with junked cars in Cheyenne. Discuss how cars can be salvaged and propose or revise a plan for salvaging junked cars. When you have agreed on a plan, make a poster or chart showing or telling of your plan. Your group will give a summary of your plan to the class.

Materials:

Interaction of Man and the Biosphere, textbook; Recycling Resources" kit; city maps, individual maps and one large wall map; large poster-sized paper; variety of pamphlets, can be obtained from can companies, glass manufacturers, beverage companies, conservation groups, groups interested in ecology, air quality boards, Game and Fish, Environmental Protection Agency, Bureau of Mines and others.

Comments:

A suggested evaluation would be by class discussion, group reports and projects and by a test that is both subjective and objective.

References:

Filmstrip, manuals and game

_____, 1971, C. Richard Heath Associates, Inc., Continental Can Company, Inc.,

Useful books and magazines

Abraham, Norman, Richard G. Beidlemen, John A. Moore, Michael Moores, and William J. Utley, 1970, Interaction of Man and the Biosphere, Rand McNally and Company, Chicago.

_____, Automobile Scrapping Processes, U.S. Department of Health, Education and Welfare, Public Health Service Publication, No. 2027.

_____, August 1970, Man's Control of the Environment, Congressional Quarterly Review, ed. Pynter, Washington, D. C.

Dean, Karl C. and Joseph W. Sterner, December 1969, Dismantling a Typical Junk Automobile to Produce Quality Scrap, Bureau of Mines, Department of the Interior.

Grinstead, Robert R., April 1972, "Bottlenecks", Environment.

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_____, October 1970, "Junk Car Disposal", Sub Council Report, National Industrial Pollution Control Council.

Lovering, T. S., 1971, "Non-Fuel Mineral Resources in the Next Century", Global Ecology, Harcourt Brace Jovanowich, Inc.,

Meyer, Judith G., September 1971, "Back in Circulation", Environment

_____, 1972, Survival Kit-Ecology and Social Action, Harper and Row, Publishers, Inc.

Useful pamphlets

_____, "Aluminum Recylcing Program", Adolph Coors Public Relations, Denver, Colorado

Clark, Thomas D., "Economic Realities of Reclaiming Natural Resources in Solid Waste", U.S. Environmental Protection Agency, 555 Ridge Ave., Cincinnati, Ohio 45313.

_____, "Glass Containers--The Ideal Ecological Package", Glass Containers Manufacturers Institute, 303 Madison Avenue, New York.

_____, "Glass Recycles", Glass Containers Manufacturers Institute, Inc. New York, NY.

Gwynne, Peter, 1971, "How Do You Get Rid of 3.5 Billion Tons of Waste a Year?", Reprint from the World Book Year Book.

_____, "The Recycler's Handbook", The Can People American Can Co., Continental Can Co., National Can Co., and Jukin Can Co.

_____, "Valued Resource", M & T Chemicals, Inc., Subsidiary of American Can Co.

Junior High

Submited by Frances Mosher

OBSERVING DIFFERENCES IN TREES

Behavioral Objectives:

1. The student will be able to describe six of the seven characteristics observed in one tree.
2. The student will be able to give four examples of how two trees differ.
3. The student will be able to compute the height of trees using the 45, 45, 90 degree triangle.
4. The student will be able to point out at least one effect that changing seasons might have on a characteristic of trees.
5. The student will be able to categorize fifteen leaves into simple, compound, or needle-like.
6. The student will be able to contrast deciduous and coniferous trees by giving three differences.
7. The student will be able to answer oral and written questions regarding data about trees recorded in his notebook.
8. The student will be able to construct a 45, 45, 90 degree triangle.

Directions to the teacher:

This activity is designed to make students become more critical of their environment. It could be done once during each season to compare trees changing with the seasons. Of course, there are some activities, such as leaf shapes, that can only be done in the fall and spring. These activities would be helpful to do before learning to classify trees.

Find an area around school or a city park where there are many species of trees, both young and old, deciduous and coniferous trees. Label the trees A, B, C, etc., with cardboard markers. Map the area so the same trees will be observed each time. The "Directions to the students" should be handed out to each person. Follow with class discussion of the characteristics of each tree. Show they changed from the previous observation, and how the season change could have affected the trees. Some activities that can be done to meet the above objectives are:

Height of trees. Compare the heights of mature trees of different and the same species. Compare the heights of young and old trees of the same species. To actually get an approximation of the height, make a 45, 45, 90 degree triangle from corrugated cardboard. Follow the directions for calculating height in Trees, p. 3.

Bark characteristics. Compare the bark of trees of different ages, different species, and on different sides

of trees. See whether the lenticels are horizontal or vertical. The color of the bark is characteristic. Obtain from a paint or hardware store, a color chart of wood to help compare color. Look at the cracks. Are they vertical, horizontal, or diagonal? Place a piece of paper on the bark. Rub the paper with the side of the crayon. The bark pattern will be copied for later reference. To make a permanent plaster cast, take modeling clay or plasticene and press it on the bark for the mold. Then pour plaster on the mold to set the bark pattern. (MacBean, et.al. 1972)

Shape of trees. Observe the branch shape of as many species of trees as possible. Make sketches of each in notebook. Some groups can make models of the trees using straws and toothpicks.

Branch arrangement. Are the branches on the main stem alternate, opposite, or whorled? You will have to show students what these look like. The model made in the bark characteristics activity can be extended to show the arrangement of branches. If the branches are broken off, look at the buds, bud scars, or branch scars.

Buds. Look at the bud arrangement. How many scales does each bud have? What is the terminal bud arrangement?

Leaves. Observe and compare the arrangement of leaves on the branches. Are they alternate, opposite, or whorled? Each leaf has a bud. Are the leaves simple or compound (containg leaflets)? What is the shape of the leaf? Have the student make a collection of leaves in their notebooks.

Fruits. Find out what type of fruit, if any, each tree produces.

Directions to the students:

We are going to the park. I have labeled fifteen trees A, B, C, etc. We will be observing these trees for about a week. In January and in May we will observe them again. You are to keep data of the seven characteristics for each tree in your notebook.

Height of trees. Before we go to the park, each pair is to make a 45, 45, 90 degree triangle from cardboard. Please follow the directions for making these and using them. Measure the heights of as many of the trees as possible, young or old, and different species. Be sure to record data.

Bark characteristics. Look at the bark on all the labeled trees. Compare the color of the bark to the color charts. Observe the bark cracks and lenticels of each tree. Are the horizontal, vertical, or diagonal? Take the paper and place on the bark. Rub the paper lightly with the side of a crayon. You will have pattern of the bark for your notebook. Each group will make a clay mold of one tree. Then a plaster cast will be made back in the classroom. To make the mold, press the clay on an area of 6" x 6" on the bark.

Shape of trees. Sketch the shape of the branches of the trees. Each group will make a model of the tree shape

using straws and toothpicks.

Branch arrangement. Look at the branch arrangement. Are the branches on the main stem alternate, opposite, or whorled? If the branches are broken off, look for branch scares, buds, or bud scars. Make your model so it will show the branch arrangement.

Buds. Look at the bud arrangement. How many scales does each bud have? What is the terminal bud arrangement?

Leaves. Observe and compare the arrangement of leaves on the branches. Are they alternate, opposite, or whorled? Are they simple or compound? Each leaf has one bud. If there is more than one leaf per bud, then the leaf is compound and each "leaf" is a leaflet. What is the shape of the leaf? Are the leaves needle-like? Make a collection of leaves of the different trees in your notebook?

Fruits. Find the fruit of as many trees as possible. Make a sketch of each or a collection of the fruits.

