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ABSTRACT

Seventy field activities, pertinent to outdoor, environmental studies, are described in this compilation. Designed for elementary and junior high school students, the activities cover many discipline areas--science, social studies, language arts, health, history, mathematics, and art--and many are multidisciplinary in use. Topics range from soil study, animal traces, and watersheds to ecosystems, food chains, and succession; from mapping, stream surveys, and effects of air pollution to listening, expressing textures, and community profiles. An introductory page for each activity lists the learning experience (topic), curriculum area(s), grade level(s), and conceptual theme. Following this is a detailed account of objectives, unit concepts, background subject information or problem identification, materials needed, procedures for conducting the field activity, numerous questions, and follow-up activities. (BL)

NOLDE FOREST STATE PARK
ENVIRONMENTAL EDUCATION CENTER
CUMRU TOWNSHIP, PENNSYLVANIA

ACTIVITY NUMBER 1-A PAGES _____

LEARNING EXPERIENCE: Microscopic Aquatic Animals

CURRICULUM AREA : Science
Life Science
Biology

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME : Fresh water habitats are natural environments in which communities of both plants and animals live.

OBJECTIVES

At the completion of this activity, the student should:

1. be able to observe microscopic objects and organisms.
2. demonstrate ability to use simple magnifying devices.
3. be able to distinguish between microscopic animals and plants.
4. be able to describe more than one microscopic pond animal.
5. recognize bodies of fresh water as natural habitats of living microscopic plant and animal communities.
6. realize that an aquatic habitat supplies the proper life needs to the microscopic animals living in it.
7. recognize that microscopic animals are so simple in structure that they do not have body coverings and distinguishable body parts.
8. realize that there are means of locomotion other than legs, wings, and fins.
9. be able to explain the following terms:
    a. microscopic
    b. protozoan
    c. algae
    d. magnify

UNIT CONCEPTS

I. Fresh water habitats are natural environments in which communities of both plants and animals live.

II. Animals can be found in almost any body of fresh water, whether it be temporary or permanent, large or small.

III. Aquatic habitats provide the animals that reside in them with all of their basic life needs.

IV. We should try to disrupt natural bodies of water as little as possible because we are disrupting a natural community of living things who make their homes in the water.

V. Many animals live in fresh water throughout their lifetime.

VI. Some animals are so tiny that we must use magnifying instruments to see them.

VII. Microscopes and other magnifying instruments cause microscopic organisms to appear larger, thus enabling us to observe them more effectively.

VIII. Many animals are so simple in their body form that they do not have distinguishable body parts such as our own body has.

IX. Microscopic animals do not have complex body coverings such as skin, fur, or feathers.

X. Microscopic animals can move very quickly even though they do not have legs or wings like larger animals.

XI. Microscopic animals feed on tiny bits of plant and animal material found in the water.

XII. Most microscopic animals are not brightly colored.

MICROSCOPIC POND ANIMALS

INTRODUCTION

One of the most fascinating aspects of animal life involves the discovery of microscopic animals in a sample of fresh water. Most small children have never seen protozoans, rotifers and other small, fresh water forms of animal life and you, as a teacher, will thrill to their amazement as they see these forms for the first time.

Collecting can be done as part of a field trip you may take with your class. Samples taken from several different aquatic sources will provide interesting variations in kinds of microscopic animals present in them.

A. Collecting

1. Preparations

Any sample of fresh or stagnant water will contain at least some microscopic animal life in it at any time of the year. During the winter, most of these forms develop some kind of protective cyst or spore to tide them over the cold temperatures, but these forms will "hatch", so to speak, after being kept in a warm room for a few days.

The only equipment you will need is any kind of a wide mouth jar, with its lid. Clean the jars before using them by washing them with a detergent. Rinse with tap water several times, then once with distilled water, if you have some available. If not, boil the jars in tap water for 10 to 15 minutes before using.

2. Where and What to Collect

Ponds and Lakes - be sure to gather some of the plant debris from the bottom mud; also, a little of the mud.

Streams - along the edges of quiet pools. Collect the same material as above.

Roadside ditches - collect some of the scum on the surface as well as a little of the edge and bottom debris.

Temporary pools of standing water - same as for roadside ditches.

Of course, be certain to get a suitable amount of the pond water itself as a culture medium. About a quart is enough.

3. When to Collect

Anytime of the year. The richest collections will be found early in the fall (late September and October) and again in the Spring from late March on.

B. Culturing

1. How to Culture

a. Aquarium Cultures - if you wish to study a larger sample of fresh water, microscopic animals collect enough pond water and debris to fill a small glass aquarium of about 1-2 gallon size. Allow the sample to stand in the aquarium for 1 to 2 weeks before examining it. Aquarium cultures do very well if a few aquatic plants such as Cabomba, Elodea or Myriophyllum are added at first.

b. Culture dishes or jars - allow the culture to stand in the open for approximately 10 days to 2 weeks before examining it. Add a small amount of boiled lettuce or beans to the culture at the start of the culturing period.

NOTE: Bacteria in the pond culture will feed on the decaying vegetable matter. In turn, the protozoans in the pond water will feed on the bacteria, thus rapidly increasing the protozoan population.

2. Special Protozoan Population

a. Amoeba - collect them from ponds or temporary pools of water (such as roadside ditches) which do not contain too much decaying organic matter. Clear water pools are best. Scrapings from the base of the stalk of cattails or the underside of floating water leaves, such as water lily, are good sources.

Place the plant material and pond water in culture dishes or jars and add 2-4 uncooked rice grains. Wait about 10 days before examining the culture.

b. Paramecium - collect scum from the surface of quiet bodies of fresh or stagnant water. Place the scum, with water from the same locale, into a culture dish or other suitable glass container. Let the culture set for 10 days to 2 weeks. You may use the vegetable material infusion suggested previously or add 2 small pieces of bark from a rough-barked tree, such as elm or silver maple. Select the pieces from the shaded dark side of the tree having a coating of green scum on it. (This is an unicellular, colonial form of green algae called Protococcus).

3. Commercial

If you do not have success in culturing, you may order pure cultures of Amoeba or Paramecium from a biological supply house. Catalogues can usually be obtained from the local high school biology teacher or by writing directly to one of the supply houses. A good supplier located in this area is:

Carolina Biological Supply Company
Burlington, North Carolina

C. General Culturing Techniques

Keep the cultures at a constant temperature, between 60°and 75°F. Room temperature is best. Medium light is ideal for the cultures. Darkness is not detrimental. Keep the cultures away from strong light sources.

Do not expect to maintain your culture for any extended period of time. You will do well if they flourish for 3 to 4 weeks.

D. Studying Your Cultures

1. Using the Microscope

Most elementary schools have access to simple compound microscopes. Use of these instruments is essential to maximum learning opportunities from the studies. While a few of the protozoa are visible to the naked eye, children of this age are generally not skilled enough observers to detect the presence of these tiny creatures. Certainly, they could observe very little about them in this manner.

In preparing the children for the concept of magnification, this writer suggests that the teacher allow the children to use simple tripod magnifiers, other types of magnifying instruments or a "Sherlock Holmes spy glass" (magnifying lens) prior to introducing them to the microscope. Have the children examine small objects such as newsprint, cloth, rocks, sand, bread or other appropriate materials.

2. Preparing the Microscope Slide

Clean the blank microscope slides thoroughly and rinse and dry. Do the same for the cover slip.

NOTE: Plastic cover slips are excellent for this purpose as they do not break.

Add a single drop of the culture (from the scum on top) to the center of the blank side using a simple medicine dropper. Do not place a large drop on the slide as it will spread out from under the cover slip.

Place the cover slip over the drop on the slide and examine under the low power objective of the microscope.

At first, allow the children to observe the rapid moving organisms. To slow down such rapid movers as Paramecium, you may use the following technique:

Add 1 drop of a 10% methyl cellulose solution to the drop of culture medium before placing the cover slip on the microscope slide. The methyl cellulose is very viscid, thus interferring with the free movement of the microscopic animals in the drop of culture medium.

The 10% solution is made by dissolving 10 grams of commercial methyl cellulose in 90 milliliters (ml) of water. Methyl cellulose can be purchased commercially from a scientific supply house or can be more easily obtained by asking the biology or chemistry teacher at your local junior or senior high school.

3. What to Observe

Unless you are using a pure culture purchased from a biological supply house, your pond water culture is quite likely to contain a highly varied collection of microscopic animals and plants.

In directing the student's observations, it would probably be best to call their attention to the larger moving forms of animal life at first. Most visible are likely to be such forms as Amoeba, Paramecium, Vorticella, Colpidium and Euplotes. Other forms are also likely to be present in a vigorous culture.

While you may wish to identify some of the common forms, it probably would be best not to go much beyond referring to most of them as simply protozoans. (Protozoans are one celled animals. A few species form colonies).

Along with the species listed above, your culture will undoubtedly contain many other forms of tiny animals. Frequently observed are such forms as rotifers, gastrotrichs and several common crustaceans such as Cyclops and Daphnia. These forms are multicellular (or more than 1 cell) but still nearly invisible to all but the most skilled observers.

Many microscopic plants are also likely to be present in your cultures. Most of them will be either forms of blue-green or green algae, with the notable exception of diatoms, which are golden-brown algae.

Most of the plants are not mobile and it will not be necessary to dwell on observation of them, except as student interest dictates.

A detailed listing of various forms of animal and plant life that might be observed in your culture is beyond the scope of this activity. Instead, you may well benefit from the use of an identification key book. The following references are good general keys to assist you in identifying some of the more common forms that may be present in your culture:

a. Field Book of Ponds and Streams - by Ann Haven Morgan
b. New Field Book of Freshwater Life - by Klots
c. Beginner's Guide to Freshwater Life - by Hausman

All listings above may be ordered from: G.P. Putnam's Sons
New York 16, New York

d. Living Things - How to Know Them - by Jaques
e. How to Know the Protozoa - by Jahn
f. How to Know the Freshwater Algae - by Prescott

All listings d through f may be ordered from:

Wm. C. Brown Company
135 South Locust Street
Dubuque, Iowa 52003

g. The Golden Nature Guides series contains a new publication entitled Pond Life and can be ordered from:

Golden Press
New York, New York

Helpful Hint

The local junior or senior high school library or biology department often has many of these books on hand as well as other useful keys.

4. How to Observe

You will probably need to prepare the microscope slides for the children. If possible, try to have more than one microscope station available, thus allowing the children to work in smaller groups. This will allow each child more time to observe the animals. A series of short observation periods over several days will likely prove most successful for the children.

5. General Observations

Do you see anything moving? What color is it? How fast is it moving? In what direction? Does it seem to travel in straight lines or does it change directions often? Does it ever stop and rest? What does it seem to be doing when it stops? What makes you think so? How does it move.

Do you see other forms? Are they the same color? The same size? The same shape? Do any of them change shapes? Why do you think they do this?

Are any of the forms you see not moving? What color are they? Do you think they are plants or animals? Why?

Do any of the forms that move have arms, legs, head, tail, eyes, ears, nose, mouth? How do you think they get their food? What do you think would happen to them if their water supply dried up? Why? Do you think these animals breathe? How? What makes you think so (or not)?

NOTE: At this point, it would probably be wise to have children compare what they have seen. Introduce

the term protozoan for the microscopic animals.

Also, try to establish the concept of relative size of these forms as compared to themselves. In doing this, using a series of decreasing size objects or animals to develop a sense of comparative "smallness" will aid the children in grasping the idea of just how small these "little fellows" are.

F. Follow Up Activities

1. Have the children bring in small jars of water from sources around their homes. Repeat the procedures above for observation.

2. Use experience charts or other such story techniques to summarize the children's observations.

3. Have the children draw what they saw. Follow this up with a show and tell session to allow the children to describe their drawings.

4. Show the children prepared drawings of some common microscopic animals and discuss with them some of the peculiarities of their individual forms. Most junior and senior high school science departments have excellent 2 x 2 slides, filmstrips, charts, or other pictures of many of the more common forms.

5. Return the pond water cultures to the places from which they were originally collected. This should impress upon the children the realization that natural habitats are homes for other living things, just as their neighborhood is for them and thus these environments should be shown the same respect and consideration that the children would expect their homes to receive.

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ACTIVITY NUMBER 2 PAGES 3

LEARNING EXPERIENCE: Pond food chain

CURRICULUM AREA : Science
Social Studies

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : All things in nature must be cycled.

OBJECTIVES

Given a list of organisms from which to select, children should be able to:

1. Construct at least two simple food chains, each of which includes at least three organisms observed in the pond.

2. To recognize the organisms present in the pond.

UNIT CONCEPTS

1. All organisms are dependent upon one another for survival.

2. Big animals eat small animals, small animals eat smaller animals.

3. Green plants are the only organisms that can manufacture food.

4. Green plants capture the energy from the sun. This energy is transferred to all other organisms.

5. Organisms can be either producers, consumers or decomposers.

PROCEDURE

Materials Needed

Dip net, enamel pans, plastic containers, hand lens or stereoscopic microscope, field guides, pencil and notebook.

ACTIVITY

What signs of animal life do you see on the surface? In the water along the shore? In deeper water? In the air over the water? What are these animals doing? Watch for indications of what they are eating.

On what are the fish feeding? Why do you think so? Scoop up a panful of water. Look at it with a magnifying glass or binocular dissecting microscope. What signs of animal life do you see? Where do these fit into the food chain of the pond? About how many of these would it take to support one fish? What would happen if we stocked the pond with more fish? Do you think we should?

Scoop up a panful of mud from the bottom and examine it. Examine decaying vegetation and undersides of the leaves of any water plants. Examine the algae (with a magnifying glass or with stereoscope). Where do these organisms fit into the food chain? Are they part of the chain only if they are eaten? Why do you say this? What do you suppose they eat?

Do any birds seem to be getting food from the water or because of the water? What would happen if there were no birds?

Are any animals feeding directly on plants? What did you observe that made you think this?

Where do the plants get their food?

Do the animals contribute in any way to the plant life? How?

What are the producers in the pond? What are some of the primary consumers? Secondary consumers?

FOLLOW-UP ACTIVITY

In the Classroom:

Make a bulletin board food chain. If each of your classmates draws several animals or plants seen at the pond, you can connect them with arrows to show what eats what.

Investigate food chains in your back yard, in the school yard, in a wooded area near you, in a corner lot, on a farm.

Set up a "hay infusion" for classroom study. Place a small handful of timothy hay in a large agate or pyrex sauce pan (do not use metal). Bring to a slow boil and cook for 1/2 hour. Cool. Pour into aquarium or wide mouthed jars. When a scum begins to form on the top "innoculate" the infusion with a small quantity of water from a pond or outdoor aquarium. Be sure to include some debris: rotting leaves or twigs, mud from bottom. Replace the water that evaporates with distilled water. Keep aquarium cool and lighted, but avoid long periods of exposure to direct sunlight. An occasional pinch of powdered milk may be added if needed to provide food for bacteria.

An alternate study would be a jar of duckweed (obtained at pet stores) with snails. Keep this covered and in direct sunlight.

These provide a constantly changing population of microscopic organisms for study. Topics for investigation could include:

Why does the population of paramecia, etc. increase, and then drop?

What will happen if we introduce many more snails? Remove the snails? Add goldfish?

What happens when oil is spread on the surface of a pond to kill mosquitoes? Experiment with a drop of oil on one of the hay infusions. What organisms besides the mosquito larvae would eventually be affected? Why?

What happens when an insecticide is used? Which has more widespread effects: the insecticide or the oil? What are the advantages and disadvantages of both?

Have children collect pictures that show misuse of land and streams and discuss what might be done to prevent this waste.

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ACTIVITY NUMBER 3 PAGES 6

LEARNING EXPERIENCE: The Drain Board of the World - "The Watershed"

CURRICULUM AREA : Science
Social Studies

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Pollution is a social problem and the efforts of society are needed to control it.

OBJECTIVES

Upon completing their study of the watershed activity the students should:

1. Understand what a watershed is and what it includes.

2. Recognize the importance of a watershed and its interrelationship in the web of life.

3. Recognize and become aware that good watershed practice:

   a. reduces soil erosion.
   b. reduces flood water and sediment damage.
   c. helps wildlife and improves woodland.
   d. eliminates stream pollution.
   e. promotes better communities.
   f. provides improved recreational areas.

4. Recognize the importance of improving the quality of our water.

5. Recognize the sources of pollution in our water systems.

6. Acquire an understanding of the water cycle.

CONCEPTS

1. Water is our most precious resource.

2. Water is basic to all life.

3. Water contains a great deal of energy.

4. Water is used to carry out many jobs.

5. A watershed is the drainage area contributing to the supply of water in a stream or lake.

6. A large watershed is made up of thousands of smaller ones.

7. The watershed supplies all living things with the water essential to life.

8. Water is made available to living things through the water cycle.

9. An over loaded population density will overdraw the underground water supply and pollute this supply by introduction of sewage.

10. Pollutants change the character of the stream as a habitat for organisms.

11. Poor land management destroys the quality of our water resources.

PROBLEM IDENTIFICATION

It is raining outside and water is accumulating in puddles. Charles and Michael are playing in the puddle and probably do not realise that some day when they take a bath or drink some water it will be the very same water in which they played. How does this happen? What is our source of water?

As a young person, you probably had a favorite mud puddle in which you liked to play. The part of the yard from which the water drained into the puddle was its watershed.

Perhaps a small stream runs by your house. It may have been dry most of the year or it may have flowed continuously. Water from a few acres drained into the little stream. Those few acres were its watershed. This small stream and others like it run into a larger one.

Small watersheds make up larger ones. The Mississippi River, for example, drains a watershed of about 1,243,000 square miles. How many square miles drain into your watershed?

Water covers three fourths of the earths surface, and evaporates from all exposed surfaces, from plants and from many other living things. This water that evaporates is changed to water vapor which eventually falls as rain to become part of our watershed. These events are cyclic, hence the water cycle.

I am the daughter of earth and water,
and the nursling of the sky;
I pass through the pores of the
ocean and shores,
I change, but I cannot die.

In essence, the poem describes the water cycle, and true, the water does not die. However, man has literally exploited this natural resource to such an extent that we are faced with the possibility of running out of usable water.

PROBLEM DEVELOPMENT

Establish a Junior Watershed Association in your classroom. Organize a committee consisting of teachers, parents and students.

PREPARATION

1. select a name for your organizatiion.
2. select a geographical area to be served.
3. establish objectives for your organization.
4. identify present and future problems in your local watershed area.
5. publicize your project.
6. enlist help from community organizations.

PROBLEM IMPLEMENTATION

Allow the students to carry out library research to establish background knowledge for the study. They should seek answers to such questions as:

1. How is water used?
2. What is a watershed?
3. What is the nature of water?
4. What is a water cycle?
5. How does water support life?
6. What is water pollution?
7. How did the water become polluted?
8. What substances cause water pollution?
9. How did man contribute to the deterioration of our water resources?
10. How important is the watershed to us?
11. What must we do to solve the problems of water pollution?
12. What is energy?

Allow the students to speculate on the answers to these questions and through their research, find answers to them. From their study they will undoubtedly raise many other questions of which their answers should be based on the research done, data collected and discussions held in class and with parents and community representatives.

USE YOUR LOCAL COMMUNITY AS A RESOURCE AREA TO DEVELOP THE LOCAL PROBLEM

1. Enlist the help of the local watershed association in your community.

2. Enlist the help of other community agencies or resource people.

3. Provide each student with a map of the local area to be stud ed.

4. Allow the students to draw a diagrammatic map of the local area showing the watershed area. (Note: You may want to enlist the help of a cartographer to help the students develop mapping techniques).

5. Allow the students to determine the number of square miles included in the watershed area.

6. Allow the students to determine the type of community. Where are farming areas, industrial centers, and residential sections located.

7. Have the students determine what the zoning laws are in the local community. (Once again, a person from the local community can be used as a resource person). Have the students find the answers to:

   a. House code for building - what minimum amount of land must be used on which to build a house.
   b. Type of water and sewage system used in the community, Are they adequate?
   c. Number of people in the community.

FIELD ACTIVITIES

1. Visit streams and ponds to carry out a stream survey to determine:

   a. What lives in a pond or stream?
   b. If there is any physical, chemical and biological evidence for pollution.
   (Note: Refer to accompanying activity for aquatic study).

2. Visit other resources in the community associated with the watershed area. Example, sewage treatment plant.

FORMULATING A CONCLUSION

From their research and data collecting have the students determine:

1. If the population density is too high for the region to be supported by the watershed.

2. If the local watershed is polluted? If so, what are the causes?

   a. How did the community contribute?
   b. How did industry contribute?
   c. How did man, as an individual, contribute?

3. What are some possible means of correcting the problem.

The students as a class should submit a formal report of their study; perhaps to the teacher, the principal, local community etc. The students can present a program for the parents of the school (P.T.A. meeting) or any interested people in the community to discuss what the students have learned in this study.

EXTENDING THE PROBLEM - TO REINFORCE THE CONCEPT

1. Conduct a survey in your class to determine how much water is consumed by one individual per day; per month; per year.

   From this determine the water consumption by all the students in the school, by the community.

2. Have the students make a list showing what demands are placed on the water supply in your community. What individual demand utilizes

the greatest amount of water?

NOTE: The average city dwelling family of four uses about six hundred gallons of water each day. Industry requires some five gallons of water to produce a gallon of gasoline, ten gallons to produce each can of vegetables and twenty-five thousand gallons to process one ton of steel.

3. Have the students study the water cycle.

4. Show a film or film strip on water pollution.

5. Develop the concept of the "web of life". Use the stream or pond survey to illustrate a food chain. (Be sure and include man's relationship with the food chain).

6. Go outside your school building during or after a rain and watch what happens to the water. Does it soak into the ground or does most of it run off? Does the water which runs off carry away soil? If so, what can you do to keep this soil from washing away?

7. Take a trip to see places where running water has cut away soil. How deep are some of the gullies which you find? Keep a record of the area visited, visit the same places after several heavy rains. Record the changes observed. Why did these changes occur?

8. Collect samples of water to take back into the classroom for study.

9. Make a survey among the students in your school to determine the kind of detergents used in the homes. From this list have the students determine the effect of these detergents on the water resources of the local area.

10. Have the students set up aquariums. Divide the class into teams (depending on the size of the class the number of teams will vary; therefore the number of different aquariums will also vary.) Set up a balanced aquarium, aquarium with plants only, and an aquarium with animals only. Have some of the group do nothing to their aquariums. Have other groups introduce various materials (pollutants) into their aquariums. Have the students observe the aquariums daily and record differences. What differences occurred? Why?

NOTE: A balanced aquarium is one in which the animal and plant life are in proper biological association with one another with respect to the water capacity of the tank used.

INSTRUCTIONAL MATERIALS

Films: "Water in the Air"; black & white; 11 minute; Cenco
"Water and What It does"; 11 minute; EBF
"Wise Use of Water Resources"; 14 minute; UWF

Pamphlets: "The Natural Water Cycle"; USFS
"Water Shed", USFS

*Raindrops and Muddy Rivers
**Living Specimens in the School Laboratory

Your local RIMC has available films and other Audio-Visual materials that can be used for this study. Refer to the General Catalogue for individual items.

Cenco - Cenco Educational Film*
1700 Irving Park Road
Chicago, Illinois 60613

EBF - Encyclopedia Britannica Films, Inc.
1150 Wilmette Ave.
Wilmette, Illinois 60091

UWF - United World Films, Inc.
221 Park Avenue South
New York, New York 10003

USFS - United States Department of Agriculture, Forest Service South Building, 12th St. and Independence Ave., S.W., Washington, D.C. 20250

*National Wildlife Federation, Inc.
**General Biological Supply House
8200 South Hayne Ave.
Chicago, Illinois 60620

Directory for Water Shed Association

Brandywine Valley Association
F & M Building
West Chester, Penna. 19380
Phone: 215-696-0425

Green Valleys Association
Birchrunville
Penna. 19421
Phone: 215-827-7843

Neshamenz Valley Water Shed Association
3 West Oakland Ave.
Doylestown, Penna. 18901
Phone: 215-348-2530

Water Resources Association of the Delaware River Basin
21 South 12th Street
Philadelphia, Penna. 19107
Phone: 215-103-8572

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ACTIVITY 4 PAGES 2

LEARNING EXPERIENCE: Water - Our most Precious Resource

CURRICULUM AREA : Science

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Interaction and interdependence among organisms is a function of life's community structure.

OBJECTIVES

After participation in this Field Trip students should be able to:

1. Define water pollution.
2. Describe pond water in terms of things floating or dissolved in it.
3. Name three important modifications of organisms which enable them to live in water.
4. Use thermometers to measure temperature and estimate temperature within 10°F using no instruments.

UNIT CONCEPTS

1. Water is basic to all life.
2. Organisms that live in an aquatic habitat have developed body structures, adaptable for a water environment.
3. Polluted water changes the community structure of the pond.
4. A community consists of organisms living harmoniously together.

PROCEDURE

Materials Needed

Thermometer, ruler, collecting nets, jars, or plastic containers, enamel pans, hand lens or stereoscopic microscopes and field guide.

FIELD ACTIVITY

1. Compare the environment in the pond with that around it. What are some of the things which an organism would have to be able to do to survive in the pond?
2. What changes would have to be made if you were to live in the pond?
3. What things do all organisms living in the pond have in common?
4. What color is the water? Is it clear, is there anything floating in it? (If so, describe it).
   Do you think that it would be good to drink? Good or bad to taste? Good for health? Can you think of anything it would be good for? Do you think this water is polluted? What does "polluted" mean? Why do you think this? Where does the water in the pond come from? What other things are in it besides water? Might there be other things in it which you can't see? How could you find out?
5. Measure the temperature of the air, then feel the water with your hand and try to estimate: Is the water temperature higher or lower than that of the air? How much? Then, take the water temperature with the thermometer and see if you were correct. Take temperatures on all sides of the pond, in sun, and in shade, in the running water of the inflowing stream and the outlet, both at the surface and at a depth of 10 inches (or a convenient depth). Record these carefully and try to explain any apparent differences.

FOLLOW-UP ACTIVITY

Collect pond water in large jars. (Ask the school cafeteria for wide mouth gallon or two gallon ones). Take several samples from different areas, but don't specifically collect a lot of animals - just take some water, some of the "Slime" present, some plants, if they are in abundance, and some of the bottom mud or dead leaves. Some jars could contain water from a mud puddle, a rain barrel, any source of untreated water. To some jars, leaves, or dry grass may be added. Tap water should never be used as the chemical treatment kills organisms in the water.

These jars should be examined closely by the class, using hand lenses and microscopes as well as any other available means of observation. They should be carefully labeled as to the date and location of collection. Lids should be placed loosely on the tops so as to retard evaporation without shutting out oxygen, then kept in a convenient place, which also may vary. Direct sunlight, for instance, would encourage plant growth but decrease the growth of bacteria and hence the micro organisms feeding on them.

It might take a few observations of the jars to see a small fraction of the living things within them, but the first few days are apt to be a disappointment. After a week or two however, changes should be occurring at a comparitively rapid rate as the Protozoa develop and the larger insect larvae or whatever you have die off. Protozoa are not too easy to identify and it is not really important to name them exactly. A descriptive name serves communication within the group and common ones may be recognized in any one of numerous books on the subject. You will probably find however, that no book encompasses the variety of life you will be able to find in your cultures.

The class should keep a notebook recording the changes observed and dates of the observations of each jar. Physical observations such as temperature and pH should also be recorded as well as the more obvious changes in odor, clarity of water, color, etc.

As the succession of organisms change and a more stable condition ensues observations may lapse to one a month, but new and interesting changes have been seen in such cultures maintained without care for years. The challenge, of course, arising in the discussion of the reasons for each observed change in the jar.

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ACTIVITY NUMBER 5 PAGES 2

LEARNING EXPERIENCE. Stream Study

CURRICULUM AREA : Science

GRADE LEVEL : 5th

6th

CONCEPTUAL THEME : Life is present in the stream.

OBJECTIVES

Students should be able

1. To describe several different features of the stream.
2. To demonstrate the use of their senses.
3. To determine what forms of life are present in the stream.
4. To acquire an understanding of the physical and chemical nature of water.

UNIT CONCEPTS

1. The stream contains various habitats.
2. Many forms of life live in a stream.
3. All the organisms in the stream need, oxygen, food, water, and a place to live.

PROCEDURE

Materials needed:

Thermometer, nets, trays, Ph kit, pencil and paper.

FIELD ACTIVITY

Look toward the creek from a distance. How can you infer that there is a stream at that location? (Different vegetation, topography of the land). Do you think the stream has always followed the same course as now? What evidence do you see that the stream has changed course? (Flat deposited land, steep undercut banks). What evidence is there that the stream is changing its course right now?

What signs of life do you see along and in the stream?

What things to you see floating on the surface of the stream? What things do you see floating beneath the surface of the stream? Do all floating objects move at the same rate of spped? What things do you see that cause differences in the current?

Try to predict the path the current follows. Go upstream and overturn several rocks to muddy the water. Watch the flow of muddy water. Does the flow of muddy water follow your predicted path? If not, why didn't it follow your predicted path?

Look for places where the current seems to be absent, or to move upstream. (NOTE: These are called eddies.) They are most often found on the downstream side of rocks or other protrusions. Why?

Does the water flow more swiftly near the shore or near midstream? (How can you find out?) (NOTE: Where the stream makes an S curve, the rate of flow will not be equal on the concave and convex sides.) Why? Where is the water flowing more swiftly? How does the speed correspond with the depths on the curves?

Can you tell the depth of the stream? How? Is the depth of the stream the same at all places? Why not? Where does the water appear to be the deepest? What words describe the appearance of the water where it appears to be the deepest?

Compare the "deep" areas of the stream with the "shallow" areas. List ways they are alike: different.

Is the water always the same depth? What are some things that change the depth of the stream? Find two things in or on the banks of the stream that would indicate the level of the water changes?

How does the water feel? Does it always feel this way? What things would change the feel of the water?

Can you find a good site to build a bridge? Can you find a good site for building a dam? Can you find a poor site? Why did you make your choices? What would happen to the area if a dam were built?

Turn over rocks and dig in the muddy bottom portions of the stream to find "creatures". Be sure to replace the rocks once you have examined them. Remember, it's their home.

Feel the rocks above the surface of the water. Feel the rocks beneath the surface of the water. Describe how they feel. Do they feel the same above the surface as they do beneath the surface? Explain the differences.

Can you find a place in the stream where it has changed its course?

What are the sources of a stream? Do you see or can you find any places where water is entering the stream? Do you see any places where water has entered the stream at some other time? Why do you think it is not entering from there now?

Does the stream stay the same size its entire length? If we walked upstream, what would you expect to happen to the width of the stream? What would you expect to happen to the depth of the stream? What would you expect to happen to the width and depth of the stream if we walked downstream?

How does the contour of the land affect the course of the stream? How does it affect the flow patterns of the stream? Can you predict where the stream would be narrow or wide by looking at the contour of the land? How has the stream affected the contour of the land? Has the stream always been in the same place? (What makes you think this?) Will the stream be in the same place next week? next month? next year? 100 years from now? What makes you think this? (Look for places where the

stream is presently eroding banks, building and removing sand bars. Compare with observations made regarding water speed and depths on S curves).

Is the appearance of the stream in a meadow area the same as in a wooded area? List the differences and similarities.

In what parts of the stream can you see your reflection or the reflection of some object? Can you see it all the time? (Why not?) In what parts can you not see a reflection? Why?

Study the surface of the stream. What does the surface appearance tell you about the bottom of the stream? Try to make a profile sketch of a stream section showing the factors contributing to its surface features.

Take samples of water from a swiftly moving portion of the stream and compare them with samples taken from a slow-moving portion of the stream.

Record the temperature of the water, of the air above the water and of the air a distance from the water. pH - explain this concept in terms of different types of chemicals present in the soil. Different chemical content produces different color reaction. This should be sufficient for children of this age. Have them check the pH of the soil, the soil from the stream bottom and the water of the stream.

Did any of these areas have the same or nearly the same pH? If any of the areas were the same or nearly the same, can you account for this likeness? If they were different, can you account for the differences? (This may be difficult to tell, but don't let that stop the discussion).

FOLLOW-UP

1. Have the student complete a list of the organisms found in the stream.

2. Have the students identify the food habits of the organisms.

3. Have the students draw a food chain, using the organisms found in their study.

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ACTIVITY NUMBER 6 PAGES 2

LEARNING EXPERIENCE: The Stream as a carrier of sediment.

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Pollution is a social problem and the efforts of society are needed to control it.

OBJECTIVES

1. Determine the amount of soil carried by a stream under various conditions.

UNIT CONCEPTS

1. The sediment washed from our water shed area destroys the land of the farmer, as well as the city dwellers.

2. The sediment washed away is the best soil used for growing plants.

3. Sediment in the stream is soil eroded from the land.

4. Sediment in our stream deteriorates the quality of the water.

MATERIALS NEEDED

1. Some kind of tall vial or narrow bottle.
2. Rubber stoppers
3. Marking pencil

PROCEDURE (Before and After it Rains)

1. Collect (1) sample each of water from a stream that gets its water from a cultivated field, from woodland and from a pasture. (Be sure to mark each bottle).

2. Allow the bottle to settle for a few days.

3. Observe them daily and record your results.

How much sediment settled out? After a few days empty the water and weigh the sediment in each container. If you use a quart of water, the result can be recorded as lbs/qt. of water. This can be figured out in lbs/lbs. Smell the container to determine if any odors are present. What is the size of the particles in the sediment. Fine, sandy, big, large, very large? What colors do you see? Is there any organic matter present in any of the jars? What differences do you see? What differences are there in the samples collected before and after it rained? Is there any increase in sediment on the sample collected after it rained? Why? What happens when heavy rains fall in bare fields? What is soil? What is erosion? Is this a form of water pollution? Does the sediment carried by the stream hinder man in any way? How can we reduce sediment deposits? Can you design an experiment to test your idea?

FOLLOW-UP

1. Collect newspaper articles.

2. The Mississippi River dumps 400 million tons of earth into the Gulf of Mexico annually. How many tons have been dumped since Columbus landed? How many tons is dumped in a month? a day? a minute? Every minute the Missouri River empties enough soil into the Mississippi River for a 20 acre farm. How many "farms" are lost in a hour? a day?

a week? a year?

3. Discuss ways erosion could be prevented.

4. Pour water on one spot of black-top that has a gentle slope. Watch how it runs in small tributaries to a large stream.

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ACTIVITY 7 PAGES 1

LEARNING EXPERIENCE: Water Quality

CURRICULUM AREA : Science
Health
Social Living

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Pollution is a social problem and society is charged with the responsibility to control it.

OBJECTIVES

At completion of activity students will be able to:

1. describe ways water is used in a community.
2. describe actions you can take in your everyday life to help improve the way water is managed.
3. tell where communities can get their water supply.
4. list factors that determine water quality.

UNIT CONCEPTS

1. Water is necessary for survival.
2. Communities can take many steps to increase the quality of their water.
3. Waters of varying qualities may be treated for use in a community.
4. The most desirable water is cool, clear, as nearly odorless and tasteless as possible, and completely free of disease causing organisms.

PROCEDURE

What is the source of water for your community? (a company or personal wells) What is the source of water that the company distributes?

FIELD ACTIVITY

Visit the area where the community's water comes from (reservoirs, river, springs, streams, wells). Look for factors that may affect the quality of the water. Is there always the same amount from this source?

Visit the water treatment plant. What is the water like when it gets to the plant? (odor, temperature, turbidity, hardness , micro-organisms). What kind of treatment does the water get to increase its quality? What standards does the water have to meet as set by U.S. Public Health Service (calcium, magnesium, iron, manganese, chloride, sulfate, detergents, total dissolved solids and pH). How is the water checked to see if it meets these standards? How often is a check made? Does it vary with the size of the community being served? Does the quality of the water vary from day to day, season to season, year to year? What causes these changes?

FOLLOW-UP ACTIVITIES

Discuss how various factors make water desirable or undesirable for individual use. Odor? Taste? Turbidity (clear)? Free of disease organisms? Which is most important? Least important? Can water have a bad odor or taste and still be safe to drink? What are some of the effects of hard water? (deposit in pipes, cooking utensils). Do standards of water quality vary with varying uses? (industry, agr ulture, drinking, swimming).

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ACTIVITY 8 PAGES 4

LEARNING EXPERIENCE: Water Pollution

CURRICULUM AREAS : Science
Health
Social Studies

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME : Water pollution is a social problem and society is charged with the responsibility to control it.

OBJECTIVES

After completing activity students will be able:

1. To explain the hydrologic cycle.
2. To demonstrate knowledge of the amount of water used by modern man in home and industry.
3. To list various sources that contribute to water pollution (natural and man-made).
4. To demonstrate knowledge of the effects of water pollution upon man.
5. To explain the importance of water to settlers in the United States.
6. To list physical properties of water.

UNIT CONCEPTS

1. All water on earth is recycled in the hydrologic cycle.
2. The average water consumption in the United States is approximately 1,800 gallons per person per day.
3. Water pollutants come from many sources.
4. Water pollution effects our everyday life through increased costs and lost recreational areas.
5. Cities and settlements were started close to water supplies.

PROCEDURE

Class discussion and activities prior to field experience.

1. Discuss the hydrologic cycle. How has man altered or interfered with the cycle? What has the construction of cities done to the cycle?
2. Discuss the physical and chemical properties of water. (Odorless, tasteless, colorless, expands when frozen, becomes lighter when frozen (ice floats), ("universal solvent").
3. Discuss water as part of the human body (90% of body weight). Man can live without water only about five days and depends on water for washing, business, industry and recreation. Man uses approximately 1,800 gallons per person or 355 billion gallons per day.
4. Have the students list sources of water pollution.
5. List water users.

   Municipalities - use only 10% of the nation's water supply.

Agriculture - approximately 40% of the United States water supply is used for irrigation.

Industry - largest consumer use for cooling, cleaning and power. Contamination of our water supply by industry is our major water pollution problem.

6. Discuss how water is re-used as it flows toward the sea. Does this reuse increase the pollution? Discuss how a river purifies itself as it flows toward the sea. What happened to the Cuyahoga River in 1969? (it burned)

7. List various types of water pollutants: (Sewage, radioactivity, cancer producing chemicals (arsenic, beyrllium, chronium), heat, oil, detergents, chemicals (pesticides, etc.), fertilizers.)

8. Discuss the economic impact of water pollution. (Water treatment facilities, fishing industry, recreation, damage to ships, bridges, dams, and other water equipment, and beauty).

9. Where were the first large cities built? Where are the largest cities today? How did the early settlers travel and move goods?

FIELD ACTIVITIES

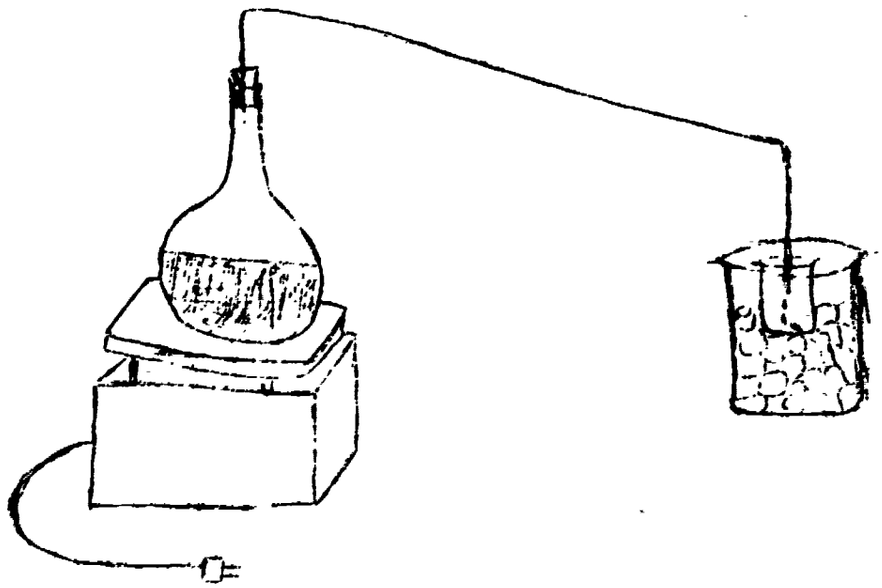
1. Visit a municipal sewage treatment plant. How does it operate? What happens to the treated waste?

2. Visit a municipal water treatment plant. Where does the water come from? How is it treated? How much does the community use each day? What makes the water fit or unfit for use?

3. Visit various bodies of water in your area. Streams, rivers, ponds, lakes. Are they polluted? How can you tell? What kind of pollution is present? Where is it coming from? What could be done to stop the pollution? What kinds of plants and animals live in the water? Were there more or less than you expected?