Materials:

Corrugated cardboard (12" x 12"); scissors, yard or meter stick; labels for trees; white paper (8" x 11"); crayon; clay or plasticene; plaster of paris; drinking straws; toothpicks; color charts of wood and notebooks.

Comments:

Evaluation would be by a combination of student participation, student notebooks projects of each group, and a test that is objective.

References:

MacBean, J. C., A. Stecher, D. F. Wentworth, and J. K. Couchman, 1972, Trees, Holt, Rinehart and Winston of Canada, Limited, pp. 29-30.

Miller, Howard A. and H. E. Jaques, 1972, How to Know the Trees, Wm. C. Brown Company, publishers, Dubuque, Iowa.

Northern, Henry T., 1958, Introductory Plant Science, The Ronald Press Company, New York, pp. 100-115, 191-201, 634-645.

Porter, C. L. 1964, Wyoming Trees, Circular 164R, Agricultural Extension Service, University of Wyoming. Laramie, WY.

Preston, Richard J. Jr., 1968, Rocky Mountain Trees, Dover Publications, Inc., New York.

_____, Series: Trees, (color slide set), J. Weston Walch, Publisher, Portland, Maine 04104.

Junior High

Submitted by Frances Mosher

TREE-RELATED CAREERS

Behavioral Objectives:

1. The student will be able to list five tree-related careers.
2. The student will be able to summarize the training requirements for two tree-related careers.
3. The student will be able to predict the need for two tree-related careers in the future.
4. The student will be able to point out how five careers are related to the environment.
5. The student will be able to compile information about one tree-related career into a report.
6. The student will be able to summarize his tree-related career in an oral report to the class.
7. The student will ask questions about a tree-related career.
8. The student will be able to operate the reader-printer machine correctly.

Directions to the teacher:

Careers should be taught with each unit and not as a unit in itself. This activity is designed to follow the activity on "Observing Differences in Trees". The basic form can be adapted to be used with most units. Some games, slides, and films can be used. See "Career Education in the Environment" for a listing of films and other resources.

Before starting the unit, construct a bulletin board letting students help. The bulletin board should consist of a tree with pictures of people doing work in tree-related careers at the bend of the branches. Also, names of careers should be at the end of branches. Add to the bulletin board as other careers are discussed by the students.

To stimulate the students thinking about careers, have a class discussion using questions similar to those under "Directions to the students". After a discussion have the students do research on one of the careers. Reports might include a job description, training, income, advancement and places of employment. Summary reports should be made to the class so all the students may benefit.

Directions to the students:

Related Questions	Some Related Careers
How do we decide what kind of trees to plant in the park? How do we keep these park trees healthy and growing? What happens if a tree becomes unhealthy?	Landscape architect City planner Soil conservationist Water conservationist Florist Nurseryman Gardener Botanist Tree surgeon Clerical worker
You have observed some common trees in our city parks. What kind of trees have you seen on our state and national parks? Did someone plant these? Who? Who decided what trees to plant and where to plant them? Who takes care of these trees? Why did more trees need to be planted? disease, fire, insects, lumber, etc. Who helps when a fire sweeps the forest? Who helps treat or prevent disease and insect damage? Who cuts the lumber? How do we decide how much lumber to cut? Where is the lumber cut?	Forest Service Ranger Forester Surveyor Statistician Technician Firefighter Accountant Clerical worker Game and Fish Personnel Zoologist Botanist Ecologist Wildlife manager Lumber jack Machinery operator Safety engineer Politican
When the trees are cut, what happens to the wood in our area? What processes does a tree go through at a saw mill? When trees are made into lumber, how does it get to the lumber yards?	Railroad worker Truck driver Clerical worker Accountant Safety engineer Machinery operator Burner operator Saw operator Stock clerk

Related Questions

Who deals with the lumber at the lumber yard?

What is probably one of the major uses of lumber in Cheyenne?

Do all types of wood have the same use?

How do we decide what to do with certain types of wood?

Some Related Careers

Shipping clerk
Building contractor
Carpenter

Materials:

Bulletin board materials

References:

_____, 1967, Encyclopedia of Careers and Vocational Guidance, Vol. I, "Planning Your Career" ed. William E. Hopka, J. G. Ferguson Publishing Company.

_____, 1967, Encyclopedia of Careers and Vocational Guidance, Vol. II, "Careers and Occupations", ed. William E. Hopka, J. B. Ferguson Publishing Company.

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_____, 1971, Careers, The Institute for Research, (series of booklets), Chicago.

_____, 1964, Occupational Briefs, Science Research Associates, Inc. Chicago.

_____, Occupational Outlook Handbook, Superintendent of Documents, U.S. Government Printing Office Washington, D. C.

_____, Career Education in the Environment (handbook), Olympus Research Corporation, Superintendent of Documents, U.S. Government Printing Office, Washington, D. C.

_____, Career Education in the Environment, Olympus Research Corporation, Salt Lake City. #1A "The State of Our Environment", #2B "Solutions to Environmental Problems", #3C "Career Implications of Solutions to Environmental Problems".

Junior High Submitted by Karen J. Patterson

DESIGN A TOTALLY FUNCTIONAL ARCHITECTURE

Bheavioral Objectives:

1. The student will be able to describe five principles of architecture.
2. The student will be able to give ten examples of functional architecture.
3. The student will be able to discover methods to express himself in architectural design.
4. The student will create an imaginative design that fits the demands of his climate.
5. The student's architectural design will be appraised by the student and the instructor on the criteria: elements of design, ease of construction, relating to the environment, use of materials and livability of design.
6. The student recognizes the role of systematic planning in solving problems.
7. The student will be able to create an architectural design that expresses his personality.

Directions to the teacher:

The role of the instructor is to direct and guide the students through an understanding of sound and beautiful architecture. The teacher must explain functionalism along with beauty and point out the absolute need both must share. The teacher must make students aware of their environment and how architecture should fit this environment gracefully.

Directions to the students:

The student will develop an architectural structure that meets a personal need such as a home, or a structure that fits a need in the community. This design must be functional, beautiful, and totally acceptable in relation to a given environment.

Materials:

Paper, pencil, T-square, triangle, drawing board, pen, ink, water colors, scale rule, and mounting board.

References:

Articles and books on and by Frank Lloyd Wright and Paul Solarie, The Dome Book 1 and The Dome Book 2.

Junior High Submitted by Karen J. Patterson

NATIVE CLAY AND HAND BUILT CLAY FORMS

Behavioral Objectives:

1. The student will be able to describe the composition of clay and how it can be formed by hand.
2. The student will be able to recognize clay that can be used in an art medium as found in nature.
3. The student will be able to take the classroom techniques of working with native clay and apply it to his personal use.
4. The student will be able to describe at least three characteristics of decomposed feldspar.
5. The student will be able to identify qualities of two native clays.
6. The student will be able to distinquish between low and high fire clays.
7. The student will be able to identify which native clay could be used as glaze on other native clays.
8. The student will be able to select those native clays that can be used as art media when presented with a display of six clays containing three that can be used as an art media.
9. The student will be able to plan systematically for the search for various clays, listing the following: selection of location, equipment, method of recovery, and transportation.
10. The student will be able to learn to mold and build in the medium and become knowledgeable of the many techniques used.

Directions to the teacher:

The role of the instructor in the unit is to introduce clay as a natural material. The instructor is to help the student gain proficiency in working with clay and an understanding of the medium. The student's understanding of the natural clay will help the student when working with clay.

Directions to the students:

The student will locate, dig, mix and use natural clay. He will discuss the merits of the local clays. He will discover which natural materials can be used for embellishment for pottery. The clay will be formed by hand and then fired in a wood or pit type kiln.