FOLLOW-UP ACTIVITIES

1. Set up a simple distillation proves to demonstrate how dissolved pollutants can be removed from water. Materials needed are: Flask, one-holed rubber stopper, large jar or beaker, small jar or beaker, ice, glass tubing, hot plate or bunsen burner to heat solution, salt (NaCl). Set up the equipment as shown on page 3.



Fill the flask about half full with a solution of water and salt. Taste the solution. Now boil the solution gently. What happens? Taste the water that forms in the small jar. What happened to the salt?

2. Fill three jars or beakers with distilled water. Label them A, B, and C. Put a tablespoon of detergent in jar A and a tablespoon of fertilizer in jar B, leave jar C as it is. Stir A and B until all the particles are dissolved. Now add an ounce of pond water, which has some algae growing in it. Now set the jars away for two (2) weeks. At the end of this time, compare the three jars. Which jar shows the greatest growth of algae? Raad the labels on the detergent and fertilizer boxes to see how much phosphate is in each product. Which jar has highest amount of phosphate? Try the experiment using different detergents and fertilizers. Keep track of the amount of phosphate in each product. Develop a color code to compare samples.

3. You will need three large jars. (Ask in the school cafeteria for jars that pickles or mayonnaise come in). Fill one with water from the faucet. Fill another with water from the faucet plus litter (paper, leaves, twigs) picked up from the school playground. Fill the third jar with pond water or water from a stream. Set the jars aside for several days. Compare the jars. What happened?

4. Set up an experiment to show how water naturally filters itself as it soaks through the ground. Use muddy water and filter it through gravel, sand, and cotton. Which one was more effective? Why? Try a system with layers of cotton, sand and gravel.

5. Set up a terrarium to observe the hydrologic cycle in nature.

6. Form a club to fight water pollution in your community.

7. See related activities: The Drain Board of the World-"The Water Shed"; Water-Our Most Precious Resource; Pond Food Chain; and Microscopic Aquatic Animals.

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ACTIVITY # 101 PAGES 2

LEARNING EXPERIENCE: Plant Identification

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Plants are divided into two major categories; flowering and non-flowering.

OBJECTIVES

After trip students should be able to:

1. List the six groups of plants found on the trip.
2. Describe two characteristics of each group.
3. Describe or draw two representatives of each group.
4. Evidence new knowledge and interest in non-flowering plants.

UNIT CONCEPTS

1. Non-flowering plants include ferns, mosses, fungi, algae and lichens.
2. Non-flowering plants do not produce seeds.
3. Non-flowering plants grow in areas, and under many conditions.

MATERIALS

Field guides for trees, ferns and non-flowering plants.

FIELD ACTIVITY

Can you find examples of the different kinds of plant groups: Flowering plants, ferns, mosses, fungi, lichens, algae?
Can you find plants that you cannot place in one of these groups?
Can you find clues and references that will give you some idea what the unknown plants are?
Which group is most numerous in the woods?
Which group is most numerous in the field?
Can you explain why some might be more numerous in one place than in another?
How many different flowering plants can you find?
How do you know they are all flowering plants?

FERNS

How can you tell one fern from another? Compare the fronds. Are they All the same shade of green? Can you find fronds that seem to be made up up of smaller fronds? Look at the backs of the fronds. Feel them. Do you notice anything that is not on the upper surface? Do all fronds have these dots? Do all ferns have them? Are they always in the same place on the fronds? Can you find a fern that has a leaflet that looks like a little stocking? What might be a good name for it?
Can you suggest names for any other ferns based on your observations? Do ferns have seeds? Why not? How do they reproduce?

MOSSES

How can you tell one moss from another? How can you recognize moss?
Is there more than one kind of moss? How many kinds of moss can you find? Describe the differences.
Can you suggest some names for some of the kinds of moss you find? Are the same kinds of moss growing in the field as in the woods? How does moss feel? (Compare with feel of lichens, algae).
How does the ground feel where moss is growing? (Compare with feel of lichens, algae).
How tall does moss grow? Measure the height of the tallest moss you can find. Find the shortest.
How does moss differ from ferns? From flowering plants?
What are the little stalks you may find growing from moss? What do they do?

ALGAE

Is that algae or moss on the trunks of the trees? How do you know? Is it true that it grows only on the north side of trees? (Which direction is North?)
Why do you suppose people say you can tell which way is north by the "moss on the trees" if it isn't true?
Why might more algae be found on the north side of trees than on the other sides?
How does algae differ from moss?
How does algae feel? Try to describe the feel. Compare with lichens, mosses.

LICHENS

How do you recognize a lichen?
How do lichens feel? Compare them with mosses, algae. Try to describe the feel.
What color or colors would you use to describe lichens?
How many different lichens can you find?
Can you suggest names for some of them? Especially one with a red top, one that looks like this?

Where do you usually find lichens? What are they doing to it?
How does the ground feel where the lichens are growing? Compare with the feel of the ground where you find mosses, ferns.
Which plants do you think would be first affected by a lack of water? Algae, mosses or lichens? Why?
What two kinds of plants live together to make a lichen? What kind of relationship is this?

FUNGI

How many kinds of fungi can you find? Feel them. How would you describe how they feel? Can you find fungi that have stripes? That are pink? Orange? Brown? Reddish? Green? What does the green color of a plant usually mean? Do fungi contain chlorophyll? What might be the green coloring on some of the fungi? Why might algae be growing on fungi? Where are the fungi growing? What reasons can you think of for it growing where it does?
Feel the wood under the fungi. Try to describe how it feels, how it looks, how it sounds when you tap on it. Why does it have these characteristics?
Both fungi and algae were found growing on trees. Are both dependent plants? If not, why is the algae growing on the trees? Could algae grow on rocks?

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ACTIVITY 102 PAGES 2

LEARNING EXPERIENCE: Woods and Field - The Effects of Light

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Light affects plant growth.

OBJECTIVES

Students should be able to:

1. Approximate age of saplings by use of terminal bud scars.

2. Find three leaves which are translucent and five plants whose leaves (or needles) reflect light.

3. Students should be able to describe at least three effects of light on living things.

THE TRIP

What effect does light have on living things?

Examine the amount of undergrowth on the forest floor. Where is there the most growth?
Is the ground cover made up of the same kinds of plants in both places?
How would you contrast the growth on the floor. Which is more spindly? Thicker? More flat-like? What other comparisons could you make?
What might be an explanation for the differences you have noticed?

Compare the amount of light in each area.
Could this account for the differences? How?
Do you think light has any other effect than determining the kind and amount of ground cover?

What other effects might it have?
What measurements could you make to find some of the effects?
Do you think plants would grow faster in the forest or in the field? Why?
(Allow time for speculation. Some observant individual may note that the forest undergrowth is more spindly than that in the field).

Try to find two saplings of the same type and age. Compare their sizes. (Note: It will probably be necessary to explain how to find the age of a sapling. Point out that where the bark is too thick to count terminal bud scars, an approximation may be made as follows: If the tree grew three feet in the last six years, it probably grew about the same amount in the preceding six years. Example: If a tree grew three feet in the last four years, and the tree is six feet tall, it is probably about eight years old).

Try to find two saplings of the same type, which are the same size. Compare their ages. Repeat these two investigations for several species of saplings. Did you find what you expected to find? Can you venture an explanation for what you did find?

Does one area have greens that appear more intense? Which area? (Note: It may be necessary to define intensity as the <u>amount</u> or <u>saturation</u> of color).

If you can find some green leaves that have fallen on the forest floor, take them to the field and look at them there. Is there any change in intensity? Now, take some leaves from the field into the forest. What observations do you make?

Does one area have greens of a predominantly different hue than the other area? (Note: Hue can be explained to the children in terms of a green with blue in it, a yellowish green, etc. Does looking at such leaves in a different light seem to change the hue?)

In which area do the greens seem to have more blue in them? Yellow? Does one area have greens of a lighter or darker value than the other area? Does your observation hold true when you look at those greens in a different light? (Note: Value may be defined as being "light" or "dark")

Do leaves transmit or reflect light?
Can you find a tree whose leaves are translucent?
Can you find a tree whose leaves reflect light?
Can you find plants whose leaves are translucent but also reflect light?
Do all leaves reflect light to the same extent?
Is there any characteristic appearance or texture to the leaves which reflect light?
Does the ability of the vegetation to reflect or transmit light have any effect on the light intensity in an area?
Is there any relationship between translucency and hue?
Is there any relationship between translucency and intensity?

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ACTIVITY # 103 PAGES 1

LEARNING EXPERIENCE : Seeds

CURRICULUM AREAS : Science

GRADE LEVEL : 2nd
3rd
4th

CONCEPTUAL THEME : Seeds play an important role in the life cycle of a plant

OBJECTIVES

At the completion of this field trip, the student should be able to:

1. Trace the sequence of events that occur in the cycle of plant reproduction starting with the seedling (or flower) and extending to seed dispersal.
2. Name and describe several methods of seed dispersal.
3. Given different kinds of seeds common to the field trip area: match the seeds with the trees or other plants that produce them.

UNIT CONCEPTS

1. Seeds grow into new plants, similiar to the plant the seed came from.
2. Seeds are adapted for dispersal by wind and animals.
3. Each type of plant produces its own type of seed.

FIELD ACTIVITY

From that direction is the wind coming? How do you know?
Do you see anything being moved by the wind?
Do you see anything being moved from one place to another by the wind?
Are the things being moved by the wind natural objects or man-made materials? Are the natural materials animals or are they plant parts?
How can you tell?

Walk through the field.
Examine your clothing. Is anything sticking to your clothing?
What is it?
Look carefully with a hand lens at the seeds sticking to your clothes.
What seed structure causes the sticking? Can you identify any of them?

How are these seeds dispersed? Is man the only animal disperser of these seeds? What other animals might do this?

Look carefully at the air. Do you see evidence of wind-dispersed seeds?
Look for plants in the field that are yielding seeds to the air.
Can you identify these plants? How do the pods of the plants look and feel?
What seed structures do these have that enables them to be wind-dispersed?

Proceed to the woods.
Examine the branches of trees. Describe what you see on the branches.
Look for fruits, pods, nuts.
Examine the ground beneath the trees. What do you see, other than leaves, that might have fallen from the trees?
Must seeds be covered with soil to germinate and take root?
How do you think that seeds on the forest floor become covered with soil?
Carefully examine an acorn, beech burr, hickory nut, fruit from a tulip tree or any other seed or seed casings that you find. What form of seed dispersal do you think has occurred?

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ACTIVITY NUMBER # 104 PAGES _____

LEARNING EXPERIENCE: Flower Function

CURRICULUM AREA : Science

GRADE LEVEL : 5th

6th

CONCEPTUAL THEME : Flowers play an important part in the life cycle of a plant.

OBJECTIVES

After field trip students should be able to:

1. Identify and differentiate between the buds of leaves and of flowers.
2. Name and describe two methods of pollination of flowers.
3. Identify the major parts of a flower that function in reproduction.

UNIT CONCEPTS

1. Flower buds and leaf buds are different.
2. Flowers are adapted to attract insects which aid in pollination.
3. Pollination is necessary for seed development.
4. The parts necessary for seed production are the pollen producing stamens (male) and pistils (female).
5. Plants bloom at different times.

MATERIALS

Hand lens, Identification keys

FIELD ACTIVITY

Observation by sight and touch and smell.

Smell the air of the woods and field. Describe the odors.
Note, from a distance, the colors and abundance of leaves.
Look at the branches of trees and the stems of other plants.
Locate the leaves. Locate the buds if any.
Locate flowers on trees and other plants.

Smell the leaves and flowers of the same tree (or other plant). Do they have the same odor? Which do you think has the more pleasant odor: Leaves or flowers? Do you think everyone would agree with you?

Look for plants that have buds but no flowers. Look for plants that have buds partially opened; fully opened.
Open a flower and a bud. Locate the ovules within the ovary. What will these look like in the fall?

Look for a leaf bud and a flower bud on a tree. Try to find the tiny leaves in a leaf bud. Describe them. Describe the differences between the two.

In the field, look for insects close to or in flowers. What insects do you see? Are they flying or crawling? Do they go to flowers of the same variety? Or of different varieties? Smell the flowers. Are the odors pleasing to you? Do you think it is the odor or some other factor that attracts the insects?

What part of these insects play in the story of seeds and their dispersal? Can you suggest other possibilities for pollination of flowers?

Can you predict the fall appearance of the plants you have observed?

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ACTIVITY 105 PAGES 1

LEARNING EXPERIENCE: Fungus on Log

CURRICULUM AREA : Science
Language Arts

GRADE LEVEL : Kindergarten
1st
?nd

CONCEPTUAL THEME : All organisms are interrelated and interdependent

OBJECTIVES

After completion of activity, students should be able to:

1. Describe an object in nature using adjectives that demonstrate the use of the senses.

2. Identify the growth on dead trees as fungus.

UNIT CONCEPTS

1. Fungus comes in many shapes and sizes and textures.

2. Fungus grows on dead trees.

FIELD ACTIVITY

Draw attention to growth on a fallen tree.

How does it look? Is it wet or dry? What color is it? Hard or soft? Does it look the same on all sides of the trees? Does the top side of the growth look the same as the bottom side?

Feel the growth. Does the growth feel the way it looks? Does it feel the way you thought it would feel?

Pull a small piece of the growth from the tree. Squeeze it. What happens when you squeeze it? What happens when you release it?

How does the growth smell? Try to describe it. Do you know of anything that has a similar smell?

Have you ever seen anything else that looks like the growth? Feels like it?

On what part of the tree do you see the growth? Do you see any other trees nearby with the same type of growth?

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ACTIVITY 106 PAGES 1

LEARNING EXPERIENCE: Numbers in Nature

CURRICULUM AREAS : Mathematics
Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : There are orderly patterns in nature.

OBJECTIVES

After completion of activity, students should be able to:

1. Examine objects in nature as to numerical patterns and geometric shapes.

2. Name several plants and their numerical patterns and geometric shapes.

UNIT CONCEPT

1. Some plants are named from their patterns and shapes.

2. Plants exhibit varying numerical patterns and geometric shapes.

PROCEDURE

Many things in nature appear to have some numerical pattern. The numerical pattern refers to number of leaves in a group; the number of petals on a flower; the number of leaves on a flower as related to the number of petals on the flower itself; the number of pine needles in a cluster. The pattern may be 3's, 6's, 9's, etc. If students have studied monocots and dicots, review these number patterns.

MATERIALS NEEDED

Pencil
Paper

FIELD ACTIVITY

Find examples of numerical patterns in nature. How many different patterns are there? Draw sketches of geometric shapes and designs found in nature.

Are any plants you know named for their numerical patterns or geometric shapes? Example: trillium - 3 petals, 3 leaves
cinquefoil - 5 petals, 5 leaves

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ACTIVITY 151 PAGES 1

LEARNING EXPERIENCE: Comparsion of Coniferous and Deciduous Woods

CURRICULUM AREA : Science

GRADE-LEVEL : 2nd
3rd
4th
5th
6th

OBJECTIVES

After a trip to a deciduous woods and to an evergreen woods, students should be able to direct the teacher in constructing a chart showing how one area differs from the other in ground cover, amount of sunlight, colors, odors, sounds, plant life, and animal life.

THE TRIP

Visit a deciduous wooded area, then, an evergreen woods.

How does the ground feel here? Is it hard? Why is this type of ground cover here?

Does this area have an odor? What does it smell like?

How many different colors can you see? How many different plants can you find here? What signs of animal life do you see? What signs of spring (fall, winter) are here?

What do you notice about the trees in this area? Does this tree have leaves and fruit? How many different kinds of trees are growing in this area? How can you tell different kinds of trees? Can you tell how old the trees in this area are? How?

What are some reasons for having an area like this?

What will the trees in this area look like in fall? winter? spring?

What is different about the two areas? What is the same?

On the way back from the field trip have students look for examples of deciduous (broad leaf) and coniferous (usually evergreen) trees. Ask them to tell what is different about them. (In the winter, evergreens are easily distinguished from deciduous trees).

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ACTIVITY NUMBER # 152 PAGES 1

LEARNING EXPERIENCE: Tree Buds

CURRICULUM AREAS : Science

GRADES 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME : Spring is a time of increased plant growth.

OBJECTIVES

After completion of activity, students should be able to:

1. Find at least three buds which open with leaves in different 'packaging' arrangements.
2. Count the number of leaves emerging from one bud and make comparisons with buds of same and different species.
3. Differentiate new growth from old on evergreens.
4. Locate at least one plant which has bloomed, one which in in bloom, and one which has not yet bloomed.

UNIT CONCEPTS

1. Buds are packaging to protect plant shoots while they are developing.
2. Buds open in a variety of ways depending on shape, size and arrangement of the shoots in the bud.
3. New leaves are lighter in color than old leaves.
4. Buds open at different times on different plants.

FIELD ACTIVITY

Do all buds open at the same time? Examine a variety of trees before coming to a conclusion.
Can you find some trees and shrubs whose leaves seem to be completely unfurled before other trees have begun to open?
Do all trees of a given type leaf-out at the same time?
Do all the buds on one tree open at the same time?

Are leaves full-sized when they emerge?
Are all leaves on a given tree the same size when they emerge?

Observe the arrangement of the leaves as they emerge. Do they "hang down"? Are they "held up"? Are they "thrust out"? Try to use descriptive phrases in telling about them, such as "rabbit ears", "a handful of playing cards", etc. Try to sketch some of these arrangements.

How have the leaves been packaged in the bud?
Find a tree whose leaf emerges folded in half. (Tulip tree)
Are both sides of such leaves exactly alike?
Find a tree whose leaf emerges accordian pleated. (Beech) Is there any relationship between this and the veining pattern?
Find a tree whose leaf emerges curled. (Willow)
Record your findings.

Compare the size and number of leaves emerging from the opening bud with an unopened bud of the same type tree, if you can find one.

How many leaves come out of one bud? Is the number the same for all buds on a given tree? For all trees of a given type?

Observe the bracts from which the leaves are emerging. What color are they? How does their texture compare with the texture of the leaves on that tree? Compare the bracts (bud scales) on different trees.
What becomes of the bracts after the leaves unfurl?

Compare flower buds and leaf buds. (Note: Broken branches from tulip and oak may have to suffice for some comparisons, as these trees do not flower until they are too tall for ease of observation).
Which open first on dogwood? Oak? Spicebush? Tulip tree? Red maple? Sassafras? Etc.
Do the leaves and flowers come from the same buds?

Observe flowers and other growth on the forest floor. Do any plants have leaves, with flower buds yet unopened? Are any flowers blooming that do not yet have leaves? Does the flower come from the same stem as the leaves? Does the answer to the last question have any relationship to the other two questions?

If evergreens are present, observe an evergreen. Can you find buds on this tree? What are the leaves on an evergreen? Where are last year's leaves? Is any part of each branch a different shade of green? What part?
Where would you expect to find buds on a branch?
Feel the light green tips. How do they feel? How do they feel in comparison with the darker needles? What might explain the difference?
How does an evergreen grow?
Are there any other kinds of "buds" on these trees?
What do you suppose they are? Why?

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ACTIVITY 153 PAGES 3

LEARNING EXPERIENCE: Tree Stumps and Annual Rings

CURRICULUM AREAS : Science
Social Studies
Mathematics

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Study of annual rings will reveal much about a tree's life.

OBJECTIVES

After completion of activity, students should be able to:

1. Count the annual rings on a cross-section of a tree to determine the age (within a five year accuracy).
2. Determine in what direction one object lies from another, when told where North is.
3. Compare the circumferences of two or more stumps to determine which is larger and compare the ages of two or more stumps to determine which is older.
4. Locate the 'starting point' of the tree by finding the smallest annual rings.
5. Measure the distance from the smallest annual ring to the edge of the stump in four directions.
6. Compare the amounts of annual growth, determining periods in which the tree grew more than others.
7. Recognize signs of injury to a tree from deformities in the annual ring pattern.
8. Find an average from data collected in the field.
9. Tell at least three things which may be learned about a tree's life history from observing the stump.

UNIT CONCEPT

1. The yearly growth of a tree is marked by annual rings.
2. Annual rings vary in size from year to year depending on growing conditions for that year.
3. Injuries received by the tree may be apparent in the annual ring pattern.
4. A tree usually does not grow evenly on all sides.

MATERIALS NEEDED

Tape measures
Pencil
Paper
Crayons

FIELD ACTIVITY

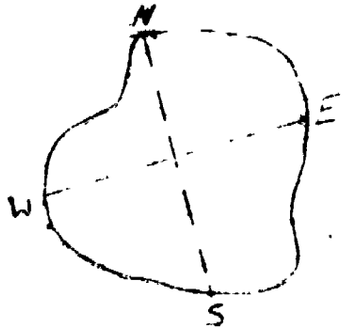
How can you find out how old a tree was?
Can you find at least two stumps that tell you how old the tree was when it was cut down?
Which is the bigger of the two stumps you found? How much bigger?
(NOTE: It will be easier for the children to measure the circumference of each tree if they work in pairs).

How old was each tree when it was cut?
Which was the older? How much older? Was the bigger one the older? If not, can you guess why not?
(NOTE: Allow time for discussion of this point. Suggestions may be made which will lead into the following suggested investigations or into other investigations.)

Does a tree grow the same amount each year? What evidence can you find to support your answer? Do some trees grow slower than others?

Did each of the trees whose stumps you are looking at grow more rapidly during its first ten years of life or during its last ten?
Assuming the two stumps you are observing were cut the same year, is there a correlation between the amount of growth of each tree during the last 10 years of their lives? (NOTE: It will probably be necessary to give the example: "Suppose both trees were cut in 1965. Did both grow more during 1964 than during 1963? Did both grow less during the last five years of their lives than during the five years just before that? Assuming they were both cut at the same time, would the last five years of the life of each be the same calendar years?") What about the first 10 years of their lives? What do you think the area was like when the tree started to grow? What evidence can you find to support your answer? (NOTE: If a student thinks his two stumps were not cut during the same year, explore what observations he has made that have led him to this conclusion. Then, for this activity, he may find two stumps that appear to have been cut at the same time and pursue this investigation if he wishes.)

Does a tree grow equally all the way around? What makes you think this?
Did you reach this conclusion after examining only two stumps?
Check at least five before coming to a conclusion.
What may explain the differences in growth? (Allow time for investigation and speculation.)
What observations led you to these ideas?
Does the stump have any close neighbors? On which side? Be sure to include other stumps as neighbors.
Are there any signs of injury or damage? What kind of injury do you think it was?
Do trees grow less on the side facing a specific direction? What direction?
How many stumps should you check before you make inferences about this?
Can you safely make such inferences after studying the stumps in this part of the forest only? Why?
Measure the distance from the smallest annual ring to the edge of the stump in each direction. (See sketch) Be sure to record your measurements and the directions.



Make a tracing of the annual rings of one of your stumps. Make the tracings in the four directions measured above. Label the directions. Then measure the distance from the stump to its nearest neighbors. Record these distances and the direction of each "neighbor" from the stump. How big are the "neighbors"? About how long do you think they have been there? Would they have had any influence on the growth of your tree during its early years? Later years? Why do you think this?

Optional Activities for Math

Is the smallest annual ring in the geometric center of the stump?
(NOTE: In the classroom, the correspondence of the geometric center and the growth center may be compared with the location of the South Pole and the geographic center of Antarctica).

If the geometric center of the stump is not the same as the smallest annual ring, how would you determine the diameter?
Will you get the same diameter each time you measure the stump?
Make five measurements and find the average.
Is the perimeter of the stump the same as its circumference?
How would you explain any variations you found?

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ACTIVITY NUMBER # 201 PAGES 3

LEARNING EXPERIENCE: Animal Traces

CURRICULUM AREA - Science

GRADE LEVEL - 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME - Communities of living organisms are dependent upon their environment.

OBJECTIVES

After completing activity, students should be able to:

1. Identify the traces of many of the animals that inhabit wooded areas.
2. Support all inferences made in regard to animal traces with logical reasoning based on his observations.

UNIT CONCEPTS

1. Animals presence is evident from sounds, partically consumed food, homes, droppings, tracks.
2. Different animal traces are evident during various seasons.

MATERIALS NEEDED

Paper and pencil
Magnifying glasses
Rope or string (1 yard)
Keys for identification

FIELD ACTIVITY

General observations and recordings upon arriving at the area.

What season is this? (Early, late?)
What is the time of day?
How does the air feel? (Temperature)
What is the condition of the sky?
What is the condition of the wind?
Look at the woods in the distance. What is the color?
Do the trees move? Do the trees appear to be conifers; deciduous a mixture? Support your answer with reasons.

Listen in silence?
What kinds of sounds do you hear?
Are the sounds natural or man-made?
How can you tell the difference between a natural and a man-made sound?
Is there repetition in the sounds you hear?
Describe the most outstanding sound you hear.

The next portions of the trip will be best accomplished if the class group can be divided into smaller groups of about 8-12 each.

Animal Traces

Listen, observe and record.
What do you hear? Describe what you hear.
How can you identify bird sounds?
How many different kinds of bird sounds do you hear?
Where are the bird sounds coming from? Do they all come from the same places?

Trees

Look at the trees as you walk. Select a tree that appears scarred.
Describe the scarring. Is it regular? Irregular?
Is the scar fresh? Is it old? How do you know?
Is the tree living? How do you know?
Look for insects on the tree.

Look for bird traces in trees. Describe them.
Look for bird traces on the ground.
What do you think produced these traces?
What will you record about these traces to help you identify them if you don't know what they are?

At which season are you more likely to find egg shell traces of birds?
If you find a feather, look for others close to the same area. Why?

Rope ring (The Forest Floor)

Place your rope ring on a leaf covered section of the forest floor. Pick up the leaves in the ring and observe the contents for animal traces by gently shaking them over a white piece of paper.
What do you see in the leaves?

Look carefully at the ground under the leaves and at the material on the white paper.
What do you see that doesn't look like a leaf?
Is anything moving? Describe it - shape, number of legs, lack of legs, wings, color.
Feel the leaves and earth. How does it feel: Cool - warm, dry - moist, hard - soft?
How many different kinds of living organisms have you found?
What various stages of development in insects can you see? (Egg, larva, pupa, adult)
Look for other traces of insects: (Cocoons, webs, holes).

Under a rock

Lift a rock - pull it back and look over the far edge.
Desctibe the earth under the rock. What is its color?
What is its texture?
Describe any living organisms you see under the rock.
Type, size, movement, color or lack of color.
Replace the rock in the same spot. Why?

Other animal traces

Listen for sudden sounds at ground level.
Look for signs of partially eaten plants, fungi, nuts, etc.
Look at leaves on growing plants. Do you see any indications that insects have been eating leaves?
What would happen to a plant if the insects ate all of the leaves?
What would happen if the leaves were no longer available to the insects?
When does man try to control this? Is this good or bad? Why?

Can you find a food cache? Has part of it been eaten? What animal could have collected the supply? Why?

Look for animal tracks. Where are they going?
Where did they come from? Who made them?

Look for animal homes. What are they made of?
Where did the materials come from? Did you find any homes the animals live in, but did not build? What objects do you see in the shelters?
Did the animals bring them there?
How are the homes different?
What homes do you see high above your head?
What animals can be found on or near the ground?
What do you notice about the size, color, position of the animal shelters that help to hide them?

Bones, fur and feathers

Look at and feel these remains if you find them. (Do not disturb!)
Examine the surrounding area for additional traces.
What remaining parts will help you to identify this animal?
Is this the remains of a bird, mammal, reptile, fish?
How do you know this?

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ACTIVITY 202 PAGES 3

LEARNING EXPERIENCE: Animals Living in the Field and the Woods

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : All living and non-living things make up a community.

OBJECTIVES

1. To have the students develop an understanding about diversity of life that exist in a field and forest community.

2. To have the students collect information and data about the living things they discover in the field and forest community.

3. To have the student recognize the natural laws that govern the organization of a community.

4. To have the students relate their findings to human communities.

UNIT CONCEPTS

1. All living things have four basic needs which must be present for them to exist. food, water, cover (shelter), and space.
2. Many animals live in both a field and woods.
3. There may be many different kinds of animal in both a field and woods.
4. The population of these animals may vary with the species (kind).
5. Animals make their homes in many places.
6. Animals are adapted for the areas they live in.

MATERIALS

Field guides
Materials for staking out plot
Paper and pencil
Hand lens

PROCEDURE

Introduction

1. Discuss objectives for the activity.
2. Ask the students the following questions and have the students compile a list accordingly:

   a. What animals do you expect to see today?
   b. What kind of habitats are present in this area where animals might make their homes.

Field Study

1. Divide your class into groups of six (6) students.
2. Have one student act as a recorder for each group.
3. Two groups of six will work in the woods while two groups will work in the field.
4. Choose the area to be worked randomly.
5. After the area has been selected, stake out a quadrant of approximately 50 square feet. Use as corner markings for the quadrant stones, twigs, or any similar material available.

a. Leaves, logs, leaf litter, soil, rocks, etc. should be examined while conducting the survey.
b. Signs or traces of animals should be recorded as the animals present in the area.
c. Record the weather conditions, air temperature and soil temperature.

7. Compile a list accordingly

Example:

Animal Common Name	Number of each kind	Location found
Earthworm	10	Under stones, leaves, logs, etc.

8. After the students have completed their survey of the field and woods, have the students assemble to compare their results.

a. Compare the survey with the inferences list.
b. What kinds of animals did you find?
c. What kind of animals has the greatest number? Why?
d. Did you find the same kinds of animals living in both the field and wooded areas? Was there a difference in the number? Why?
e. Were the habitats different in both areas? What were these differences?
f. Relate you findings to the community in which you live.
g. What is a community?

FOLLOW-UP ACTIVITY

1. Develop the concept of a community, using the town or city in which the student lives. Have them determine:

a. The most important part of their community.
b. The natural boundaries that restrict the community.
c. The different components of the community.
d. The laws that regulate society in that community.

2. Allow the students to:

a. Construct a map of the community as it now exists.
b. Construct a map to show how to improve the community environment.

3. Have the students express their feelings towards the community:

a. Is there evidence of pollution? What kind?
b. Are there to many people living in the community?
c. How important are the laws that regulate your community? Should we have laws?
d. What role as human beings do we play in our community?

e. Should we be concerned about other people and how they feel about the community?
f. Should the schools become more community controlled?

4. Take your students on a listening walk through the community. Have your students use a tape recorder to record the sounds of a city. Take your students in a field, a forest. Allow the student to record the sound they hear. In the classroom listen to the tape recordings and compare responses to the different sounds.

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ACTIVITY # 281 PAGES 2

LEARNING EXPERIENCE: Listening to and Looking at Insects

65

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Insects are adapted to live in all types of areas.

OBJECTIVES

After completing the activity, students should be able to:

1. Describe the appearance of insects observed, noting characteristics which seem applicable to a number of species, and noting characteristics which, while often associated with insects, are not shared by all species.

2. Pick out at least three sounds made by insects, differentiating them either by identifying the insects making them, or by describing them with appropriate adjectives.

3. Describe ways insects are adapted to live in different habitats.

UNIT CONCEPT

1. Insects have 6 legs and three body divisions.

2. Sounds made by insects are produced in a variety of ways thus creating a variety of sounds.

3. Insects have adapted various body parts to best suit the habitat in which they live. These adaptions include: flight, locomotion, mouth parts, size and coloration.

MATERIALS

Thermometer
Stop watch
Clear containers for observation
Reference books on insects

FIELD ACTIVITY

Where can you find insects? Would you expect to find many insects here? Do you expect to find more flying or non flying insects?

Are there any insects in the leaf litter? Are there any insects in the crevices of tree trunks? Did you find any cocoons? (If so describe them. If not, can you guess why not?) What will come out of the cocoon later? How much later? Did you find any soil dwelling insects? Did you find the dwelling itself?

Listen for the sounds of insects? Can you follow one of the sounds and find the insect that is making the sound? What happens when you approach the insect? Why do you think this happens? How might you get the insect to start making the sound again? Can you find out how the insect makes the sound you heard?

Do you hear any insect sounds from farther away?
Does the sound seem to be made by one insect or by a chorus of insects?
What makes you think so?
Can you use words to describe the sounds of insects? Which ones are repetitive? Buzzing? Clicking?

Can you make up words that go with the sound? (Such as "Katy-did, Katy-didn't").

What do you hear when you hear insects flying around you?
What part of a bee makes the buzz?
Do all insects sound alike when they fly?
Can you think of words to describe the sounds various insects make flying?

You can tell the temperature by the chirp of the snowy tree cricket (Oecanthus niveous). Count the number of times a cricket chirps in fifteen seconds. Add 40. This will give the Fahrenheit temperature. All crickets chirp more rapidly when it is warmer. Can you determine a formula for finding the temperature based on the number of times per minute a field cricket chirps?

Look for insects. Where would you look?)Allow time for suggestions, and then for some investigations). Did you find insects where you expected to?

How do the insects you found move? Do they fly? Crawl? Hop? How are their legs arranged? Does this seem to have any relationship with the way they move? How many legs does the insect have? How many parts does the insect's body seem to have? To which part are the legs attached? The wings? (if you can find wings). How many eyes does the insect appear to have? What is the proportionate size of the eyes to the rest of the head? The rest of the body? How does this compare with your eyes and your head? Look at the insect's mouth. Does it have a mouth adapted for chewing? For sucking? For something else? What makes you think what you do? Does the insect have a tongue? Where is it? Try to describe it. Does the insect you found have antennae? Does your insect have wings? How many? Can you find any insects that don't seem to have wings? Do all grasshoppers have wings? Do all winged insects have the same number of wings?

What color is a grasshopper? A cricket? Can you find an insect with spots? Stripes? Can you find an insect that is one color all over? How many different color combinations can you find on insects? Does the color of the insect seem to have any relationship to the place where you found it? Can you find an insect which can be camouflaged by color?

Rope off an area about one foot square. Try counting the number of insects in that area. About how many do you think there are in the whole field?

What will become of these insects during the winter? How can you find out? How do you think this species will survive till next spring? Can you find egg cases or signs of insect homes?

How might insects be helpful to plants? To animals? Are insects "good" or "bad"? Are all insects either good or bad? Should we bring some "bug spray" on our next trip? Why? If we spray the insects, will it hurt any other animals? What animals? Why do you think this? If we removed all the plants from the area, what would happen to the insects? If we removed all the insects, what would happen to the area?

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ACTIVITY NUMBER # 232 PAGES 2

LEARNING EXPERIENCE Insects and Plants

CURRICULUM AREA : Science

GRADE LEVEL : 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME : Organisms are interrelated and interdependent.

OBJECTIVES

After completing activity, students should be able to:

1. Locate at least five evidences of insect activity on plants.
2. Describe ways that insects use plants and what effect this has on the plant.
3. Explain effects of insecticides on insects and other organisms.

UNIT CONCEPTS

1. Insects use plants for food, shelter, and laying eggs.
2. The use of insecticides can upset the ecological balance.
3. Insects change plants by enlarging or destroying parts of the plant.

MATERIALS NEEDED

Magnifying lasses
Insect identification books

FIELD ACTIVITY

What evidences can you find of insects using parts of plants for food? For shelter? For laying eggs or bearing young?
What parts of the plants have been used?
Does the insect change the plant in any way? Does it enlarge a part of the leaf or stem? Does it destroy part of the plant? What part?
Has this change effected this plant or this part of it? Which do you think more damaging: eating a part of a leaf or boring a hole in a fruit? From whose point of view? Is this true in all cases?

Has the insect used the plant as a foundation for making a cocoon, web, etc.? In doing this, has the insect changed the appearance of the plant? How?

Investigate any galls or other evidences of insect alterations on plants. (Example: foamy white bubbles. These are produced by an insect called a spittle bug. It sucks the juices from a plant stem and mixes them with air to make the bubbly mass in which the young are hidden?.
NOTE: Be sure to have children examine aspen and oaks carefully and the stems of goldenrod. If there are cherry trees or witch-hazel bushes in the area, these are also good subjects for investigation.

Describe the gall or web or whatever it is you have found. What is the shape? Texture? Size in relationship to a familiar object? Is it solid? Is it hollow? Does the insect appear to be within? What makes you think this? Can you suggest a name for this gall or for the insect that made it? Can you find any examples of insects which are helpful to plants? How is this insect beneficial to the plant? What makes you think this?

Have most of the insect activities you have observed today been beneficial to or harmful to the plants? Would man consider these activities beneficial or harmful? Why?

What would happen if DDT or another insecticide were sprayed on this field? Would this be good or bad? From whose point of view?

If an insecticide were used which was harmful to chewing insects only, but not harmful to insects which gather nectar from flowers, would this be all right to use? Why do you think so? (NOTE: If children seem to agree that this would be an acceptable insecticide, suggest that some of them do some research on the life cycles of butterflies, such as the Monarch and Swallowtails).

What would happen to the insects if man and all his insecticides disappeared from earth?
What would happen to the earth, the vegetation and other animals?

What would happen to man if all the insects disappeared?

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ACTIVITY NUMBER 283 PAGES 7

LEARNING EXPERIENCE: A Social Insect

CURRICULUM AREA : Science
Art
Social Science

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME : The social societies of various insects exhibit a high degree of specialization. An understanding of insect societies can help man better understand his social order.

OBJECTIVES

Having completed their observations of an ant colony, the children should:

1. know that ants are insects.
2. realize that ants are social insects and have a basic understanding of what this means.
3. know that ants show complete metamorphosis in their life cycles; having egg, larvae, pupae, and adult stages in their developmental history.
4. realize that the queen ant is the only reproductive member of the colony.
5. be able to distinguish the male, queen and workers in a colony.
6. understand that mating between the young winged queen and winged males occurs only once during the nuptial flight.
7. understand the roles of the queen, males and workers in a colony.
8. be able to describe how an ant colony is developed.
9. be able to describe what goes on during the daily routine in an ant colony.
10. know how ants are able to survive in their environment.

UNIT CONCEPTS

1. Ants have six legs; thus, they are insects.
2. Ants live in colonies and have a well developed social structure.
3. Several different stages of an ant life history may be found in a colony at one time, including eggs, larvae, pupae, and adults.
4. The queen ant mates only once in her lifetime and remains fertile thereafter.
5. Male ants are winged individuals and mate with the queen during the nuptial flight. Soon afterward the males die.
6. The worker ants perform all of the necessary duties of an ant community.
7. The queen ant produces all offspring in the colony.
8. Ants are very sensitive to their environment and have well developed sensory receptors.
9. Ants feed on a variety of foods and pass regurgitated food from one to another.
10. Ants are very strong, being capable of carrying loads much greater than their own body weight.
11. Most of the ants in a colony are wingless, sterile females called workers.
12. Ants live year around in their colonies and store food for the winter.

INTRODUCTION

Perhaps no other animal we could study so typifies young children as does the subject of this activity, the ant; at least, in the eyes of beleaguered mothers and teachers. For who has not compared this age with the proverbial ant, when after an arduous day of grappling with their frantic antics, wearily observed that "they're so restless, you would think they had ants in their pants".

When is an "ant" not an ant? Why, when it is an aunt, as any good teacher can tell you after an exercise in frustration incurred in attempting to get their young students to distinguish between the lower order form, an insect, and a dear relative, their parents' sisters.

Adults should also enjoy studying these restless little creatures as there is much about their way of life that is not too unlike ours. Ants are social insects and have evolved many of the characteristics of man's social structure;

or is it the other way around? Regardless of your order of preference, a study of the community life of these tiny creatures will reveal striking similarities between some of their ways of life and those of man.

Their society exhibits a high degree of specialization in life roles as does ours, for they have workers who perform various special duties just as we do. Also, they have armies of professional soldiers to wage their wars, much the same as man does. Also, at various times in different ant communities, we can find individuals who rob, steal, and enslave, thus mimicking elements of our own society. If an ant from a different community should wander in, he is treated like an outcast at first and, if he does not soon learn the meaning of "when in Rome, do as the Romans do", he may be assasinated. This does not differ greatly from trends evident in many segments of our society today.

To place the "icing on the cake", one needs only to examine the role of the female in the ant world to determine a striking similarity between ant social order and that of man. For within ant communities, the queen rules the family roost, and how does that differ from the family situation common to most American communities?

If you find this whole matter of comparison in social order distressing, we can turn to other aspects of ant life for relief.

Ants are probably the most numerous form of animal life on earth and thus, we can hardly escape their influence.

They are among the more serious pests that man must contend with, doing untold damage to our agricultural areas, houses, fence posts, farm buildings, and cupboard stores of various foods and grains.

Had enough? All is not lost, however, when it comes to ants, as a study of their activities will provide hours of fascinating observation as you marvel at their feats of boundless energy and strength. Also, who has not relished the thought of a snack of chocolate covered ants after a hard day of observing ants and their ways?

A. Collecting

Ant colonies are found all over the United States and are quite common in most locales. In most areas, it is best to attempt your collecting during the spring, summer, or fall.

1. Preparation

You will need a closed container to carry your living ant collection in. A clean quart jar or similar container will do nicely. Large coffee cans with covers will also serve very well.

Ants are most easily collected from an ant hill so it is best to have a digging instrument along with you when you collect. A trowel or small shovel will do the trick very well.

If you are planning to collect your ant specimens from a log or fence post, take along an instrument, such as a small hatchet or wood chisel, to break into the ant colony.

A large white cloth for sorting out the various types of ant specimens on from your colony will also prove helpful.

2. When to Collect

Ants can be collected at almost anytime of the year, but spring, summer and early fall are best.

If you wish to be certain of getting winged individuals (fertile females or queens and males), a warm, humid, late summer or early fall day is the best time to collect, for this is the time of the mating season for many species.

3. Where to Collect

Outdoors, ants can be found almost anywhere; your school grounds or home yards (especially, the garden) are excellent collecting sites. Following is a list of places to look for ant colonies:

1. in fields and gardens
2. in the foundations and walls of old buildings
3. under stones, in woods and fields
4. in dead wood, logs, and fence posts
5. in living plant tissue in central cavities, including insect galls
6. in papery nests attached to twigs and rocks

It is probably easiest to collect from an ant hill in a field or garden.

4. How to Collect

Look for ants by turning over stones, peeling bark off from logs and breaking open stumps, dead limbs, rotting fence posts, insect galls and ant hills.

The large carpenter ants are wood dwellers and can be found embedded in logs, building timbers, fence posts, dead tree trunks and stumps.

Small red and black ants are easily found in prominent ant hills located in fields, lawns and woods. These and the carpenter ants are probably the easiest to collect.

Either break open the wood containing the black carpenter ants or use your trowel to dig into an ant hill.

Spread some of the moist, internal ant hill soil or powdered wood onto a piece of white cloth to make the ant types easier to spot.

In late summer - early fall, the large winged individuals are the queens. The smaller winged ants are the males. The remaining ones are infertile females serving as workers (all types) and soldiers.

It must be noted here that different species of ants swarm and mate at different times of the year, from spring to fall, so that winged members are available at varying times according to the mating habits of the species concerned.

Also, after their nuptial flight, during which they mate for the only time in their lives, the females lose their wings upon settling down and establishing a colony of their own. They can then be identified by their size, being several times larger than the other residents of the colony.

The males are found in the colony at swarming time, when they can be identified by their wings and the fact that they are much smaller than the winged queens. After mating with the queens during the nuptial flight, the males die within a few days.

Once you have identified the types within the colonies you have opened, place some of the moist dirt or decayed wood from the colony into the collecting jar. Add a few queens along with an ample supply of the other types.

Try to include a few larvae and the whitish, transparent cocoons containing the pupae. These are often mistaken as eggs.

Now seal the collection jar and return to the classroom.

B. Culturing

1. Housing your Ant Colony

a. building a formicarium or ant house

The term "formicarium" is derived from the scientific classification of ants; they are members of the family Formicidae, class Insecta.

To build such a house, secure two pieces of single strength window glass, 8 x 10 inches in size. Next cut two 3/4" strips of wood 8 inches long and two others 9 inches long.

In one of the 9" strips, drill three 1/4" holes evenly spaced apart, the outer ones placed about two inches from the ends.

Nail the three undrilled lengths together with the longer piece at the base, thus forming a U-shaped frame.

Next, tape the two pieces of glass to the frame, using wide adhesive tape.

Now, fasten a piece of sponge under two of the 1/4" holes you drilled in the second 9" length of wood. Tack a piece of fine mesh screen over the top of the third 1/4" hole, thus allowing you to swing this screen open when needed.

b. "seeding" your formicarium

Add about 6 to 7 inches of moist material collected with the ants to the ant house. Now place the ants in the "house" and quickly fit the piece of wood with the three 1/4" holes in place at the top of the house.

c. Finally, cover the whole structure with dark paper to simulate life in the ground.

2. Feeding the Ants

a. watering the ant colony

Each day, add enough drops of water to one of the sponges so that the water will soak through to the bottom side of the piece of sponge.

b. feeding the ant colony

Place enough drops of a 50% mixture of honey and water on the other sponge to allow it to soak through to the underside of the piece of sponge. Do this daily.

Also, drop a few small pieces of meat or dead houseflies through the hole with the screen cover. Corn meal and bread crumbs can also be fed to the ants.

3. Commercial Sources

Ant houses and living ant colonies can be purchased from biological supply houses. A good supplier in this part of the country is:

Carolina Biological Supply Company
Burlington, North Carolina

C. Studying Ants

1. How to Study Ants

Allow a few days for the ants to acclimate themselves before beginning your observations.

To observe, remove the dark paper cover from around the ant house and examine with the naked eye or a magnifying glass.

2. What to Observe

a. General Characteristics

Draw the childrens' attention to the general body features of the ants.

What color are the ants? Are they all the same color? Do they have more than one color on their bodies? Are all ants the same color? How large are the ants? Are all of the ants of the same size? Are most of them about equal in size? Do you see some that are much larger than the rest? (These are the queens).

What shape is the body? Call their attention to the very large head and narrowly constricted "waist". Do you see a definite head, eyes, legs, abdomen? How large are the eyes in relation to the head? How many legs can you count? (Six, as ants are insects). Is his body hairy, rough or smooth? Do any of the ants have wings?

NOTE: Young females, before their nuptial flight, have wings. After that, they lose their wings and can be distinguished by their

much larger size. Also, males may be present, and if so, they are winged, but considerably smaller than the queens.

b. Ant Activities

Have the children observe tunnel building. Call their attention to how they carry materials and what size of objects they can carry. Ants are very strong for their size and can carry several times their own body weight for considerable distances. All of this work is done by the workers, who are infertile females.

c. Ant feeding

Observe the ants as they secure water and honey from the two sponges. What do they seem to be doing?

Watch what they do with the bits of ~~dry food~~ that are dropped into the ant house. Where do they take it? How does the queen get fed? How about the pupae in the white capsules?

A remarkable characteristic of the feeding activity in many ants colonies is their habit of exchanging regurgitated food from one member of the colony to another, including the pupae. Have the children observe this activity and ask them what they think is happening. Accept all responses.

d. Ant locomotion

Watch ants moving. Do they move slowly or rapidly? Do they seem to know where they are going? Do they move at the same rate? Does the queen move around much?

NOTE: In the winged state, both the young queens and the males can fly. After the nuptial flight, the males die and the fertile female sheds her wings, never to fly again. The female may live another 15 to 25 years, producing new offspring each year. The workers may live up to 7-8 years.

e. Sensory perception

Call the children's attention to the two large compound eyes. Can you find his eyes? How many do they have? Do you think he sees as well as we do?

NOTE: Being compound eyes they do not form a concise image as do our eyes. However, they are quite sensitive to light and movement. Also, there is good evidence that ant eyes may be sensitive to different colors.

Now, observe the two "feelers" or antennae and notice their shape. In the queen and workers, they are bent in a sharp angle. Notice how they are used. How many antennae do you see? Does the ant seem to be using them? What makes you think so? What for? (Accept all responses).

NOTE: The antennae of an ant are used in the same manner as in crayfish as sensory receptors to "sample" the environment.

f. Ant Reproduction

The reproductive cycle has been previously described. At this point call the children's attention to the queen, winged males (if present), tiny, worm-like white larvae and the white capsuled pupae. Try to locate newly hatched ants. Aid the children in identifying these life cycle stages and explain what they are. Eggs are laid by the queen, but these may be difficult to observe.

3. References

Any introductory college zoology text.
Other good references are:

a. Swain - The Insect Guide by Doubleday Publishers
b. Lutz - Field Book of Insects by Putnam Publishers

D. FOLLOW-UP ACTIVITIES

1. Once you have completed your observations, return the ant colony to its natural habitat. Again, this will serve to strengthen the idea that animals and their habitats should be respected.

2. Have the children draw an ant.

3. Develop an experience chart on ant activities and characteristics.

4. Have the children bring in pictures and stories about ants. Read the stories to the class.

5. Show a film of filmstrip on life in an ant colony. Discuss the film or filmstrip afterwards.

6. Construct a longitudinal view of an ant hill, using a chalkboard and colored chalk or a flannel or bulletin board and appropriate paper cut-outs. Have the children suggest what goes into the interior organization of an ant hill and make a list from these suggestions.

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ACTIVITY 284 PAGES 3

LEARNING EXPERIENCE: Spiders and Relatives

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Spiders are adapted to live in many different areas.

OBJECTIVES

After completion of activity, students should be able to:

1. Name six physical characteristics of spiders.
2. Briefly describe how a spider builds a web and the purpose of the web.
3. Explain how the spider moves on a dragline.

UNIT CONCEPT

1. Spiders have four pairs of legs attached to the cephalothorax.
2. The cephalothorax is the combination head-thorax.
3. The spider has two body parts: cephalothorax and abdomen.
4. The cephalothorax contains the brain, stomach, and poison glands.
5. The abdomen contains the heart, digestive tract, reproductive organs and spinnarets (silk glands).
6. The legs of a spider are jointed and end in two or three claws.
7. Spiders molt as they grow.

MATERIALS NEEDED

Hand lens
Field Guide to Spiders

FIELD ACTIVITY

How do you know you've found a spider? How many legs does a spider have? How many parts does a spider body have?
Is a spider an insect? How many legs does an insect have? How many parts does an insect body have? Do spiders have antennae? Did you ever see a spider with wings?
(NOTE: If children have not previously studied insects, and have had little experience with spiders, these questions may constitute the basis of the entire trip, rather than just an introductory survey and review. In that case, all small creeping, crawling, hopping, flying, buzzing and biting things should be examined for number of body parts, number of legs, antennae, wings (not all insects have them), and silk-like web or dragline production (although some insects, such as caterpillars, produce silk at various stages in their life cycles).
The animals found and examined for these characteristics could then be classified into three groups: those having 6 legs and 3 body parts, those having 8 legs and 2 body parts, and those having more or fewer than 6 or 8 legs.*

*Not all 8-legged creatures are spiders, however, Harvestmen ('daddy-long-legs') are not. Neither are ticks, mites or scorpions.

OBSERVING SPIDERS

To what part of the spider's body are the legs attached?
Are the legs jointed or unjointed?
Does a spider have claws? suction discs? How many?
Are the legs smooth or hairy?
Is the rest of the spider smooth or hairy? Is it sticky? Does it feel moist? dry? warm? cold?

How are the cephalothorax and abdomen joined?
What color is the cephalothorax? the abdomen? the legs?
Is the spider the same color on the underside as on the topside?
Are there any special markings which might suggest a name for this spider?
Does the spider blend with or contrast with the background? (is the background its usual environment?)

Is the cephalothorax larger or smaller or the same size as the abdomen?
Is the abdomen rounded? pointed? round or oval?
Are the legs longer than, shorter than, or the same length as the body parts?
Are all the legs the same length?
Is the over-all appearance of this spider longer than it is wide, wider than it is long, equal in length and width?

Does the spider have eyes? Where? How many? How large are they compared to the rest of the cephalothorax? Do they seem to be compound eyes like an insect's?

How does it breathe? Can you find nostrils? spiracles? (NOTE: if children have studied insects, they should know to look for spiracles (breathing holes) in the sides).

What is the over-all size of this spider? (Record this, and then look for another spider of the same type. Use differences in size to make observations and inferences about males and females, and spider growth).

How does this spider move? Does it run, hop, jump?
Does it move forward? backward? sidewards? Can it move in all these directions?
Does it pick up more than one foot at a time?
Does it move alternate feet or opposite feet? (at the same time? one after the other?)
Are all the feet used in moving?

Look for a spider on its dragline. (NOTE: a dragline is the single thread by which spiders often descend).
When a spider is descending on its dragline, does it hold on with any of its legs?
Can a spider go back up its dragline? If so, what does it do with the silk below it? Do you think the spider eats the silk? Dissolves it with some chemical? Winds it up for later use? Is the silk elastic like a rubber band?
When the spider is going back up the dragline, how many legs does it use?
Can the spider move the line or must it drop straight down? What happens if the wind is blowing? (Be a wind and blow gently on the dragline. What happens?) If there is no wind blowing, how can the spider make

horizontal threads to spin a web? (This may take follow-up investigation!)

Look for a spider in its web, or using a horizontal dragline. How does it move?
Does it travel rightside up or upside down? forward or backward?
Does it use all its legs?
How does it avoid getting caught in the web (like some insects may be observed caught in it?) Did you just guess this answer, or did you observe something that made you think this?

OBSERVING A NON-WEB SPINNING SPIDER

Look carefully at the flowers of goldenrod, Queen Ann's lace, milfoil, or even a garden species such as zinnias. You may see a small, light-colored spider with long front legs. The "crab spider" is lying in wait for a meal.
How do you suppose this spider catches food?
If there a web nearby? (Better not ask this if the web of another species is near at hand).
How does the spider's color blend with its background?
Does it appear to see you? What makes you think so?
Try to find an ant, or other small insect to place on the flower near the spider. Observe what happens.
How did the spider catch the insect?
Can the 'crab spider' change color like the chameleon?
Look for spiders which mimic ants.
Look for female wolf spiders carrying egg cases or carrying their young on their backs. (Wolf spiders will most frequently be found near the outside foundations of buildings.)

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ACTIVITY NUMBER 285 PAGES 8

LEARNING EXPERIENCE: The Worm That Isn't A Worm

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : All living organisms are born, age, and die.

OBJECTIVES

Upon completing the study of mealworms, the children should:

1. understand that mealworms are insects.

2. recognize the four stages in the life cycle of the mealworm.

3. be able to know the roles of the larve (mealworm), pupa, and adult beetle in the life cycle.

4. be able to describe the location of the natural habitats of these animals.

5. know what molting means and understand why it is important in the life cycle of the mealworm.

6. know what mealworms eat and where they get their water from.

UNIT CONCEPTS

1. Mealworms are the larval stage in the life cycle of the grain beetle, Tenebrio molitor.

2. The Tenebrio beetle has four stages in its life cycle, showing a biological characteristic known as complete metamorphosis.

3. It takes about 4 to 5 months to complete the life cycle of the Tenebrio beetle.

4. Mealworms are scavengers, feeding on grains and related plant materials, as well as decaying animal debris.

5. Mealworms do not require a large supply of water, as they derive their water requirements from the foods they eat.

6. The mealworm stage in the life cycle of the grain beetle is the main growing stage. The mealworms must molt (shed their skins) in order to grow because their skins are hard and rigid, thereby preventing growth.

7. Mealworms prefer damp, warm environments having restricted light.

8. The adult beetle is the reproducing stage in the life cycle. The male and female beetles mate and the female deposits the fertilized eggs which will hatch into the larvae (mealworms).

9. This animal is an insect, both the larva and adult having the characteristic six legs.

10. Mealworms and the adult beetles are very sensitive to their environment, having antenna, eyes and other sensory receptors.

INTRODUCTION

Anyone who has raised frogs, salamanders, or lizards as a study or hobby very likely is familiar with this, in many ways, unfortunate creature.

His name is incorrect from a scientific viewpoint, though most appropriate from a practical standpoint. This lowly animal is actually the larval state in the life history of the Tenebrio beetle, a grain beetle. His name is appropriate, however, since the larval stage (the longest in the complete life history) does look like a worm and he does reside in areas when grain meal is available. Another aspect of his name which is perhaps even more indicative of his modern state in life is the "meal" portion, since these creatures are commercially raised throughout our land as food for many laboratory animals; thus, truly serving as a "meal worm".

In addition to their commercial value, mealworms have been widely used in studies of insect physiology. Also, as this activity will develop, they are rapidly becoming universally popular classroom study animals, providing hours of meaningful learning experiences involving insect life cycles, behavior, feeding and development.

As one young students so aptly expressed it"

"Pity the poor mealworm
He is not an ideal worm
In fact, he's not a real worm
But a bug, ugh!"

No matter what he is, you will discover with your students the magic attraction he has for the young observer.

A. Collecting

Mealworms are probably best purchased from a local supplier or a biological supply house, since they are so widely available. However, for those who prefer to collect them in their natural habitats, directions follow:

1. Preparation

All that is needed is a collecting container and a small trowel. Battery jars or large pickle jars, mayonnaise jars or even a shoe box will do. Be sure to take along covers for your containers.

2. When to Collect

As these animals are year around inhabitants of their natural environments, which is inside places where grains or grain products are stored, they can be collected at practically anytime of the year.

3. Where to Collect

As indicated above mealworms live where a supply of grain or grain products is available, especially in places that are rather damp and dark.

Places to look are:

a. granaries
b. home - stored cereals
c. neglected grain piles in corners in mills
d. under bags of feed in warehouses and feed stores
e. litter of chicken houses
f. when fully grown, the larvae wander about seeking a place to pupate. Look for them almost anywhere where there is dampness and darkness and a supply of stored grain or other products. They have even been found in bags of fertilizer and salt, boxes of soda and bales of tobacco and even pepper.

4. How to Collect

Mealworms are scavengers and will devour decaying grain and milled products which are damp. Also, they will feed on scraps of meat, feathers, dead insects and other organic debris.

After having located a mealworm colony, scoop up some of the material they are living on and place it in your container. Try to include some adults pupae as well as larvae.

B. Culturing

1. The culture "house" or Tenebrium"

Mealworms do not require a very fancy abode. It is more important that the proper "furniture" and "utilities" be supplied than constructing a fancy home.

Some "houses" you can use are:

a. large (1 quart) glass jars
b. small pails or other metal containers
c. a fish bowl aquarium
d. a small terrarium
e. a plastic box

2. The "furniture" and "utilities"

a. Fill your tenebrium about half full with the following:

bran (breakfast type))
breadcrumbs) any combination of these
oatmeal) or singly
corn meal)
wheat or corn flakes)

b. on top of the cereal or grain, place a layer of shredded newspaper (for cover).

c. place a slice or two of apple, or potato on top of food supply for moisture. (Place them under the newspaper). A whole carrot pushed down into the cereal or grain will also serve well.

NOTE: Remove these items when they dry and shrivel or become moldy.

d. cover your tenebrium with a fine mesh screen or piece of cheesecloth.

e. if the tenebrium has glass walls which are transparent, cover it with dark cloth or paper.

f. change the grain and/or cereal medium whenever it becomes powdery. This indicates that the mealworms have used it up as much as they desire to.

g. store in a dark locale at about 82° to 86° F.

h. new colonies can be started by transferring adults, pupae, and larvae to properly supplied tenebria (mealworm houses).

3. Commercial Sources

Mealworms can be purchased from local pet shops as well as from biological supply houses.

A good supply house in this area is:

Carolina Biological Supply Company
Burlington, North Carolina

C. Studying Mealworms

1. How to Study Mealworms

a. first allow the children to examine the whole culture. They will undoubtedly ask questions such as:

What are they feeding on?
What is the newspaper for?
Why are the apple slices there?
Why do you keep the jar covered?

Let the children speculate on the answers to these questions and others they may raise. If necessary tell them the reasons for the procedures and materials used.

b. Provide each child with the following materials:

.....a plastic container, such as a soft margarine container.
.....a small amount of bran or corn meal to place in their study containers.
.....from the culture - 2 or 3 larvae of different sizes.
.....1 or 2 pupae
.....an adult beetle (alive)
.....an adult beetle (dead)
....."skins" of molted larvae
.....eggs - if you can find them

c. each time you make bservations, be sure to have the children examine the parent culture. At the end of each study period, the children's culture can be covered (use cheesecloth to seal) and stored with the parent culture until the next study period.

d. the whole study should be completed over about 5 to 7 consecutive daily study periods.

2. What to Observe

a. General Characteristics

Call the children's attention to the adult beetle.

About how large is he? What color is he? Touch the beetle. Is he soft or hard? Rough or smooth? Can you see a definite head? Body? Legs? Does he have antennae? How many? Can you find eyes? How many? Can you see his mouth and jaws? Does he have wings? (Yes, 2 pairs)

Next, draw their attention to the pupa.

Do you think this is related to the adult beetle? Why? Does it look like the adult in anyway? How? Does it seem to be alive? What makes you think so? Does it move? Touch it. What does it feel like? Is it rough or smooth? Soft or hard? Dry or moist? Does it have an odor? If so, describe it. What color is it? What do you think this is?

NOTE: The pupal stage lasts from 1 to 3 weeks. The emerging adult is white at first but will go through a series of changes in color until it becomes black in about 2 or 3 days.

The adults are either male or female (very difficult to distinguish), mate, then exist for a few months before dying. At this time it might be advisable to discuss the generalized life cycle of beetles, explaining the relationship between the adult, eggs, larvae, and pupae, in order. You might introduce the idea of complete metamorphosis in explaining the life cycle. The children may not understand what you are telling them in using this term, so do not dwell on it now. Next, direct their attention to the larval stage or "mealworm".

How big is it? Does this look like either the adult or pupa? Does it have anything in common with either?

NOTE: The children may notice the segmented body, antennae, jaws, 6 legs and the hard, smooth, shiny, outer covering. Try to call their attention to these features. Can it move? Fast or slow? Does it have legs? How many? Does it have "feelers"? How many? Can you find its mouth and jaws? Do you see any eyes? (Yes, there are 2,

one behind each antenna. They are black and very small). How many? What color? Is the body covered with a coat? What color is it? Is it soft or hard? Rough or smooth? Wet or dry? Smell the animal. Does it have an odor? Describe it. Does the body seem to be in one piece or is it divided into segments? How many?

Now, ask them why they think this stage is called a mealworm. Accept all responses. It might be good to refer to the two drawings provided with this exercise at this time. This will help the children visualize what they have seen.

b. Locomotion

In the adult - Does the beetle move? How fast? What does he use to move with? How many are there? Does he have wings? (Yes, two pairs). Does he fly? (Seldom. He may hop for short distances, however.)

In the larva - Does the mealworm move? How fast compared to the adult beetle? What does he use to move with? How many does he have? Does he have wings? Can he fly, then?

c. Feeding - For both adult and larva

Can you see the animals feeding? Do they chew their food? (Yes) What with? (Their pair of mandibles). How do they seem to locate their food? (They use their antenna, the short, antenna-like palpi on their mouth parts). Do they need water? (Yes) Where do they get it? (From the fruit or vegetable and from the grain itself). Does the pupa seem to feed? (It is an inactive state).

d. Sensory perception

Notice the action of the feelers. What does the animal seem to be doing with them? Why does he do this? Do you see any eyes? (Yes) How many? (Two) How large are they? What color are they? Where are they located?

NOTE: In the adult and larvae they are located just behind the antenna, on either side of the head.

Which has the larger eyes, the adult beetle or the larval mealworm? Does he seem to be able to see? How well does he see compared to humans?

NOTE: In the adult, the eyes are compound like insects in general. They see movements quite well, but probably do not form a single, concise image as we do.

The larva has simple eyes which serve primarily as photoreceptors. There is some evidence that

mealworms are sensitive to colors.

e. The Life Cycle

The Tenebrio beetle shows complete metamorphosis, having eggs, larvae, pupae and adults, all of which look different.

After mating, the female beetle may lay as many as 500 eggs before she dies. The eggs are white, very tiny (about 0.05 inch) oval shaped and quite sticky. They hatch in about a week under favorable conditions.

The hatching larvae (mealworms) are very small and will grow to about 1 inch in length during their life phase of 4 or 5 months. As they have a hard exo-skeleton they must molt (shed their skin) in order to grow. They do this often, from 9 to 20 times during the larval state. These molts leave the skin intact and children are often led to believe that the mealworms have died.

As soon as the larvae have grown to full size, they will metamorphose into the pupae. This is the inactive stage and will last from one to three weeks. After this, the adult beetle will emerge.

Ask the children to notice the different stages in the life cycle. Try to locate the tiny eggs. If the children are lucky, they may see an adult emerging from the pupal state. Also, call the children's attention to the "skins" (molts) of the larvae. Ask them what these are. Let them speculate.

One way to show the true nature of the molt skins is to paint the backs of several small mealworms with red nail polish. After molting, the skin left behind will have the nail polish on it, but the mealworm will not.

3. References.

ESS (Elementary Science Study), Behavior of Mealworms Education Services, Inc. 1964.

FOLLOW-UP ACTIVITIES

1. Since mealworms are actually pests to man in many ways, it is not advisable to return your culture to their natural habitat. Instead, mealworms are best used to feed other laboratory animals, such as crayfish, frogs, salamanders and snakes.

   Doing this is an excellent opportunity to bring out the role of predatory animals in the animal world.

2. Have the children draw a mealworm, the pupa and the adult beetle.

3. Develop a finger play depicting the activities of the mealworm.

4. Show a film or filmstrip on mealworms, if one is available to you.

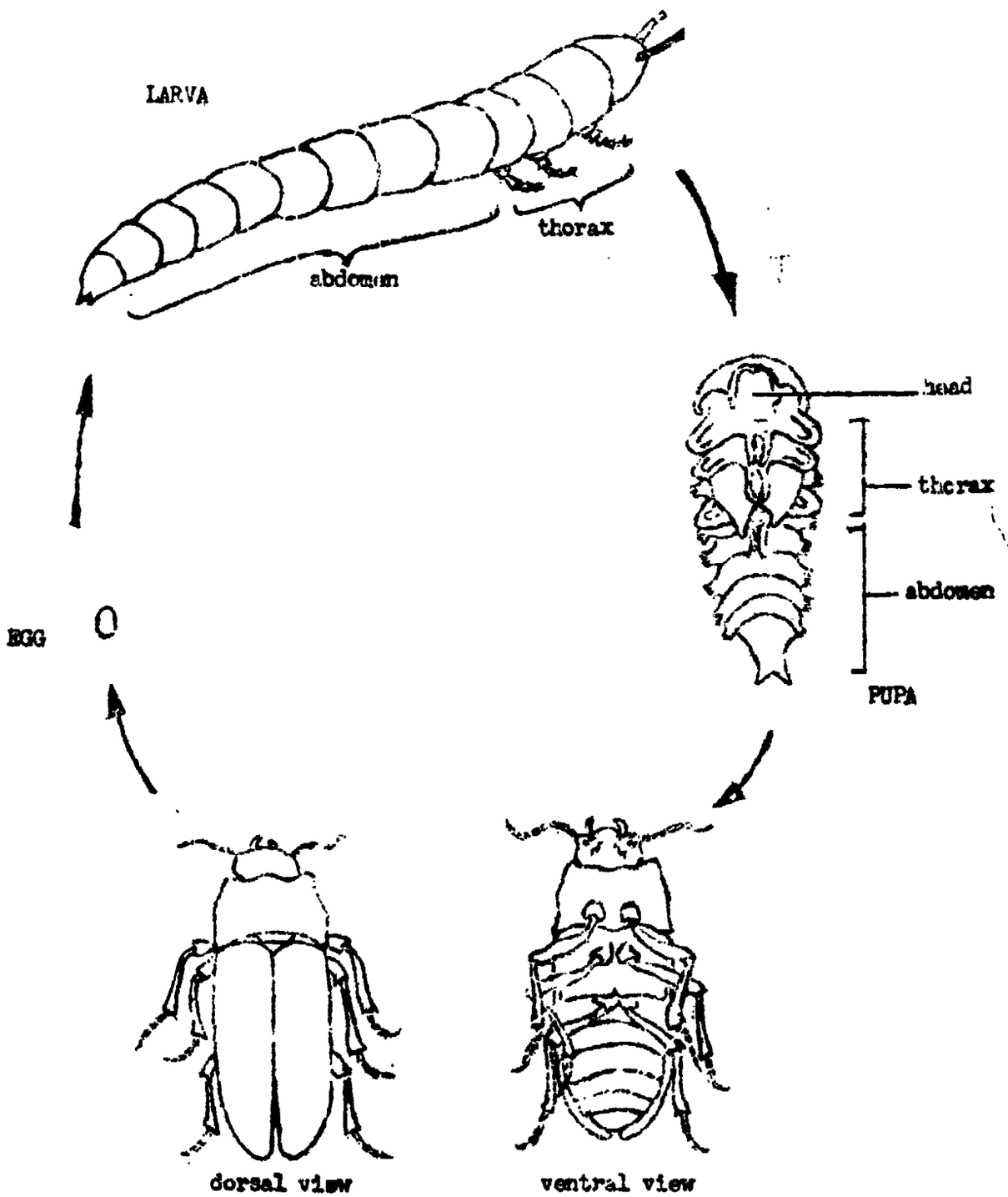
5. On flannelboard, place the following words in a clockwise arrangement, egg (at 12 noon); larvae (at 3 o'clock); pupa (at 6 o'clock), and adult (at 9 o'clock). Then have cutout drawings or pictures available of each stage. Have members of the class come forward and place each of the stages over the correct title to complete the life cycle.

6. Discuss the following:

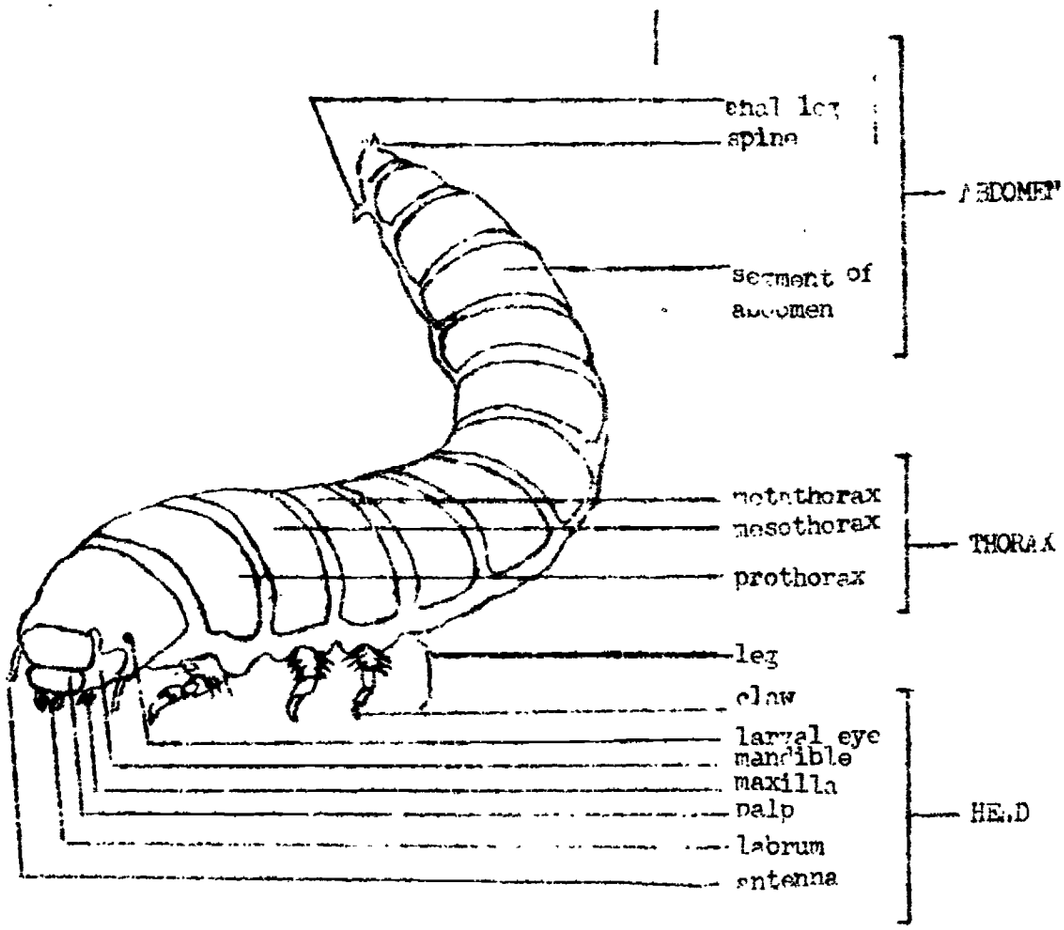
   a. Complete metamorphosis - use terms such as change in place of metamorphosis. Compare the life cycle of the mealworm to our own where we have the fertilized egg; the baby, child, adolescent and finally, the adult.

   b. The roles of larva, pupa, adult in the mealworm life cycle.

   c. The necessity for molting in the mealworm (larval) stage.



LIFE CYCLE OF MEALWORM
Tenebrio molitor (4x)



THE MEALWORM LARVA

HOLDE FOREST STATE PARK
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READING, PENNSYLVANIA 19607

ACTIVITY NUMBER 286 PAGES 6

LEARNING EXPERIENCE: A Grazing Insect

CURRICULUM AREAS : Science

GRADE LEVELS : 5th
6th

CONCEPTUAL THEME : Grasshoppers are an important element of many field food chains, being fed upon by many predators.

OBJECTIVES

At the completion of this study, the children should:

1. be able to tell why grasshoppers are insects.
2. know the three stages in the life cycle of the grasshoppers.
3. understand that a grasshopper nymph must molt (shed his skin) in order to grow.
4. understand why grasshoppers are called insect herbivores.
5. realize why grasshoppers are among the worst enemies of man's agriculture.
6. know how a grasshopper overwinters.
7. be able to describe how grasshoppers:
   a. feed
   b. move
   c. sample their environment
   d. communicate

CONCEPTS

I. Grasshoppers have six legs and are insects.

II. The grasshopper life cycle is similar to that of the praying mantis, having only the egg, nymph and adult stages.

III. The nymph is the growth stage in the grasshopper life cycle, molting being necessary for growth.

IV. Grasshoppers are herbivores, that is, they eat plant materials, mainly grasses, for food.

V. Because of their feeding habits, grasshoppers are among the worst of man's agricultural pests.

VI. Grasshoppers are an important element of many field food chains, being fed upon by many predators.

VII. As insects go, grasshoppers are well adapted to their environment, possessing three means of locomotion and well developed sensory receptors, including an excellent means of communication.

VIII. These creatures overwinter as eggs deposited in the soil by the female.

INTRODUCTION

A GRAZING INSECT

Any one who has taken a walk through a field during the spring, summer or early fall has established an acquaintance with this common insect pest, for he is the chief herbivore of the insect world, the grasshopper.

Whether you tread the field or not you will be aware of their presence as Lutz (1) put it so well:

> "The poetry of earth is never dead. When all the birds are faint with the hot sun and hide in the cooling trees, a voice will run from hedge to hedge about the new-mown mead. That is the grasshoppers."

These herbivorous consumers are among the best known and most widely spread insects in the world. They cause untold millions of dollars in damage to grain crops in the United States and other parts of the world. The record of their destructive forays is as long as the history of civilized man, for the Bible contains more than one reference to the "locust hordes" devouring the grain fields, thus, producing widespread famine.

There are many kinds of them in our country, numbering over 600 species. Only a few are serious pests to man's agriculture. About 90% of their damage to field crops is caused by just five species, while some twenty species attack our grassland plants.

In the Great Plains, one of the most feared sounds known is the deafening hum of hordes of migratory grasshoppers, commonly called locusts, as they darken the sky while invading the vast grainlands of this part of our country. Such a swarm can destroy hundreds of acres in a matter of hours.

In the East, grasshopper populations do not usually assume such epidemic proportions, though they become numerous enough during August and September to cause substantial damage to grass crops.

While it would be unwise to minimize the negative importance of these pests, there is a positive side to their existance which is of some importance to the biological community.

Grasshoppers are staple items in the diet of many animals, including numerous birds, skunks, snakes, toads, frogs, shrews, mice and moles, to mention a few.

To close on a positive note, the next time you go trout fishing, try attaching a live grasshopper to your hook. You will be amazed at your success in luring the wary trout to snap up this much desired delicacy in a "git while the gittin's good" frame of appetite.

(1) Lutz, Frank E. Field Book of Insects 3rd. Edition, page 56

A. Collecting

1. Preparation

Grasshoppers are best collected in the adult or nymph stages. The adult female deposits her fertilized eggs in burrows in the soil in late summer or early fall, in which form the insect survives the winter. Discovering these buried eggs is a monumental task for the skilled collector and nearly impossible for the novice.

To catch these energetic creatures, you will need an insect net to achieve best results. It is possible to catch them with your hand, if you are quick enough; but this is a slow, tedious task.

Your grasshoppers can be transported in a glass jar with a few grass leaves added. Be sure to punch small holes in the cover of the jar.

2. When to Collect

In the late spring, all summer, early fall (September and October.)

3. Where to Collect

Really, almost anywhere in season. Best results will be obtained in grassy fields.

4. How to Collect

Simply sweep them up in your insect net and transfer them to your carrying jar, making haste in placing the lid on it before the grasshoppers can hop out.

B. Culturing

1. Housing the Grasshoppers

These animals can be stored in almost any kind of container just so long as it is closed and has a good air supply.

Suggestions for housing units are:

a. a terrarium
b. a large fish-bowl aquarium sealed with fine mesh screen
c. one gallon wide-mouth jar sealed with fine mesh screen
d. battery jar with the top sealed with a fine mesh screen

2. "Furnishing" your Grasshopper House

a. Line the bottom of your rearing house with a section of grass sod which entirely covers the bottom of container. Sod with tall, green grass is preferable.

The grass will provide food for the hoppers and the soil a place for the females to deposit her egg cases.

b. Addition of a larger herbaceous plant and a branch will enhance the livability of your rearing house.

3. Feeding the Grasshoppers

a. The grass and herbaceous plants should provide enough food if you do not have too many grasshoppers in the rearing house. Once in a while, add a few lettuce leaves, carrot tops, alfalfa plants or other leaves.

b. Water the grass sod to keep it from drying out. The hoppers will get their water in this way.

4. Commercial Sources

Egg cases of the Lubber grass hopper, Romalea microptera, can be obtained from a number of biological supply houses. Instructions for culturing are also provided.

A good supplier is:

Carolina Biological Supply Company
Burlington, North Carolina

C. Studying Grasshoppers

1. How to Study Grasshoppers

a. Generally, observations should be made in situ that is, in their rearing cages.

b. It is sometimes desirable to slow down the grasshopper's actions in order to make more detailed observations. To do this, all that is necessary is to transfer one or two to a separate jar with holes in its lid; then, store them in a refrigerator until you notice a marked reduction in their level of activity. Being cold-blooded animals, they should slow down to a suitable rate of activity within an hour, usually 30 minutes is sufficient.

c. The use of magnifying lenses to observe 'cooled off' specimens will increase the detail of observation.

2. What to Observe

a. General Characteristics

How large are the largest grasshoppers that you can see?
Are all of them the same size? What color are they?
Are they the same color over all of their bodies? Do all of them appear to look the same in color?

Can you see a definite head, eyes, mouth, feelers, wings, abdomen, legs? How many of each? Is this animal an insect? What makes you think so?

Do the smaller forms (nymphs) look about the same as the largest ones? Do you see any forms that do not look like a grasshopper?

b. Locomotion in Grasshoppers

Do the grasshoppers stay very long in one spot? Are they easily frightened? When they are in place do they remain motionless or can you see some of their parts moving? Which?

How many different ways of moving can you observe in grasshoppers? What do they use to accomplish each means of locomotion?

NOTE: Grasshoppers move in 3 general ways:

1. flying - in traveling substantial distances, they use their two pairs of wings to fly.
2. hopping - if you observe the hind pair of legs, you will notice that they are much larger and highly modified for leaping.
3. walking - the grasshopper uses his 3 pairs of walking legs to travel short distances. This is a slow process.

Can you tell why these animals are called grasshoppers? (Allow the children to speculate freely here and accept all responses.)

c. Sensory Perception in Grasshoppers

Call the children's attention to the pair of antennae located on the front of the head.

What are these structures? How many does each grasshopper have of them?

NOTE: The short antenna-like appendages situated on either side of the mouth region are called palpi (sing., palpus) and serve as chemore-ceptors and tactile (touch) receptors during the feeding process.

Does he move them? Why do you think he does this? (They function much the same as in other animals we have studied.) Next, have the children observe the two prominent compound eyes situated on either side of the head.

Do you see any eyes? How many? What color are they? Are they large or small in relation to the animals' head size? Do you think he can see very well? What makes you think so?

NOTE: Vision in the compound eyes of a grasshopper is probably similar to that of other animals having this kind of eye structure.

Also, grasshoppers have three simple eyes located at the front of the head, two at the base of the antennae and one between the antennae. These are primarily photoreceptors.

Finally, call attention to the thin, membranous structures located just above the third pair of walking legs. These two structures are called tympanic membranes and function in a manner similar to our eardrums, serving as the organs of hearing in the grasshopper.

d. The Feeding Process in Grasshoppers

Observe the grasshoppers feeding. Do they grasp the food (grass)? What with? Do they chew the food or swallow it whole? (Chew.) What do they use to do this? (The mandibles or jaws.) Are they noisy when they eat? What sounds do you hear?

NOTE: Grasshoppers make a humming noise when they feed. Also, they can "sing" by drawing the femur, or thickened first segment of their enlarged hindlegs, across the thickened veins of the fore wings, fiddle style.

In flight, they make a rattling noise (which will startle the unsuspecting observer) by vibrating their hind wings against the fore wings.