Materials:

Geological survey maps, shovels, wire screen, water, burlap, rolling pins, boards for drying of clay, sponges, wood for firing, brushes, and buckets.

Junior High

Submitted by Karen J. Patterson

NATURAL DYE AND MACRAME

Behavioral Objectives:

1. The student will be able to identify four basic macrame knots.
2. The student will be able to identify eight plants that can be used for fabric dye.
3. The student will be able to distinguish between natural and commercial dyes and fibers.
4. The student will be able to select colors from dye that excites and satisfies his aesthetic values.
5. The student will be able to propose a plan for dying fibers and making a wall hanging.
6. The student's design and the use of color will be evaluated by himself and the instructor on the basis of composition and use of color.
7. The student will be able to select those plants that can be used for dye in his planned design.
8. The student will be able to design a hanging using natural dye and macrame.

Directions to the teacher:

The role of the instructor in this unit is to introduce the dying of fibers. The instructor will help the students select those natural items that will produce satisfactory dye. The instructor will help the students design a hanging that is both an example of good design and use of colors.

Directions to the students:

The students will select plants that can produce dye suitable for dying fibers. The students will experiment to discover which plants will produce the colors they have planned for their design. The students will dye both yarn and cloth for their creative design and will assemble the hanging using exciting colors, composition and interesting textures.

Materials:

Plants from the area that will produce dye, hot plate or stove, containers for heating and dying fibers, cloth and yarn, sticks for hanging the designs.

References:

Natural Dye and Macrame, Golden Press, Western Publishing Co. Inc., 850 Third Aven., New York, NY 10022.

Junior High Submitted by Earl Richardson

EXPERIMENTING WITH SOIL

First Activity: Testing Soils

Behavioral Objectives:

1. The student will be able to list two reasons for testing soil.
2. The student will be able to distinguish between acid and alkaline soils.
3. The student will be able to relate at least three growth characteristics of a plant to the soil in which it is being grown.
4. The student will be able to differentiate between adequate and inadequate supplies of elements in a sample of soil.
5. The student will be able to compile his findings of several tests in an area and create a plan to restore needed elements to the soil.
6. The student will be able to interpret his findings and explain why the elements need to be restored to the tested soil.
7. The student will be able to test soil for major elements needed in proper plant growth.
8. The student will voluntarily select and perform other tests for minor elements in the soil.

Directions to the teacher:

Review how to take soil samples and test soil for the needed elements. Also review testing for acid and alkaline soil. Be familiar with area in order to help students find a suitable plot to test. It is important for the student to write accurate observations for the next two activities. This activity may be used in conjunction with the development of the school garden.

Directions to the students:

Measure two rows in the garden area. Stake and label with name and important data received from testing. As a group, make a chart showing the location of your row in relation to others. Take several samples of soil, test, and record your observations.

Stake off an area with string approximately the same size as the garden row. Take several samples of soil and test for the major and minor elements needed in the soil for proper growth.

Make another chart or label an existing map of the area showing where your test plot is located. Compare your findings in the garden plot with the other plot. Also observe the different plants growing and make observations for discussion.

Materials:

Soil testing kits, notebooks, large piece of poster paper for charts and maps.

Comments:

The activity need not be limited to two areas for testing. More plots in the area could be used if the student desires to do more testing.

Junior High Submitted by Earl Richardson

EXPERIMENTING WITH SOIL

Second Activity: Fertilizing Soil

Behavioral Activities:

1. The student will be able to identify two purposes for fertilizing soil.
2. The student will be able to estimate the amount of elements needed in a given area for proper plant growth.
3. The student will be able to demonstrate two different ways of fertilizing.
4. The student will be able to point out from a list, the proper techniques for applying fertilizer to the soil.
5. The student will be able to propose a plan to experiment with a fertilized and an unfertilized area.
6. The student will be able to compare a fertilized area to an area not fertilized and interpret observation data.
7. The student will select and measure two areas to be used in the activity.
8. The student will voluntarily read more about soil testing and methods of fertilizing.

Directions to the teacher:

Be certain the student does a complete job on the first activity. Many of the needed elements for fertilizer may be obtained at local stores or greenhouses. Review with students how to determine percentages needed for mixing fertilizer. Much of this will determine the type of soil testing kit used because many times the approach is different. Accurate measurements of the test plots will determine this.

Directions to the students:

Work out the percentages of elements needed for each plot if the need is indicated. Elements should be obtained from the instructor. Be sure to mix thoroughly. Take the mixed fertilizer and spread evenly (use of a commerical spreader is recommended). Work fertilizer in with a rake and sprinkle with water. Avoid water run-off. Next day test soil in fertilized area and write observations.

Materials:

Soil testing kits, elements for fertilizer, fertilizer spreader, notebook. Some of the elements needed are: nitrogen, phosphorus, magnesium, potassium, sulfur, iron, and calcium.

Junior High Submitted by Earl Richardson

EXPERIMENTING WITH SOIL

Third Activity: Testing for Loss of Elements from the Soil due to Rain and Irrigation

Behavioral Objectives:

1. The student will be able to identify two possible adverse effects on the environment from fertilizer.
2. The student will be able to estimate the amount of fertilizer washed off from an area in a given time period.
3. The student will be able to demonstrate two ways to determine the amount of elements in commercial fertilizer that washed from an area.
4. The student will be able to select the proper water tests to perform on a water sample taken from a run-off area.
5. The student will be able to design a plan to conserve the elements in the soil.
6. The student will be able to collect, analyze, and determine the amount of pollution in a sample of water run-off.
7. The student will be able to compare a commercially fertilized area with a non-fertilized area to the amount of polluting elements found in the run-off.
8. The student will voluntarily read books and articles about water polluted by different fertilizers (commercial and non-commercial.

Directions to the teacher:

Review with students the use of the water testing kits. Be sure the first two activities were completed and accurate.

Directions to the students:

At the botton of each test plot form a basin in the soil to catch water run-off to be used in testing for phosphates, nitrates, and other elements.

Once a week take soil sample from each plot, test and write observations in notebook and chart. After watering plots take sample once a week and write observations in notebook and chart. At the end of activity discuss and compare observations and charts with group.

Materials:

Water, testing kit, soil testing kits, notebooks, and charts.

Junior High

Submitted by Earl Richardson

WATERSHED

Behavioral Objectives:

1. The student will be able to define a "watershed".
2. The student will be able to give two examples of a watershed.
3. The student will be able to relate a watershed to the environment that it would encompass.
4. The student will be able to predict the behavior of the flow of water in a watershed.
5. The student will be able to combine information he has read, observed, and heard about areas to create a design for a controlled watershed.
6. The student will be able to compare and contrast properly controlled watershed to an improperly controlled watershed.
7. The student will be able to construct a model of a watershed.
8. The student will voluntarily read more information on watershed control.

Directions to the teacher:

Contact the city engineer, state and federal departments of agriculture and other people, who have knowledge and experience working in the area of watersheds. Have some of these people speak to the group and tell what a watershed is, its function, problems, and its effect upon the environment and the people associated with it. Take a field trip and study watersheds affecting the student and his environment.

Directions to the students:

Collect information from newspapers, textbooks, books, and magazines on watersheds and be prepared to discuss with visiting resource people.

On the field trip observe the different watersheds and its effect on your environment. Also make a sketch of a watershed and label important areas and items.

Take the sketch and information you have obtained and create a design for a well planned controlled watershed. From the design create a model from any materials you desire to use.

Materials:

Large sheets of drawing paper and notebooks. The student in most cases can bring his own materials for the model.