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ACTIVITY # 301 PAGES _____

LEARNING EXPERIENCE: Rocks and Minerals

CURRICULUM AREA : Science

GRADE LEVEL : 2nd.
3rd
4th
5th
6th

CONCEPTUAL THEME : Rocks have varying textures, composition, and characteristics.

OBJECTIVES

Students should be able to:

1. Use their senses of sight and touch to examine rock specimens.
2. Observe and describe the characteristics of these specimens in terms of color, texture, cleavage, hardness and relative weight.
3. Observe the environment in which the specimen occurs.
4. Describe rocks as sedimentary, metamorphic or igneous.

UNIT CONCEPTS

1. Rocks are described in terms of color, texture, cleavage, hardness and relative weight.
2. Different types of rocks are found in different areas.
3. Rocks are divided into three major classifications by the way they were formed sedimentary, metamorphic, and igneous.

MATERIALS

Magnifying glasses, penny, pocket knife.

FIELD ACTIVITY

Describe the external characteristics of the rock you have found.

What is its color?
Is it the same color all over?
Is the color solid, or is the rock speckled?
Do you think this is the true color or has something stained the rock? How could you find out the true color? What might have stained it?

What is the shape?
Does it have rectangular edges?
Is it rounded? (What may have caused this rounded shape?)
How heavy is it? Is it heavier or lighter than you expect it to be?
How does it compare with a familiar object of the same size, such as a baseball, an egg, an eraser, etc?
What is the texture? Smooth? Porous? Crumbly? Sandy? Etc. (What descriptive words can you use?)
How could you get a better idea of the real color and cleavage of this rock? (CAUTION: When breaking open rocks, be sure those taking part have eyes protected with safety goggles).
Is the rock the same color on the inside as it is on the outside? (If not, why not? Which is the true color of the rock?) Describe the interior color? Is it solid color? Does the color appear in lumps or speckles? Examine the interior with a hand lens. What do you see.

Do you see any indications of sedimentary formation? What? Describe the texture on the freshly broken surface. Are there any crystals? Describe the cleavage. What shape are they? How many sides does each have? NOTE: Due to heavy trail usage and limited numbers of rocks this cannot be done in the woods.

What is the hardness of this rock? Will it scratch your fingernail? A penny? The blade of the knife? Can it be scratched by your fingernail? The Penny? The knife?

How is this rock a part of the total area? Is it part of an outcropping of underlying rock? Are there large boulders like it here? Are there many pieces like it here? Might it have been carried here by a stream? By man? By gravity?

What is this area? A roadside? A part of a farm? The base of a mountain? The floodplain of a stream? Is rock of this type weathering into soil here? (What makes you think so?)

Do you think this rock is composed of only one mineral or does it seem to contain more than one mineral? Have you tested only one mineral or have you carried out your investigations for each of the minerals in the rock?

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ACTIVITY 351 PAGES 3

LEARNING EXPERIENCE: Comparsion of Soil Types

CURRICULUM AREA : Science

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Soil is a very important life supporting system.

OBJECTIVES

Students should be able to.

1. List three components of soil

2. Describe orally differences in texture, color and water absorptive quality of a variety of soils (at least two varieties after the trip; more, if follow-up activities are used).

3. Participate in class studies of soil, by bringing in soil samples and/or performing the experiments.

4. Make soil and grow seeds in it.

UNIT CONCEPTS

1. Soil supports a variety of life.

2. Soil is composed of rock particles, plant particles, and animal remains.

3. Soils can be recognized as sandy, loam, and clay.

4. Soils can be identified by many recognizable properties - texture, color, odor, etc.

PROCEDURE

Materials Needed

Square of white cardboard; water; hand lens; spade.

FIELD ACTIVITY

What color do you think soil is?

See what colors of soil you can find on this path. Allow at least 15 minutes for investigations.

What seems to be giving the soil these colors? Of what is soil made? Did you see anything that makes you think this? (NOTE: If children do not suggest that rock crumbles into soil, ask such questions as: Did you find anything else on the path the same color as the soil? What happens to the stones when you rub them together?)

What causes the rock to break down into soil?
Can you find any rocks which show signs of weathering?
Can you make soil from any of the stones on this path? (Allow about 15 minutes for experimentation - safety glasses should be worn if rocks are to be broken).
How does your soil look compared with what is already here? How does it feel? Squeeze a handful of your soil and a handful of soil that was already here and seems similar to it: Compare the texture, the way the squeezed handful holds together. How would you describe any differences? Look at your hands. What color are they? Smell the soil you have made. Does it have any odor?

Is there anything in the soil besides pulverized rock? Investigations should not involve tearing up plant roots. Look for areas where the soil is already partially exposed.

Take a handful of soil from near the roots of the grass. Squeeze it, holding your hand near your ear as you do so. Do you hear anything? Describe what you hear. Compare the squeezed sample with yours. Compare the texture of this soil with the soil you made. Smell this soil. How would you describe any odor you notice? Look at the color of your hand. What do you notice? Examine this soil carefully, using a magnifying glass. Do you see anything in it that was not in yours? What? Look around to see if you can get any idea what this is. Does what you see help explain what you heard and smelled? How?
Spread out several handfuls of this soil and describe all the differences you have noticed in the preceding investigations. NOTE: If the weather has been dry for a long period of time, it may be necessary to pour a little water on the soils being examined. Even if the soil is moderately moist, if time permits, further observations can be made by pouring water on soil and observing what happens. Was the water absorbed? How quickly? If not, where did it go? What went with it? What color changes took place? What happens now if you squeeze a handful?

If you were going to make the very best possible soil you could make, what would you put in it?
Of what value are the rock particles in soil?
Of what value are the plant particles?
Of what value are the animals?
Value to whom?

FOLLOW-UP ACTIVITIES

1. Collect soils from different places (school yard, home yards, woodlots, fields).

   a. Sieve a sample of each. What is left in the sieve. Did more soil go through the sieve or stay in it? Why?

   b. Take an equal quantity of each soil sample. Heat each in an oven until dry (or in a pan over a hot plate). Weigh each sample. Record dry weight. Put each dried sample in a glass bottle or test tube. Add an equal quantity of water to each. Observe how quickly the water disappears into the soil. Pour in more water measuring the quantity until each tube is filled to the brim. Did each take the same amount? Let stand 5 minutes. Pour off excess water from each. Measure the quantity and note clarity. Which soil absorbed the most water? the least. Weigh each sample and record wet weight. Compare with dry weight.
   Let stand 5 days. Weigh again. Compare the weights. What do you think accounts for the differences in weight loss? From what soil type did water evaporate most rapidly? more slowly?

   c. Put a sample of each soil type in a test tube or bottle of water. Describe what you see happening. Cork the bottles and shake each. Let the bottles stand, and watch the soil settle. Observe at

15 minute intervals. How long is it before the water in each tube is completely clear? Which soil type settled most quickly? Which took the longest to settle? Why do you think this is so?

d. Combine several different soil types. Add water to just more than cover. Shake. Observe the settling action. After 24 hours observe sediment layers.

2. Make the very best soil you can from natural materials. Play fair! Write your recipe. Try growing seeds in your soil. Have a class contest. Whose soil do seeds find best? Grow some of the same type seeds in the other soil samples. Compare growth.

3. Find examples of decomposition in the school yard and at home. Does decomposition continue if the object is brought into the classroom? What factors hasten decomposition?

4. What is a compost pile? Perhaps some students could start one with parents help. What reasons could you give for having one?

5. What decomposers are in the soil you can't see? Sprinkle particles of decaying wood or pulverized soil in the surface of agar in several sterile agar plates. Keep the plates in a warm (72°F), dark place for several days. What do you see on the plates? Which plate showed the most growths? (Check with a high school biology teacher for directions on preparing the agar).

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ACTIVITY NUMBER 352 PAGES 1

LEARNING EXPERIENCE: Erosion

CURRICULUM AREA : Science

GRADE LEVEL : 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME : Erosion is a natural process that has been aided by man's intervention.

OBJECTIVES

After completion of activity, students should be able to

1. List three factors contributing to erosion.

2. Suggest two methods of erosion control.

UNIT CONCEPT

1. Flowing water is the major cause of erosion.

2. The numbers and types of plants growing in an area help to determine the amount of erosion.

3. Erosion can be controlled by altering the flow of water and numbers and types of plants in the area.

FIELD ACTIVITY

Look at a grassy hillside or any sloping piece of ground. Can you see any water running over the soil? Where do you see water? Where is this water going? Where is the water coming from? Is the water clear? Brown? Compare an open piece of soil with one covered with grass or other plants.
How does the contour of the land affect the run-off pattern of the water?
Trace the flow of surface water from a stream to its source.
What path does it follow?
What factors will affect the speed of the water run-off?
Which areas do you think are damaged the most by erosion?

What natural methods of erosion control do you see? What artificial (man-made) methods of erosion control do you see?
What would happen to this area in a rainstorm if all plants and trees were suddenly removed? What makes you think this? Have you observed examples of this or have you learned of this through reading or hearsay?

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ACTIVITY 353 PAGES 2

LEARNING EXPERIENCE: Decomposers

CURRICULUM AREA : Science

GRADE LEVEL : 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME : Decomposition is natures way of taking care of her litter.

OBJECTIVES

After completion of activity, students should be able to:

1. Differentiate between living and decomposing wood.

2. Name three organisms that aid decomposition.

3. Find examples of decomposition in their yards and near the school.

UNIT CONCEPT

1. Decomposition is an important soil builder.

2. Decomposition is aided by many organisms including plants and animals.

3. Decomposition is a slow process.

FIELD ACTIVITY

Do you think these trees are dead? Why?
What is the difference between a dead tree and a living one?
What will become of these trees if they are not taken away from here?

Is the bark still on the tree? What happened to the bark?
What is under the bark?
Tap on the bark. How does it sound? How does this compare with the sound of the living trees?
Feel the bark and the wood under it.
How would you describe it?
Does it feel the way it looks?
Does all the wood under the bark look the same? Feel the same?
Push and poke it. Can you find some that is fibrous? Spongy? Powdery?
What other words can you use to describe the way it feels?
Is there anything on these tree trunks and logs besides bark?
Is this material living or dead? Why do you think so?
What color are fungi? (NOTE: Although white or grey will probably be the answer, suggest they look more closely for other colors with such questions as: Are they all the same shade of white? Grey? Can you find fungi that are striped? Brown? Orange or reddish black? Cream colored? Some other color?)

How would you describe the appearance of fungi? Can you find fungi that are: semi-circular, flat, or needle-like?
Are all the fungi living? Why do you think this?
Can you find fungi that look like open umbrellas? Closed unbrellas? A deer's antlers? What other ways could you describe them? From looking at them, how do you think fungi feel?
How do they really feel?
How many different textures can you find? Can you find fungi that feel velvety? Leathery? Granular? Like paper?
What other words can you use to describe them?
Where does the fungi get its food? Do you think this does anything to the tree? Do fungi get seeds? Why do you think this? Where are the spores formed?

Can you find signs of other organisms that are or have been in these logs? What signs?
What do you think made the holes or marks?
Does the animal which made the hole seem to be there now? What makes you think this? Why do you think this animal was/is here?
What part might this animal have played or be playing in the death and/or decomposition of this log?
On what observations, if any, are you basing your answer? Might there be some other explanation? How could you find out?

Have all these logs been lying here the same length of time? What makes you think this? Find the one you think has been here the longest. Where does the log stop and the forest floor begin?
What will eventually happen to the log?

Should the park staff clean these woods and remove these logs?
Why do you think this?

Is there any other place in this forest where decomposition is taking place? How about in the filed? In your yard and garden?
What would the world be like without the decomposers?

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ACTIVITY #354 PAGES 2

LEARNING EXPERIENCE: Soil Study

CURRICULUM AREA : Science
Language Arts
Social Studies

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Soil is an important life supporting system.

OBJECTIVES

After completion of activity students should be able to:

1. List three components of soil.
2. Describe soil in terms of texture, color, odor, and water absorption qualities.
3. Describe three ways in which the living organisms in the top part of the soil affect the soil.
4. Determine the slope of the land.
5. Describe ways man uses and manages the soil.
6. List factors to consider when determining the use of soil.

CONCEPTS

1. Soil is composed of rock, plant and animal particles.
2. Soil can be described and identified by texture (sandy, silt, clay), color, odor and structure.
3. Soil supports a variety of plant and animal life.
4. Slope is an important factor in determining land use.

MATERIALS NEEDED

Pencils
Trowels
Thermometers
pH test kit
100 or 50 inch stick
yard stick or tape measure, level or jar with water
tin cans with top and bottom removed
data sheets

FIELD ACTIVITY

Divide the group into smaller groups of two or three students each. Give each group a clipboard, pencil, data sheet to be filled out. pH test kit, trowel, thermometer and a can with top and bottom removed. Instruct them how to do the pH test, and how to run the permability test. (Push can into ground an inch or two. Pour a cup of water into the can and count the number of seconds it takes for the water to soak into the ground). Assign the students to different areas and have them complete the data sheet.

After they have completed the sheets, discuss their findings, adding the following questions.

Is all soil the same color? What do you think soil is made of? Can you find any rocks breaking down? What causes them to break down? What else is needed for soil? (organic matter) Do the plants and animals you found do anything to the soil? When might you find more organisms in the soil? Less? Different?

Does the temperature of the soil vary with the season? Can you think of a place where the soil may be warmer? Colder? At what temperature do you think organisms grow fastest? (65° - 70°).

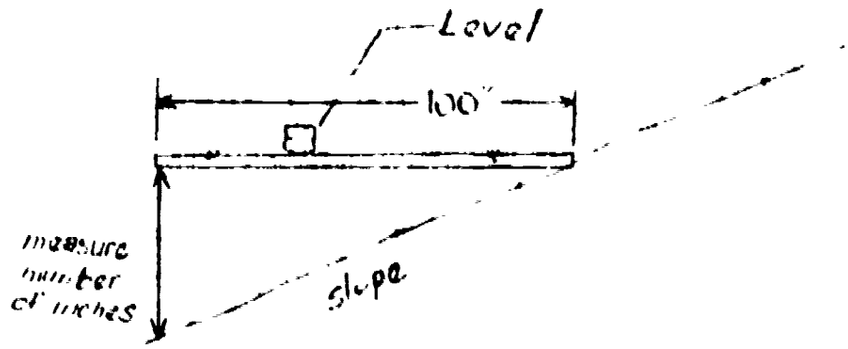
What was the pH of the soil? Do different plants like different pH's? Below is a list of plants and their preferred pH.

4-5 - rhodendron, azaleas, blueberry, fern
5-6 - pine, holly, oak, birch, rhodendron
6-7 - maple, aster, peach, carrot, lettuce
7-8 - beech, asparagus

What do you think makes pH different in different places? Would pH be the only factor that determines whether a plant grows? What about animals?

Does water soak into some soils faster than others? Why

Determine the slope of the land. Select a place that represents the average slope of the land being studied or take several measurements and average them. Place one end of a 100 stick on the slope you want to measure. (or use 50' or 25 stick, but remember to multiply findings by 2 or 4). Hold stick outright to be about level. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until level. Measure the number of inches the free end of the stick is off the ground. The number of inches is the slope of the land in percent.



Does the soil type change with slope? Does slope effect erosion? Organisms present?

Does the slope of the land limit its use? What other factors would limit the use of the land? (soil depth, permability, texture).

Activity #354 DATA SHEET

Ask your Guide for help if you need it.

1. What color is the soil?
2. Is it all the same color?
3. What does the soil feel like? Gritty Smooth Sticky Slippery
4. Can you make the soil into a ball?
5. Does the soil have a smell?
6. What does it smell like?

7. How many different plants are growing in your soil?
8. How many animals can you find in your soil?
9. List the plants and animals or draw a picture of them.

Plant	How Many	Animal	How Many

10. What is the temperature of your soil?
11. Does the color of your soil change as you dig deeper?
12. Does it feel the same as you dig deeper?
13. What is the pH of your soil?
14. How many seconds did it take for the water to soak into the ground?

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ACTIVITY NUMBER 401 PAGES 1

LEARNING EXPERIENCE: Dictionary and Writing Skills

CURRICULUM AREA : Language Arts

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Ideas about the out-of-doors can be communicated more accurately by emphasis on vacabulary growth.

OBJECTIVES

1. To help students develop a conversation vocabulary.

2. To help students improve their dictionary and writing skills.

PROCEDURE

Learning Activities:

The teacher could put a list of any of the following words on the blackboard.

Soil — weathering, erosion, humus, mantle, germinate, dormant, topsoil, subsoil, bedrock, loam, silt, clay, water table, crop rotation.

Water — pollution, condensation, evaporation, contamination, purification, chlorine, filtration, distilled water, reservoir, algae, sewage.

Forests — chlorophyll, chloroplast, epidermis, conifers, cambium, photosynthesis, taproots, termites, botamist, cellulose, lichens, sequoia, simple leaves, compound leaves, bark, deciduous, evergreen, hardwoods, soft woods, juniper.

Plants — chlorophyll, photosynthesis, stamen, petals, phloem, pistil, roothairs, roottips, buds, flower.

Have the students use some of these words in a sentence (use of words would require dictionary work, if the students did not know them.) Allow the students to select a word, develop a theme centered around environmental problems. Allow the students to select another word to develop a theme showing man relationship with his environment.

FOLLOW UP

1. Many ideas and concepts develop from these students' writings. The writings could then be shared with the class by allowing the students to read their papers orally and discussing the concepts presented.

2. Have students read poems and stories using some of the words listed.

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ACTIVITY NUMBER # 402 PAGES 1

LEARNING EXPERIENCE: Observing with Senses

CURRICULUM AREA : Science
Language Arts

GRADE LEVEL : 1st
2nd
3rd
4th

CONCEPTUAL THEME : Man learns about his world through sensory perception

OBJECTIVES

After this activity, students should be able to

1. Draw the general outline
2. Describe the texture and the quality of the object using a list of adjectives.
3. List at least three colors found in the object. (The number may vary depending on the object.)
4. Describe the parts or units which make up the object.
5. Describe briefly the steps and senses used in the processes of observation.
6. Write a description of the object which, when read to the class, sufficiently describes the object so that others can guess, with no more than three guesses, what it is.

UNIT CONCEPTS

1. An object can be described by shape, size, texture, color, smell, and weight.
2. Learning involves the use of the five senses.

MATERIALS NEEDED

Hand lens

FIELD ACTIVITY

Pick it up if you can. Is it heavy or light? Compare its weight to something you know.
Is it wet or dry, firm or pliable, soft or hard? Do you think it would break or bend if you dropped it? (Don't drop it until after you have finished examining it).
How would you describe the shape of the object? Compare it to something you know.
Describe the texture of the object. How does it feel?
Does it feel the same all over or do different parts feel different?

Sniff it. Is there a distinctive odor? Can you describe it?
What color is it? Compare its color to something more familiar.
Is it all the same color or does the color differ from one part to another? If so, describe the variations.
Look at it closely. How does one part differ from another? Are there holes in it? (Many, few, big little?) Any other fine details?
Is the object all one piece or is it made up of smaller units?
Are they regular? Can you count them?
Might this be a part of a larger thing? Check the area for smaller things related possibly to it.
What importance might it have for some plant or animal in the area?

[illegible]

ACTIVITY NUMBER A A 3 PAGES 1

LEARNING EXPERIENCE: Nature Walk

CURRICULUM AREAS: Language Arts

SCALE LEVEL: Kindergarten
1st.
2nd.
3rd.

CONCEPTUAL TYPE: There are similarities and differences in the natural world.

OBJECTIVES

After activity students should be able to

1. Compare two articles noting their similarities and differences.
2. Share ideas through discussion or conversation and work, stories, etc.

CONCEPTS

1. Items are distinguished and identified by noting their similarities and differences.

MATERIALS NEEDED

Two man made items exactly alike (pencils, nails, buttons) natural items whose absence will not impede the area (dead leaves, weeds, seeds, seed pods, rocks, nuts, rotting wood),
List of feel words (fuzzy, crinkly, prickly, bumpy, rough, smooth, squeezy, fluffy).

FIRST ACTIVITY

Being two man items that are exactly alike. Point out and discuss their exact likeness. Collect two items such as leaves, rocks, blades of grass. Discuss their similarities. Explain that they are similar because they are the same type of item, from the same plant, or of the same color and texture. Can you find two items that are similar? Can you find two items that are alike? Why or why not?

Give the group the natural items you have collected one at a time. Tell them to look for a matching item and to return to the leader when they have found one. (Make sure they do not venture too far in their search). Compare the items the children bring back. Discuss the similarities they see that helped them to make the match. Go on to the next item, repeating the process till all the items have been used. Go on to the feel words using the same method as with the items. Can none of the items collected be classified under more than one word?

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ACTIVITY NUMBER 42/ PAGES 1

LEARNING EXPERIENCE: Listening

CURRICULUM AREA : Language Arts

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Man learns about his world through sensory perception.

OBJECTIVES

1. To enable students to recognize that learning experiences occur by listening.

2. To teach students to use their senses to discover and learn about the world they live in.

UNIT CONCEPTS

1. The five senses are valuable learning tools.

2. Man learns by using his eyes, ears, tongue, nose, and fingers.

PROCEDURE

Materials needed:

Tape recorder, record player, records of bird calls, other animal sound and other sounds of nature.

FIELD ACTIVITY

1. Take students on a field trip (around your school, to the Nolde Center.)

2. Divide your class into groups of five (5) students each. Each group should have a group leader.

3. Allow the students to sit down along various areas of the trail to record the sounds of the forest or field. Listening activities should not necessarily be limited to bird calls, but sounds of other animals and other out-door sounds.

4. In the classroom this tape can be played and, at the same time, pictures of corresponding animals displayed and discussed.

FOLLOW UP

1. Allow the students to write a theme about the sounds heard.

2. Take your students into the city to compare the sounds and the producers of these sounds.

3. Play for your students LP records.

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ACTIVITY NUMBER 431 PAGES 2

LEARNING EXPERIENCE: Experience in sketching

CURRICULUM AREA : Art

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Patterns and designs exist in nature.

SUBJECT

Nature: particularly plant life with emphasis on detail of one subject and not an entire scene.

OBJECTIVES

1. To develop an awareness of the patterns and designs that are found in nature.

2. To understand how some modern art is a form of reality. Some paintings are magnified showing great detail rather than a distortion of a shape with no real meaning or purpose.

MATERIALS FOR INTRODUCTION

1. Collect pictures of nature such as:

   (a) trees
   (b) flowers
   (c) grass
   (d) different tree bark, etc.

   Several close-up views showing great detail is necessary. A good source is the Audubon magazine January 1969 and 1970.

2. One 9 x 12 sheet of oak tag. Cut a window 3 x 5 from center.

3. If appropriate slides are available, these could show detail in patterns in nature.

INTRODUCTION

1. Show pictures of forests, fields, flowers as an entire picture.

2. Use the oak tag sheet and place over these pictures to only show a section of picture.

3. Bring to students' attention the lines, patterns, or designs that are created by this method.

4. Point out this is what they should be looking for when sketching, parts of a whole rather than the entire scene or object.

MATERIALS NEEDED FOR FIELD TRIP (each student)

1. 2B sketching pencil (or any soft pencil).

2. Gum eraser.

3. Cardboard (9 x 12 or slightly larger) - to use as writing board.

4. Large "bull clip" to attach paper to cardboard.

5. Several (6) [illegible] sheets newsprint.

PROCEDURE

Each student selects a spot or subject to sketch and proceeds to make "thumb-nail" sketches in the following manner"

1. Quick lines.

2. Free moving (not forced).

3. Employ shading where necessary.

4. Emphasize details, not completed picture.

As many thumb-nail sketches should be made as time will allow.

FOLLOW-UP PROJECTS

Using thumb-nail sketches as subject, finish in following manner:

1. Pen and ink sketch

2. Scratch board

3. Colored pencil finished sketch

4. Water color using:

   (a) wash for background with pen and ink sketch overlay
   (b) dry brush

5. Copper relief

6. Wax paper - watercolor resist

Colors used may suggest plant or feeling.

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ACTIVITY # 432 PAGES 2

LEARNING EXPERIENCE: Experience in Expressing Textures

CURRICULUM AREA : Art

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Nature provides aesthetic value for man to enjoy.

OBJECTIVES

1. To develop an awareness of texture in nature using the sense of feeling.

2. To acquire a knowledge of expressing textures on paper through art.

3. To understand the correlation (symbolism) between shapes and colors with textures.

4. To re-enforce the concept of the primary and secondary colors.

5. To develop an appreciation for the aesthetic value in nature.

UNIT CONCEPT

1. Textures are surface designs.

2. Textures illustrate variations in depth within the design.

3. Sharp to smooth curving lines are found in textures.

4. Patterns in textures are created by the depth and the lines.

MATERIALS

1. Large black crayon without paper (each).
2. Small pieces of tissue paper - various sizes and colors.
3. Piece of cardboard for drawing board (each).
4. White drawing paper - 9 x 12 (each).
5. White glue.
6. Small glue pan or dish (several).
7. Small paint brushes (2 doz.)

PROCEDURE

Introduction:

1. Talk briefly on the five (5) senses.
2. Emphasize the sense of "feeling", asking the students how can we express this feeling to others.
3. Ask the questions:

    a. How is "feeling" expressed in nature? (texture)
    b. How can we translate these textures elsewhere?
    c. What relationship do the following words have with textures?

        (1) rough - smooth
        (2) jagged - curved
        (3) red - blue (also other colors)
        (4) large - small

4. Demonstrate:

    a. Texture rubbing on tissue paper.
    b. Tearing the tissue paper to express textures.
    c. Overlapping the tissue paper to create additional colors, thus expressing other "feeling".

NOTE: The sense of touch is not the only "feeling" in nature. A student might have an emotional feeling about a texture which can also be expressed through shape and color.

FIELD ACTIVITY

1. Have students make as many texture rubbings as they wish keeping in mind the following relationships:

   a. Texture to size of paper.
   b. Texture to color.
   c. Feeling to size of paper.
   d. Feeling to color.

2. After texture rubbings are finished, arrange rubbings on a piece of white drawing paper. Keep in mind the following:

   a. Size relationship.
   b. Color
   c. Overlapping to create new colors.
   d. The feeling (emotional) created by the texture.

   There should be an informal balance of these relationships.

3. After a pleasing arrangement is made remove all tissue paper from the sheet of white paper, remembering where each piece is to be placed. Starting with the piece of tissue paper that was on the very bottom of the overlappings, spread a glue mixture (one part white glue with one part water) on the back of the tissue paper with a brush. Put this piece of tissue paper back on the white paper where you had orginally placed it. Continue until you have completed your arrangement again.

FOLLOW-UP PROJECTS

1. A texture collagé made with actual texture pieces.

2. A three dimensional collage' with emphasis on form as well as texture.

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ACTIVITY NUMBER # 433 PAGES 1

LEARNING EXPERIENCE: Shapes and Patterns

CURRICULUM AREA : Art

Language Art

GRADE LEVEL : Kindergarten

1st

2nd

3rd

4th

CONCEPTUAL THEME : Objects are recognized by shape and pattern.

OBJECTIVES

After completion of activity, students should be able to.

1. List articles in order of relative size from largest to smallest, when given a set of articles in a natural environment.
2. Find leaves of at least three different shapes and be able to sketch shapes seen in flowers, trees, clouds, and other natural phonomena.

UNIT CONCEPT

1. Objects come in varying shapes and sizes.
2. Objects can be ordered byshape and size.

MATERIALS NEEDED

Pencil and paper

FIELD ACTIVITY

What shapes can you see? Are all trees shaped the same? Sketch a few. What shape is a leaf? Trace at least three leaf outlines. What shape is a flower? Find one that is bell shaped, triangular, round. What shape is a cloud? Try to sketch some. What happens while you draw? Can you find a triangle, a rectangle, a square, a circle, etc?

What sizes can you see? List some things you can see starting with the biggest thing and getting smaller until you reach the smallest thing you can find. What things can you see that can be both big and little?

What patterns can you see? Sketch some. Can you find patterns in the bark of the tree? Can you see patterns in plants, birds, insects and other animals?

Can you find a tree that reminds you of something: A figure? A vase? Etc.

Can you find a texture in some natural object that you would like in cloth? What would you make from such cloth?

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ACTIVITY NUMBER 434 PAGES 3

LEARNING EXPERIENCE: Communications: Sketching and Writing

CURRICULUM AREAS : Language Arts
Arts
Self-expression

GRADE LEVEL : 3rd
4th
5th
6th

CONCEPTUAL THEME : Patterns and designs in the out-of-doors invoke varying individual mental impressions.

OBJECTIVES

Students will:

1. identify sensual qualities of an object and convey their impressions of the object to others.
2. interpret the responses of others to animate and inanimate objects.
3. recognize basic physical patterns and designs in their surroundings and attempt to reproduce them on paper.
4. attempt to convey their emotional response to what they see to others.
5. sketch an organized pattern or design in nature and verbally describe the basic patterns included in their drawing.
6. express in writing their responses to an organized design or pattern in the out-of-doors.
7. respond to the impressions others receive from what has been said or written.

UNIT CONCEPT

1. Objects individually have certain qualities by which we recognize them.
2. Each individual may have a different response to what he or she experiences in the out-of-doors.
3. How we interpret the environment depends on the emotional experiences we have in the out-of-doors.
4. Our environment or surroundings is the sum total of the objects we perceive.
5. Objects in our surroundings relate to one another; our perception of all the objects together is the basis for our response to our surroundings.

MATERIALS

Cardboard for writing
Cardboard picture frames
Pencils
Paper for writing and sketching

PROCEDURE

Have each student find a single object somewhere near them. Ask each student to write down on paper at least four (4) words which describe the object. Gather the students together and with each student in turn: without telling us what the objects is that you described, how or what did you feel about the object? Were you happy? Sad? Afraid? Excited? Have the student read the words he or she has written on the paper to the other students. Ask the other students to attempt to guess what is being described. When the object is mentioned what other words would you use to describe the object to somebody. How did each of you feel about the object when you found out what it was?

Ask each student to find two other objects that are nearby or aside one another. Sketch the object on your paper so that they look as real as you can make them. When they have finished, have the students exchange their sketches with one another. Taking each individually, ask the student to look carefully at the picture and identify what the objects are. As the objects are identified; do you think it is light or dark in color, heavy or light in weight, larger or

smaller than yourself? What basic shapes can you see in the drawing? Circles, squares, rectangles? Do you think it would have a smell? How would it smell? Are they sharp or dull? Friendly or dangerous?

Find out who the owner is. Ask; why did you choose those two objects? Do you like the objects? Are you afraid of the objects? (Get the student to use emotional words in describing the subject such as strong, beautiful, ugly, old, nice, strange, peaceful, exciting, etc.). Why do you feel that way about the objects? Do the rest of you feel the same way? If not, why not? (Get students to relate personal experiences with objects).

Give each of the students a square picture frame. Ask them to hold the frame in front of their face and look closely at something small (ex: a bug on the ground, a pebble, a small weed). Keep watching the small object and move back until you can see another (new) object in the picture frame. Do this several more times until you have five (5) or more objects in your picture. Sketch your picture on the paper using straight and curved lines, circles, and other familiar shapes. Show the objects size relationship to one another. If something is dark, use shading to show how the objects contrast in color qualities. As you draw your picture try to show how you feel about the objects you see.

When the students have finished their sketches: write a few sentences about what you have drawn or make up a little story to go with your picture. As you do this try to use words that show how you feel about the objects and the picture you sketched.

When the writing has been completed: ask the students to individually describe their sketch and what objects are present. Ask the other students to close their eyes and try to imagine the picture that is being described. Allow the other students to question the student describing the picture for details. Ask each student to then draw the picture he or she has imagined. Have them compare their sketches to the original. Discuss any significant differences that occur as they each compare. (What kinds of feeling were experienced by the listeners as the picture was being described? Encourage the use of emotion connoting words).

Following the discussion ask the student to read the sentences or story that he or she has written. Look for emotional indications in the written material. Question the writer about these emotions and relate them to those experienced by the listeners or have other students determine the emotional experiences of the writer (do you think he or she was afraid of the objects, liked or disliked the objects and why?).

If time allows repeat the above using larger areas as subjects.

FOLLOW-UP

1. Have students examine selected objects and write stories about the objects. Ex: how they came to be, how they came to be located where they are, what effects the object may have on others. Have the students orally read their writings and compare what they have written with what others have written.

2. Using a procedure similar to that in # 1, poll the student's emotional responses to the objects. Are most afraid? Did most enjoy seeing the object or dislike it? Discuss the various responses and investigate the reasons for the common responses.

3. Sketching skills could be developed by practice in recognizing detail and object relationship in prepared sketches.

4. Have students list all the words that could be used to describe an object, or a complete picture.

5. Collect and examine composite pictures prepared professionally. Poll the students for emotional response and recognition of detail in organization.

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ACTIVITY 451 PAGES 4

LEARNING EXPERIENCE: The Effects of Air Pollution

curriculum area : Science
Health
Social Living

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME : Pollution is a social problem and society is charged with the responsibility to control it.

OBJECTIVES

At the completion of this activity, the student should

1. be able to recognize that air pollution is injurious to the body and threatens human health.
2. demonstrate the ability to recognize sources of air pollution.
3. become aware that air pollution destroys the aesthetic delights of nature.
4. realize that air pollution can kill plants, animals, and human life.
5. demonstrate the ability to recognize various kinds of air pollution.

UNIT CONCEPTS

1. Air pollution contributes to disease and premature deaths.
2. Air pollution is a complex problem.
3. Air pollution obscures visibility.
4. Air pollution attacks materials.
5. Air pollution injures and kills plants, animals, and human life.
6. Air pollution is an economic waste.
7. Air pollution consists of hydrocarbon, carbon monoxide, solids, SO_2, other gases.

INTRODUCTION

The most dramatic evidence of the effects of air pollution on human beings lies in the disasters that have overtaken large and small communities. At various times in history these disasters have awakened the public to the problem of air pollution.

The problem of air pollution is always present and affects all of us, especially the city dweller. Various pollutants affect us in different ways, but it is the human body, especially, our lungs, which are the most vunerable.

The effects of breathing polluted air are cumulative. In most cases the damage is done before we realize it and then it is too late for the damage is irreparable.

There is a marked increase in lung diseases such as emphysema, chronic bronchitis, lung cancer and colds. The rate of incidence of these diseases in metropolitan areas is twice the rural rate. These effects of air pollution can be seen in absenteeism in industrial plants throughout the United States.

Air pollutants corrode, soil, abrade, tarnish, erode, crack, weaken and discolor materials of all varieties. Plants are damaged and destroyed due to air pollution.

The major variables that affect the type and severity of air pollution at anytime or place are:

types of pollutants
quanity of pollutants
wind speed and direction
topography
sunlight
precipitation
change in air temperature with altitude
susceptibility of individual to particular pollutants

PROCEDURE

Before field trip students should:

1. List all the things the class knows about air pollution. Separagely or as a group.

2. Discuss the types and sources of air pollution (man-made and natural).

3. Discuss some of the problems created by air pollution's effects on human body, effects on plants, economic factors. (increased cleaning costs, corrosion etc.) Would it be less costly for industry to cut down on air pollutants instead of paying costs to reverse the effects of air pollution?

4. Discuss the factors that contribute to the severity of air pollution in a given area.

5. What are the air pollution problems in your own community?

FIELD ACTIVITIES

1. Examine plants that grow outside. Compare plants growing in an area of high air pollution (in a city, along busy highway) with those growing in an area of low air pollution (park, farm). Are some plants more resistent to air pollution?

2. Use a Ringelman Chart (available from the U.S. Bureau of Mines) to determine the severity of air pollution coming from smokestacks in your area. The chart is based on the darkness of the smoke coming from a stack. Take many readings at different times of day, week, season, weather conditions.

3. Visit a city and look for effects of air pollution. Deterioration of materials such as paint on houses. Eye irritation, decreased visibility, crumbling buildings, soot and dirt on buildings, decreased machinery efficiency.

4. Test for particulate matter in the air at various sites and under various conditions.
   Use a tank vaccum cleaner, attach filter paper over the hose. Run the cleaner for a pre-determined length of time. As the cleaner runs, air is pulled through the hose, and the particulate matter is trapped by the filter paper. Compare the filter paper with an unused piece.

Compare various areas and different times of day. Is the air in the classroom polluted?

FOLLOW-UP ACTIVITIES

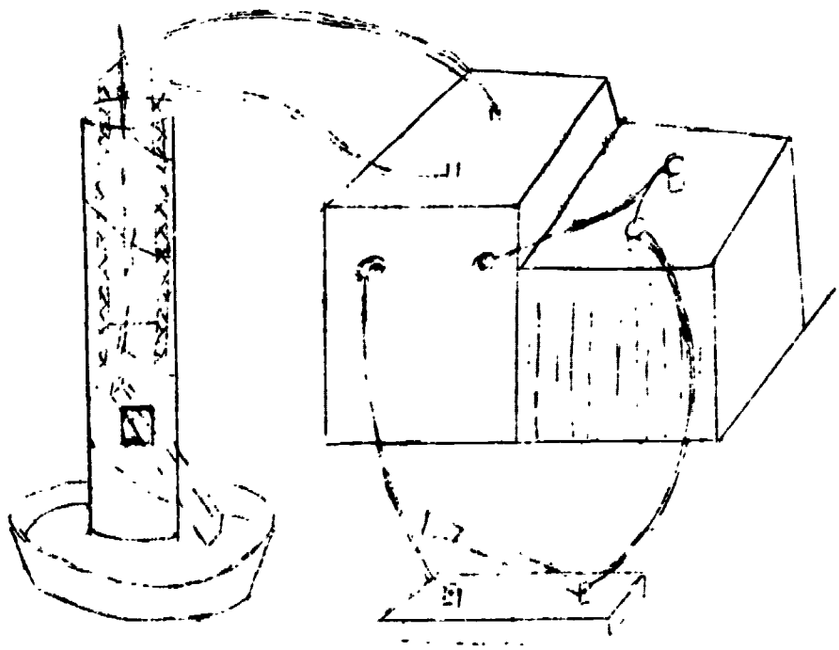
1. Make a collection of photographs of various sources, and types and effects of air pollution.

2. Discuss solutions to the problems in your area. Make a scale model of a Cottrell precipitator.

You will need:

1 carboard tube
2 strips of copper screen 6" x 1"
6 feet of standard wire
2 toothpicks
1 stick of incense
1 spark coil
1 knife switch
1 6 volt battery
1 metal dish

Set it up as follows:



Light the incense. You will be able to see the smoke traveling up the tube and smell the incense. Now turn on the spark coil. What happens? Why? How could this device be used to prevent air pollution?

3. Make a map showing areas of high and low air pollution.

4. Test for particulate matter around your school or community.

   Coat microscope slides with petroleum jelly. Place outside for several days. Particulate matter will adhere to the petroleum jelly. Compare different areas.

   Place jars of a measured amount of water at various locations for several days. Bring inside and evaporate the water which will leave the particulate matter. Weigh. Be sure to evaporate an equal amount of water that has not been placed outside to compare your samples with.

5. Start a club to fight air pollution in your area.

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ACTIVITY _____ PAGES _____

LEARNING EXPERIENCE: Noise Pollution

CURRICULUM AREAS : Science
Health
Social Living

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Pollution is a social problem and society is charged with the responsibility to control it.

OBJECTIVES

At completion of activity students will be able to.

1. Name properties of noise and sound.

2. Give reasons for increased noise levels and noise sources.

3. List effects of noise.

4. Give ways to reduce noise levels.

CONCEPTS

1. Sound is judged on loudness and pitch.

2. Noise involves irregular and intermittent sounds, localization, unnecessary sound, reverberation, unexpected sound, background noise and time of day.

3. Noise affects our everyday life.

4. There are ways to reduce noise pollution.

PRECEDURE

What is sound?
What is noise?
How did you tell sound from noise?
Did you consider the receivers, (the people who hear and complain about sound?)
What is loudness?
Will any sound become noise if it gets loud enough?
How do we measure loudness? (decibels - one decibel is the smallest change in loudness that the average human ear can detect).
How loud is normal talk?
At what level does noise become painful?
What is pitch?
Are high or low pitched sounds more annoying?
Do intensity (loudness) and pitch interact to determine sound or noise?
What other characteristics affect sounds?
Irregular and intermittent sounds are usually considered noisy more often than steady sounds. Can you think of any sounds like this?
How do you feel if you don't know where a sound is coming from?
Do sounds that you feel are unnecessary bother you more than sounds that are necessary?
What are some examples of this?
What is a reverberation (echo)?
Can you hear them in any room?
What is different about rooms that have echoes and those that don't?
What do you do when you hear a sudden noise?
Would you react the same way if you knew the noise was going to happen?
Can the area in which a sound is heard determine if it is noise or not?
What about a motorcycle in a residentual area? in a city? in the country?
Find out how much sound different kinds of machinery make.
Is it noise when your mother runs the vaccum cleaner? What if you are trying to watch television in the same room?

Are sounds "noiser" at different times of the day?
What are some of the sources of noise? (population explosion, urbanization, automobiles, trucks, buses, motorcycles, airplanes and airports, industry).

FIELD ACTIVITY

Visit various areas in the community that have different sound levels. Take a tape recorder (if available). Tape the volume dial, so it is always at the same level. Record for approximately five minutes and make a list of the sounds you hear during that time. Compare different areas. Compare the same area at different times of day. Where are the sounds coming from? What is making them? Do you classify them as noise? How could some of the sounds be reduced? eliminated? Can you think of an experiment to test your ideas?

FOLLOW-UP

What are some of the physical effects of noise? (hearing loss, emotional effects, financial effects). Discuss various ways that noise can be reduced in various areas.

Study waves to find out how sound travels. What happens when sound waves enter the ear? How do we hear?

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ACTIVITY 475 PAGES 2

LEARNING EXPERIENCE: Natural Environment vs. Cultural Environment

CURRICULUM : Social Studies - History
Sociology
Political Science
Geography
Economics

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME Man's cultural environment affects the natural environment and vice-versa.

OBJECTIVES

Students should be able to:

1. Determine the historical value of the region and the local community.
2. Relate the general role of the historical trail to the economic-socio-political development of the discussed areas.
3. Identify factors which cause stable growth in community and regional environments.
4. Determine factors which hinders growth in community and regional environments.

UNIT CONCEPTS

1. Man migrates to meet his needs of survival.
2. Natural environment affects mans decision to develop an area.
3. Natural biological environment affects mans cultural environment in three general ways: economically, sociologically, and politically.

PROCEDURE

Pre-trip

1. Teacher should give broad explanation of economics, sociology, politics and other social science disciplines previous to the visit in the field.

Field Activity

2. Students will be taken out into the field to discuss the social studies areas requested by the teacher. Factors to be pointed out will be: economics of forest and forest products to local wildlife and this relationship to the cultural environment of the local community, social relationship between plants and animals - and their role on the social relationships of man; the politics of a natural environment - and its relationship to politics of mankind.
3. Discussion and comparison of all social studies activities involved. Observation and thought on such topics as class stratification in natural realm compared to class stratification in cultural realm.

FOLLOW-UP ACTIVITIES

1. Map local region.
   a. Find the various types of natural resources in the mapped out areas.
   b. Point out river valleys and communities which ahve grown on their banks. Discuss why locations were selected.
   c. What in the natural environment caused people to settle in this area.

d. What social causes led to migration to this region? Was it economical gain? Political gain? Religious persecution?

e. Was the area developed by one major ethnic group? Were they city dwellers? Farmers? Wanderers? If developed by one group, during what period did other ethnic or racial groups migrate ot the area?

2. Compare cultural environment growth (such as cities, villages, town, farmlands, resevoirs, parks, etc.) to the decline of natural environment (meadows, forests, wildlife population, etc.). Were these ratios different in the year 1400 than in the year 1900? In what ways? How will they differ in 2000 A.D.? Can a 50 year comparison study be done?

3. Continued discussion and observation.

a. Students can compare groups of people or individuals in the role they play in their environment. How does a civic league utilize the outdoors? How does a farmer decide what fields to plant?

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ACTIVITY NUMBER 476 PAGES 2

LEARNING EXPERIENCE: The Changing Environment

CURRICULUM AREA : Science
Geography
History

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Man's occupation of an area is affected by his physical environment.

OBJECTIVES

Upon completion of this activity students should be able to:

1. Determine how geography of the local community has affected the politico - socio - economic development.

2. Describe the geography of the various regions of the local community.

3. Recognize past accomplishments and present problems by man as his physical environment changed.

4. Determine the geological, physical, sociological structure of the community (or Nolde) and note the changes which have occurred over the years.

UNIT CONCEPTS

1. Orderly laws appear in nature; these laws seem to govern the distribution and success of living things.

2. The structure of a community changes with time.

3. Everything within a community is cyclic.

PROCEDURE

Class discussion prior to field trip and accompanying activities.

1. Students should compare and contrast the definitions of "physical geography" and "ecology".

2. Secure topographical map of area. Have children observe the map and hypothesize as to the location where the early settlers decided to live. Children should consider all the necessities of life as it would apply to colonial days. Children should provide reasons why they have chosen specific sites on the map.

3. Students should make a listing of the necessities of life and the possible types of employment for settlers during the colonial times.

4. Have students discuss what they feel would be necessary for a colonial farmer to know in order to be successful.

FIELD ACTIVITY

1. Students, on their way to the Center, should visit the saw mill; collect data on physical features of the area; and compare their

classroom hypothesis from the topographical map with the observable features (can use class time to conclude this activity).

2. Students should compare and contrast the Water Shed area and the Farm area as possible sites for agriculture in the colonial days. (Possibly students could be presented with the problem: If you were a colonial farmer which of these two areas would you choose as a possible site for your farm? Why?)

   a. Students should observe the following features of each area:

      (a) Geological features
      (b) Various types of soil
      (c) Types of flora present and abundance in each area
      (d) Types of fauna present and abundance in each area

   b. During observation students should speculate as to why knowledge in these areas would be helpful to a farmer.

   c. Students also should be able to investigate, to some extent, the interrelatedness of the flora and the fauna in the area as it relates to farming.

   d. Students should keep in mind the question: What did the settlers who were farmers have to know about an area if they expected to be successful in their work?

      SUGGESTION: Students could be divided into specific study groups concentrating on (a) geology and soil formation, (b) fauna of area - their needs and habits, and (c) flora of area - habitats and necessities for growth and reproduction.

      Sepcific questions and/or problems could be assigned to students to arrive at some understanding of assigned area.

FOLLOW UP

1. Students, either at school or at the Center, could be gathered to discuss what knowledge was necessary for a farmer to be successful both in colonial times and today.

2. The following questions could be considered:

   a. Of what use is geology to a farmer?
   b. Of what use is knowledge about the habits of animals present in an area to a farmer?
   c. Why would a farmer have to know about the plant life that is present in an area?
   d. Is it necessary for a farmer to know about the science of ecology?
   e. What are some problems that a farmer would face if he did not use ecological approach to his farming?
   f. Based on your observations, which of the two areas considered at the out-door education center would you choose to farm on if you were a settler in this area?

d. Is it necessary for a farmer to know about the science of ecology?
e. What are some problems that a farmer would face if he did not use ecological approach to his farming?
f. Based on your observations, which of the two areas considered at the out-door education center would you choose to farm on if you were a settler in this area?

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ACTIVITY NUMBER 435 PAGES 13

LEARNING EXPERIENCE: Community Profile

CURRICULUM AREA : Social Studies
Math
Science

GRADE LEVEL : 4th
5th
6th
7th
8th
9th

CONCEPTUAL THEME : The environment of an urban community has many diversified features.

OBJECTIVES

Upon completing the activity, students will be able to:

1. differentiate between the types of people in the area surveyed.

2. differentiate between the variety of needs which people have in the surveyed area.

3. discover the importance of components, such as transportation, business, etc., in helping to keep the community alive.

4. identify the role of the student, as an individual, within the community.

UNIT CONCEPTS

1. Within a community, we can identify groups of individuals on the basic of age, employment, race and ethnic background.

2. Within a community, we can identify the economic needs, such as food, water, clothing, and shelter, that are basic to individual survival.

3. Urban communities have various man-made systems which help urban areas to function (such as roads, sewers, telephone, heat and light, etc.)

4. Each individual has his own niche in the urban community environment.

II. Planning Your Survey

You could. survey every third structure - or - survey four structures in each block at random.

Decide on the numbers and locations, and make sure each team does the same.

Will you do both sides of the street?

Who will ask the questions at each place? You will probably want to take turns.

KEEP IN MIND:

How much time you will have.

It is best NOT to enter a house.

You are representing a professional group.

People will be happier to answer your questions if you are courteous.

PRACTICE

Interview your friends

Have them pretend to be difficult or talk about things you don't ask. You can expect some people you survey to be this way.

COMMUNITY PROFILES

This section presents a framework for an active community investigation by the students. The studies could be focused on real problems in the community.

The "work sheets" on the pages that follow are written for the students. These can be duplicated and given to them as a small booklet, if you desire. The annotations on the top of each page are for your use in guiding the section.

In this section the students will learn things about the neighborhood around the school - about the people who live and work there and the types of homes and businesses they might find. To do this they will want to make a survey. But it is impractical to survey every dwelling or business in the community. Instead, they will have to take samples. The sampling method can be compared to a poll, such as the Gallup Poll and the Harris Survey, which do not contact all people but do give reliable surveys of public opinion.

Instead of surveying every home within a five block radius of the school, the class could for example, plot imaginary lines from the school in various directions and survey all the buildings along these lines. If the students want they could have these lines cut across back yards and through the middle of houses From a practical standpoint, however, this would obviously be inconvenient for the homeowners and would make the survey harder for the students. A simpler method would be to have the lines run along the streets. This way, the students could canvass the people on both sides. If they use this method, they will be doing what is called a "transect study." When the investigation is completed, they will have gained some information about various aspects of the community.

The results of the study should be displayed with maps, pictures, and colorful histograms. The students should be able to interpret these easily.

NOTES TO THE TEACHER:

This section is optional depending upon the availability of cameras. The school may have some. Polaroids are ideal, since they give instant results.

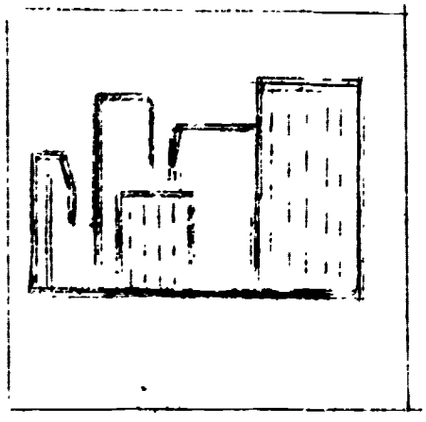
If only one group goes out at a time, one camera will suffice.

If the students offer to bring a camera from home, you might check with their parents for permission. One camera per group is ideal. To insure return on the pictures, the school should supply the film and developing.

The class is now ready to go out. The number of necessary trips will depend upon the time available and the length of the transects.

PICTURES-SHOW OTHERS

If cameras are available you can photograph the places you survey.
Practice using a camera.
Decide who will take certain pictures.
Take the picture after you talk with the people.
Keep a list of the order of the pictures in the camera as you take them. If there is any possibility of confusing one building with another, make notes to help keep the pictures and houses in order after they come back from the developer.



PICTURE NO.	SUBJECT	LOCATION
1	Old House	325 Elm
2	Apartment	327 Elm
3	Garbage	329 Elm
4	Old house(dog in yard)	333 Elm
5	Vacant lot	--------
6	House (under construction)	347 Elm
7	Old house(for Sale sign in yard)	349 Elm

NOTES TO THE TEACHER:

The pictures can be grouped in ways which emphasize the aspects studied:

These can be done by separate groups, or the students can put their pictures together.

A group discussion can be based around the pictures.

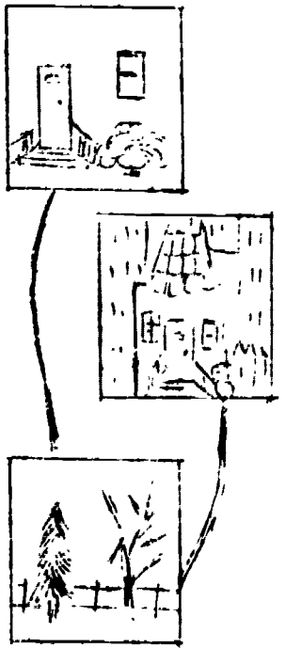
Possible discussion questions:

Why are these places dangerous?
What makes these places safe?
What would you do to make the dangerous places safer?

You will want to develop questions which pertain directly to your specific study.

WHAT CAN YOU DO WITH THE PICTURES?

Arrange them like a string map



Contrast them

old

new

big

small

safe

dangerous

Group them

Places people Play

Places people live

Places people work

Places people buy things

Places that help people

NOTES TO THE TEACHER:

Point out that the scale on the left of this histogram is different and stands for a different thing.

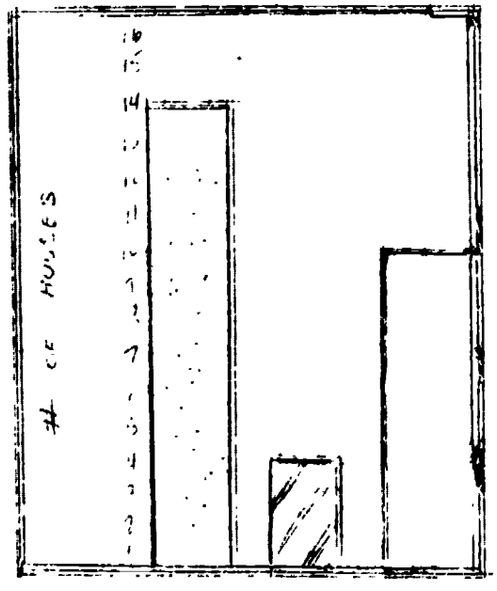
Ask the students to interpret the key this time.
What does the dotted bar stand for?
What does the lined bar stand for?
Histograms can help in interpreting results but they do not always give clear-cut answers. This one indicates (a) and (c) but not (b). Lead the students into a debate over the "right" answer until they discover there is more than one answer. After this discussion, the various interpretations of their own histograms should become more apparent.

II. Comparing age of Houses

An histogram showing ages of houses can indicate at a glance how old most of the houses are along your transect. You may find that every house along your transect was built at approximately the same time. If this is the case, your histogram may have only one or two upwards columns darkened in. The houses along other transects may have a wide variety of ages and the histograms can be used to show this variety.

Key:

- Houses 20 years old or more.
- Houses 10 years old but less than 20 years old.
- Houses less than 10 years old.



What does this histogram tell you?

(a) Most of the houses here are old.
(b) Most of the houses here were built between 10 and 20 years ago.
(c) Many new houses have been built in the last 10 years.

NOTES TO THE TEACHER

Even if you haven't made up booklets for the students, you will want them to have copies of this page and the next one. You could make a transparency of the sample histograms as a center for class discussion.

Ask the students to interpret the samples, and explain why they give the answers they do.

Example:

"The answer is (b) because the biggest bar is for the people who have lived here a long time."

"It isn't (a) because the smallest bar is for the new people.

Point out the scale on the left of the histogram and explain what it means.

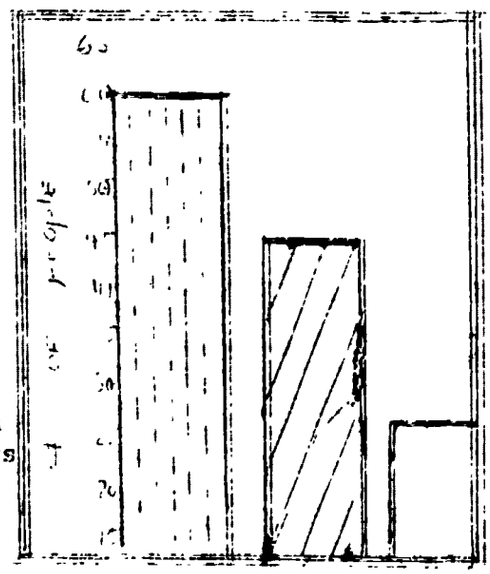
You may also want to help them with the key.

HISTOGRAMS

I. Comparing length of Residence

Make histograms of the different things you surveyed that you can count.

Here is an example, but make your graphs to fit your results.



KEY

- People living here more than 10 years.
- People living here more than five years, less than 10 years
- People living here less than 5 years.

What does this histogram tell you?

(a) Most of the people here are new.

(b) Most of the people here have lived here a long time.

NOTES TO THE TEACHER:

The results of the survey should be tabulated before making the histograms. The sample survey summaries in the back of the book can be used as a pattern. However, the conclusions (the summaries of data) should not be drawn until the histograms are complete.

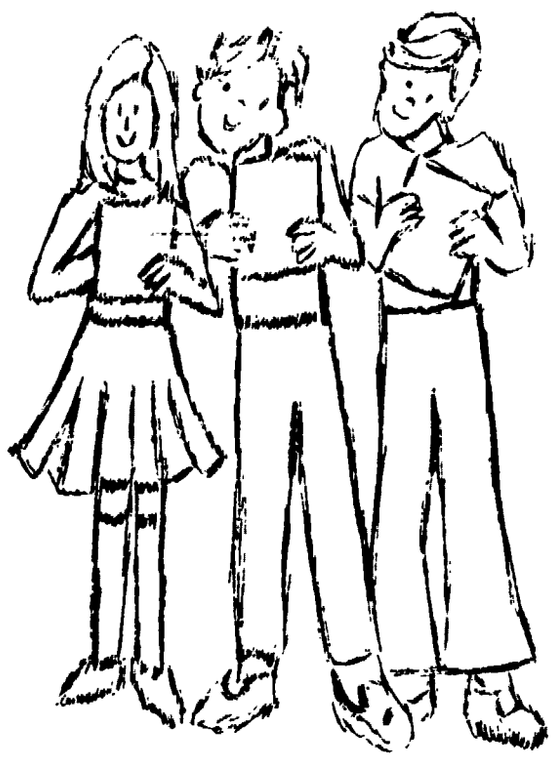
Guide the discussion of the real histograms along the lines of the sample ones.

Write down each conclusion or interpretation. These can be attached to the bottom of each histogram.

The students will probably decide that the class histograms give a better picture of the community as a whole. However, some students will say that their section of the area was not like that, as their histogram is more accurate. Both ideas are correct. The whole is the sum of its parts, but these parts are not all alike.

III. Summary of Histograms

Decide what your histograms tell you. Compare them with the histograms of the other groups. Do they all tell the same thing?
Get together with the other groups and make big histograms by putting your results together. What do these big histograms tell?
How do the big histograms compare with the ones made by the separate groups? Which ones give a better picture of the whole community?
If you had done some of the same surveys 10 years ago do you think the results would be about the same? Would they be different and if so, in what ways?
Would your city government have any information that would show you what certain residential areas were like ten years ago?
Suppose you were to do similar surveys 10 years from now. Can you predict what those surveys might show? For example, are new families tending to live in your town for shorter periods of time than they used to?
Your city government might have made studies on how long individual families tend to remain in your town or city. There might also be predictions on whether present trends will tend to change in the future or remain the same. Your city hall may be able to provide you with information.



Transects:

Make a map of your designated area.

Draw four lines in different directions from the center of the area(to be demonstrated on chalkboard in classroom.)

The transect line will be your guide. It will help you to decide where to conduct the survey and what each team member in the survey will do.

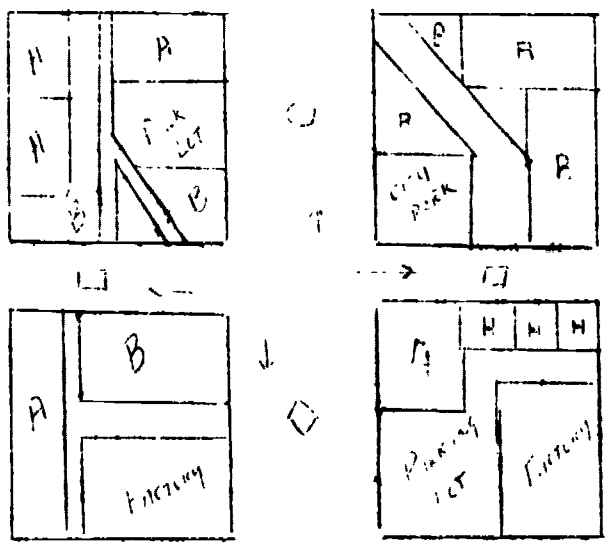
The class will divide into four groups.

North - ○ East - *

South - ◇ West - □

Make a map of your group's transect.

The map should show the street which the transect follows and all the streets which cross the transect. Place in street names. Indicate where all the buildings are along the transect; showings houses - h, apartments - a; businesses - b, and so forth. Prepare a map legend.



b - business
f - factory
a - apartments

h - home
pk - park
pg - parking lot

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ACTIVITY 486 PAGE 3

LEARNING EXPERIENCE: Natural Community Profile

CURRICULUM AREA : Social Studies
Math
Science

GRADE LEVEL : 4th
5th
6th
7th
8th
9th

CONCEPTUAL THEME : The environment of Natural Community has many diversified features

OBJECTIVES

Upon completing this activity, students should be able to:

1. Differentiate between the types of plants and animals in the area surveyed.

2. Differentiate between the variety of needs which the plants and animals have in the surveyed area.

3. Discover the importance of components which aid in the development of a good natural community; such as light, clean air, animal trails, etc.

4. Identify the role of at least three plant or/and animals in the natural community.

CONCEPTS

1. Within a natural community, we can identify groups of plant and animals on the basis of sight, color, odor, taste, touch and habits.

2. Within a natural community, we can identify the economic needs of plants and animals; such as food, shelter, water, air, space and other needs that are basic to specie survival.

3. Natural communities have certain basic natural systems which help the community to function (such as animal trail systems, streams, light and dark areas, micro-climates, etc.)

4. Each plant and animal has their own niche in the natural community environment.

NATURAL COMMUNITY PROFILE

This activity provides for an active natural community investigation by the students. The study can focus on the types of problems that affect the natural community.

The 'field community questionnaire' at the end of the activity are written for student investigation out in the field. The questionnaire, and work sheets can be duplicated and given to them in a small booklet form. Notations throughout the activity will help you in guiding the study.

Since it is impracticle in many cases, to survey large area of the forest, the activity is designed so that students can select their own sample areas. This method can be compared to a 'Harris' or 'Gallop' Poll of a natural area, which does not survey the entire area, but give reliable sample of communities within the area. When the survey is completed, they shall have information about various interactions within the natural community.

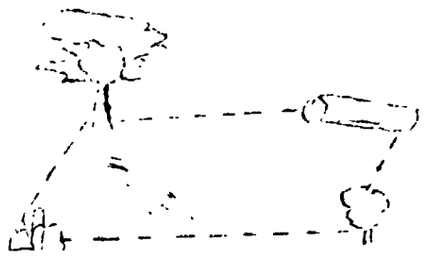
Results from the study could be placed on boards in the form of histograms, maps or pictures. If the cultural community profile activity (#485) is used, differences and similiarities can be drawn from both types of communities.

Profile of a Natural Area

Find a general area where your students will work on the survey. Establish a landmark to identify your general area of survey.

Divide the class into groups of two or three. Have each of them select their own area either North, South, East, or West of the landmark. If additional teams are available you may want to assign them to certain areas which are rich in diversity.

Once they ahve identified a specific area have them outline (using natural features) the section they will survey. Within the imaginary line

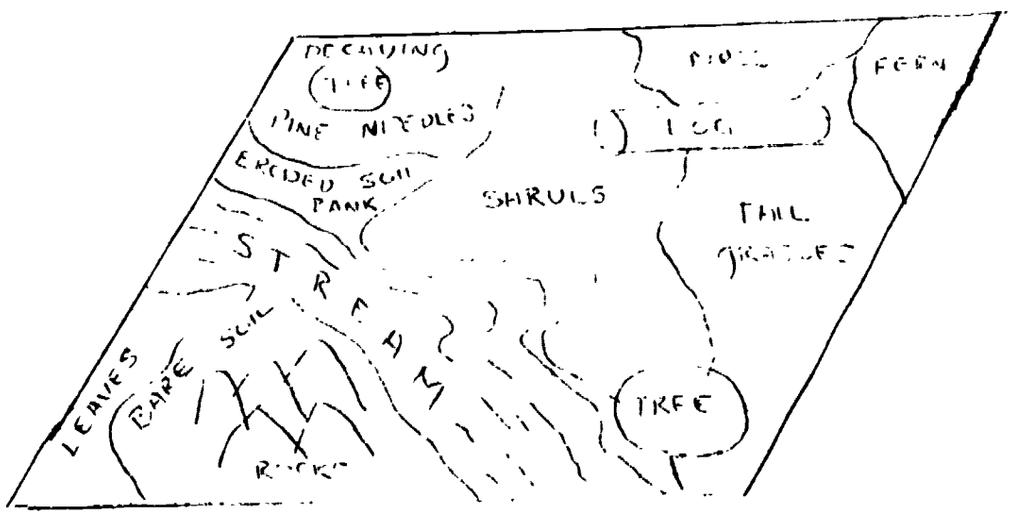


will be the community they are to study.

A. Recording the Various Types of Families in the Natural Community:

1. On a blank sheet of paper students should map and locate the various types of plants and animals found in the area they are surveying. It may be in detail or in generality (example shown: Figure A) but it is important to map out the general natural community you are working with.

Figure A.



Upon completing the mapping the students should specifically identify the various types of trees, shrubs, grasses, etc., and animals that live within the given co-munity. This may involve using a key to plant and animal life.

II. Students should then select two or three families in the community to interview (using the attached questionnaire). In all cases, students should answer the questions on the 'work sheet' with great accuracy, utilizing the sensory approach to develop the answer.

III. Discussion of Activity

We have selected a community in the forest to study - now we should talk about its functions.

Discussion of Plants - How many types of plant families live in this family community?

Are there more taller plants than shorter plants or vice versa? Is there any special reason why? What are the needs of this plant for survival? (food-water-air-shelter).
Where do the plants get their food in this community?
Do any other plants or animals get their food from the same source?
Where do the plants get their water? (roots, stream, air, etc.)
Do other plants and animals get water from the same source?
Where do the trees find shelter?
How are they protected from the cold and wind?
Is a tree's protection different to that of a blade of grass?
How does the tree help the air to stay 'fresh' in the community?
Do they help each other in any way? (moisture, light, etc.)
If plants are absent in any part of the community, how does that area differ to the area where they are present? (teacher can expand discussion to soil study, light needs in the given area, photosynthesis, necessity of space for growth, and so forth).

Discussion of Animal Families

How many types of animal families were in the community you surveyed?

Teacher: Develop a student discussion on the food these animals eat.
Develop a student discussion around the water these animals drink.
Develop a discussion on the types of homes the animals live in and on their methods of selecting these homes.

How many animals can you find living on plants?
How many types of animals in your community eat plants for food?
Do the animals in your community get along well with each other?
How much land would you estimate that each animal has as his own backyard?

Teacher: You can expand discussions through the development of food chain, food webs, interrelationships between plants and animals, survival, means of protection of various organisms, adaptation to environment and so forth.

Do you think this was a healthy community - and if so - what do you feel makes a good strong community?

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ACTIVITY 501 PAGES 2

LEARNING EXPERIENCE: Signs of Spring

CURRICULUM AREAS : Science
Language Arts

GRADE LEVEL : 1st
2nd
3rd
4th
5th
6th

OBJECTIVES

After activity students should be able to:

1. Name several sounds heard in the Spring.
2. Name several animals and birds seen.
3. To identify animal droppings as a sign of animal presence.
4. Define hibernation and migration; and tell what is happening in these processes now.
5. Show evidence of vocabulary by answering questions and using words in their vocabulary and in writing.
6. Pick out three leaves with differing shades of green and three leaves with differing textures.
7. Describe leaves in terms of color, texture and possibly odor.
8. Write description of spring, involving observations made with all the senses.
9. List signs of spring.
10. Demonstrate an increased awareness of different shades of a color by comparing shades of same color in their clothes and in their environment.

UNIT CONCEPTS

1. Spring is a time of increased plant and animal activity.
2. Increased activity is triggered by warm weather.
3. Hibernating animals emerge in spring.
4. Migrating birds are returning.

THE TRIP

Plants

When you think of spring, of what color do you think? Are all greens the same? Try to describe any differneces you see. Are different plants different shades of green? Can you find more than one shade of green on one plant? Do some plants have different shades of green on the upper and undersides of their leaves? Are the leaves and buds the only parts of the plants that are green?

Are all buds green? When you look up toward the sky, do all the trees look green at the top? Describe some of the differences. Do you see any buds that are brown? Do you see any buds that are red? Orange? Can you find, closer to eye level, any opening buds with a brownish or reddish color? What part of the bud is that color?

Do all plants get green at the same time? Look at the tops of the trees, the shrub layer, the forest floor Have any plants already bloomed? What makes you think so? Are some plants in bloom now? Can you find flower buds on some plants? Do some plants just seem to be coming up now? Do you think all of these plants started getting green at the same time? Why or why not?

Look at the leaves on the forest floor. Are they green? Were they once green? What makes you think so? When? How do they feel? Feel some green leaves and describe how the green ones feel compared to the brown ones.

Feel green! Try to describe how several feel. Rub the surfaces of some of the leaves. Can you find leaves that feel smooth, sticky, fuzzy, bumpy, glassy, waxy? Does the undersurface feel like the upper surface? Does the leaf feel the same when you rub your fingers along the leaf from the tip to the stem as when you rub your fingers along the leaf from one side to the other? Do you see anything on the leaf that makes it feel the way it did? Look at the leaf after you rubbed it. Is it the same shade it was? How do your fingers feel?

Hear green!
Rub your fingers along and across some of the leaves again. Do you hear anything? Try to describe the sound. How is what you hear explained by what you feel and see? How does a handful of green leaves sound compared to a handful of brown leaves?

Smell green!
How would you describe the smell of the leaves on the forest floor? Do the new leaves smell like this? Can you find leaves with different smells?

Animals

Do you think we can find any birds or animals today? Will we see as many as in winter? summer? Can you find signs of animal life? Where might we find signs of animals? Do you think we would see any baby animals? When do animals give birth to their young? How do animals behave when they are afraid? Would you expect to see animals when you are in a small group? Alone? In a large group?

Could you get stung by a bee today? Would you expect to see a fly? Where do you think we would find insects? Do you know anything that eats insects?

Birds

Some brids leave their homes in the fall. Where do they go? When do these birds come back? How can you tell if there are birds around? What kind of activity are birds busy at now? Where would we find bird homes? What do birds eat? Where should we look for birds? Do all birds have the same song? Why do birds sing? (to defend territory, attract a mate, warn other birds of danger). What might we see that could tell us the type of bird that has been here before us?

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ACTIVITY NUMBER 52[illegible] PAGE 3

LEARNING EXPERIENCE: Summer Outdoors

CURRICULUM AREA : Science

Language Arts

GRADE LEVEL : 1st

2nd

3rd

4th

5th

6th

CONCEPTUAL THEME : There is much activity in the natural world during the summer.

OBJECTIVES

After completion of activity students should be able to.

1. Name three or four sounds heard in Summer.
2. Name several animals or birds seen.
3. Pick three leaves of differing shades of green and three with different texture.
4. Write a description of Summer involving observations made with the senses.
5. Describe a park and rules for behavior in the park.
6. Name the seasons of the year and describe characteristics of the season, berbally in pictures, in stories.
7. Name colors seen in Summer.
8. Identify animal homes.
9. Name two characteristics of a stream and several animals that might live in it.

UNIT CONCEPTS

1. Animals are active during the summer.
2. Plants have leaves and are busy making food.
3. Plants and animals are preparing for winter.

PROCEDURE

FIELD ACTIVITY

How many seasons of the year are there? What season is it now? Look around. Can you see or feel things today, that you cannot see or feel in winter? What does summer look like? Is summer everywhere? What color is summer? Close your eyes. Listen. What are summer sounds? Take a deep breath. Does summer air feel and taste the same as winter air?

Plants

What color do you think of, when you think of summer? Are all greens the same? Are differnet plants different shades of green? Can you find more than one shade of green on the same plant? Are leaves the only parts of the plant that are green?

Can you find any plants with buds? What kind of buds are they? Do all plants bloom at the same time? Can you find one that is blooming? Can you find a plant that has already bloomed? How can you tell?

Look at the leaves on the forest floor. Are they green? Were they once green? What makes you think so? How do they feel? Feel some green leaves and describe how the green ones feel compared to the brown ones.

Can you find leaves that feel smooth? Sticky? Fuzzy? Bumpy? Waxy? Does the undersurface feel like the upper surface? Do you see anything on the leaf that makes it feel the way it did?

How would you describe the smell of the leaves on the forest floor? Do new leaves smell like this? Can you find leaves with different smells?

Animals

Do you think we can find any birds or animals today? Will we see more than we would see in winter? Can you name some of the animals that might live in the park? If we don't see any, how can we discover if any live here? Why might we not see any animals? Would you expect to see more animals when you walk alone in the woods or with a large group? Do you think we would see any baby animals? When do most animals give birth to their young?

Sometimes an animal can be very close to us but we don't see it, do you know why?

How do animals behave when they are afraid?

Insects

Could you get stung by a bee or see a fly today? Could these things happen in the winter? Where should we look for insects? Would you find them in the ground? Trees? Air? Bushes?

How many legs does an insect have? Can you find an insect? Can you find an animal that might be related to an insect?

What do insects eat? Do all insects eat the same things? Can you name any that eat plants? Do they hurt the plant? Do you know any insects that eat other insects? What else might insects eat? What might eat insects?

Birds

Will you see or hear many birds today? How can you tell if there are birds in the park? Do all birds look alike? Do all birds sound alike? Why do birds sing? What happens when you get near a bird? Listen to the songs of the birds. Do the sounds change as you approach? Why do birds fly away when they hear a noise?

What do you think birds are busy doing now? Where would you find bird homes? What do birds eat?

Creek

Do you see any running water? What do we mean when we say running water? Does water have legs? What do you call this kind of water? (creek, stream.) What kind of noise does it make? What do you see on the bottom?

Is the water clear or muddy? Is the water deep or shallow? Why is it deep or shallow? Where does the water come from? Where does the water go? When the water hits the stones and rocks on the bottom, what happens? How is a stream different from a pond? What might live in the stream? What do they eat? Where would they have their homes?

What would the stream look like in the winter? Where would the animals be then?

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ACTIVITY NUMBER 551 PAGES 3

LEARNING EXPERIENCE. Signs of Fall

CURRICULUM AREA . Science

Language Arts

GRADE LEVEL . 1

2

3

4

5

6

CONCEPTUAL THEME : Community structure changes throughout the year.

OBJECTIVES

After completion of activity, students should be able to:

1. Name three sounds heard in the Fall.
2. Name several birds or animals seen.
3. Find three leaves in different stages of color change. Name colors seen in Fall.
4. Write a description of Fall involving observations made with the senses.
5. Name the seasons of the year and describe characteristics of the season.
6. Identify animal homes as a sign that an animal has been there.
7. Define hibernation and migration and name an animal that engates in these activities.
8. Describe leaves in terms of color, texture and odor (if any).

CONCEPTS

1. Trees drop their leaves during the Fall.
2. Some animals are preparing for hibernation while others migrate.
3. Fall is characterized by cooler temperatures, shorter days and change in plant and animal activity.
4. Animals and plants learn to adapt to the changing seasons.

FIELD ACTIVITY

How many seasons of the year are there? What season is it now? Look around, can you see some things that helped you decide it is Fall? What color do you think of when you think of Fall? Are all plants the same color and shades? Are some plants still green? Close your eyes, listen, what are the Fall sounds? What do you hear? What don't you hear that you may hear in the Summer? Take a deep breath, does the air feel and taste the same as Summer or Winter air?

Are there newly fallen leaves on the ground? How do you know? Are the leaves dry or wet? Pick the leaves up, feel them, smell them. Can you find the tree that these may have fallen from? Compare growing living leaves, with those on the ground What is the biggest difference between the two? What will happen to the leaves that fall to the ground? Can you find any of last years leaves on the ground? Is this surface matter helpful or harmful to the forest? What would happen if man removed the leaf litter each year?

What will the forest be like next Spring? How will it look? Smell? Feel?

What shapes can you see? Are all trees shaped the same? What shape is a leaf? What shape is a cloud? Can you find a rectangle? Square? Triangle? Circle? What patterns can you see?

What sizes can you see? List some things you can see starting with the biggest thing and getting smaller until you reach the smallest thing you can find. What things can you see that can be both big and little?

What are some of the things that have changed since the Summer? Are there changes you can see? Hear? Smell? Feel?

Can you find any seeds? Can you find the plant they came from? What might happen to this seed? Grow into a new plant? Eaten by an animal? What kind of animal might eat it? How did the seed get here? (Wind, animal, etc.) Would you expect to find seeds in the Spring? As many as Fall?

ANIMALS

Do you think we can find any birds or animals today? Will we see as many as we might see in Summer? Can you name some animals that might live in this community. Make a list of all the animals that live here. If we don't see any, how could we discover if any have been here? Where would be the best place to look for animals or signs of animals? Would expect to see more animals when you walk in a small group or alone in the woods or with a small group? Why? How do animals behave when they are afraid?

How will the change of season affect the animals who have their home here? Can you name some animals that hibernate? How do animals prepare for the Winter?

BIRDS

Will we see and hear as many birds today as we will hear in Spring and Summer? Some birds leave their homes in the Fall. Where do they go? Why do they go? What is their trip called? When do these birds come back? How can we tell if there are birds in the community. Do all birds look alike? Do they sound alike? Where would we find homes of birds? How many legs does a bird have? What enables a bird to fly? What does a bird have on the outside of his body?

What happens when you get near a bird? Why do birds fly away when they hear a noise? What might we see that could tell us the type of bird that has been here? Lets observe some birds to understand how they interact with the other parts of the community.

INSECTS

Could you get stung by a bee or see a fly today? Could these things happen in Summer? Winter? Where should we look for insects? Would you find them in the ground? Trees? Air? Bushes? What stage, in the life cycle of an insect, might we find? What is meant by 'life cycle'?

How many legs does an insect have? Do all insects have the same number? What do insects eat? Do all insects eat the same things? Can you find where an insect may have been eating? Do they hurt the plant? Can you name an insect that eats plants? Do you know any insects that eat other insects? What else might insects eat? What might eat insects? How many body divisions do insects have? How do they see? Smell? Feel? What are those two long things sticking out from their head? What kind of insect homes can we find?

CREEK

Do you see any running water? What do we mean when we say running water? What do you call this kind of water? (creek, stream). What kind of noise does the creek make? What do you see on the bottom? Is the water clear or muddy? Why? Is the water deep? Shallow? Is it the same in all spots?

Where does the water come from? Where does the water go? How is a stream different from a pond? What might live in a stream? What do they eat? Where would they have their homes? What would the stream look like in Winter? Where would the animals be then?

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ACTIVITY NUMBER #576 PAGES 5

LEARNING EXPERIENCES: Winter Outdoors

CURRICULUM AREAS : Science
Language Arts
Art

GRADE LEVEL : 1st
to
6th

OBJECTIVES

1. Children should be able, verbally, to describe a park and rules for behavior in a park.
2. Children should be able to name the seasons of the year and describe characteristics of the season, verbally, in pictures, in stories.
3. Children should be able to name three or four sounds heard in the park in winter, name colors seen in winter.
4. Children should be able, by deduction, to identify winter food and homes of birds and animals.
5. Children should be able to name two or three animals and birds they see, or might see in winter and why others are not seen.
6. Children should be able to identify tracks, as such, not necessarily by name of bird or animal, and be able to identify droppings as such.
7. Children should be able to describe snow as to color, touch, and tell where snow comes from and when snow falls in this environment.
8. Children should be able to define verbally and pictorally what hibernation and migration means.
9. Children should be able to identify food sources of birds and animals in winter.
10. Children should be able to name two characteristics of a creek or stream.
11. Children should evidence a concept of vocabulary by
    a. answering knowledgeably to questions
    b. using the word as a normal part of their vocabulary
    c. drawing pictures of words or ideas
    d. writing a story or dictating a story describing concepts, specimen, season, insect, bird, animal, seeds, nuts, cones, rocks, roots, trunk, branch, twig, bud, seed pod, creek, stream, pond, bare, heat, snow, bush, tree, nest, track, field, forest, food supply, running water, ice, fresh, droppings, park, fur, feathers, hole, feet, beak, pads, hoofs, claws, nails, front, hind, tail, fly, soar, flapping, glide, melt, bark, shelter, woods, wooded areas.

UNIT CONCEPTS

1. Winter is not dead.
2. Some animals are active during the winter.
3. Some animals hibernate during the winter.
4. Some animals migrate during the winter.
5. Deciduous trees loose their leaves during the winter months.

FIELD ACTIVITY

How many seasons of the year are there where we live?
What season is it now?
Look around, can you tell some things you see or feel today that you cannot see or feel in summer? Today let's look for winter.
Look down, is winter there? Look up, what does winter look like?
Look to the right, to the left. Is winter everywhere? What color is winter? Close your eyes, listen, what are the winter sounds?
What don't you hear that you might hear in summer?
Take a deep breath, does winter air feel and taste the same as summer air?