Junior High

Submitted by Dean Runkle

CHROMOTOGRAPHY

Behavioral Objectives:

1. The student will be able to define chlorophyll.
2. The student will be able to list and collect green plants in the environment and determine that all plants are not green.
3. The student will be able to demonstrate how a scientist extracts chlorophyll from green plants.
4. The student will extract one other substance that is present in the leaves of green plants.
5. The student will be able to compare the colors found in different varieties of green leaves.
6. The student will be able to differentiate between chlorophyll and carotenes found in green leaves.
7. The student will be able to devise an experiment to explain the purpose of chlorophyll in green plant leaves.
8. The student will be able to manipulate the laboratory equipment necessary for paper chromotography separations in such a way to get results which are accurate.

Directions to the teacher:

Discuss the color of fresh leaves. Include some plants that are not green. Reinforce the relationship between green color and chlorophyll. The students should collect their own samples if possible. You should demonstrate the correct way to grind a sample of leaves in a mortar. It is very important that the dot of leaf extract be small and dry before placing the strip of filter paper into the effluent solution. Allow the students to suggest or experiment with various solutions for the effluent.

Paper clips should be bent in the shape of a hook and inserted into the corks before beginning the activity. A 180mm test tube is most desirable. Have the students suggest experiments to test the purpose of chlorophyll in green plants. This could include such experiments as leaves under a funnel in a beaker with a test tube full of water to collect the oxygen gas. A glowing splint test to identify the gas could be an additional suggestion to the students. Try to give the student insight to the idea that in answering one question several new ones usually arise.

Directions to the students:

Collect some leaves and add a few coarse grains of sand. Grind the leaves in a mortar with a pestle. As you are grinding, add a few drops of acetone. You will note that the

slurry turns green. Try to get a drop or two of the acetone as concentrated with the green color as possible. The smaller the amount of acetone the better. Your teacher will give you a strip of filter paper, a cork, a paper clip and a stand. Assemble these as directed. Place 2cm of test solution in the test tube and place the stopper. Draw a light pencil line across the paper strip so that this line will be 1cm higher that the level of the test solution that is in the test tube.

The next part should be done slowly and carefully. Use a toothpick to put a dot of the green liquid in the center of the pencil line that is near the bottom of the paper strip. Immediately blow on the dot to dry it. Repeat this procedure at least ten times. Try to get as concentrated and as small a dot as possible. When the dot is thoroughly dry, hang the filter paper strip in the test tube so that the dot is 1cm above the liquid in the tube.

Do not disturb for twenty or thirty minutes. When you remove the strip, tape it on a sheet of white paper. Note the color bands on the strip. The yellow bands contain the substance that gives a carrot its color. What are the green bands? Can you think of an experiment or two that will give you a clue as to the purpose of chlorophyll, the green material, in the green leaves? Outline your experiment and present it to your teacher for approval. If time allows, you may want to perform this experiment.

Materials:

For each student you will need one test tube, one test tube holder, one ring stand, one paper clip, one cork to fit test tube, six inch strip of chromotography paper, ½ml acetone, toothpick, mortar and pestle, some green leaves, a pinch of sand, and 2-3ml of several solvents such as ethyl alcohol.

References:

Almost any modern chemistry book or lab manual contains information on paper chromotography.

Slowinski, Masterton, and Wolsey, 1969, Chemical Principles in the Laboratory, W. B. Saunders Company, Philadelphia, London, Toronto.

Junior High Submitted by Dean Runkle

HOW DO GASES ENTER AND LEAVE PLANTS

Behavioral Objectives:

1. The student will be able to define guard cells and stomates.
2. The student will be able to list several gases that pass through the stomates of leaves.
3. The student will be able to predict the function of stomates.
4. The student will be able to identify the parts of a microscope.
5. The student will be able to practice techniques for removing the colorless skin from the underside of a leaf.
6. The student will be able to determine that each kind of leaf has openings for gases to enter and leave the plant.
7. The student will be able to state at least one other function of a leaf.
8. The student will be able to operate a microscope and prepare slides.

Directions to the teacher:

This activity is concerned with how plants obtain energy. Supply each student with at least three different kinds of leaves. Some students will have difficulty finding the colorless skin on the underside of the leaf. It may appear as a narrow colorless border on the lower portion. Fresh leaves are best. Have forceps, microscope slides, cover slips and water available at each station.

You may have a three to four week old bean plant available for students that finish early. This plant or plants should receive only water and sunlight. Other plants may be ready that have had the leaves covered with plastic or smeared with petroleum jelly. You should be familiar with the iodine test for starch and encourage the students to go beyond the regular experiment.

Be sure that the students record all results and if possible draw a sketch of what they have observed. Other plants may be grown in the dark. Encourage the idea that answering one question can raise many more questions and that these new questions can be answered with new experiments.

Directions to the students:

How do plants obtain energy and how do gases enter and leave a plant? You will find out by examining part of a leaf under a microscope. Take a leaf and fold it so that the top comes together and the bottom part is up. If the leaf cracks,

don't worry. Tear the leaf so that the lower portion appears as a narrow colorless border at the torn edge. Remove this skin carefully with a pair of forceps. Carefully place it at once into a drop of water that was previously placed on a slide. Cover the skin and drop of water with a cover slip. Examine the leaf "skin" under a microscope and look for structures that resemble a pair of lips. Make a drawing of what you see.

The structures you observed are called guard cells. The openings in the guard cells are called stomates. One opening is called a stoma. Can you predict the function of the stomates? Can you suggest other experiments that may give you a clue as to the function of plant leaves? Your teacher has set up some bean plants and labeled them for you. Work with your teacher to develop other experiments that many answer the question of leaf functions.

What gas do you think a plant must have to make food? What do plants store in their leaves? Read some reference materials to get ideas for a new experiment and to be able to answer some of the questions above.

Materials:

A supply of different kinds of fresh leaves; microscopes; microscope slides and cover slips; small beaker and dropper; forceps; iodine for starch tests; means for heating water; test tube; alcohol; and bean plants that have been described in the activity.

References:

Morholt, Evelyn and Others, 1966, A Sourcebook for the Biological Sciences, Harcourt, Brace, and World, Inc., Chicago, Burlingame.

Wong, H. K. and Malvin S. Dolmatz, 1972, Ecology, Prentice-Hall, Inc., New Jersey.

Junior High

Submitted by Dean Runkle

INDIVIDUAL ECOLOGY INVENTORY

Behavioral Objectives:

1. The student will be able to list six or more daily activities by people that contributed to local environmental pollution.
2. The student will be able to state how he relates to his environment as a unique individual and be able to decide if his activities help or hinder the environment.
3. The student will be able to voluntarily read about six or more phases of environmental quality trends.
4. The student will be able to plot on a graph similar to the Web of Life Chart at least six of his daily activities that have consequences on his environment.
5. The student will be able to determine how many of his daily activities could be changed to help the cause of environmental balance.
6. The student will be able to predict ways that the could change his behavior in order to help improve or protect his local environment.
7. The student will manipulate laboratory equipment or various test kits in order to test for pollution.

Directions to the teacher:

The purpose of this activity is to arouse an awareness in students that environment quality is more than just finding fault with the activities of others. Probably, we need to confine our investigations within the area of our influence. Each individual can help in his own way even if it means changing many of his daily activities. Perhaps, each of us needs to take a critical look at how he is functioning within our environment.

Thomas L. Kimball, Executive Director of the National Wildlife Federation, has said that even technicians agree it is easier to shoot a man to the moon than clean up New York City. If America is in trouble, it is probably due to our own greed, apathy, and blind indifference to human values that have put us on a collision course with environmental diaster.