1. TREES

Do all the trees look the same now as in summer? Where are the leaves that were on the trees?
Are all of the trees bare? Do you see anything on the trees that are not leaves? What shapes are the things on the tree? What are they? Why are they there?
Can you find something on the ground that looks like the seed on the tree?
Put your arms around the trunk of a tree. What shape is the trunk of a tree? Feel the bark. Do you think all bark is alike on every tree?
How can you tell one tree from another?
What do you call the arm-like things growing out of the tree? (branches)
Is anything growing on of the branches? (twigs)
Is anything growing on the tree other than twigs and branches?
What holds the tree in the ground?
Is a tree alive? When what do all living things need?
How does a tree get the food and water it needs to live?
Do trees get sick like you do?
How many things can you name that might make a home in a tree?
What signs might we look for that a bird or animal uses a tree as home?
Can you find anything that shows that trees and plants are preparing for Spring? Can you find a tree where there is a bud and a seed pod? Is anything in the seed?
Do you see any fallen trees on the ground? Did they all fall in the same direction? Why? Did the roots pull out of the ground?
Are there more fallen trees in one area than in other areas?
What might make a large tree fall down?
If no one touches the tree on the ground and you come back when you are grown up, do you think it will look the same then as it does now?
Now let's see, we know that trees have roots, a trunk, branches and twigs. The outside of the tree is covered with bark. Leaves and seeds or nuts grow on trees. We can tell trees by the difference in color, bark, size, shape, leaves and seeds. Now detectives, you said all the leaves fall off and that birds, animals and insects make homes in trees. Who will be the first one to discover a tree that still has leaves on it and who can discover something growing on the tree that is not a bird, animal or insect? (moss)

2. FIELDS

Do you see any birds or animals in the field?
What grows in the field? Are all the plants alike? the same size and color? same shape? Are the plants alive or dead? What color do you think they will be in spring and summer?
Is there food for birds and animals in the fields?
Do you think any animals would make their home in the fields?
Why don't you see many trees in the field?
If we could dig up some earth in the field what do you think we would find?
Are there as many leaves in the field as there are in the forest?
Why not? How did the leaves get here that are on the ground?
Would it be easier for animals to see and be seen in the field or wooded areas?
If you were going to build a house would you build it in the field or woods? Why? If you were out in the fields and woods alone, would you be able to find food and shelter?

3. ANIMALS

Do you think we can find any birds or animals today?
Will we see as many as we might see in summer?
Can you name some animals that might live in the park?
If we don't see any how could we discover if anything has been here? (tracks, droppings) Are the tracks alike? How are they different?
Do animals have to eat in winter? Then where would be the best place to look for animals or signs of animals?
Do you think we might find tracks near the edge of water? Why?
How do animals prepare for winter?
Do you sleep some part of every day? Do animals sleep too? Does anyone know what hibernation means? Do you hibernate? Why do some animals hibernate?
Would you expect to see more animals when you walk in a small group or alone in the woods or with a large group? Why?
Do you think we would see any baby animals in the winter?
When do most animals give birth to their young? When could you expect to see babies?
Sometimes an animal can be close to us but we don't see it, do you know shy?
How do animals behave when they are afraid?
Do any of the trees or branches look as if they have been chewed? Are the marks high or low on the tree? What does that tell you about the size of the animal?

4. INSECTS

Could you get stung by a bee today or see a fly?
Where are the insects in winter?
Where do you think we could find some?

Do you know anything that eats insects?
Where would birds look for insects that are sleeping in winter?
If we had no birds to eat insects what would happen?

5. BIRDS

Will we see and hear as many birds today as we will hear in spring and summer?
Some birds leave their homes in the fall. Where do they go? Why do they go? What is their trip called? When do these birds come back?
How can we tell if there are birds in the park?
Do all birds look alike? Do they sound alike?
Where would we find winter homes of birds?
Do birds have to eat in winter? What do they eat? Then where is the best place to look for birds?
How many legs does a bird have? What enables a bird to fly? Put your arms out and pretend they are wings. Flap your wings. Now glide and soar.
What does a bird have on the outside of its body?
What happens when you get near a bird? Listen to the songs of the birds. Do the sounds change as we approach? Why do birds fly away when they hear a noise?
What might we see on the ground that could tell us the type of bird that has been here before us? (tracks, droppings, nest)

6. CREEK AND POND

Do you see any running water? What do we mean when we say "running water", does water have legs? What do you call this kind of water? (creek, stream, pond).
What kind of noise does the creek make today? Is it quiet or laughing?
What do you see on the bottom of the stream?
Where are all the animals now that you can find in the creek in summer?
Is the stream clear or muddy?
Is it full or shallow? Why is it full or shallow? Where does the water come from that fills the stream or pond?
When the water hits the stones and rocks on the bottom, what happens?
Is the water frozen? Why or why not?
How is a stream different from a pond?
Can animals live under the water when it is winter?
Does the ground feel the same under your feet near the edge of the pond or stream?
Where does this water go?

7. FOOD

If you were a bird or animal and you were hungry where would you look for food?
Why are some berries and nuts still on the trees and bushes?
Do you see more food in the forest, the field, or edge of the field?
Can you find a nut on the ground? Is there anything in it?
Can you find any seed or nuts that have been opened?
Who opened them?
What do you call the outside of a nut?
Do you like some foods better than others? Do you think all birds and animals like the same food?
What do you suppose would happen if all animals and birds ate the same food?
Could you find a bird or animal more easily if you knew the type of food it liked to eat?

8. IF THERE'S SNOW

How would you describe snow to someone who has never seen it?
Where does snow come from?
What is snow? (condensed water vapor in clouds exposed to freezing temperatures, air is held between snow crystals within angles and acts as insulation).
What happens to snow when you hold it in your hand?
How can you tell when something has walked on the snow? Do all tracks look alike? Describe any tracks you find. Look at your own tracks, do they look like animal or bird tracks? What do you have on your feet that would change the track made by you in winter and the one made by you going bare foot in the summer? Why do tracks change in the snow?
Is the snow even wherever you look?
Is the snow deeper in the field or forest? Why?
Why are some areas bare and some places piled high with snow?
How do birds and animals find food when there is snow on the ground?
Is food easy to see when there is snow on the ground?
Is there snow on the trees?

Describe the sound your feet make when you walk on snow.
Is the snow hard or soft on top? Is this new snow or has it been on the ground for awhile?

Do you see any signs of snow melting?
Will you be able to see tracks better in fresh snow or "old" snow?
Do you see any green plants? Look carefully, what is happening to the snow around each plant? (small melting circle) What melts snow?
Then do plants give off heat?
Where would you look for animals today? Where would be a good place for animals to stay?
What helps keep animals warm in winter?

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ACTIVITY 601 PAGES 1

LEARNING EXPERIENCE: Habitats

CURRICULUM AREA : Science

GRADE LEVEL : 5th
6th

CONCEPTUAL THEME : Many factors inter-act to determine the habitat of an organism.

OBJECTIVES

After completion of this activity, students should be able to:

1. identify and describe a habitat.
2. construct a diagram of an energy cycle using observations of organisms in the field.
3. explain the outcome if one group were removed from an energy cycle.
4. define decomposers, producers and consumers.

UNIT CONCEPTS

1. Many factors interact to determine a habitat area.
2. A habitat of an organism is the place where it lives or the place one would go to find it.
3. An energy cycle involves the interaction of light, plants, animals, and decomposers.

PROCEDURES

Field Activity

After selecting a habitat area (forest, field, aquatic), discuss the following questions.

What animals would you expect to find living here? What do these animals need to survive? How could you determine if these animals are here? Where would you look for animals around here?

Divide class into small groups. Explore the area for about a half hour. Record animals that are seen or evidence of animal presence (partly consumed food, excrement, homes). List food sources that may be used by animals.

What animals or evidence of animals were found? What were the characteristics of the area? How was it similiar or different from what was expected? Why is this area more or less desirable for animals to live in than an other area? Are the needs for survival present?

Build a food pyramid showing the comparative amounts of animals and animal evidences found. Build an energy cycle discussing terms such as producers, consumers and decomposers. What might happen if one group was removed from the cycle?

Discuss changes that may occur or have occurred in the area: use evidence of change and the influences that brought it about; what the area was like before the change, including life forms present: how a change affected the life present; the influence of man in bringing about changes.

FOLLOW-UP

Visit other habitat areas and compare them. What habitat had the most animals? What could account for the differences and similarities of the habitats.

Construct food chains and webs from information gathered in the field.

How have some animals adapted to live in areas produced by man?

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ACTIVITY NUMBER # 602 PAGES 1

LEARNING EXPERIENCE: Plot Study

CURRICULUM AREAS : Mathematics
Science
Language Arts

GRADE LEVEL : 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME : All organisms are interrelated and interdependent.

OBJECTIVES

After completing the activity, the students given a specific area will be able to:

1. List five items and/or characteristics found in the area.
2. Describe the soil in the area in terms of texture, color and odor.

CONCEPTS

1. Plant and animal life found in an area are dependent on soil type, water, and amount of sunlight present.
2. Soils are composed of organic and in-organic matter in varying degrees of decay.

MATERIALS NEEDED

For each group.

String six feet long
String one foot long
Trowel
Pencil and paper, white cardboard or paper
Magnifying glass

FIELD ACTIVITY

Have the students select a plot. Help them place a corner stake and have them measure off an area six feet square. Have them mark the other corners with items they can find in the area such as sticks and stones.

How many different things can you find in your plot? (Sticks, rocks, seeds, plants, etc.) How many are there of each item? Where did the sticks or seeds come from? What is the ground covered with? Is it the same all over the plot?

How many different kinds of plants are there? How many are there of each kind? How tall are they (use the one foot string to estimate their height). How much of the ground do they cover in your plot? Do all the plants in your plot feel and look alike? How are they different? Do any of them have a smell?

Draw a map of your plot and mark where the plants are.

Can you find any insects? Animals? Are they on the plants or on the ground? Do you find the same insects in both places? Can you find any signs of animal activity? Are the insects or animals affecting the plants in any way? Can you find any evidence that animals were here?

What color is the soil? What seems to be giving it this color? What does it feel like? Can you squeeze it into a ball? Why or why not? Does it have any odor? Can you describe it?

Dig a small trench and see if you can see different layers in the soil. What makes their layers different? How many layers can you see?

Can you find anything alive in the soil?

Take a handful of soil and place it on one corner of a piece of cardboard or paper. Sort through it, as you find different things move them to different corners of the paper.

Is the soil in all parts of your plot the same?

Compare your plot with the other plots. Are the things in them alike? Similar? Different?

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ACTIVITY NUMBER # 603 PAGES 1

LEARNING EXPERIENCES Finds in a Field

CURRICULUM AREA : Science

GRADE LEVEL 2nd
3rd
4th
5th
6th

CONCEPTUAL THEME An organism is adapted to its environment.

OBJECTIVES

After activity, students should be able to:

1. Name several objects native to a field area.

2. Name several ways in which objects not native to a particular habitat may be introduced there.

3. Give examples of organisms observed on the trip that did not originate in the field.

CONCEPTS

1. Organisms are native to a given area due to physical characteristics and needs of the organism.

2. Organisms may be introduced to a new area by natural or unnatural (man) events.

FIELD ACTIVITY

What can you find in the field that seems to have come from another area? Why do you think it did?

(NOTE: Finds may range from nuts brought in by squirrels, seeds washed in by rain or blown in by wind, and litter thrown in by man, to once-in-a-lifetime oddities).

Where did it possibly come from? How might it have gotten in here? What will become of it in here?

If wind-blown seeds are in evidence: Can you play detective and track down the source?

Can you find anything man brought in? Do you think grown people or school children brought it? Why?
Can you find anything a squirrel might have brought in? Can you find anything a bird might have brought in? Can you find anything the wind might have brought in? Can you find anything the rain might have washed in? Can you find anything that came from nearby trees, shrubs or vines? Did you find any seeds? Can you find anything that is creeping in from the surrounding land? Can you find anything for which an insect might be responsible?

Could all the seeds found here grow? Should the things that did not originate here be removed? What will happen if they are allowed to grow?

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ACTIVITY 604 PAGES 3

LEARNING EXPERIENCE. The Study of a Biotic Community

CURRICULUM AREA : Science

Mathematics

GRADE LEVEL : 5th

6th

CONCEPTUAL THEME : A community is a collection of living organisms having mutual relationships among themselves and to their environment.

OBJECTIVES

Students should be able:

1. To determine the kinds and population densities of plant and animal organisms present in the fields studied.

2. To determine the interaction of the organisms with their environment and with each other.

3. To determine the soil characteristics of the site.

4. To compare the field sites studied.

CONCEPTS

1. All living things have four basic needs which must be present for them to exist: food, water, cover (shelter), and space.

2. A living community consists of the sum of all interactions among the species populations in the community.

3. A living community is dependent upon the physical factors so that community.

MATERIALS NEEDED

Field guides
Soil testing kit
Soil bore or trowels
10 meter string
Stakes
Thermometer
Stereomicroscope or hand lens
Pencil
Notebook
White cardboard
Forceps

PROCEDURE

1. Introduction

   a. Discuss objectives for activity (can be done as pre-trip).
   b. Introduce students to the concepts being developed.

2. Field Assignment

   a. Divide the class into teams of approximately 13 students each.
   b. Allow the students to work in groups of four within the team.
   c. Select a team leader (to do done by team members).
   d. Designate specific responsibilities to each group of students.

      (1) Soil testing - 4 students
      (2) Plant survey - 4 students
      (3) Animal survey - 4 students

e. Each team will randomly select two quadrants of 10 square meters. Use the 10 meter length string to mark off your area. Use stones, sticks, or any other materials as corner markers.
f. One group of each team will conduct the following survey:

(1) Soil testing

(a) Soil pH - to determine whether the soil is sour (acid) or sweet (alkaline)
(b) Soil temperature
(c) Take a soil bore to determine

(1) soil texture
(2) color
(3) oder
(4) profile - depth of various types of soil

(d) Survey soil for soil inhabiting organisms.

(1) To separate animals from the soil, place the soil in the center of a piece of white cardboard. With a forceps break up the soil and spread the soil over the cardboard. Pick out the organisms and identify them.

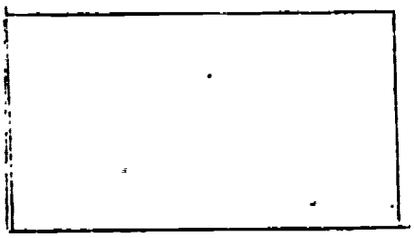
(e) Take three soil tests on each quadrant worked.

(2) Plant Survey

(a) Determine the major kinds of plants present within the quadrant.
(b) Count the plants of each kind and determine their density. This means the number of plants per quadrant. This will be recorded as the number of plants per 10 meter square.
(c) Estimate how much area each kind of plant within the quadrant occupies as a percentage. This is called cover.

(1) Draw a map of the field and locate your quadrant on the map. Draw a map of your quadrant. Illustrate on your quadrant map the amount of cover in each quadrant.

Example:



Approximate total cover
A - Grass - 40%
B - Herb - 30%
C - Bare ground - 30%

(3) Animal survey

(a) Determine the different kinds of animal present in each quadrant.

(b) Count each different kind. Note - include in your list of animals any sign or traces of animals that indiaate their presence.

RESULTS AND DISCUSSION

Prepare your data as suggested and present your findings to the whole class. Consider the following points when making your analysis.

1. What life is common to all quadrants?
2. What were the dominant kind of animals? In the soil? In the field?
3. What were the dominant kind of plants?
4. Based on the physical data of the soil, what influence, if any, does the soil have on the kinds of plants and animals present in each quadrant.
5. Based on the amount of cover in each quadrant, did you notice any soil differences? Did you notice a change in the animal population?
6. Did you have any variation in the occurrence of plant and animal life on each quadrant studied? If their is a difference, why? Support your answers with the data collected from each plot.
7. What interactions, if any, are occurring within this community studied?
8. If you studied these sites during another season of the year, what differences should you expect?

NOTE: All organisms and areas studied should be left in their natural state (condition) when your study is finished.

FOLLOW-UP

Habitat Survey: Allow students to work in pairs to survey the habitats available to birds, mammals, insects and plants in several city blocks. Have the students compare this to survey with a field or forest survey.

Population Study: Have the students survey various areas of a city to determine the population density of the city. Have the students determine the environmental impact on the city, based on the density of that particular area. The students should consider the economic, political, technological and sociological issues.

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ACTIVITY 651 PAGES 2

LEARNING EXPERIENCE: Rainy Day

CURRICULUM AREAS : Science

Language Arts

GRADE LEVEL : Kindergarten

1st

2nd

3rd

4th

5th

6th

CONCEPTUAL THEME : Rain is important for plant and animal life.

OBJECTIVES

After completion of activity, students should be able to:

1. Describe the patterns made by falling raindrops.
2. Describe rain in terms of sound, feel, and effects on color.
3. Name some things you can observe on a rainy day which could not be observed on a clear day.
4. Describe the way differing surfaces react to water.

UNIT CONCEPT

1. Rainy days are cold and wet.
2. Animal and bird activity is reduced during rainy periods.
3. Rain drops vary in size and shape.
4. Rain changes the color, texture and smell of things.
5. Rain collects in puddles and streams.

FIELD ACTIVITY

Where does rain come from? Does the rain come straight down? Slant? Curve? What might cause this? Where does the rain go after it lands?

What color is rain?
How does rain affect other colors? Examine lichens and algae on wet and dry portions of tree trunks. Note the blacktop, the walls and roof of dry portions of tree trunks. What color is a rain drop? On a branch? On a leaf? On a flower? In the air? Bouncing out of a puddle?
What shape is a raindrop? Bouncing out of a puddle? Falling through the air? Hanging on a branch? On a leaf? On grass?
Look through a raindrop hanging on a branch. Describe what you see.
Count the seconds between the time a raindrop falls from a branch until another one collects in the same spot and falls. Compare your raindrop count with that of a friend counting raindrops on another branch. Whose raindrops drop faster? Why?

Do raindrops always collect at the same place on a branch? Why do they collect where they do? Are all the raindrops on your branch the same size when they fall? Measure the length and width of your raindrop. Is it easy to get an exact measurement? Why or why not? What precautions must you take? Find the biggest raindrop you can and measure it. Find the smallest. Is there a relationship between raindrop size and how often they fall from a branch?

Look at the surfaces of different kinds of leaves, such as mayapple, violet, garlic, jewelweed, different grasses, solomon's seal, holly, beech, maple (or whatever variety of leaves are common and in season). Count the raindrops on several leaves. Do the raindrops affect the leaves or plants in any way.

Do they look wet? Do they feel wet? Are some wet all over or just in spots? What spots? Be sure to look at a leaf from several angles. Does there seem to be a characteristic texture to leaves that are wet just in spots? Try to describe what you feel. Have you ever spilled water and watched it bead in spots only? Where did that happen? What reasons can you think of that might cause some leaves to be wet in spots only? Are your explanations really facts or are they inferences? NOTE: Take time for the group to share their opinions on this subject and to evaluate them.

Turn some of the leaves over and observe how the rain "wets" the underside. Does the leaf's underside react the same as the leaf's upper surface? Does the underside look the same as the upper surface? Does it feel the same?

Can you find any leaves with "down" on them? What do you notice? How do these leaves look in the rain? How do they feel?

How do plant and leaf shapes shed or hold water? What happens to the rain that falls on the leaves of different plants?

Find some plants that are in bloom. Are the flowers open or closed? Why might this be?

Can you find some things that look dry but are wet?
Can you find some things that look wet but don't feel wet?
Can you find anything that is dry? Why is it dry?

Feel the dead leaves on the ground. Are they wet? How would you describe the feel of the wet leaves? Try to find some dry dead leaves. Do they feel the same as the wet ones? Do wet dead leaves feel the same as wet living leaves?

Listen to the rain on your raincoat, rain hat (umbrella, poncho, or whatever it is!)
Stand in the woods and listen, stand in the open and listen. Do all rain drops sound alike? Do you hear as many in both places? Describe the differences. What seems to cause the differences in sound? Can you hear rain more easily in the woods or out in the open? Listen to the rain falling on the ground in the woods. On the grass. On the path. Listen to the rain falling on the pond, stream and in a puddle. Try to describe what you hear. When do you hear rain? Is what you hear rain or wind?

Can you smell rain? How do these things smell when they are wet: The path, the grass, different bushes and flowers, tree bark, dead leaves, the earth, your raincoat?

What does rain taste like. Does rain that falls on your tongue taste the same as a raindrop you catch from a branch?

What do animals do in the rain? Look for spider webs. Are they wet? All over? Is the spider in them? Does the spider look wet? Look for insects. Do they look wet? Where are they? What do they seem to be doing?

Do you hear any birds? Are they noisy? Quiet? Do you see any birds? Where are they? What do they seem to be doing? What kind of shelter do you suppose they find. Watch for rabbits, squirrels, groundhogs. Do you see

many? What are they doing? Do they look wet?

If you are near a pond or a large puddle

Are there reflections in the pond today? What color is the pond during rain? Is all the surface the same color? The same texture? What geometric shape does rain make when it falls on the pond?
What happens to this "shape"?
Throw a pebble into the pond. Does the water look the same when the pebble hits it as when the raindrops hit it? Describe the similarities and the differences.
Do you think all the raindrops falling on the pond are the same size? Why do you say this?
If you have been to the pond before, at this time of year when it wasn't raining, do you notice any differences in the animal activity you see today?

Is the drop that you see bounce up the same drop that fell into the puddle? What makes you think so? What happens when a raindrop hits the puddle? Describe what you see.

Find some more puddles. Do you find more puddles on the driveway, on the grass, or on the path?

What is the surface of the earth like where you find the puddles? What covers it? Is it flat? Sloping? What is the area around it like? Compare the height of the area around it with the area where the puddle is. How does it feel when you walk on it?

Guess why puddles form where they do and not in other areas.
Think of any places near your house or near school where there are many puddles during a rain. How are those places like these places that have puddles?

Where does the rain go that doesn't go into puddles? Where will the rain go if this puddle gets bigger? Where will the water in this puddle go when it stops raining? What good are puddles? Are puddles ever not good? Where? When? Why? Do raindrops falling in a puddle look like raindrops falling on a pond? Do you think a pond is really a big puddle? Why?

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ACTIVITY NUMBER 701 PAGES 2

LEARNING EXPERIENCE: Compass Use

CURRICULUM AREAS : Mathematics

Geography

GRADE LEVEL : 5th

6th

CONCEPTUAL THEME : Measuring instruments strengthen feelings of distance and direction.

OBJECTIVES

At the completion of this activity, the student should:

1. Be able to find directions with a compass.
2. Be able to tell the difference between true north and magnetic north.
3. Be able to name the main parts of a compass.
4. Know what the angle of declination is.

UNIT CONCEPTS

1. You use the compass to find your way.
2. The needle of a compass is a magnet.
3. One end of the needle aways points northward.
4. The earth acts like a magnet.

PROCEDURE

Materials needed: compasses, globe, maps of area.

Class discussion and activities prior to field trip.

1. Students should compare and contrast the conventional compass which use 360 equal parts or degrees with the old fashioned 32 points of the mariners compass.

2. Students should learn the three main parts of the compass (the needle, the compass housing, and the base plate) and their functions.

3. Have students discuss the difference between true north and magnetic north.

4. Discuss why the angle of declination is not built into compasses. Find out what the angle of declination is for your area.

5. Have students find different direction with the compass.

FIELD ACTIVITY

1. Keep tracks of the direction you are moving as you travel to the site.

2. Box or square your compass:

   a. Find a relatively flat, clear area.
   b. Face north with the aid of the compass.
   c. Walk a specified number of steps in that direction.
   d. Turn 90° to the East and walk the same number of steps in that direction.
   e. Repeat (d) twice (South at 180°, and West at 270°).
   f. You should be back at your starting point.

3. Try to go from one point to another (determined on a map) with use of map and compass.

4. Set up a course to a specific site or to return to the same point. Use directions and land marks such as trees and stumps.

FOLLOW-UP ACTIVITIES

1. Discuss the value of the compass.

2. Discuss why some people did not reach the designated spot on map and compass or course work.

3. Make a map of your classroom, schoolyard or neighborhood.

4. Discuss ways, other than using a compass, to find direction.

5. Have the students make a sample compass.

   a. Hang a bar magnet from a piece of thread. Hang the magnet from its center. Make sure it is evenly balanced. Wait until it is perfectly still. Then check the direction it points with a compass.

   b. Now magnetize a darning needle by rubbing it with a bar magnet. Balance the needle carefully on a large piece of cork. Fill a large container with water. Now put the needle and the cork in the water. Wait until the water and the cork are perfectly still. Now check the direction the needle points with a compass. Keep the compass well away from the needle.

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ACTIVITY 702 PAGES 3

LEARNING EXPERIENCE: Mapping

CURRICULUM AREAS : Mathematics
Science

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Maps are important for travel, property division and early development of the United States.

OBJECTIVES:

After completion of this activity students should be able to:

1. Use a compass to find direction.
2. Estimate and pace distance.
3. Recognize basic map symbols.
4. Convert distances to a scale on paper.
5 Construct a map, using compass, pacing and scale.

CONCEPTS:

1. Direction is the geographic relationship of two objects.
2. A compass is used to determine direction.
3. Symbols are used to represent objects on a map.
4. A scale tells the actual physical distance between places on a map.
5. A map is a picture of an area, using symbols to represent places and things.
6. Accurate map construction is dependent upon both scale and direction.

MATERIALS NEEDED:

Silva type Compasses - one (1) per student
100' rope
Graph paper
Pencils
Clipboards
Protractors

FIELD ACTIVITY:

Directions are usually indicated as North, East, South, and West; and their sub-divisions NE, SE, SW, NW. Normally a circle is divided into 360 parts or degrees. For greater accuracy, degrees are often used instead of N, S, E, W. For instance: 0 degrees is North, 90° is East, 180° is South, and 270° is West. North may also be designated by 360 degrees.

Orient your compass by turning it until the North end of the needle points to the letter N on your compass. Allow the students time to do this. Have them all face North.

Now lets suppose that an airplane crashed in a nearby woods and your group was asked to rush there to help out. In the woods there are no street signs, no road markers to show the way. You are told that the wreckage is 40 degrees, 1000 feet from a given spot.

(Explain slowly and carefully the steps to use to find the wreckage).

Notice several parts of the compass. The direction of travel arrow on the plastic base. This is the arrow that shows which way to walk after the compass is set.

Demonstrate the housing and how it turns. The numbers on the outside of the housing are degrees. Whichever degree number is at the direction of travel arrow is the degree setting of the compass. Inside of the housing is an arrow shaped needle which swings on a pin. It is the magnetic needle. It always points North, and therefore is not the way to go. The direction of travel arrow points the way to go.

Now lets determine which way is 40 degrees - the way we want to go. First turn the housing until the figure "40" is at the direction of travel arrow. Now the compass is set, do not turn the housing any more.

Second, hold the compass level, about waist high, with the direction of travel arrow pointing straight ahead of you. Hold the compass with both hands, keeping your elbows tight against your sides. Rotate your body and watch your compass. Keep turning until the red end of the magnetic needle points to the letter N on top of the housing. As you turn make sure to keep the direction of travel arrow pointed straight ahead of you at all times. When you have turned far enough so that the red end of the needle points to N, you are facing the correct direction to walk.

Look up and sight on objects, such as a tree or a bush in that direction. Then forget the compass and walk to that object. When you arrive there, repeat the process and pick out a new object. Repeat until you reach your destination.

Give the students several degree readings, till they can quickly and accurately find the direction to travel.

The most accurate way to measure would be to use a tape measure. But since this is rather time consuming, we will step off distances. Stepping can be very accurate with little practice. Usually it is well to learn the feel of a specific length such as 2 1/2 feet, which is an average step for most people, two steps equaling 5 feet. That makes measurement easy because all you need do is count by fives to determine your distance. We have rope - 100' ft. long. Practice walking along it till you get the feel of a 2 1/2 foot step. Start with your right foot. Each time your left foot hits the ground count by fives. If you reach 100 by the time you reach the end of the rope, your step is about 2 1/2 feet. If you fell short of the end of the rope, take larger steps. If you passed the end of the rope, take shorter steps. Practive till you come out right several times.

Now lets see if we can combine direction and distance. Give the students the following distances and directions. 0° for 50', 90° for 50', 180° for 50' and 270° for 50'. You should be back where you started from. Try other directions and distances.

To make a equalateral triangle and return to start:
40° for 35', 160° for 35', 280° for 35'.

To make a six sided figure and return to start:

72° for 25', 132° for 50', 192° for 75', 252° for 25', 312° for 50', 12° for 75'

To make 5 sided figure and return to start:

245° for 50', 317° for 50', 29° for 50', 101° for 50', 173° for 50'.

Suppose you wanted to find the direction to an object? How could you do it? Face the point toward which you want to take the direction reading. Hold the compass level, with direction of travel arrow pointing straight ahead of you toward the distant point. Turn the compass housing until the red end of the arrow points to N on the housing. Read the number of degrees on the outside rim of the compass housing.

Students should now be ready to construct a map.\ Briefly discuss map symbols and scale. What kind of symbols could we use on our map? Should everyone use the same symbols?

What is a scale? (scale tells actual physical distance between places on a map). Should everyone use the same scale? Distribute graph paper and decide on the scale to be used. For example: 2 steps or 5 feet equal 1 square of graph paper.

Divide students into groups of 3 or 4, assign each group an area to be mapping.

Outline the steps they should follow in constructing the map.

1. Draw an outline of the plot on the graph paper indicating direction and distance.
2. Select a starting point (such as a corner) from which distances and directions will be taken.
3. Start at any object in the field and measure the distance to the two nearest sides of the area.
4. Place the object on the map at the appropriate spot. Be sure to convert to scale.

After they have completed the maps, ask the students what problems they had. Is there any other way a map would be constructed? To construct a more accurate map, have students record directions and distances to objects from a given starting point. Use protractor and rulers to map the directions and distances on paper.

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ACTIVITY 703 PAGES 3

LEARNING EXPERIENCE: Estimating Distances

CURRICULUM AREA : Mathematics

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Estimation of distances can be applied to everyday living.

OBJECTIVES:

After completion of activity students should be able to:

1. Estimate distances by pacing.
2. Estimate an inaccessible distance (i.e. width of a stream) by one of several methods.

CONCEPTS:

1. Distances can be estimated by pacing.
2. Inacessible distances can be estimated by using similiar triangles.

MATERIALS NEEDED:

Stakes
Hammer
Measuring device
100 Foot Rope

FIELD ACTIVITY:

Have the students determine their pace, either by having the students find the length of their average step or having them learn to take 2½ foot steps. Obtain a rope 100 feet long or measure off a 100 foot distance. Have the students walk the distance several times counting the number of steps it takes to complete the distance. Average the number of steps necessary to walk the 100 feet and divide by 100 to obtain the size of an average step. This method results in fractions that are difficult to work with, when pacing distances.

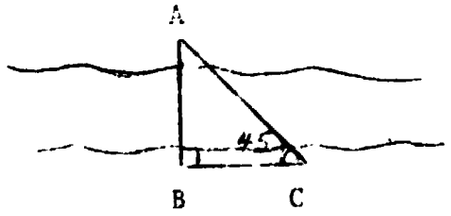
A much more useable system is to have the students learn the feel of a 2½ foot step, thus the distance being paced can easily be counted by five's every two steps.

There are several methods which can be used to estimate inaccessible distances, all make use of similiar triangles (those having two angles which are equal). Some of the methods are more accurate than others.

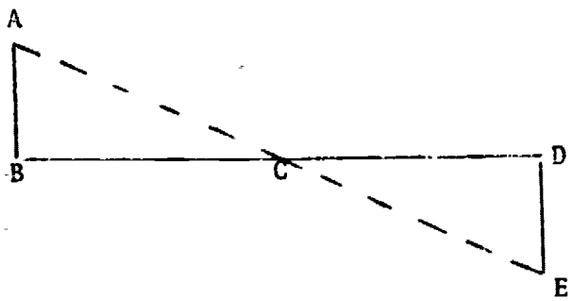
1. The Napolean method is one of the least accurate but easiest methods to use. Assume an unknown distance AB. Wearing a brimmed hat, or holding your hand to simulate a brim, stand at B and look toward A. Tilt your head until point A is just visible under the brim of the hat or your hand. Holding the head perfectly still, turn at a right angle to AB. Line up the hat brim or hand with some landmark, point C. The distance from where you stand, point B, to the sighted landmark, point C approximates the width of the river. Pace it off, BC, to determine the distance

2. One similiar triangle method makes use of a 45° right triangle. Again assume an unknown distance AB. Walk at a right angle to AB toward C which is the point at which A can be sighted at a 45° angle from BC.

Distance BC is equal to AB.

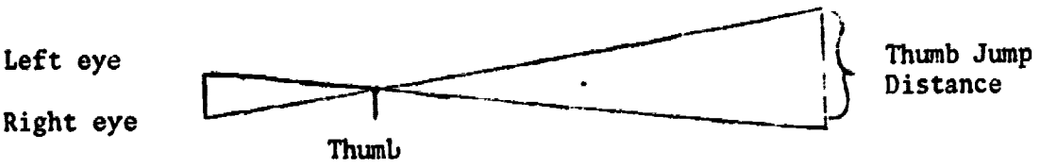


3. Another similiar triangle method establishes two similiar triangles, one half the size of the other. Assume an unknown distance AB. A marked by a tree or other landmark. At B, use a tree or place a stake to mark the spot. Walk at a right angle (90°) to AB. Take 50 steps and at this point (C) place another stake. Continue walking along the same line for another 25 steps, and at this point (D) place another stake. Turn and walk at a right angle (90°) to DB until you sight point C and A in a straight line. This is point E. DE is then half the distance across the river.



BC= ½ CD By measurement since ABC and CDE are similiar.
AB= ½ DE

4. The thumb-jump method gives a quick estimation of a distance. The distance between your eyes in approximately 1/10 the distance to your thumb with your arm outstretched. Select a point (A) at the distance you wish to estimate. Hold your arm in front of you with the thumb pointing upward. Close the right eye and center your thumb on point A, using the left eye. Then close the left eye and open the right eye. Your thumb will appear to "jump" . Estimate the distance (in feet), that your thumb appears to jump. You may have to blink your eyes several times to estimate the distance your thumb "jumps". Multiply the estimate distance of thumb jump by 10 to equal the estimated distance to point A.



Estimate distances using different methods. Which method is easiest to use? Why? Which gives the most accurate estimation? Try guessing the distance before estimating. Was your guess close to the estimation?

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ACTIVITY 704 PAGES 2

LEARNING EXPERIENCE: Estimating Heights

CURRICULUM AREA : Mathematics

GRADE LEVEL : 4th.
5th
6th

CONCEPTUAL THEME : Estimation of heights can be applied to everyday living.

OBJECTIVES:

After completion of activity students should be able to:

1. Estimate heights by using one of several methods

CONCEPTS:

1. Heights can be estimated by using various methods that make use of similiar triangles.
2. Similiar triangles have two (2) sides and one (1) angle equal or two angles equal.

MATERIALS NEEDED

Yardstick
Measuring Tape

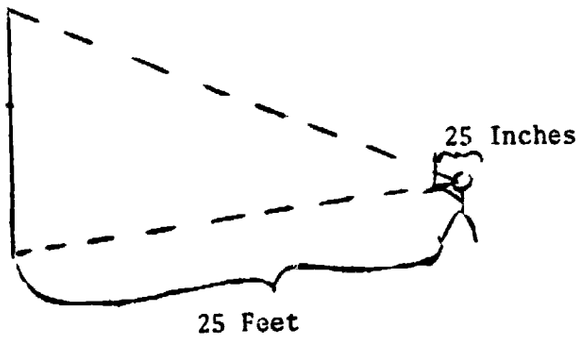
FIELD ACTIVITY

The stick method for determining heights provides a rough estimation of the height of an object (i.e. tree, flag pole, building). Have a student of known height, preferably an even number of feet or half feet, stand next to the object whose height is to be estimated. Have the rest of the class stand back from the object, approximately 100 feet. Using a stick or pencil held vertically at arms length, mark off on the stick what appears to be the height of the student. See how many times the measured height appears to be in the height of the object.

The shadow method makes use of a proportion from similiar triangles. Measure the shadow of a student or object of known height using a tape measure, stick or string. Then see how many times the shadow length can be measured on the shadow of the object whose height you want to obtain. Calculate the height of the object.

$$\text{Height of Object} = \frac{\text{Height of Student} \times \text{Shadow of Object}}{\text{Shadow of Student}}$$

The Merritt Hypsometer makes use of similiar triangles using your eye, a yard stick, and the object whose height you want to find. Measure the distance from your eye to your outstretched arm in front of you. For each inch, pace off one foot from the object. Hold the yard stick vertically at arms length. Holding your head steady, line up the bottom of the yardstick with the bottom of the object, then look to the top. Where the top of the object crosses the yard stick, read the number of inches, which equals the height of the object in feet.



Estimate heights of trees, buildings, flagpoles, etc. Which method is easiest to use? Why? Which gives the mose accurate estimation. Try guessing the height before estimating. Was your guess close to the estimation?

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ACTIVITY 705 PAGES 1

LEARNING EXPERIENCE: Estimating Diameters

CURRICULUM AREA : Mathematics

GRADE LEVEL : 4th
5th
6th

CONCEPTUAL THEME : Estimation of diameters can apply to everyday living.

OBJECTIVES

After completion of activity students should be able to estimate diameters of trees, or other objects.

CONCEPTS

1. Diameters can be estimated by direct measurement of the circumference, using a diameter tape.
2. Diameters can be estimated by using a biltmore stick.

MATERIALS NEEDED

Tape like material or masking tape back to back.
Pipe, dowel, or roll with one inch diameter.
Yard stick or similiar piece of thin wood.

FIELD ACTIVITY

Mark the tape off in 3 1/7 inch sections, as many as you wish. Why 3 1/7 inch sections? It is found that if you wind the tape around an object 1 inch in diameter, the tape is 3 1/7 inches long. So every 1 inch diameter of a circle is equal to 3 1/7 inches in circumference. This constant 3 1/7 is known as π (pi) and is used in the formula Circumference = π (pi) X Diameter. Wrap the tape around a tree or other round object. Where the tape meets read the diameter in inches.

Construct a biltmore stick by marking off spaces on a yardstick using the measurements given below.

6 - 5.4 inches	16 - 12.5 inches
8 - 7 inches	18 - 13.7 inches
10 - 8.4. inches	20 - 14.9 inches
12 - 9.8 inches	22 - 16.0 inches
14 -11.2 inches	24 - 17.1 inches

Hold the stick horizontally against the tree about 25 inches from your eye. The zero end of the stick should be in line with the left edge of the tree trunk. Holding your head still, sight over the stick to the other edge of the trunk. The diameter is read directly from the stick at the point where your line of vision meets the right-hand edge of the tree trunk.

Does the biltmore stick or diameter tape give a more accurate reading? Which is easiest to use? Which is quickest to use? Try guessing the diameter before estimating. How close was your guess.

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ACTIVITY NUMBER 202 PAGE 2

LEARNING EXPERIENCE. Animals migrate to meet their living needs.

CURRICULUM AREA : Social Studies
Science
Math

GRADE LEVEL : 5th
6th
7th

CONCEPTUAL THEME : City growth has caused animals of certain species to migrate from a natural environmental area to a cultural environment area.

OBJECTIVES

Student should be able to:

1. List various animals that have migrated to the city from natural areas.
2. Determine reasons why animals have migrated to the city from natural areas.
3. Compare the habitat of a urban dwelling animal with that habitat of a natural dwelling animal.

UNIT CONCEPTS

1. The city supports a variety of animal life, both domestic and natural.
2. Man has played a predominant role in giving cause to animal migration to the city.
3. Man unconsciously, supplies the basic of life for the new breed of of city animals.

MATERIALS NEEDED

Binoculars
Notebook

FIELD ACTIVITY

How many animals do you know that live in the city? Do they have cousins in the forest? How many types of animals can you kind in your city block? What animals are most common on your block?

What basic needs do city animals abve? What basic needs do their forest cousins have?

Discuss animal capability to get food, air, water, and shelter.

In the city, is it easier for an animal to find food than in the forest? What kind of food would city animals eat?

Is it easier for a city animal to find shelter? What type of shelter do city animals live in? Has man helped them find homes?

What do city animals do when they need a drink? (rats go to the sewers, birds fly to outlying regions or city parks, some animals use pools and puddles).

What types of protection do city animals have? (lack of natural predators, buildings to hide in, sewers to run in, parks where hunting is not permitted).

What man-make problems have aided animal increase in the city? (dumps, garbage, deteriorated houses, etc.). What man-made methods of exerminations do animals have to fear? (rat-control, poisons, traps, etc. - most of these not likely to be found in the forest).

Do you think city animals are healthier than forest animals? Which do you think weighs more - a city rat or a forest rat? Do you think a crow living in the city flies more than a crow in the forest?

FOLLOW-UP ACTIVITIES

A. List various animals that frequent the area around your school, home or play area. Write down the physical features of the animal. Does it have a family? Does it frequent a certain area for a special

r ason (such as food). Note its habits and how it makes its way around the neighborhood.

Present it as a project to your classmates.

B. Compare the way that the city animals get his food, air, water, and shelter as compared to a pet at home or a fish in a tank at school.

Does your love for a pet affect its personality in any way? Take your dog and in a deep harsh tone say "You are a pretty kind dog, I love you". Does he show fear? Then in a mild manner - tell him that he is a "bad dog". Does he react to your voice or your words? Do city animals react to habits of people? If a garbage can is left open and a rat goes in ot eat the food - is that a reaction to a human habit?

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ACTIVITY 1-5 PAGES 4

LEARNING EXPERIENCE: The stream: an aquatic habitat.

CURRICULUM AREA : Science

GRADE LEVEL : 7th
8th
9th

CONCEPTUAL THEME : The stream is a diverse habitat with unique physical and biotic features.

OBJECTIVES

Upon completion of this activity students will:

1. Be able to write a paragraph describing at least 5 physical features of a stream and indicate the use of at least two senses other than sight in their description.

2. Describe orally at least two methods of measuring physical and chemical characteristics of the stream habitat.

3. Be able to identify several niches within the stream habitat by orally discribing their physical and biotic characteristics.

4. Be able to name several forms of aquatic animal life, describe their dependence on their aquatic havitat in terms of their specific adaptations and needs. (food, protection, oxygen)

5. Be able to identify several forms of aquatic plant life and describe their interaction in the stream habitat.

6. Be able to identify the importance of the stream in the hydrolytic cycle by telling about the origin of the stream and its contribution to a larger bodies of water.

7. Demonstrate recognition of the importance of local pollution by tracing the progress of a pollutant through the hydrolytic cycle.

UNIT CONCEPTS

1. The stream as a habitat is composed of many microhabitats which have basic similarities and differences.

2. The physical fearures of a stream set up conditions which make possible or determine habitation of organisms in various areas.

3. The stream affects the physical and biotic features of the land through which it flows.

4. The stream supports a variety of plant and animal life forms which are specially adapted for aquatic living.

5. The stream is involved in a constant process of change, both in physical and biotic features.

6. The stream is also affected by the activities that occur on land surface in the vicinity.

7. The stream is only part of the total water available on earth; the health of the stream and quality of the water within the stream contributes to the quality of all water available on earth.

MATERIALS NEEDED

Data sheets	Dissolved oxygen kit	Bottom scoop
Thermometers	Hardness kit	Nets
Psychometer	Ruler or long stick (for measuring depth)	Trays
pH kit		Plastic containers

FIELD ACTIVITY

I. Physical Features of the Stream
(as the stream is approached - before sighting!)
If you were asked to go and find a stream or creek where would you look? Why? (land topography differences in flora or fauna)
(as stream is sighted)
Look upstream and then downstream. What differences do you see in the stream (as each is mentioned, How do you suppose that feature developed?) Has the stream always flowed in the path in which one sees it now? (no) How can you tell that the water has changed its course? (flat deposits of silt, embankments that were cut away) Do you think that this stream often overflows? How can you tell?
Look more closely at the flow of the water. Does it seem to be flowing at the same rate of speed throughout the stream? (no - faster or slower at some places) Why? (Deeper pools, riffles, obstacles)
Have the student determine flow of the water.
Try to predict the path the water follows. Have one or two of the students go upstream an overturn some of the bottom rocks to muddy the water. Watch the flow of the muddy water. Does the flow of the muddy water follow your predicted path? If not, why not?
Use a ruler or several dry sticks to determine the depth of the water. Insert the stick into the water at several points along one bank and at about the same places along the other shore line. Is the stream depth the same throughout? How can we account for differences in the depth of the water? How does this affect the rate of flow of the water? What will happen to the stream bottom on those areas thwer the water flows rapidly? Why? What will happpen to the stream botton where the water is deeper and slower moving? Why? How might we determine the average speed of the water? Would this be important to know about if we were studing animal and plant life in the stream? Why?
Listen to the stream. What do your ears tell you about the stream? (sound of riffles) Why is it important that streams have riffles in them? (supply oxygen to animal life, provides a special microhabitat for organisms which are adapted to rapidly moving water) Feel some of the rocks that are half submerged in the water. Describe how they are different. Why are they different?
Lets examine some other physical features of the stream. What else besides stream banks and rate of water flow do we need to know about? (provoke students to respond: type of bottom, composition of the bottom, temperature of water, oxygen in the water, dissolved solids, and acidity or alkalinity of the water)
NOTE: As each of these responses are made: ask "How might we learn more about type of bottom?" As students suggest ways of investigation have them perform the investigation (ie: scoop up a bottom sample from various areas and examine it for rocks, pebbles, silt) One or two students may be assigned the responsibility for carrying out the discovery. Have students measure stream bottom, slow moving water, side pools of eddies, rapid moving water temperatures. Before providing the thermometers ask "Is the water warmer or cooler than the air? How can we tell?" (have students put their hand in the water, then compare sensation relative to body temperature)
For dissolved solids: Have students collect several small clear glass jars of water. Is the water clear or cloudy? What does this tell you

about the substances in the water? (if cloudy - silt - erosion)
NOTE: In clear: Have the students allow the jars to stand until near the end of the activity, then examine for sediment. This should also be done with the clouded water to demonstrate settling effects that result in meandering streams. With more advanced groups, use Limnology Kit to determine water hardness (i.e: Dissolved calcium and magnesium salts)
Where do these substances in the water come from? Should their presence be considered good or bad? Why?
For dissolved oxygen: Instructor should demonstrate chemical method of testing for dissolved oxygen. Is it important that oxygen is dissolved in the water? Why? (aquatic animals, reduction of possibilities of anaerobic decomposition)
Acidity or Alkalinity: What does it mean when we say that water is acid? alkaline? (hydrogen ion - hydrocyl ion concentration) How can we test the water to determine its pH? Instructor to demonstrate and carry out pH test on water. What does the pH of the water tell you about the stream and where the water is coming from: Is the pH of the water important of the animals and plants that live in the stream? What do you suppose would happen if the pH suddenly changed - say became more acid because of wastes from a nearby industry?

II. Biotic Features of the Stream
What kind of animals would you expect to find in the stream? As each is suggested: Where in the stream would you look for this animal? Why?
Divide the group into several smaller groups (4). Assign a different area to each group and have them discover as many different kinds of living things as they can. Describe places where animals might be found if not brought out by the students. Tell the students to capture as much as they can without harming the animal or plant using a plastic container and net and then place all specimens found in that area in a single tray. Have them remember or take notes on where the animal or plant was found.
How many different kinds of plants did you find? Where were they growing? Why were they growing there? (develope concept of aquatic and semi-aquatic plants and their environmental needs) Do you know the names of any of the plants? (use field manuals for identification information - should be placed on data sheet)
How many different kinds of animals did you find? Where did you find them? Why do you suppose they like to live where you found them? (question students as to basic requirements for life and how their chosen environment niche' meets their needs) Do you know the names of any of the animals you discovered? (use identification manuals) Identification of aquatic larval or nymph stages may provide an opportunity to discuss metamorphic changes in insects. Discuss adaptation of aquatic animals identified to an aquatic habitat. Example - legs for grasping, gills instead of lungs: How do they get their oxygen, food, protection?
Of what importance are the animals to the balance of life within the stream? (develope concept of food chain)
Of what importance are the plants growing along the shore? Under the water? (primary producers, cover for small organisms, oxygen added to water through photosynthetic process)

Do you think this stream will remain the same? What changes could you predict about the physical characteristics of the stream? How would these changes effect the plants growing on the stream edge? Those under the water? Would the kinds of animals also be changed? What would you expect to find under the new conditions?
If we went away for 50 years and then came back to the same spot, would the stream still be here? Would it look basically the same as it does now? How would it be different? How would the land on either side of the stream be different?
Suppose that we were to empty a bottle of chlorox bleach onto the ground near the stream. How would this effect the stream? Would its effect stop with the stream or would it effect other things besides the stream? Where could the chlorox eventually go? Do you suppose it would do any harm?

FOLLOW-UP ACTIVITIES

1. Have students visit and investigate other streams. Are the findings the same in other streams? the same as in the first investigated? How are they similar? How are they different? Which supports the greatest abundance of life? Why?

2. Have students study the life histories of some of the aquatic insects discoverdd. What effect does man's pollution of water have on the completion of their life cycle? Is man's intervention in nature justifiable in controlling insect pests which have aquatic stages in their life cycle?

3. Have students develope a food chain using the organisms found in their study. Extend the concept to energy transfer and energy loss as they identify 1st, 2nd, 3rd order consumers.

4. Have students make a study of a nearby stream and from their study divise methods for stream improvement.

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ACTIVITY NUMBER 2 - s PAGES 4

LEARNING EXPERIENCE: The stream as an ecosystem.

CURRICULUM AREA : Science

GRADE LEVEL : 7th

8th

9th

10th

CONCEPTUAL THEME : The stream represents an ecosystem; a biotic community along with its habitat.

OBJECTIVES

Students will be able to:

1. Demonstrate recognition of physical stream features by describing and comparing variations in depth, speed of water flow, bottom composition, embankment grade, meandering temperature, and oxygen levels.

2. Identify several microhabitats within the stream by identification of organisms and describing how their specific physical requirements are met by the selected environment.

3. Recognize the existance of a food web and energy flow in the stream by identifying organisms and their interdependencies within the stream.

4. Recognize a biotic community by identifying plant animal communities within the ecosystem.

CONCEPTS

1. Physical features of a stream vary according to topographical features.

2. A specific site along the stream may be considered an ecosystem complete with specifically adapted life forms and their physical habitats.

3. Physical features of the stream can be described in terms of depth, current, bottom composition, embankment grade, meandering, water and air temperatures and oxygen levels.

4. The stream ecosystem can be identified by the organisms and microhabitats which make up the unit.

5. Within the stream we can identify a complete biotic community made up of plant communities and animal communities that are characteristic of the stream.

6. Within the biotic community of the stream food chains and a food web exist in which there is a constant flow of energy and exchange of matter.

MATERIALS

thermometer
nets
trays
oxygen kit
pencil & paper
data sheets
plastic containers
ruler
wood block
pond & stream identification manuals
binocularscopes

PROCEDURE

Divide the group into groups of two or three students. Supply each group with a ruler, wood block, pencil, data sheet, and thermometer.

Think of this stream as a small world in itself. What are the most obvious components of this world? (Soil, water, air above the water, stream bottom, animals in and on water, plants in and on the water) Where does this world get its energy from? (Sun) What might we call this special combination of physical structures and the living things found there? (Ecosystem)

To continue the study of the stream as an ecosystem, please look at the data sheet provided. You will notice that the stream study consists of two parts; a study of the physical features and a study of the living or biotic features. Under the column headed "physical characteristics" you will notice some things to discover about the stream.

Depth: How can we determine the depth of the stream? Will it be the same depth at different places? How will you record the depth? (as an average)

Speed: How can we determine the speed of the flowing water? Will it be the same at different places? How should you record the speed (average feet/sec.)

Bottom Characteristics: How should you describe the bottom? (rocky-smooth pebbles mud)

Embankment Grade: Are the sides of the stream steep or level with the water? Do they slope away from or toward the stream? (Draw a picture)

Meandering: What does this mean? What does a meander look like? (Draw a picture)

Temperature: What temperatures should you record? (water, air, bottom, soil bank)

Oxygen: Follow directions with the kit.

Each group identified earlier select a site about 5 feet long along the side of the stream. Try to select a site that in some way is different from the sites selected by the other groups. One group may work where there are riffles, another where there is a slow pool, another where there is a fallen log or overhanging tree roots. Divide the work among yourselves and complete the information on the data sheet under the column headed "physical characteristics."

Allow the students time to complete their investigation of the selected site. In order to conserve time, carry out the oxygen test at only two different sites for comparison.

After data has been collected, recall the groups and compare their findings. Was the stream the same depth at all the different sites? How can we explain why the varies in depth; why it is deeper one place rather than another? Does the

depth of the stream have anything to do with the kinds of life we might expect to find there? Carry out a similiar type of questioning and comparison which each of the physical factors investigated.

(Some key questions)

Speed: Does the speed of the water have any effect on the type of bottom? What kind of bottom was found in slower moving water? Compare it to the bottom in faster moving water.

Bottom: How many different kinds of bottoms are in this section of the stream? Do you think the type of bottom has any effect on the kinds of animals or plants that can live there? What effects?

Embankment Grade: What process is responsible for the grade of the embankment?

Meandering: Why do stream meander? What effect does this have on the speed of the water flow? What effect does this have on the bottom? On the embankment? On the life within the stream?

Temperature: Where was the temperature the highest? Lowest? Why was there a difference? Will the temperature have an effect on the plants and animals?

Oxygen: Was the oxygen level the same or different at the sites tested? Where was the oxygen content the highest? Lowest? Why? How does oxygen get into the water? Why is it an important characteristic to measure?

Now examine the data chart again, this time for biotic characteristics. This time the same groups should return to the same sites studied previously and record the different kinds of animal and plant life you can identify. As you identify the organisms be sure to record the number found and where they were found. Use the nets, trays, and plastic containers to retain your specimens if you need help to identify them.

Allow the students ample time to complete their investigation. Aid in the identification of organisms. When finished recall the group.

How many different kinds of animals did you find? Plants? Did you find more than one kind of animals living in the same place? Why or why not? Why do you suppose these animals prefer to live where you found them? When you examined the animals did you take notice of any special body structures that enabled them to live in the special place where they were found? (Use specimens collected to demonstrate physical adaptations to the environment.) Was there any place in the stream where you could not find any living things? Why do you suppose none want to live there?

What kinds of plants were you able to find in the water? Where were they growing? Why do you suppose they prefer to live there? Are they adapted in any way to survive in the special habitat?

Of the plants and animals you found, do you suppose that any of them depend on another for their survival? In what ways? (Develop the concept of Food Chain

and ultimately the food web through the examples of plant and animal life forms discovered.)

Where does the energy come from that supports the life in the stream? How does it get to the animals? From one animal to another? Where does it go after it reaches the last animal?

Of the animals you found, which were most abundant? Which were least abundant? Does the abundance seem to have anything to do with the size or type of animal? (If students are receptive interject concept of pyramid of numbers.) Why do you suppose there are fewer of the larger animals and more of the smaller ones? (Smaller animals have more available habitats - larger animals have fewer suitable habitats and depend on the number of smaller animals as source of food)

All of the plants and animals you discovered make up the biotic community of the stream. What were some specific animal groups or communities you found? Some plant communities? What relationships do these communities have to one another? (Animals and plants both depend on their physical environments. Animal communities depend on the success of plant communities to survive. Some animals (predators) depend on the success of other animals to survive.)

From your investigation, how many small habitats did you find in the stream? What were some of them? What animals or plants or both did you find in each of these microhabitats? Are the animals or plants in the microhabitats dependent or independent of other microhabitats? In what ways are they depent upon one another? How does the stream compare to a city as an ecosystem? Can we identify "microhabitats" within a city community? Can we identify different communities within the city? Does one community in the city depend on other communities within the same city? In what ways?

FOLLOW-UP ACTIVITIES

1. Have students evaluate other ecological units or ecosystems such as a deciduous or coniferous forest and compare physical and biotic characteristics of each.

2. Conduct a more intensive study of some of the organisms found to discover their individual environmental requirements and role in the web of life within the stream.

3. Continue the development of comparative community structure between the natural and cultural world of man.

4. Survey several other streams to determine if the biotic communities of one stream are much like the biotic communities of other streams.

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ACTIVITY #3-S PAGES 5

LEARNING EXPERIENCE: Stream Survey

CURRICULUM AREAS : Science - Life Science, Biology, Biochemistry
Earth and Space, Geology, General Science

Social Studies - Geography

Vocational - Agricultural Science

GRADE LEVEL : 7th

8th

9th

10th

11th

12th

CONCPETUAL THEME : Chemical, physical, and biological characteristics of a stream contribute to the ability of a stream to support life.

OBJECTIVES

Upon completion of this activity, students will be able to:

1. Identify physical features of a stream by observing and measuring directly the type of bottom, water temperatures, velocity of flow, volume of flow, cross-sectional profile, and average depth.

2. Identify the chemical features of the stream by direct measurement of dissolved oxygen, free carbon dioxide, acidity or alkalinity, hardness (Mg and Ca) phosphate content, and nitrate content.

3. Identify the biotic features of the stream by identifying plant and animal varieties found in the stream; their habitats, environmental needs, physical adaptations and population distribution.

4. Relate physical features identified to the presence and/or absence of organisms in terms of their environmental requirements and physical adaptations.

5. Relate chemical features identified to the presence and/or absence of organisms in terms of their chemical environmental needs.

6. Attempt to establish food chains and/or food webs from the varieties of organisms discovered in the stream.

7. Evaluate the stream in terms of its ability to support life by comparing results obtained to optimal physical and chemical characteristics of a "good" stream.

CONCEPTS

1. Physical features of a stream can be measured; each is an important characteristic contributing to the kinds and abundance of life forms within the stream.

2. Chemical features of a stream can be measured; each is an important characteristic contributing to the quality of the water and the kinds and abundance of life forms which can exist within the stream.

3. The organisms present and their abundance within the stream depends upon the physical and chemical characteristics of the stream and their ability to adapt to these conditions of the physical environment.

4. Organisms present within a stream are indicative of the quality of water and abundance of other organisms.

5. Deviations from optimal physical and chemical qualities of the stream provide a means of measuring the effect of man on the stream and a means for bringing about stream improvement.

MATERIALS

LaMotte Water Test Kit
Thermometers
String
Wood blocks & 5 meter string
Seives
Binocular scopes
Hand lenses
String for stream profile
Portable chalkboard and chalk
Pencil

MATERIALS Cont'd

Data Sheets
Watch
Meter sticks
Plankton nets
Stream and Pond Identification Handbooks
Life History Charts of some Common Water Animals

PROCEDURE

"Today we are going to measure some of the physical, chemical and biological characteristics of a stream. When we have finished with our measurements we shall attempt to evaluate the quality of the stream".

Determining Physical Characteristics of the Stream

"What features of the stream would be considered physical?" Have the students identify the following:

1. Water temperature
2. Air temperature
3. Type of bottom
4. Velocity of water flow
5. Volume of water flow
6. Average depth of water
7. Cross-sectional profile

as each is identified ask why the measurement is important.

After all of the above have been mentioned, ask the students to suggest ways of making each of the measurements. While discussing methods explain how the measurement should be made. The following procedures should be used:

1. Water Temperature: Since temperatures will vary at different positions within the stream, several temperature readings should be made, and an average computed. The following areas are suggested. (See Data Sheet)

Sun	Shade	
_____	_____	Surface water temperature
_____	_____	Stream bottom
_____	_____	Stream water between surface and bottom
_____	_____	Riffle water temperature
_____	_____	Pool water temperature
_____	_____	Average

2. Air temperature: Should be taken in a variety of locations; both sunny and shaded.

Sun	Shade	
_____	_____	Air immediately above water
_____	_____	Air several feet above water
_____	_____	Air on stream bank
_____	_____	Average

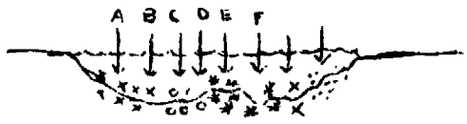
3. Type of Bottom: The type of bottom may vary along the length of stream being noted. Categories of stream bottoms are: bedrock, rubble (large stones), gravel (coarse or fine), sand, mud or silt.

Students should note on the Data Sheet, the types of bottom by drawing the stream and identifying variations in stream bottom along the length of stream being studied. Combinations of two or more types are common and should be indicated. Students should scoop up some of the material of the bottom and determine its texture and composition, then describe the bottom features in writing on the Data Sheet.

4. Cross-Sectional Profile: The stream profile may help to explain certain variations in temperature, velocity, and types of life across the width of the stream.

   Suspend a string across the width of the stream and tie the ends securely at each side. Measure the depth of the water at intervals of 10 to 50 centimeters (or 1/2 foot intervals). Record the bottom type on a profile map. (See Data Sheet).

   Illustrate or demonstrate on chalkboard at teaching station.



O = gravel	A = 6"
X = sand	B = 8"
* = rubble	C = 10"
..= mud or silt	D = 3"
	E = 6"
	F = 3"

5. Velocity of water flow: Stand near the center of stream and drop a wooden float, to which a 5 meter piece of string has been attached, into the water. Begin timing as soon as the wood float has been dropped. Hold on to one end of the string and determine how long it takes for the wood block to travel a distance of 5 meters. Stop timing as soon as the string becomes taught. Repeat the procedure at several places along the stream. Record the time and distance and average the results of 3 or 4 trials. The average should be recorded in meters per second.

6. Average depth of the water: Repeat procedure for profile study using the string at several different places along the length of the stream. Average three profile readings, then average the averages profile depths

7. Volume of flow: Determine the following:

   (w) = average width in meters of the stream section
   (d) = average depth in meters of the stream flow
   (a) = constant 0.8 (rubble or gravel bottom) or 0.9 (sand or silt bottom)

   to compute rate (r) or volume of flow in cubic meters per second use the formula r = wdav
   v = velocity of flow (meters per second)

Determining the Chemical Characteristics of the Stream

Measurements of the following should be taken using the materials and instructions in the LaMotte Water Test Kit:

A. dissolved oxygen (D.O.) - needed animal life forms.
B. free carbon dioxide - forms acid in water causing corrosion. High amounts indicate low D.O.

C. pH - Organisms are very sensitive to the acid or alkaline content of water.
D. Magensium
E. Calcium : Total Hardness: maybe dangerous if present in excessive amounts.
F. Phosphate content
G. Nitrate content : plant nutrients not normally in abundance
H. Silica content - not generally harmful except to industry

As each of these is mentioned ask the students why it is important to know how much of the chemicals are present in the water.

Determining Biological Characteristics of the Stream

Have the students conduct a survey of the plant and animal life within and along the stream. Their investigations should include the following: (try to get the students to realize the following through a questioning process).

Plants

(a) where growing, stream bottom, attached to rocks, floating on side on the bank next to the water
(b) general color
(c) relative abundance
(d) importance to the stream
(e) name
(f) physical conditions of where they are found

Animals

where found - under rocks, in water, hiding in the bank.
color
relative abundance
importance to the stream
name
physical conditions of where it was found
noticeable physical adaptations to its habitat.

After reviewing what the students are to be looking for, divide the students into groups of two or three and assign their work to collect data on the three areas of the investigation. Remind them to fill in as completely as possible, that portion of the data sheet for which they are responsible. If any of the student groups finish with their data before the others, ask them the help another student group to complete their section. Be sure to instruct the students doing the chemical analysis not to dump the chemicals into the water and not to get them on their skin or clothes.

When all students have finished in the collection of their data have them assemble at the teaching station and proceed to exchange the results. Discuss the results obtained by the students and emphasize the questions which follow the recorded data. After all the data has been compiled, discuss the interrelationships between the physical, chemical and biological characteristics of the stream, emphasizing that all of these factors contribute to the ability of the stream to support life.

Select a few of the organisms discovered and discuss their relationship to the total environment of the stream. Ask the students the following:

1. where was the organism found?
2. why was it found there?
3. what does it use for food?
4. how does it get its food?
5. does it have any special body structures or forms which help it to live in that part of the stream? What are the structure and how are they helpful?
6. does it have any natural enemies? Did you find any? Were there as many of the enemies as there were of the prey? Why not?
7. What would happen to this animal of the velocity of the water increased? If the temperature of the water increased? If it became more acid? If the water could not carry as much dissolved oxygen?

FOLLOW-UP ACTIVITIES

1. Carry out water analysis of several different streams. Compare the results.
2. Research the various chemical substances that may be found in water. Determine their acceptable levels and how an excess or lack may affect the life in the stream.
3. Carry out experiments within the classroom on stream organism to determine the effects of selected pollutants on the behavior and ability of the organism to tolerate increased levels or decreased levels of substances.
4. Research the organisms discovered and develop profiles on their survival needs and relationships to other organisms.
5. Some aquatic organisms are indicator organisms. Make up a list of organisms which indicate specific water characteristics.

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ACTIVITY 10-S PAGES 5

LEARNING EXPERIENCE: The Pond: An Ecosystem

CURRICULUM AREA : Science
Life Science
Biology
Biochemistry
General Science
Social Studies

GRADE LEVEL : 7th
8th
9th
10th

CONCEPTUAL THEME : The pond represents an ecosystem; a biotic community along with its habitat.

OBJECTIVES:

Upon completion of this activity, students will be able to:

1. Demonstrate recognition of physical pond features by describing and comparing variations in depth, speed of water flow, bottom composition, enbankment grade, oxygen levels, carbon dioxide levels, and total hardness of the water.

2. Identify several microhabitats within the pond by identification of organisms and describing their specific physical requirements are met by the microhabitat in which they live.

3. Recognize the existence of a food web and energy flow in the pond by identifying organisms and their interdependency within the pond ecosystem.

4. Recognize biotic communities by identifying plant and animal communities within the pond ecosystem.

5. Identify the biotic features of the pond by identifying plant and animal varities found in the pond; their habitat, environmental needs, physical adaptations, and population distributions.

CONCEPTS:

1. Physical features of a pond vary according to the type of depression which retains the water and forms the pond.

2. The pond as a whole maybe considered a ecosystem in which organisms live within many different microhabitats. The life forms found within the microhabitats are specifically adapted to their physical surrounding and environmental needs.

3. Physical features of the pond can be described in terms of depth, current, bottom composition, embankment grade, water and air temperatures.

4. The chemical features of the water within the pond determines much of the life which can exist within the ecosystem. Oxygen levels, hardness of the water, p^H, available nitrates and phosphrates, all contribute to the health of the water within the pond and determines the type of life forms which can exist there.

5. The pond ecosystem can be identified by the organisms and microhabitats which make up the unit.

6. Within the pond we can identify a complete biotic community made up of plant communities and animal communities that are characteristic of the pond.

7. Within the biotic community of the pond, food chains and a food web exist in which there is a constant flow of energy and exchange of matter.

MATERIALS NEEDED:

Thermometers	Oxygen kits	Phosphrate & nitrate test kit
Nets	p^H kit	Carbon dioxide test kit
Trays	Hardness Kit	Pencils and paper
Plastic Containers	Yardsticks	Data Sheets
Wood block & string	Binoculars scopes	Pond & Stream Identification Manual
Small clear jar	Secchi disc	4 foot poles

MATERIALS NEEDED:continued

Bottom Samplers
Plankton Net
Specimen vials

PROCEDURE:

Note to the Instructor: This activity should be conducted in three stages.

A consideration should be given to the physical features of the pond, the chemical qualities of the water, and the types of living things to be found in the pond community. In order to conserve time, the student group should be subdivided so that smaller groups of students can work on each phase of the investigation concurrently. If sufficient time is available, all students should have the opportunity to experience the methods of meausrement involved in all of the sections.

Think of this stream of a small world within itself. What are the most obvious components of this world? (the water in the pond, soil on the bank, plants growing at the waters edge, plants growing around the pond, larger plants growing some distance from the pond, any obstacles seen in the water). Where does this world get this energy from? What might we call this special combination of physical structures and the living things found there? (Ecosystem).

In order to organize out work more effectively, please look at the Data Sheet provided. You will notice that the pond study consists of three parts; A study of the Physical Features; A Study of the Chemical quality of the Water; A Study of the Living or Biotic Features. Under the column heading "Physical Characteristics" you will notice some things to discover about the pond. We will need to know the air temperature, water temperature, and bottom temperature near the shoreline. Where do you suppose we should take our air temperatures? (Students should respond at several places to determine an average) We will also want to take note of the water color. How can be describe the color of water? (Green, brown, clear, or colorless). As we take note of the color we should also notice the transparency. What do we call an object which light passes through that we can see through? (Transparent). How do we describe an object that only allows some light to pass through so that ce can not see clearly through the object? (Translucent). There are many different levels of translucency. On your Data Sheet you will notice that there are columns 1, 2, 3, Since there are varying degree of translucency, if the water is very translucent, check item # 1. If the water barely be seen through, check the column #3. If it falls somewhere between the two, check the #2 column. What do we call an object which allows no light to pass through it? (Opaque). If the water is opaque, What does this tell you what is in the water?(much dissolved solids). We will also want to take note of the amount of suspended solids. If the dissolved solids meter is available, measurements can be taken directly from the meter. If the meter is not available, have the students fill one of the speciment vials with a sample of water. Tell them to hold the vial up to the light and look closely for tiny particles floating around in the water. Have them note on the Data Sheets the amount of solids which they can see suspended in the water.

Depth, is another important characteristic of the pond. The depth of a pond often determines the ability of life to survive within the pond. How do you suppose we should measure the depth of the pond? Students should respond; by dropping an object into the water which has a string attached to it, and measuring the length of string until the object settles to the bottom. In order to determine the depths of the pond, we will need to get out over top of the pond to use this method.

On the Data Sheet you will notice that there are three trials to [illegible]. The average should be computed so that a new average [illegible] of the pond, since the pond depth will vary [illegible]. You will notice the pond bar profile. What is you should [illegible] by recording measurements of distances from the profile [illegible] at each interval for measurement if one foot. [illegible] the [illegible] water stick attached to it, insert the marbidic into the bottom [illegible] from shore, [illegible] two feet from shore, five [illegible] four feet from shore. Record the depth at these one foot intervals. In the variable [illegible] the pond, record also the type of bottom which is encountered. For example [illegible] rocks, or pebbles. What are typical factors [illegible] to measure will [illegible] water speed. [illegible] do you suppose we can [illegible] by studying its flowing? Describe the method using the wood block and the measured section from shoreline. Instruct the students to conduct at least three trials. They should record the meters per second for each of the trials and compute an average. After each section of the Data Sheet, you will find a series of questions. These questions should be answered as you are conducting your investigation. Be sure to answer them as completely and accurately as you can. We will discuss the data and the answers to these questions when you have finished your work.

Now turn to the section on the Data Sheet which deals with chemical characteristics of the water. Why do you suppose it is important to know the chemical quality of the water in the pond? Will this have any affect on the type of animal life? How might it affect the plant life? What are some chemicals that we will be testing for? Have the students look at the list provided on the Data Sheet. Identify the abbreviations that are on the sheet if the students do not know what they stand for. For example: pH, CO_2, O_2, and (ppm). In order to conduct the chemical tests we need merely to follow the instructions given in each of the kits. Be sure that you read the instructions carefully, and carry out each step of the procedure as it is given on the card. If you have any questions about the terms that are used, be sure you ask before you proceed. When you have completed this section of the Data Sheet go on to answer the questions. Hints are given in each of the questions to help you answer the question. Answer them as completely and accurately as you can. When we are finished, we will also discuss your findings about the chemical quality of the water. The last part of our investigation deals with the animal and plant life which exists within the pond. This of course will vary with the season of the year. Before having the students start their biological investigation, explain to them that many forms of animal life living within the pond will remain active even during the wintertime. However, many more kinds of organisms can be found in the Spring and summertime. Why do you suppose we will not find as many kinds of organisms in the wintertime as are present in the summertime?

Now turn to the section on the Data Sheet which provides space for you to record your findings of plants and animals. You will notice that the Data Sheet is sub-divided for different areas within the pond. Be sure that you examine each area of the pond thoroughly before going on to the next. Identify the organisms as best you can using the books and guides provided. Before moving on to the next section be sure that you include total number of each kind of organisms that you found in the area. You will notice that you are to examine the shore just bordering the pond, the pond edge, the pond bottom, and the floating plants.

You will also want to determine the different kinds of animal life present in the pond. Again, each area of the pond is identified on the Data Sheet.

Be sure to examine each area carefully, looking under rocks, logs, the under sides of leaves, as many different places as are available in the area. You must remember that the organisms will be hiding and that you will have to look for them in order to find them. Record again the name of each different kind that you find. When you have finished the section record the total number of each kind that you have found.

In order to examine the microscopic life within the pond, we will of course need a microscope. We have with us binocular scopes which will enable us to see some of the larger microscopic forms of life. Place a drop or two of pond water in the petri dishes and place the petri dish on the stage of the binocular scope. Examine the water for any life form that maybe present. If some appear green, they are properly algae. If they do not appear green but seem to be moving or swimming they are properly animal forms. Try to identify as many different kinds of algae and small animals forms of life as you can. List them on the Data Sheet and record the number of them that you found. In order to examine just one milimeter of water, use an eye dropper and place twenty-two drops of the water in the petri dish . If this amount of water does not seem to be sufficient, double the amount. Put when you record the number on the Data Sheet, be sure that you record only half the total kind of organisms that you observed. When you have completed this section go on to answer the question. You will notice that the first question is about microhabitats. List all the different microhabitats that you encountered as you studied the area. As you identify the microhabitat identify the animal and plant forms of life that were living there.

In order to understand how the organisms interact within the pond, we need to examine the different kinds which we found. You are asked to construct a food chain or a food web using the living things that you found in the pond. In order to do this you will need to know what the organisms eat. This information can be found in the 'guide to some small fresh-water organisms' that will be provided for you to look into. In order to diagram the food web, simply write the name of the organism, and connect with a line to organism upon which it feeds. Do the same for all of the other organisms that you find, until all are in some way related to all the others.

In order to complete the microscopic study, samples of pond water should be taken back to the classroom to be examined under the microscope. Organism such as the paramecium , amoeba, stantor , vorticella , cladifora , and others that should be present, should be recorded and worked into the food web.

FOLLOW-UP ACTIVITIES

1. Visit several ponds and compare the different kinds and numbers of microscopic organisms living within the water.

2. Conduct bacterial tests of the pond water that was brought back to the classroom. If samples were taken from different ponds, they will more than likely contain different amounts and kinds of bacteria. The importance of the bacteria to the ecosystem of the pond.

3. Using an plankton net take several samples of the organisms living with in the water of the pond. Identify within the samples such organisms as Daphina, Cyclops. Have the students culture these tiny crustaceans within the classroom. Examine the effect of light upon their growth. Examine the types of food which they require. Place some predators within the tank, and observe what happens to the population of the organisms.

4. Visit several ponds in different stages of development. Identify the characteristic of the pond which are under going the natural process of aging, such as occurs during pond succession. Identify changes in acidity, oxygen content, carbon dioxide content. Relate this to the decaying process which occurs within the pond.

5. Conduct a study of pond edge succession. Develop the concept of the pond naturally filling in with debri, and the emergent plants progressing toward the center of the pond until the pond no longer exists.

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ACTIVITY 101-S PAGES 4

LEARNING EXPERIENCE: The decidious woodland in Winter: Identification of forest associations.

CURRICULUM AREAS : General Science
Biology
Agriculture

GRADE LEVEL : 10th.
11th.
12th.

CONCEPTUAL THEME : Identification of trees in a forest community indicate that only certain trees can successfully compete in a plant association.

OBJECTIVES:

Upon completion of this activity, students will be able to:

1. Identify trees on the basis of winter characteristics; (ie. twigs, buds, and bark) by using a dichotomous key.

2. Identify specific associations of trees in the forest community by listing the types of trees identified.

3. Identify dominant, predominant, and subdominant trees in the forest community by counting populations and observing interactions among co-existing trees. (Including recognition of competion for sunlight and moisture)

4. Describe the vertical strata of the forest community by identifying association members as part of the "seedling", "sapling", "understory", or "canopy".

CONCEPTS:

1. Characteristics of winter phase twigs, bark and buds can be used to identify trees using a dichotomous key.

2. Plants in a forest community compete with one-another for light and moisture. Those most able to survive the conditions set by the dominant members are most likely to succeed and eventually replace the dominant forms.

3. Dominant trees in a forest community establish the conditions for the growth of other community members.

4. Predominant trees are those which are most numerous in the community.

5. Subdominant trees are those which tolerate the conditions set by the dominant species.

6. Trees occupying certain vertical levels in the forest community help us to understand the process of change occurring in the forest community.

MATERIALS:

Handbooks: Common Trees of Pennsylvania
Summary Dichotomous keys for deciduous trees (Winter)
Data Sheets
Pencils
Cardboard for writing

NOTE:

This activity may be used as a study of a given (identified) part of a forest or as a comparative study involving the distribution of trees in two (2) or more different forest communities.

FIELD ACTIVITY:

As the student group approaches the area to be studied, ask the students to generally survey the plants they can see from a distance.

Key Questions:

1. Can you distinguish among any of the kinds of trees in the forest?

2. What features of the trees did you use to make a distinction among different kinds?

   (Some may have leaves: conifers, others will not: decidious)
   Tall - Small, Color, Texture, type of branching.

3. Do the trees in the area seem to be mostly one or two kinds, or are their many different kinds mixed?

4. Do you think this woodland is young or old? What standards of age did you use in estimating the age?

During the summer, trees may easily be identified by observing the leaves.. Could we identify any of the trees by leaves now? (Yes- examine the ground for leaves that have fallen) Have the students quickly collect as many different kinds of leaves as they can.

Have the students identify as many of the leaves as they can. Could we use this as a clue to identifying the trees now? (Yes) Is this an accurate means of identifying trees in the winter? (No) Why not?

Pick out two different trees nearby one another. Compare the parts of the tree. What differences can you observe? (bark, twig branching, texture, lenticels, bud arrangement, leaf scars)

As students identify differences point out correct vocabulary terms and have students use the terms in describing the differences observed.

Leaf Scar: Mark on twig where last season's leaf fell from the stem. Usually found just below the bud.

Bud Scale: The hard outer covering of buds.

Pith Partitions: The pith is the core of the twig. When sliced lengthwise you sometimes see partitions like the rung of a ladder.

Catkins: These are little stiff tassels (often one (1) or two (2) inches long) that hang on some trees. Frequently found on the birches.

Witches' Brooms: Seen on hackberry, like a bunch or tangle of twigs.

Terminal Bud: Bud at end of twig.

Lateral Bud: Buds on sides of twig or stem.

We can use these characteristics in winter to identify the trees using a dichotomous key.

First: Look for the buds. Note their arrangement, shape, size, and scales. Pay special attention to buds at the end of the twig.

Second: Look for the leaf scars. Note the shape, location on the stem, and the arrangement of the dots in them.

Third: Look for other clues. These may or may not be present: bright colors, thorns, catkins, peculiarities of pith, sap, twig or bark.

Fourth: Read through the dichotomous key and as you read each statement answer as "true or false". If the first "1" does not fit, go on to the next "1". When "1" fits, then take "2" under the "1" that fits. And so on until you reach the answer.

Divide the students into groups of two or three. Have them select an area of defined limitations or use markers (ropes) to mark boundaries. Before students are given their assigned areas, point out that they are to record the name, location, and size of the trees in their area on the data sheet. If students are unfamiliar with the terms "seedling", "sapling" and "canopy", review these terms with the students.

seedling	=	0 - 3 feet tall
sapling	=	3 - 10 feet tall
understory	=	10 - 20 feet tall
canopy	=	tallest, forming roof of forest

Ask the students to select a nearby tree and as a group, attempt to identify the tree using the dichotomous key provided. Help the students move step-by-step, first examining the twigs, then branch characteristics, buds and bud scales and leaf scars. Have the students take notice of the small dots within the leaf scars.

When it is evident that students will be able to use the dichotomous key, send the students to their assigned areas. Remind the students to carefully fill in the necessary information on the data sheet as they progress through their work. Instruct the students to identify as many of the trees as they can recording the number of trees in the area in which they are working.

As the students proceed to identify the trees in their area check each group to be sure the keys are being used correctly. As a tree is identified have them check their identifications against the pictoral guides provided with the "Common Trees of Pennsylvania" handbook.

Allow some time for the students to complete their work. After all student groups have finished their work, assemble the students and review the data that has been collected.

Some Key Questions for discussion:

1. Which of the characteristics of winter trees was most useful in identifying the tree in question?

2. How many different kinds could you identify?
3. Were there any you could not identify? Why?
4. What kinds of trees are the tallest? Are they primarily one kind or several kinds? What part of the vertical layer of the forest is formed by their upper branches? Would these trees be considered predominant, dominant, or subdominant? How do these trees affect the growth of the other trees? Do they compete among themselves for light or moisture?
5. What kinds of trees are found in the understory layer? Are they the same as the canopy trees?
6. What kinds of trees did you find in the sapling layer? Are they the same or different from those forming the canopy and understory?
7. Which kind of tree was the most numerous? Are these the predominant, dominant or subdominant species?
8. How can you account for this kind being most numerous?
9. Which of the trees you identified would be considered subdominant? Why?
10. What kinds of seedlings did you find? Were they the same as those making up the canopy and understory?
11. What will happen to the seedlings? Will they grow to the extent of the larger trees? Will all of them survive? Why or why not?
12. What kinds of trees would you expect to survive in this forest? What growth characteristics will they have to possess?
13. If we came back to this forest in 50 years, and repeated the same study would we find the same kinds of trees in the same numerical distribution? Why or Why not?

FOLLOW UP ACTIVITIES:

1. Research the trees identified to determine specific growth features in forest conditions, (ability to compete with other members of the forest community)

2. Research the seral stages of forests in the "Pennsylvania" (Temperate) forest regions. Identify climax stages and trace the successional stages.