It is hoped that each student will make a chart or list of the various phases of our environment and honestly inventory the things they use and the activities they do that affect our air, our water, our timber, our soil, our minerals, our wildlife etc. They should use this list to suggest ways to curb this individual pollution and also keep daily records that may show any trends in their behavior. In some cases they may want to use test kits to verify that

pollution exist. Activities that could be investigated are: littering, trash disposal at home, family transportation, detergents, types of tissue used at home and its color, use of plastics and their disposal, smoking and its effect on house air, types of grocery packages bought for the home, and many, many more.

Directions to the student:

Read carefully the phases of pollution that the teacher has suggested plus any others that interest you. Construct a list of daily activities from the time you get up in the morning until you go to bed at night. Investigate thoroughly these activities in order to find those that contribute to pollution. An example might be to calculate the amount of carbon monoxide that the family car dumps into the atmosphere each week. Present car engines release about three pounds of carbon monoxide for each gallon of gasoline consumed. This is about 200 gallons of gaseous carbon monoxide.

After you have listed your individual contributions for pollution, it is important that you see your activities objectively. Devise a graph or chart to display your list and compare it with other students. Do you like what you see? Can you suggest and implement ways to improve? Continue with your record for at least six months and compare again with other students.

It has been demonstrated by chemical tests that many of our living rooms have poorer quality air than New York City during the rush hour. Only you can improve your immediate environment! Are you willing to try?

Materials:

Paper and pencils; CO test strips; lead and water test kits and other test kits may be used.

References:

Buchsbaum, 1957, Basic Ecology, Boxwood Press, New York.

Chant, D. A., 1970, Pollution Probe, New Press, New York.

Kormonday, E. J., 1969, Concepts of Ecology, Prentice-Hall, Englewood Cliffs, N.J.

Junior High

Submitted by J. D. Sewell

THE CHEYENNE ENVIRONMENT INTELLIGENCE QUOTIENT

Behavioral Objectives:

1. The student will be able to define the seven types of pollution identified in the EIQ.
2. The student will be able to distinguish between the seven types of pollution.
3. The student will be able to discover where these types of pollution can be found in the Cheyenne area.
4. The student will be able to point out three possible consequences for the population if these polluters are allowed to go unchecked.
5. The student will be able to devise a plan for lowering the total EIQ.
6. The student will be able to relate community problems to the seven various pollutants that comprise the EIQ of Cheyenne.
7. The student will be able to report to the class his findings on one of the seven topics in the EIQ of the world.
8. The student will be able to locate sources of pollution on a map of the Cheyenne area.

Directions to the teacher:

Class discussion with your students should identify as many types of pollutants as possible. Place this information on a chalkboard or overhead projector. This list should contain the following: air pollution, noise pollution, water pollution, solid waste, fertilizers, pesticides, and local factories or industries. Focus the attention of your students on situations of local pollution.

A community EIQ of 100 would be perfect, 90-99, good; 80-89, fair; and below 80, poor. To arrive at these EIQ values, each area is given a point value system and these values are subtracted from the perfect EIQ of 100.

Example: To determine the noise EIQ of Cheyenne, have the students select certain location from a city map, establish a particular time of day to check each location. Use the scale of 2, 4, or 6 at each station selected for this study. The total of all stations will be added together. This raw score will then be subtracted from 100 points giving the noise EIQ score.

Directions to the students:

Think of as many sources of pollution as you can in our community. You are going to find the CEIQ, Cheyenne Environmental Intelligence Quotient. This will determine

the activities of the people in Cheyenne in regard to polluting the city. An EIQ value of 100 points is a perfect score. To find the EIQ, decide if the problem is rated good, fair, or poor. A good rating would have two points subtracted; fair, four points; poor, six points. The rating scale will be explained in greater detail by your teacher. Discuss each area of pollution and decide its value and subtract the number of points from the total of 100. This will determine the EIQ of your community.

		100 Points
Noise Pollution		
Air Pollution		
Solid Waste		
Water Pollution		
Fertilizers		
Pesticdes		
Industries		
	TOTAL EIQ	

	Good	Fair	Poor
Noise	-2	-4	-6
Air	-2	-4	-6
Solid Waste	-2	-4	-6
Water	-2	-4	-6
Fertilizers	-1	-2	-3
Pesticides	-1	-2	-3
Industries	-1	-2	-3

Junior High

Submitted by J. D. Sewell

ENVIRONMENTAL ACTIVITY

Behavioral Objectives:

1. The student will be able to define the following terms: asn, dust, spores, and soil.
2. The student will be able to distinguish between the different types of particulate matter and gases.
3. The student will be able to construct a chart showing the types of air pollution.
4. The student will infer the possible origin of the air pollutants he finds.
5. The student will devise a plan to decrease the air pollutants he has found.
6. The student will be able to appraise the air pollution in his locality.
7. The student will write a 200 word report of air pollution in his city.
8. The student will be able to build additional laboratory equipment to study air pollution on his own.

Directions to the teacher:

There are several inexpensive methods to study particular air pollutants. One method is to use fly paper attached to a board or cardboard backing. This fly paper can be placed in different locations by students in the class. If private property is to be used, it would be wise to caution the students to secure permission before trespassing.

The student should label the paper as to its location and the direction it was facing. It would be necessary to have a grid on the paper to facilitate the categorizing and counting of the materials that adhere to the fly paper. The student can count and catagorize using a microscope or hand lens. The size of the squares is three inch square with a grid of one-half inch drawn in. The time that squares should be left outside could vary from one day to one week.

An alternate method would be to use three inch squares of wax paper attached to cardboard and marked off in one-half inch squares and covered with a thin coat of Vaseline. The preceding mentioned methods are strictly for particulate pollutants, however, there are kits available to test for gases. A simple test for H_2S is to take a nylon stocking and mount to a 35mm slide. One can be kept for a control and the students can place others throughout the community. These slides can be projected to show the results. H_2S is very hard on nylon and deteriorates it readily. The test boards could be pre-made or the students could make them.

Directions to the students:

Obtain an air pollution particle test set. With this test set you are to find how much, what kind, and possible sources of particulate air pollution. You will label your test set with the location and the direction it was pointing. You are to set your test in place from one to seven days.

When you bring your test set back to the classroom, use a microscope or hand lens to observe the types of particulate pollutants your test set picked up. Describe and catagorize the pollutants. Make a chart showing the types of pollutants you discovered and where they may have come from. In a 200 word report tell what types of polluters exist. For further air pollution studies, your teacher will give you materials and you can construct your own test set.

Materials:

Fly paper, Vaseline, wax paper, cardboard, microscope or hand lens, slide blanks, nylon stocking, air pollution test kits.

Junior High Submitted by J. D. Sewell

WATCH THE GRASS GROW

Behavioral Objectives:

1. The student will know the common names of five microorganisms.
2. The student will be able to distinguish between five different types of microorganisms.
3. The student will be able to predict what will occur in the grass-water mixture.
4. The student will be able to infer comprehension of one possible food chain.
5. The student will be able to compile a well-organized record of weekly changes that take place in the community that orginated from the grass and water.
6. The student will be able to summarize the data he collects over a four week time period in the form of a 200 word report.
7. The student will be able to write a 200 word report on the microorganism which interests him.
8. The student will be able to locate similar microorganisms in a different environment.

Directions to the teacher:

Have on hand or have students bring glass jars (mason type) which have a lid that will fit securely. Provision should be made for obtaining water. If you use tap water, you should have it in an open container for several days because this allows the chlorine to escape. Chlorine may inhibit the growth of microorganisms. It would be preferable to sterilize water from an aquarium or pond.

The student should be able to choose the amount and kind of grass. Freshly cut grass does not yield good results. Jars should not be placed in direct sunlight and not too close to a heat source. The mixture will become cloudy and will have an unpleasant odor. It will take several days before the microorganisms become visible. If the students are not familiar with the use of a microscope, this would be a good opportunity to go over the proper procedure. Let the students discover what occurs in the mixture.

Directions to the students:

In this experiment you will need to bring some grass clippings to class. Your teacher will give you a jar and water. Add the grass clippings to the water. At the beginning of each class observe your jar with a microscope. Keep a record of your observations in your notebook.

Materials:

Grass clippings, pond water or de-chlorinated water, jar and microscope.

Junior High

Submitted by Jeannie D. Talagan

ENVIRONMENTAL POLITICAL ACTION

Behavioral Objectives:

1. The student will be able to successfully define and identify five legal and five ecological terms.
2. The student will be able to explain the organizational structure of legislative processes (five steps of how a bill becomes a law) and estimate costs.
3. The student will be able to prepare at least one chart and/or graph of past or existing legislation in this area.
4. The student will be able to point out or distinguish some major inadequacies of this existing legislation.
5. The student will be able to creatively write a bill in some area of environmental protection.
6. The student will be able to the best of his ability justify such legislation and its cost.
7. The student will be able to demonstrate a belief in a democratic process by voluntarily lobbying or spreading information door to door (or by phone to other citizens.
8. The student will be able to make posters to illustrate points or demonstrate need for such legislation successfully.

Directions to the teacher:

The teacher should be familiar with the democratic process of drafting legislation. He should also examine past legislative achievements in the environmental area and prepare helpful examples. Possibly a field trip to the state legislature would be helpful as well as some insight into legislative committee work.

Directions to the students:

The students should study the lawmaking bodies of the United States of America as well as that of their own state.

Materials:

Any good civics textbook could be used to supply background materials. Guidance Associates offer a multitude of filmstrips on the Congress of the United States which could be utilized. Copies of Wyoming state bills can be picked up at the office of the Attorney General of the State of Wyoming as guidelines.

Junior High

Submitted by Jeannie D. Talagan

INDIVIDUALIZED STUDY IN SOLID GARBAGE

Behavioral Objectives:

1. The student will be able to define ecological terms related to and including the term, solid garbage.
2. The student will be able to convert at least three terms to figures and percentages.
3. The student will be able to apply at least three concepts to his own home environment.
4. The student will be able to differentiate the differences in uses of environmental protection principles in families or individuals.
5. The student will be able to integrate a new scheme for solving problems of excess solid garbage (using his own ideas).
6. The student will be able to compare and contrast the results of his scheme with other individual schemes in the class.
7. The student will be able to conduct similar experiments in other areas such as water use or electrical use.
8. The student will be able to carry and weigh solid garbage.

Directions to the teacher:

The best preparation a teacher can make for such an experiment is to actually try it out in his own home environment. Actually the whole point of this experiment is to calculate approximately how much garbage is used by most average households (in pounds) during a specific period of time. The teacher can alter the experiment as he wishes, for example, separation of recycleable materials.

Directions to the students:

The student should explain the experiment carefully to his family and respectfully request the cooperation of each family member in aiding this project.

Materials:

Some accurate instrument for weighing of garbage, and possibly a type of bag to carry the garbage would be the only materials needed.

Comments:

Provisions should be made for those students who will not be allowed to conduct this type of experiment at home.

Junior High

Submitted by Jeannie D. Talagan

STUDENT DEBATE ON ENVIRONMENT

Behavioral Objectives:

1. The student will be able to define terms for the affirmative and negative positions of the debate (teams of two).
2. The student will be able to interpret and accept each other's definitions.
3. The student will be able to apply and manipulate information to show their positions.
4. The student will be able to recognize illogical arguments and assumptions of the other team.
5. The student will be able to propose a plan.
6. The student will be able to appraise opposing plans critically and summarize with support their own proposals.
7. The student will be able to display a great deal of emotion and fervor during the debate.
8. The student will be able to file and withdraw information in card files during the debate.

Directions to the teacher:

The teacher should be familiar with the procedure of correct debate, including types of speeches and their timing, as in the following example: 1st Affirmative Speech, eight minutes; 1st Negative Speech, eight minutes; 2nd Affirmative Speech, eight minutes; 2nd Negative Speech, eight minutes; 1st Negative Rebuttal, four minutes; 1st Affirmative Rebuttal; four minutes; 2nd Negative Rebuttal, four minutes and 2nd Affirmative Rebuttal, four minutes.

It is the responsibility of the affirmative side to establish a plan and successfully defend it. Have the rest of the class serve as judges.

Directions to the students:

The students must spend a great deal of time in preparation by researching the subject as extensively as possible. The more current the information used, the more effective and persuasive the debate will be.

Materials:

All periodicals especially "U.S. News and World Report" should be used for reference. Quotations from influencial persons should be gathered for the endorsement technique. A card file and index cards for each debater. A textbook from any high school speech class.

Junior High

Submitted by Beauford Thompson

NATURAL RESOURCE GAME

Behavioral Objectives:

1. The student will be able to state in his own words that in our activities we generally use natural resources and that our natural resources are not limitless.
2. The student will be able, after playing the game, to give examples of how our natural resources are used.
3. The student will be able to relate the situations used in the game to real-life situations.
4. The student will be able to analyze given examples to determine which natural resources are being used.
5. The student will be able to identify the natural resources when given three examples of activities and compile lists of them to determine which resource is most frequently used.
6. The student will be able to discriminate between two examples of the use of one natural resource and determine which is the better use of the natural resource.
7. The student will show his awareness of the relatively fixed reserves of natural resources by discussing this concept with his peers.
8. The student will be able to manipulate the cards used in the game.

Directions to the teacher:

This game can be played quickly with a minimum of space. Prior to playing the game, discuss with the students the fact that most of our activities involve the use of natural resources. In order to use these resources wisely, we must determine for what and how they will be used. Be sure they understand that this game places no true value on any business situation; the values were chosen arbitrarily for this game. Be sure the students understand the rules.

Prepare the following Natural Resource Unit tokens on 3 x 2½ cards with the value written on the token. The number of tokens needed for each token value is given:

No. of Cards		No. of Cards	
12	100 Natural Resource Units	16	1,000 Natural Resource Units
8	200 Natural Resource Units	2	2,000 Natural Resource Units
12	300 Natural Resource Units	2	3,000 Natural Resource Units
4	400 Natural Resource Units	2	5,000 Natural Resource Units
12	500 Natural Resource Units		

Prepare the following 3 x 5 cards which will be labeled "Natural Resources Use" on the reverse side. Try to use a different color from the tokens.

Four cards each: Service Station 1,500 Natural Resource Units
Community Penalty: Direct and indirect destruction of wildlife habitat, indirect contribution to pollution

300 Natural Resource Units each player

Three cards each: Motel 2,000 Natural Resource Units
Community Penalty: Direct and indirect destruction of wildlife habitat, poor use of energy reserved

300 Natural Resource Units each player

Four cards each: Drive-In Restaurant 1,000 Natural Resource Units
Community Penalty: Direct litter pollution, increased air pollution

200 Natural Resource Units each player

Two cards each: Farm 3,000 Natural Resource Units
Community Penalty: Direct destruction of wildlife habitat, poor farming methods, use of poisonous insecticides and herbicides

400 Natural Resource Units each player

One card each: Sawmill 4,000 Natural Resource Units
Community Penalty: Air and water pollution, destruction of forests through improper logging, chemical release in water

1,000 Natural Resource Units each player

Housing Development 5,000 Natural Resource Units
Community Penalty: Direct and indirect destruction of wildlife habitat, poor waste disposal, poor use of land

1,000 Natural Resource Units each player

Copper Mine 5,000 Natural Resource Units

Community Penalty: Direct and indirect destruction of wildlife habitat, water and air pollution, destruction of top soil

1,000 Natural Resource Units each player

Also to be included in "Natural Resource Use" cards are four "Disaster Cards"

One card each:

Improper logging and farming cause flooding
200 Natural Resource Units each player

Water becomes polluted
300 Natural Resource Units each player

Air becomes polluted
400 Natural Resource Units each player

Human caused forest fires
400 Natural Resource Units each player

Prepare the following on 3 x 5 cards which will be labeled "Replenishment Cards" on the reverse. Again try to use a different colored card.

Five cards each:

Litter collected

Each player may donate 100 Natural Resource Units to Usable Natural Resource Units

If all player donate, 300 Natural Resource Units may be transferred from Used Natural Resource Units to Usable Natural Resource Units.

One card each:

Recycling of used resource material began

Each player may donate 200 Natural Resource Units to Usable Natural Resource Units.

If all the players donate, 2,000 Natural Resource Units may be transferred from Used Natural Resource Units to Usable Natural Resource Units

Soil Conservation Practive

Each player may donate 300 Natural Resource Units to Usable Natural Resource Units.

If all players donate, 2,500 Natural Resource Units may be transferred from Used Natural Resource Units to Usable Natural Resource Units.

Zoning Laws Enacted

Each player may donate 100 Natural Resource Units to Usable Natural Resource Units

If all players donate, 1,000 Natural Resource Units may be transferred from Used Natural Resource Units to Usable Natural Resource Units

Sewage Treatment Plant Built

Each player may donate 200 Natural Resource Units to Usable Natural Resource Units

If all players donate, 2,000 Natural Resource Units may be transferred from Used Natural Resource Units to Usable Natural Resource Units

Strict Air Control Laws

Each player may donate 200 Natural Resource Units to Usable Natural Resource Units

If all players donate, 2,000 Natural Resources may be transferred from Used Natural Resource Units to Usable Natural Resource Units.

Explain the following terms to the students:

Usable Natural Resource Units Usable Natural Resource Units are the units that have not been used. These represent the natural resources that are available for man to use.

Used Natural Resource Units These are units which have been used. They cannot be used again except when the Replenishment Cards are used.

Replenishment Cards These cards may be used to replenish the Usable Natural Resources. No player, except the player who drew the card, has to donate any Natural Resource Units to Usable Natural Resources. If all the players donate the required amount, an amount designated may be transferred from the used Natural

Resource Units to the Usable Natural Resource Units.

Natural Resource Use Cards These cards show how the Natural Resource Units are used. The cards are divided into two sections. The first section indicate how many Natural Resource Units the player receives for drawing the card; the second section tells the penalty each player must pay for the card. Every player must pay, even the player who drew the card.

Directions to the students:

Following are the directions for the game:

Play Each player draws a "Natural Resource Use Card" from the stack. The player receives the Natural Resource Units indicated on the card. Every player must place the designated Natural Resource Unit in a pile for the Used Natural Resource Units. When a player has no units remaining, he is out of the game. Each player keeps the cards drawn.

Disaster Card A disaster card may be drawn from the Natural Resource Use stack. When this occurs all the players must pay the Units indicated to the Used Natural Resource Units pile.

Players This game is to be played with four players.

Replenishment Cards When a player thinks the Usable Natural Resource Units pile is getting too low in Units, he may draw a Replenishment Card. If he draws a card, he must donate what is indicated. Players can agree to donate prior to drawing the card.

Natural Resource Unit Tokens Each player received 5,000 Natural Resource Units. Below are the numbers of tokens each player receives:

1,000 Units	2	300 Units	2
500 Units	2	200 Units	2
400 Units	1	100 Units	2

At the beginning of the game 30,000 Natural Resource Units should be available in the Usable Natural Resource Units.

When all the Natural Resource Use Cards have been drawn, the game is over. The winner is the player with the most Units over 5,000. If no person has more than 5,000 Natural Resource Units, no player wins.

Materials:

You will need three packages of different colored 3 x 5 cards.

Junior High

Submitted by Beauford Thompson

TAKING A GRASSHOPPER CENSUS

Behavioral Objectives:

1. The student will be able to list at least three favorable conditions in the specified area conducive to grasshoppers.
2. The student will be able to explain the results of the census.
3. The student will be able to demonstrate in which of the area grasshoppers would be most numerous on a map depicting topography, vegetation, water, etc.
4. The student will be able to show densities per square yard of grasshoppers by diagraming the acre of land sampled.
5. The student will be able to compile the results of the census to determine the grasshopper population per acre.
6. The student will be able to compare the different areas within the acre sampled to determine more favorable environment for grasshoppers.
7. The student will be able to recognize the need for proper grasshopper control after completing the census.
8. The student will be able to measure an acre of land.

Directions to the teacher:

This activity involves two parts: measuring an acre and the actual census. Preparation for the census should be initiated several days in advance. The marking of the acre should be done at least one day prior to counting the grasshoppers to avoid influence on the grasshopper numbers by movement of the students.

Part One: Measuring an acre

Discuss with the students the area of an acre. Explore with them the possibilities for determing an acre. Some of the methods for measuring an acre may include the use of a ruler, yardstick, or pacing. Allow the students time to practice measuring an acre. The area of an acre is 43,560 square feet. Possible dimensions of an area are: 242 yd. x 20 yd; 121 yd x 40 yd; 60 yd. x 80 1/3 yd; or 69.6 yd. x 69.6 yd. (4844.16 sq. yd.) It is easier to measure an area in yards than in feet. Give the students the assignment to locate a site at the Eco-Lab or another location which would give a variation in factors for grasshopper population and measure an acre of the site.

Part Two: Taking a grasshopper census

On the day prior to taking the census, select the site for the census and mark the acre in yard plots. The best way to mark the plots may be by making a grid using string.

Discuss with the students methods of taking samples. Depending upon the situation, they may wish to sample every third square yard or devise a procedure of their own. Prime importance must be given to keeping the method constant.

Be sure the students have paper and pencil, string and pieces of wood to use as stakes. The students should be aware that they are responsible for reporting factors within the environment of the grasshoppers. Assignments could be made to individual students regarding the moisture content of the soil, vegetation, and soil types.

Directions to the students:

Part One: Measuring an acre

Find the area of an acre. Be prepared to tell how you would show another person how large is an acre. Practing measuring an acre using a yardstick and by pacing. Before pacing an acre, practice pacing until you can average a yard pace.

Part Two: Taking a grasshopper census

After you have selected your site for the census, measure an acre and mark the corners with stakes. Using string and stakes divide the acre into yard square plots. Be sure the string is securely tied so it will not blow away. Mark the yard plots you will sample. You may want to tie strips of cloth to stakes placed in the plots.

As you count the grasshoppers, be sure to look for factors influencing the population. Does vegetation make a difference? What about water? Where do the grasshoppers seem more dense? Are grasshoppers found more frequently on one type of plant than on others? Are there evidences of grasshoppers being preyed upon? What do the grasshoppers prey upon? How extensively?

Make a map showing the acre sampled, and the number of grasshoppers in each plot. Record on the map amounts of water in the soil, types and amounts of water in the soil, types and amount of vegetation, and any other data you consider relevant. From the completed map, can you determine any facts about grasshopper behavior or preferences? Which areas on your map would be most affected if the grasshopper population was suddenly doubled? tripled? What if it were reduced by one-half? What other organisms would be affected if any of those possibilities became a reality?

Materials:

You will need the following materials: yardsticks, rulers, stakes, string, paper, and pencils.

References:

Borror, Donald J., and Richard E. White, 1970, A Field Guide to the Insects of American North of Mexico, Houghton Mifflin Company, Boston.

Jaques, H. E. 1947, How to Know the Insects, Wm. C. Brown Company, publishers, Dubuque, Iowa.

Lutz, Frank E., 1948, Field Book of Insects, G. P. Putnam & Sons, New York.

Junior High

Submitted by Beauford Thompson

TAKING A PINE-SEED CENSUS

Behavioral Objectives:

1. The student will be able to state two methods pine seeds are distributed from the tree.
2. The student will be able to distinguish a pine seed from other objects such as small pebbles, etc.
3. The student will be able to predict the areas under a pine tree where pine seeds would most likely germinate after observing seeds and seedings under pine trees.
4. The student will be able to draw a diagram showing density/square feet of pine seeds under a pine tree after taking samplings from under the pine tree.
5. The student will be able to relate in written form three reasons for the failure of most seeds to germinate to some factor in the environment.
6. The student will be able to discriminate between pine seeds which will germinate and pine seeds which will not germinate.
7. The student will voluntarily discuss the implications of his findings with other individuals.
8. The student will be able to measure a square foot of soil and be able to count the pine seeds in the measured area.

Directions to the teacher:

Several days prior to the activity, discuss with the students the life-cycle of everygreen trees, particularly conifers. Explain the concept of sampling, being sure to emphasize that in the activity the sample areas should not be adjacent to one another.

On the day of the activity be sure the students have brushes for brushing away soil and debris, ruler, nails (4), string (at least 50 inches), paper and pencils. Have a liberal supply of containers for samples of seeds, plant material and insects. Magnifiers will also be of aid in the field.

Directions to the students:

Draw a map of the area, indicating the location to be sampled. Take three samples from each of three random areas from under the tree. (You will have nine samples from each tree.) The three areas are: (1) one to four feet from the trunk of the tree; (2) four to ten feet from the trunk

of the tree; and ten or more feet from the trunk. Vary the distances from the trunk of the samples in each area.

Measure one foot squares and mark them by placing nails at the corners and stretching string around the corners.

Carefully remove the needles, leaves, dead grass, etc. Count any pine seeds you observe. Try to determine which seeds will germinate and which will not. Explain the reasons for the seeds not germinating. Be sure to record all information for each randomly chosen sample site.

Attempt to determine the extent animals have fed upon pine cones and pine seeds. If there seems to be a large amount of chewed seed coverings and pine cones, see if you can discover the number of animals and their dens or nests.

Look for evidences of the method of pine seed and pine cone dispersal from the tree. Consider such things as wind direction slope of the ground, limbs, etc.

Collect any insects which you think may have eaten any pine seeds. Try to get direct proof that they are pine seed eaters. CAUTION: Do not attempt to capture mammals without proper equipment and supervision. Should you be bitten by a mammal, report it immediately to your teacher.

Materials:

Pencils, paper, rulers, small brushes, vials or small bottles, tweezers, magnifiers, string.

References:

Miller, Howard A. and H. E. Jaques, 1972, How to Know the Trees, Wm. C. Brown Company, Dubuque, Iowa.

Peattie, Donald Culross, 1953, A Natural History of Western Trees, Houghton Mifflin Company, Boston, Mass.

Porter, C. L., 1964, Wyoming Trees, Circular 164R, Agricultural Extension Service, University of Wyoming, Laramie.

Junior High

Submitted by Margaret Albert
Julie Luhr
Jeannie Talagan

ECOLOGY CONCENTRATION

Behavioral Objectives:

1. The student will be able to identify ecological terms and facts; know methods and procedures of how to play the game.
2. The student will be able to distinguish and estimate related data.
3. The student will be able to apply facts and theories to practical situations.
4. The student will be able to evaluate and analyze the relevancy of the data.
5. The student will be able to formulate or compile new data for the present game form.
6. The student will be able to justify and support why the two ecological statements make a match.
7. The student will be able to volunteer to adapt a similar simulation game.
8. The student will be able to manipulate the game board skillfully.

Directions to the teacher:

Game board data must be placed in strategic areas and concealed with numbered cover cards. The teacher will call upon an individual or team to make the selection of two numbers. A master answer sheet will be checked to confirm or deny matches. When a match is successfully achieved, team member(s) will receive both cards of that play. Cards will count as points. The master sheet and scoring can be placed on a student level.

For additional game procedures, see the directions to the students.

Directions to the students:

Students should become acquainted with ecological and environmental information. Recall is necessary to achieve matches, though chance is also a factor. One point is earned per card; one additional point can be earned if the student can justify or explain reasons for his match. The student or team accumulating the most points wins the game.

The following information should be typed as printed onto cards. These cards inturn are fitted into a pocketed board as shown by the diagram of "game board layout". A numbered card is placed in front of each information card. Now you are ready to play Ecological Concentration.

Information for Game Cards

Forest destroyed by fire	Replanting seedlings
1000 oil spills every year	New law: $10,000 fine for not reporting spills
1000 U. S. City systems showed water in 40% of cities was inferior in quality 9% dangerous	12,000,000,000 will go into new municipal sewage plant construction over next three years
Nuclear power plants have been big thermal polluters	EPA now requires cooling towers for new power plants
The U.S. is the most wasteful nation	Salvage pays processing cost
U. S. industry uses 17 trillion gallons of water every year, less than 1/3 is treated before discharge	EPA officials say that with 1980 technology, 95% of all polluants can be removed
Skyrocketing demands for more and more timber products	Recycled paper already saves 200,000,000 trees a year and that could easily be doubled
Windbreaks of trees and shrubs planted on farms, ranches and homes	Provide food and cover for wildlife, protect crops, land from damaging wind
Landfill space is running out so solid garbage cannot be buried	Recycling will improve our quality of living, conserve irreplaceable resources, and pay its own way
Transportation of all kinds contributes 42% of our air pollution with private autos -- villian Number One	60 mph maximum speed would reduce pollution by over half in cities
Sources of solid garbage	44% households; 30% factories & construction; 26% stores and businesses

Pollution	Pollution is the changing of the environment thru the activities of man, in a manner that the environment becomes limited in its usefulness
Recycling	Recycling - reuse or salvage
Ecology	Ecology - the study of environmental systems
One cubic foot of garbage produces	75,000 flies
U.S. junks 7 million cars annually	U.S. steel production now contains 55% scrap
Fight pollution by	Knowing the problem supporting legislation to perserve
Noise can damage hearing	Decibel standards have been set
Noise is measured in decibels; pain begins at 120 decibals for humans	Rock music, 115; rioting, 120: living room, 40; freeway traffic, 8
Each year we lose 2 million acres of land	One million goes for recreational uses (can be used for general)
The list of endangered species stands at 101	We have more than 30 million acres in wildlife refuges
Known natural gas reserves will last only 13 years; experts see rationing by 1976, (has already begun).	Conversion plant will convert 500 tons of garbage daily into 3 million cubic feet of fuel gas
Every area of ecology is aggravated by population expansion	There has bee a dramatic decline in birth rate
Don Quixote of the environmental scene	Ralph Nader
Cheyenne	Purest air in the United States
Sierra Club	First organization to promote environmental protection
EPA	Environmental Protection Agency
YES	Youth for Environmental Salvation
Symbolic character representing good use of public land	Johnny Horizon

Penalty for littering along Wyoming highways — $100.00 fine

Game Board Layout

ECOLOGY CONCENTRATION				
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30