3. Repeat the study in a coniferous forest using dichotomous key for evergreens.

4. Repeat the study during spring or summer conditions using leaf characteristics to identify trees in a forest community.

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ACTIVITY NUMBER 301-s PAGES 3

LEARNING EXPERIENCE: Geological Succession

CURRICULUM AREAS : Geography
Geology - Earth and Space Sciences
Physical Science
Agricultural Science
Art - Landscape Features
Biology - Paleoecology

GRADE LEVEL : 7th
8th
9th
10th
11th
12th

CONCEPTUAL THEME : Topographical characteristics and biological activity interact to progressively alter features of terrain resulting from past geological activity.

OBJECTIVES

After completing this activity students will:

1. Identify several geological forces which have caused the present topographical features observed and describe how each has altered the land surface.

2. Be able to identify some physical and biological agents involved in soil formation from rock.

3. Identify wind, water, and temperature variations as physical factors at work in altering topographic features.

4. State the role of plants and animals in contributing to soil modification and in altering physical topographic features.

5. Describe how the topography of an area may determine the types of plants and animals present.

UNIT CONCEPTS

1. The earth's surface has undergone a slow process of change resulting in present day topographical features.

2. Geological forces such as uplifting and falling of masses of rock, and glaciation in the past determine basic topographic features of an area.

3. The presence of sedimentary, metamorphic, or igneous rock are clues to determining the geological history of an area.

4. Wind, rain, running water, and temperature variations are physical factors which contribute to altering topographic features and soil formation.

5. Plants and animals also play an imprttant role in soil formation and in altering topographic features of an area.

6. Topographic features of the area may determine the types of plants and animals present by establishing physical environmental characteristics to which organisms must adapt in order to survive.

MATERIALS

soil auger
100 ft. piece of cord string marked off at 10 ft. intervals
two stakes
compass
geologist's pick
data sheet
pencil

FIELD ACTIVITY

Select an area where there is considerable difference in elevation within about 100 feet. Instruct two of the students to stretch a 75-100 foot length of string between them while one is standing at the highest point and the other at the lowest point. Have the students separated by at least 50 feet. Both students should push stakes into the ground where they are standing and attach the piece of string to the stake.

How would you describe the surface of the land around you? Are we standing on a mountain side in a valley, or on a mountain top? What have you observed that enabled you to decide?

Have the students walk 50-100 feet away from the string perpendicularly. "Pretend that there are no plants growing directly under the string, and diagram the surface of the land in the box on the data sheet." (Return to the original site) Each of you walk as straight a line as you can under or aside of the string. As you walk identify on your diagram what material you find making up the ground surface. (Example: illustrate for the students by walking some distance and identify sandy soil, boulders, small rocks, stream etc.)

Has this (mountain side) always been as we see it now? What do you suppose it would have looked like before the time that plants and animals appeared on earth? Before the time that water as a liquid appeared on earth? (It may be necessary to review earth history) What earth forces caused the formation of these mountains? Are they young or old mountains? How can you tell? What has caused these mountains to wear away? At the highest point on our line did you notice the outcrop of rock? What is the color of the rock? Is it the same color all over? Is the rock a solid color, speckled, or layered? Do you suppose the rock is the same color below the surface? Have student chip away some of the rock and examine the inside surface. If the rock is colored differently inside: Why is the rock a different color on the outside. Examine the inside of the rock with a hand lense. Is the inside of the rock a solid color? Does the color appear in lumps? Can you see many smaller stones of different colors? How do you suppose this rock was formed? What kind of rock is this? (Sandstone or conglomerate) What could we conclude about the geological history of this area from this rock outcrop?

On your maps you indicated that you found soil. Was the soil the same color everywhere you walked? What was the color of the soil? Does this tell you anything about the minerals in the soil? How does the soil feel where plants are growing? Is it the same in open areas? Why is the soil different in these two areas? (decaying organic matter from plants and animals) Does the soil have an odor? If you look at the soil closely, can you identify any materials in the soil? Pick a spot arbitrarily. How far down does the soil extend? Is it the same in its make-up all the way down? Have the students use the soil auger. Analyze the soil to determine its make up.

Where did the soil come from? Do you see any rocks lying about that have the same color? Do the rocks show any signs of weathering? What causes rocks and stones to weather (wind - rain - temperature variations) Ask how each of these contributes to soil formation.

Collect several small stones from the stream and several from the ground. Do they feel the same? How are they different? Why are the stones from the stream smooth and polished while those from the ground are more rough. Would you consider running water an important agent in soil formation? Why? What happens to the soil that is formed by running water?

Do plants and animals help to break down rock into soil? Can you kind any plants that are breaking the rock down ino osoil now? (Have tham look for plants growing on bare rock surfaces) what kind of plants are these? How are they able to grow on solid rock? How do they help to break the rocks down into soil. Can you find any other evidence of plants or animals contributing to soil formation? (Look for activities of burrowing animals, decaying leaves twigs, plants growing out of cracks or crevices of solid rock.) Discuss with the students how each contributes to building soil.

Are we standing on the north, south, east, or west side of the mountain? Which side of the mountain gets more direct sunlight? Why? Which side would have the higher average temperature? Why? Which side would retain the most moisture? Why? How would the amount of sunlight, temperature, and moisture effect the types of plants that can live here? How would these physical factors and the types of plants that live here determine the kinds of animals that can live here?

FOLLOW-UP

1. Visit other areas such as flood plants, maintain tops or combinations of topographical features. Determine the past geological activities which caused their development. Have student compare the results of various geological activities and identify the topographical results of these activities after many years of weathering.

2. Have student conduct investigations of various biomes such as chaparrals, tundras, tropical biomes, and desert biomes to identify geological activities which have determined the topographical characteristics and set the physical environmental factors affecting the life forms found in the biomes.

3. Visit a very steep mountain side. Determine elevations and other physical factors which contribute to the occurrence of zonation. Have them map out the mountain side to determine the elevations to which the various zones of plants occur.

4. Have student collect soils from various locations. Determine mineral content, organic matter, water holding capacity, and origin of the soils.

5. Have student collect several different kinds of rocks. Identify each as to its origin, the type of soil which results from its breakdown.

6. Ask students to visit a mountain top and draw a landscape of the panoramic view. Discuss each of the drawings as to how the hills, mountains, valleys, or rivers come to be. Drawing should show variations in flora. Discuss the reasons for the variations observed.

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ACTIVITY 402-S PAGES 4

LEARNING EXPERIENCE: Environmental Awareness

CURRICULUM AREAS : Science
Language Arts

GRADE LEVEL : 7th
8th
9th

CONCEPTUAL THEME : Critical observation is basic to understanding organisms, objects and conditions in the natural environment.

OBJECTIVES

Upon completion of this activity, students will be able to:

1. Demonstrate the use of senses in observing by describing verbally an object or condition showing the use of at least three of the senses.

2. Describe the parts or units of an object and demonstrate an understanding of the relationships of the parts to the whole by recognition and analysis of the functions of the parts.

3. Relate color, form, textures, and other qualities of an object to function by selecting a random object and verbally describing and discussing its qualities.

4. Identify general physical and biotic conditions of a selected natural area.

5. Identify, by selecting a random organism, the needs of the organism and relate verbally the dependencies of the organism on the physical and biotic characteristics of the area.

6. Select an object in a given area and relate its relationship to the "whole" area in which it was found.

7. Describe a "niche" by selecting an organism at random and identifying the specific physical and biotic conditions which make its existence possible. also adaptations of the organism to the physical and/or biotic features of the 'niche'.

CONCEPTS

1. We learn about our environment through the use of our senses.

2. Scientific tools and machines are simply extensions of the senses we already possess.

3. Color, form and texture of an object are qualities we can observe directly and use as clues to understanding the natural world.

4. The parts of an object or organisms have specific form and function which relates to the performance of the whole object or organism.

5. The physical and biotic conditions of an area will determine what organisms can survive in the area.

6. Organisms are specially adapted to survive under very specific environmental conditions; any slight environmental change will have some effect on the organism

7. Every organism has some effect on its physical and biotic environment.

8. The immediate surroundings, its physical and biotic features which make possible the survival of an organism because of its adaptations, is called a niche. It is the intimacy between a specific organism and its environment.

MATERIALS

1. Hand lens
2. Binoculars
3. Thermometers
4. Binocularscopes

GUIDE NOTE: Full advantage of seasonal changes and conditions should be taken advantage of for this activity. Make maximum use of such topics as seed dispersion, matter and energy cycles, animal homes and behavior, habitat comparisons, object comparisons and adaptations.

PROCEDURE

Concept: Using The Senses

Instruct the students to look for some interesting object somewhere near them. Ask them not to tell what the object is. Ask one of the students to describe the object as completely as possible. Use leading questions such as: What color is the object? Are there many of the objects nearby? If there are, are they all the same color? same size? Does the object make a sound? Is it alive or non-living? If it is alive, could we recognize it by its sound? What kind of sound would it make. Can you pick the object up? If you could would it be light or heavy? Does the object have form? If there are many of these objects: Do they all have the same form, same size? How would it feel if we were to touch the object? If we were to hold the object in our hands? Would you want to taste the object? How would it taste? Would it be safe to taste the object? Does it have an odor? How would you describe the odor?

Repeat this process with several other students. When finished, ask the students if they noticed how the objects were described. Help them to identify the senses which are most commonly used, and those which should be used more. Ask one of the students to get the object they were describing and ask one of the other students to describe the object. Compare descriptions. What did they forget to mention? Did they use all of their senses in describing the object? Repeat the process until it becomes obvious that the students are using at least four (4) senses in observing an object.

Concept: Extension of the Senses

"Much of what we observe is described by comparing things we can sense. For example we can see when an object is "big" or "small". Pick out something (object) near you that is "big" and pick out another which is "small". Ask the students, one at a time to relate what they chose. When all have answered; Compare the objects they identified with one another. Which is the largest? Which is the smallest? Is there some object near that is larger than the largest? Smaller than the smallest? Are we limited to what we can see, hear, smell, or feel? Are there objects around us which we cannot feel? Are there objects around us which we cannot see, hear, smell, or feel? If there are, how do we know they exist? What tools or machines do we use to observe things near us now that we cannot see, feel, smell, or hear? Find something near where you are standing which you can just barely see. How would you describe it again. Examine it under the binocularscope. Now describe it again.

Feel the soil. Describe its temperature. How warm or how cool is it? Can you guess what its temperature is? How can we find out its exact temperature? Have one of the students measure the soils temperature. Feel the soil in some other area. Is it the same temperature? What temperature is it? If time remains this same technique can be employed with other senses, identifying amplifiers, hearing aids, smelling objects, air pollution test equipment, and tasting.

Concept: Relationship of the parts to the whole.

Find an organism nearby which seems to be made up of several parts. What parts can you identify? How are they different from one another? How are they alike? If a part were removed from the object, how would it affect the object? What does the part do for the object? Do the parts work separately or do they work together? If they work together, how do they work together? Can you see any parts that are "specialized" to do a certain job? What job are they specialized for? Could any of the parts be removed without interferring with the work of the others? Think of the organism as a part of the area where you found it. Could it be removed without effecting the area in any way? How would its removal effect the area? What do you suppose would happen if there were too many of these "parts" in that area.

Concept: Recognizing physical and biotic features.

How would you describe the area that we are standing in? Lead students to describe lighting, temperature, air movement, available space, soil characteristics, types of plants, types of animals present. Repeat the process with a smaller area such as under a fern stand, a fallen log, or some other nearby natural feature. Why are these plants growing here and not somewhere else? Lead students to recognize basic needs of organisms such as light, available moisture, protection, food source, etc.

Pick out a small area. Ask students to find some organisms. Where did you find the organism? Why do you suppose it was there and not somewhere else? How does it get its food? its water? Was it hiding? Why do you suppose it was hiding? Does it stay there all the time? When it leaves, where do you think it goes? Does its color match the place where you found it? If not, why not? If so, why? Examine the parts of its body. Do any of its parts help it to survive where you found it? How are the parts used? Compare several organisms found at different places. How are they adapted to live in the different places? How are they similar in structure? How are they different? Does the shape or form of the body tell you anything about how it lives? where it lives? What are the physical characteristics of the place where you found the organism? As specific features are identified: What would happen to the organism - or how would it react if the amount of light, the temperature, the food source, or amount of water present, were taken away. Does the organism depend on these features for its survival? Associate the term "niche" with the concept of dependency of the organism's survival on specific environmental conditions.

FOLLOW-UP ACTIVITIES

1. Investigate the use of scientific apparatus within the school of what senses are they extensions?

2. Critically observe a particular living organism to determine the specific uses of its body parts. Determine, according to its physical structure, in how many different kinds of environments and what kinds

of environments could it possibly exist?

3. Determine specifically the limitations of the human senses. Compare human capabilities with those of other organisms. Relate the differences that are discovered to need in terms of survival and environmental adaptation for specific modes of life.

4. Identify the characteristics of specific niches of some selected organisms. Investigate and identify them as a part of a larger unit.

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ACTIVITY 435-S PAGES 5

LEARNING EXPERIENCE: Communications: Organizing sentences and recognizing parts of speech: Nouns, verbs, and adjectives.

CURRICULUM AREA : Language Arts

Creative Arts

Self-Expression: Communications

GRADE LEVEL : 6th

7th

8th

9th

CONCEPTUAL THEME : Patterns and Designs in nature provide opportunity for practice in using parts of speech and sentence construction.

OBJECTIVES

Upon completion of this activity students will:

1. Utilize at least three of their senses in describing objects found in the natural environment.

2. Identify adjectives as descriptive words having sensual qualities by listing words which describe objects found in natural environments.

3. Identify adjectives as a means of communicating emotional reactions to objects and events by using adjectives which describe their own reactions to the objects experienced.

4. Recognize words which name or identify objects as nouns by preparing lists of various objects found in a particular area.

5. Recognize words that communicate some change or action as verbs by listing action words associated with the objects defined.

6. Structure complete sentences using several adjectives describing the noun.

7. Create rhythmic sentences and identify the grammatical parts of the sentences they have written.

CONCEPTS

1. Adjectives are words used to convey characteristics of an object or an event.

2. Adjectives also communicate our emotional response to objects or events.

3. Most adjectives are words that communicate sensual quality of objects or events.

4. Nouns are words which communicate identity of objects and events.

5. Verbs are words which communicate action or change or an object.

6. Sentences are complete thoughts which convey information through verbal or written communication.

7. Organization of words (nouns, adjectives, verbs) gives a thought rhythm and aids in effective communication.

MATERIALS

Cardboard for writing
Cardboard frames
Pencils
Paper
Papers impregnated with several odors

FIELD ACTIVITY

Before using this activity, the instructor should select a natural area which has a variety of sounds, sights, and natural qualities. Such an area might be found near a rapidly flowing creek or stream.

Have the students sit quietly in a semi-circle around the instructor. Using the small papers, impregnated with identifiable odors, have the students write on a piece of paper at least two words that describe each of the odors they smell. This should be done for each of the papers. Allow some time for thought. When the students have finished selecting their words, ask each student to read the words they have written on the paper. As their word choices are given pick out those words which are used most often. Do any of the words selected identify the odor? If so, which? Which of the words that were mentioned do you consider to be the best words to describe the odor? Repeat this line of questioning for each of the odors that the students have described.

Select two or three objects nearby which have different textures. Pass the objects among the students. As each student feels the object ask them to write down on the paper two words that describe the sensation they experienced when they felt the objects. Again review the words chosen by the students. Pick out those words which seem to be the ones most frequently used.

Ask the students to sit as quietly as they can for a minute or two. At the end of the minute or two, ask the students to write on the paper at least two words that describes what they could hear or what they could not hear. When all the students have finished, again review the words chosen. Select those words which are used most frequently. Have the students underline or write down on the paper the most frequently used words for each of these activities.

Select two objects nearby which could produce noise. For example a dried-out branch maybe laying on the ground nearby. A rock may be also selected. Ask the students to close their eyes. Ask them to concentrate using their sense of hearing. While all the students are concentrating with their eyes closed, break the stick. Ask the students to write two words on the paper which describes what they heard. Again review the word choices and select the word or words used most frequently. Do any of the words chosen sound like the sound that was heard? If so, in what way? Point out to the students that descriptive words arising out of the use of their senses often help to identify the object or source of the sound itself.

Select two or three objects nearby which vary considerable in their appearance. Variations might involve color, form, shape, and size. Point out the objects to the students. Ask the students to write two words describing the objects visual appearance. When the students complete their writing review the words chosen. Select those words used most frequently with each of the objects.

All of the words they have written on their paper are words which describe objects. What do we call the words which describe objects? Ask the students to write the following on the paper:

The _____ is _____, _____, _____, and _____. Have the student fill in the last four blanks with the adjectives that they had selected as the most frequently used in the exercise just completed. After they have finished writing in the adjectives ask them to fill in the blank following the word "the". Inquire of each student what object they chose that would have all of the characteristics which they have placed in the last four blanks.

Ask the students to pick out some object nearby. Ask them to write on their papers as many words as they can think of that describe the object. They should not identify what the object is. When the students have finished, ask each of the students to read the words they have written on their papers. As they finish their list, ask the other students to try to identify what the object was that was observed. After the object is identified, ask the students in general, whether the words chosen were good ones for describing the object. Ask the students to identify how many of the senses were used to describe the object. Do any of the words chosen by the individual reflect how the individual feels about the object? What did you (the listener) feel about the object as you heard the list of words that described it?

Have the students select another object nearby then. Ask the students to write three or four phrases which convey their individual responses to the object. Examples should be given such as: as heavy as ..... , as beautiful as ....., as small as ....., When the students have finished ask them to verbally exchange the written phrases they have on their papers. As each reads the set of phrases, inquire of the other students as to how they think the writer felt about the object that they were describing.

When we communicate, we attempt to convey a complete thought or an idea. A complete thought or an idea if it is spoken or written could be a sentence. All complete thoughts or complete sentences have three main parts to them. They have words that identify the object. There words that describe the object. There words that tell about the action of the object: what it does. In this next exercise we are going to identify the objects that we see.

Distribute the cardboard frames among the students. Ask the students to focus looking through the frames, on an area about five feet away from themselves. Instruct them to concentrate on the object that they see through the frame. Instruct the students to make a list of all the objects they can see through the frame. When the students have finished, inventory the objects which the students have identified on their papers. Which objects were seen most often? Which objects were seen least often? Who identified the most objects?

Select three or four of the objects the students identified. Taking one object at a time, give the object some action. For example if a rock was identified, Pick up the rock and drop it. Ask the students to write words on the paper which describes what the object did. Inventory the action words that the students have written on their papers. Repeat this with two other objects. Words that identify objects are called what? Words that tell of the action of an object are called what? From the work that we've done so far with words what are the three basic parts of a complete thought? Have the students identify adjectives, nouns, and verbs. As they identify the terms, ask them to define what each does for the sentence or complete thought.

Have the students once again use the frames to focus on an area a short distance away. Ask the students to inventory all of the objects they see in the frame and list them on their paper. With each of the objects they list, ask them to also identify adjectives that describe those objects. For example colors, textures, smells, sizes, and shapes. With each of the noun and adjective groups, ask them also to write several action words with each group. When they have finished their word groups have the students develop sentences using all of the words associated within a group. When the students have finished the exercise, ask several of the students to read the sentences they have written. Ask the other students to identify the nouns, adjectives, and verbs in the sentence. Ask the students if there is more than one noun. More than one adjective. More than one verb.

Another type of word we often find in complete sentences is a word which describes the action. Action words we call verbs. A word which would add to or describe the action we would call an adverb. Ask the students to select one sentence that they have written and alter the sentence putting in a word which helps to describe the action word. Example: The original word may be "a leaf is falling to the ground". Revised putting in the adverb, the sentence might read "the leaf is falling gently to the ground." Review the revised sentences with the student group. Have the students identify the adverb within the sentence.

What we have done thus far simply involves identifying, describing, and giving action to common objects that we see in our natural environment. Let us try now to be a little more creative.

For this next exercise, I would like you to select two objects in close proximity to one another nearby you. Quickly sketch the objects on your papers, as you sketch the objects, try to give them some character. That is; give them life. Make them look life-like on your paper. As though they were individuals that could communicate with one another. If these two objects could speak, what do you suppose they would talk about? What would they say to one another? Under your sketch write a few sentences that might be what the one object would say to another. Also write what the other object might replay. A conversation between two individuals is called a dialogue. I would like you to place a caption under your drawing that is a dialogue between your two individuals. Allow your students some time for sketching and for writing. When the students have finished ask them to show their sketch to the other students and read the dialogue they have written as a caption under the picture. As each student reads their sentences, ask the other students if the sentence is a complete thought. Ask the students what makes the statement a complete thought? Repeat this with each of the students, giving each an opportunity to show their original ideas. Select a few and discuss with the students why these two objects were chosen by that individual. Ask the students how they think the writer felt about the objects as created the dialogue. Was the writer able to convey their emotions in their writing? What emotions did the writer feel?

Next we shall try to do some more creative writing, only this time instead of writing a dialogue we're going to write a short poem. What is a poem? How does a sentence in a poem differ from a sentence that we normally use? The students should respond that sentences are structured to have rhythm or rhyme. Read the following for the students as an example of rhythm in a sentence.

RAIN

The rain is raining all around,
It falls on field and tree,
It rains on the umbrellas here,
And on the ships at sea.

As this is read for the students, ask the students where there is rhythm in the sentence. Ask the students where there is rhyme in the sentence.

Ask the students to select some object or event which is occuring around them now, and write a short poem which has rhythm and rhyme. Allow the students some time to be creative. If some have difficulty ask the student what most impresses them about where they are. Have them write about that. After all the students have completed writing their short poems, have each read their poem to the class. As each is read, ask the students if there is one, two, or more sentences in the poem. Have the student re-read the poem being questioned.

Identify in their sentences the parts of the sentence studied in this activity. Students should be able to identify nouns, adjectives, verbs, and adverbs.

If time remains at the end of this activity, the activity can be continued by reviewing the sentences that they have written. While reviewing the sentences have the students point out the order of the sentence parts as they occur in a sentence. For example: does a noun come first or last? Do the adjectives come before or after the noun? Do adverbs come before or after verbs?

FOLLOW-UP ACTIVITIES

1. Present selected objects to a class. Have them write short poems on the histories of the object.

2. Present several objects to the class. Ask the students to list as many adjectives as they can based only on their senses. Have the students use the adjectives in sentences.

3. Present several selected objects which have action qualities, Have the students list the verbs which could be applied to the objects. Have them use the verbs in sentences.

4. Have the students write descriptions of natural objects. Have them identify nouns, adjectives, adverbs, and verbs used in communicating a complete thought about the object.

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ACTIVITY 451-S PAGES 5

LEARNING EXPERIENCE: Noise in our Environment

CURRICULUM AREAS : Social Studies
Life Science
Biology

GRADE LEVEL : 7th
8th
9th

CONCEPTUAL THEME : Many of the sounds we experience in our daily lives, resulting from man's technology, can be considered noise when compared to sounds of undisturbed natural environments.

OBJECTIVES

Upon completion of this activity, students will be able to:

1. Recognize noise as a natural quality of our environment.
2. Demonstrate an increased awareness of natural sound by identifying sounds of an undisturbed natural environment.
3. Distinguish between sound and noise by identifying whose sounds which are pleasant and whose which are unpleasant.
4. Identify physical sources of sound in natrual environments.
5. Identify biological sources of sound in undisturbed natural environments.
6. Demonstrate an awareness of the effect of background noise on our perception of noise intensity.
7. Demonstrate an awareness of sounds in our daily lives often over-looked by identification of those sounds to which we have become accustomed and unconsciously accept.
8. Identify and compare sound produced by the result of man's technology.
9. Identify noise pollution as the collective result of many sources of sound in our daily life.

CONCEPTS

1. Sound is a natural quality of our environment.
2. Sound which is unwanted or unpleasant becomes noise.
3. Most of the sounds we would experience in undisturbed natural environments or that are produced by natural causes are not to be considered noise.
4. Sounds maybe the result of purely physical events that occur in nature.
5. Sound experiences in undisturbed natural environments maybe the result of animal or plant activities.
6. Sounds that we normally produce in our daily activities may seem louder or less louder in a natural environment.
7. Our perception and awareness of the apparent intensity of sound is affected by the amount of background noise we experience.
8. We often learn to accept noise as part of our natural environment - we become insensitive to sound due to constant exposure.

MATERIALS

Four (4) Cassette Tape Recorders
1 Musical instrument per group (such as a Clarinet, piccolo)
Plastic bags
Rubber bands
Masking Tape
Paper
Pencils
Yardsticks

LEAD ACTIVITY

Before beginning the field work, it will be necessary to make the children aware of some sounds that they should expect to hear in studying an undisturbed natural environment. A short period of time should be spent on general awareness. To accomplish this, it would be beneficial for the students to listen to such records as Insect Sounds, Bird Calls, Or Sounds of the Night. Following each of these records discuss with the students the sounds that they have heard. During the discussion, identify the sounds as being simply sound or noise. During the discussion it is essential that the students recognize the difference between sound and noise.

In order to prepare for the trip the cassette tape recorders should be checked for recording effectiveness. All recorders should be set at the same volume for recording. A small piece of masking tape should be placed over the volume control. This is to avoid the students accidently altering the volume during the recording.It should be pointed out at this time, that all recordings of sounds should be made at about the same distance of their sources this will be imperative in determining sound intensities.

FIELD ACTIVITY

After the students have experienced some natural sounds, the group should be sub-divided into smaller groups so that each group will have a cassette tape recorder.

Discuss with the children, the reasons why they're visiting an undisturbed natural area to make sound recordings. In order to become aware of noise problems in our communities, we must first be able to sort out those sounds which we should consider noise and those which we should not consider noise. Does noise pollution exist within a natural undisturbed environment? Before soliciting an answer from the group, have the group stand quietly for two or three minutes and just listen very intently. At the end two or three minutes, ask them what sounds they heard. Was it at anytime silent? Is it ever silent in a natural undisturbed community? The children may respond "yes" to this question. If they do, continue the questioning process by asking them if there might be some sounds in nature which we cannot hear. The response this question should be "yes". When they respond "yes" inquire further as to what sounds they could expect to hear if their hearing were more sensitive. Continue the questioning and discussion at this point, but be sure that the children understand that they will not be able to hear all the sounds that are occuring in a natural environment.This is simply because their ability to hear is limited within a specific range. If the concept is difficult to get across, it might be well to mention the ability of a dog to hear a whistle which we cannot hear. There are many other examples in nature in which we find many animals are able to hear sounds that we cannot hear. Ask the children to give examples of other sounds that exist in nature which we cannot hear, but that other animals can hear.

Today we are going to record some of the sounds that naturally occur within an undisturbed environment. To accomplish this, we must visit several different areas and several different environments. Why do you suppose this will be necessary? The students should respond that different physical areas will be sources of different sounds. Ask the students what kinds of habitats or environments they might visit to record many different kinds of natural sounds. As suggestions are given by the students have one of the students jot down the different sources of sounds. Distinguish, within the list, those that are the result of physical qualities of the environment and those that are biological qualities ofthe environment.

Ask the students to give reasons why the sounds they record in different areas might differ from one another. Students should be led to realize such differences as composition of the forest floor. The abundance of plants in the immediate vicinity. The amount of background noise in the immediate vicinity.

Ask the students what kinds of sounds they should record in the natural environment. Those that should be suggested if not mentioned by the students include the following: the sound of water flowing, the sound of water falling, the sound of a student walking through an area, the sound of a normal conversation in a natural environment, the intensity of strained human sound in an area, the solids of an area, the amount of sound produced in a group conversation within a natural forested area or open area, the sound of bird calls and other animal sounds, the sound of traffic on a rural road, the sound of a musical instrument in a natural undisturbed environment. As these activities or recordings are mentioned have the student prepare a list of the sounds to be recorded during the activity. Instruct the students that each group shall record the sound of the stream from a distance of perhaps one foot. Instruct the students to place the plastic bag over the microphone, and secured with a rubber band. Instruct them to insert the microphone tip just beneath the surface of the water and record the sound which is occuring under the water. Instruct the student to go very close to a waterfall. Have them record the sound of water falling of a distance of perhaps of two or three feet. The students should walk over several different areas perhaps two or three students at a time. As the students walk they should not be talking but the microphone should be placed near their feet. This should be done in at least three different areas. Under a pine forest, under a deciduous forest, over an open area of ground.They might also think of doing this through a grassy or shrubbery area. Have two or three of the students conduct a normal conversation. Record the conversation at a distance of about four or five feet. Have one of the students yell, have one of the students whistle, have one of the students play the musical instrument. This should be repeated in at least two areas - in a deciduous woodland and in a coniferous woodland. They might also do this in an open area. Have the student group stand absolutely quiet. They should remain standing quietly for two minutes. Have the student group engage in conversation. Each student should be speaking while the recording is made. If a recording of bird calls is available, try calling in the local birds. As the birds are called in, have the students record the bird call and estimate the distance at which it was recorded. Have the students visit the nearby road surface. Have them record the sound of passing cars and trucks.

Since the group will be sub-divided to carry out this activity, the order in which these sounds are recorded should be the same for both groups. This will be necessary for later comparison. If time is a factor during the activity, it might be wise to send one group to one area such as a coniferous forest, and send the other group to a deciduous forested area. A limit should also be placed on the length of time recording each of the sounds. A suggested limit might be no longer two minutes.

After the groups have finished making their recordings, re-assemble the students. Have each group of students take turns playing back the sounds they have recorded in the different areas. As the recordings are played back, discuss with the students any differences that are noticeable in intensity. If it seems that one area absorbs less sound than another area, ask the students what reasons they can give for the difference.

Addendum

The following order should be strictly adhered to in recording sounds for this activity. The list is presently in order of natural areas to be visited. Order of recording should be Deciduous Forest, Coniferous Forest, and finally Open space area.

Standing Quietly	
Student walking across Forest floor	Repeated in
Normal speaking level of one student	
Normal speaking level of two students in conversation	
One student calling another (at great distance)	Deciduous,
One student whistle loudly	
Group conversation in which all members are talking	Coniferous
Group casually walking through area	
student playing musical instrument	Forests, and
Student playing instruments loudly	
Bird calls	Open area
Other animal sounds	
Water running	
Water falling	Stream
Under water sounds	
Traffic on rural road	Road

As the recordings are played back, have them make notice differences in background noise. Why do we refer to this as background noise? Ask the students what effect their physical surroundings have had on their recordings. Ask the students which of the sounds they recorded would be considered noises. Have them give reasons why they would consider the sounds noise. When completed, ask the students if any of the sounds are familiar to them. Do any of the sounds occur where they live? Which of the sounds do they hear daily if any?

As the second part of this activity the students should be taken to an urban area. The same list that was used in recording in the undisturbed natural environment can be used in an urban environment. The only exceptions are the water running, the water flowing, and bird calls. Other special sounds, three in number, can be selected from the urban area chosen. Have the students perform the same sound producing activities in the urban environment as were performed in the undisturbed natural environment. When they have completed their recordings, compare the sounds recorded in the natural environment with those in the urban environment. Background noise should now be obvious. Have the students identify specifically what sounds in the background are to be considered noise. Have them identify these sounds.

FOLLOW-UP ACTIVITIES

1. Have the students visit an area within the city where construction is taking place. Have them record the intensity of the sound produced by the construction activity. Could this be compared to any naturally occuring sounds?

2. Have the students conduct a comparative study among three selected areas within the city. For example center city, the fringe of the city, and the suburbs. As sounds are recorded from each of these areas and played back, the amount of background noise should be obvious; decreasing from center city to the suburbs. Have the stuients identify those sounds which complies the background noise. Have them study the sources of the sound and recommend means of which these annoying sounds could be controlled.

3. Have the students visit a rural area which is transected by a major highway. Have the students attempt to record natural sounds in the area. Upon playing back the tape notice should be given to those sounds that are produced by the result of the highway. They then can be identified as noise pollutants.

4. Obtain decibel meter. Repeat any of the above activities or this activity measuring specific intensity of sound in various areas. The results could then be complied and charted so as to indicate decreasing or increasing intensities of sound levels associated with human communities.

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ACTIVITY NUMBER 45 S PAGES 7

LEARNING EXPERIENCE : Air Quality

CURRICULUM AREA : Science: Biology, Earth, General
Health
Social Studies

GRADE LEVEL : 7th.
8th.
9th.

CONCEPTUAL THEME : Air pollution is a major environmental problem. An understanding of air pollutants and their effect upon living and non - living objects is basic to recognition of the environmental problem.

OBJECTIVES

Upon completion of this activity students will be able to:

1) Identify natural components of air and their origins by verbally naming, Oxygen, Nitrogen, Carbon Dioxide, Ozone, and Water Vapor and identifying natural cycles as their sources.

2) Identify pollutants of air by verbally naming Sulfur Dioxide, Nitrogen Oxides, Particulate substances, and Carbon Monoxide

3) Identify sources of pollutants by verbally associating the pollutant substances with their sources; industrial production, energy production, internal combustion engines.

4) Verbally describe a method for testing for pollution components resulting from internal combustion engines after observing a demonstrated measurement.

5) Discuss the destructive effects of SO_2 on materials such as nylon after observing fabric destruction microscopically.

6) Describe and compare the amount and kinds of particulate matter in air by examining microscopically slides upon which dust has settled.

7) Describe the effects of selected pollutant gases on plants by indicating on paper differences in general health occurring between control and experimental closed systems.

8) Define a temperature inversion and explain verbally how this phenomenon is responsible for major environmental air pollution episodes by setting up and demonstrating an inversion situation in an experimental chamber.

CONCEPTS

1) Air is a mixture of gases which have a natural origin in earth's physical and biological cycles. Natural "AIR" is composed of 78% Nitrogen, 20.9% Oxygen, 1% Water Vapor, Ozone, Inert gases and Carbon Dioxide.

2) Air pollutants are solids, liquids or gases introduced into the atmosphere which have harmful effects on materials and living things. Man's technological methods of meeting material needs and energy needs has resulted in pollutants such as Sulfur Dioxide, Nitrogen Oxides, Ozone, Carbon Monoxide and particulate matter in abnormal quantities in the air

3) Major sources of air pollution include industrial processing, the automobile engine, power generating, and improper solid waste disposal.

4) Gaseous air pollutants resulting from automobile engines can be tested for chemically by sampling measured quantities of exhaust or air.

5) Sulfurous oxides combine with water vapor to form sulfuric acid in the atmosphere which attacks and destroys material goods and living cells.

6) Large quantities of liquid and solid particulates are introduced into the atmosphere every year causing economic loss, decreased visability, and temperature changes.

7) Gaseous pollutants such as Hydrogen Sulfide, Sulfur Dioxide, and Nitrous oxides have a definite harmful effect on the health of plants and animals.

8) Temperature Inversions are responsible for major air pollution episodes during which pollutants become trapped and concentrated.

MATERIALS

Data Sheets
MSA Universal Testing Kit
Air tight plastic garbage bag
Balloon
Nylon Hosiery (15 runs)
Microscope slides and coverlips
Petroleum jelly
Atomizer
Hair dryer

Cardboard Box with string
Ice Cubes

Candle
Temperature Inversion Chamber
2 - glass aquaria or terraria
Seedlings - white pine, tomato, or alfalfa
Microscopes or binocularscopes
½" transparent tape
Sulfuric Acid
Hydrochloric Acid
Ammonium Hydroxide
Or Nitric Acid

Notes to the Teacher

Portions of this activity require preparation and accumulation of materials for study at least one week prior to the activity. The following items must be prepared.

1) Construction of a temperature inversion demonstration chamber. See "Air Pollution Experiments for the Science Classroom by the Commonwealth of Pennsylvania, Department of Health (H732.727P) page 63.

2) Students must prepare petroleum jelly coated microscope slides and expose them to the atmosphere in selected areas for at least five (5) days.

3) Sample seedlings must be germinated (tomato, alfalfa, a similar sensitive plant) and placed in control and experimental situations for 1 to 2 weeks prior to observation.

4) It is prerequisite that students have some knowledge of natural air composition and air pollutants.

PROCEDURE

Natural Components of Air (Introductory)

Have the students discuss the physical qualities of air. Students must recognize air as a mixture of gases. Once the concept of air as a mixture has been established, have the students identify the major gaseous components of air. If necessary, give them the proportional quantities of each component. (See concept # 1). Ask the students to write these components. Discuss each of the components with the students. Inquire as to their origin and their fate. Example: Oxygen is a product of photosynthesis and is used by animals during respiration to oxidize food for energy production. Have the students record the information on the data sheet.

Air pollutants (Introductory)

Ask the students to identify the major air pollutants. As the pollutants are identified, have the students consider their sources and harmful effects. As the information is given ask the students to record this information on the data sheet. The following chart may be useful in conducting the discussion.

Air pollutants Cont'd

Pollutant	Source	Harmful Effects
Carbon Monoxide	Autos	Displaces O_2 in blood, causes dizziness, headache, fatigue, slow reaction time - can kill.
Sulfur Dioxide	Industrial and Consumer coal and Sulfurous Oil fuels	Irritates eyes, causes lung damage, kills plants, rusts metal, contributes to smog formation
Nitrogen Oxides	Nitrogen containing fuels, paper mill products, rubber	Forms a stinking brown haze irritates eyes and nose, shuts out sunlight.
Hydrocarbons	unburned petroleum fuels autos	contributes to smog cause cancer
Particulates - Smoke - fly ash - dust - fumes	solid and liquid matter from burning fuels or trash, autos, building materials, fertilizers	Soils clothes increases dirt in house , scatters light, carries poisonous gas to lungs.
Photochemical Smog	chemical reaction of gases and particles caused by sun from gas products and fuel burning	irritates eyes and nose, difficulty in breathing, damages crops, damages buildings

Diseases associated with pollution: Emphysema, Bronchitis, Lung Cancer, Common colds, Pneumonia, Bronchial Asthma

Following the introductory discussion, have the students become involved in the following:

Measuring pollutants in exhaust emmisions:

Using the plastic garbage bag, collect a sample of automobile exhaust. Test the sample for hydrocarbons, sulfur dioxide or carbon dioxide using the Universal Testing Kit which gives a direct reading in quantity/volumes of air. As the exhaust is sampled have the students explain the function and possible uses of the instrument. Allow the students to make the readings by using the comparative charts supplied with the Kit. Compare the readings in ppm with the following chart:

Air pollution levels - "significant harm" to the health of persons.

SO_2	1 ppm	24 hr. average	0.3 ppm/24 hr. emergency level
Particulates	8 COH_5	" "	7COH_5 / " "
SO_2 & Particulates	1.5ppm (Av.of two)"		1.2 / " "

Carbon Monoxide

50 ppm	8 hr.	(40 ppm/8 hr.- emergency level)
75 ppm	4 hr.	
125 ppm	1 hr.	

Nitrogen Oxides (NO_2)

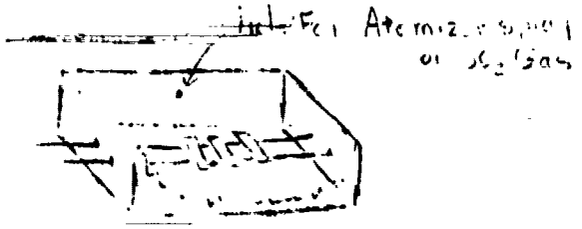
20 ppm /	1 hr. av.	0.4/hr. emergency level
0.5 ppm /	24 hr. av.	

Questions such as the following should be raised. Do all cars emit the same amount of pollutants? What would make a difference in the amount of pollutants? How might we control the amount of auto pollutants entering the atmosphere? (mass transit, pollution control devices, not to let car idle, use non-leaded gasoline etc.) Was the reading we got indicative of a health hazard? How were you able to decide?

Destructive effects of Sulfur Dioxide (SO_2)

What were the sources of Sulfur Dioxide. Have students refer to data sheets. Do you suppose there is a relatively large quantity of Sulfurous oxides in the air today? When or where would you expect to find concentrations of this pollutant? Why? What makes Sulfur Dioxide a dangerous chemical pollutant? If students cannot answer explain the reaction of SO_2 with H_2O in air to form sulfuric acid (H_2SO_4). What effect does sulfuric acid have on materials like marble? rubber? plants? animals? synthetics like nylon? Lead the students to recognize that H_2SO_4 is a powerful oxidant that reacts and decomposes material.

Have the students set up the following experiments Supply the students with pieces of nylon. Have them tightly stretch the nylon over a white card or microscope slide and fasten securely with tape. Have the students examine the nylon under the microscope or binocular scope and diagram the appearance on the data sheet Instruct students to be especially aware of breaks in the nylon threads. Have the students suspend the cards with nylon in a cardboard container and introduce Sulfuric Acid by means of an atomizer.



After the nylon has been exposed to the acid vapors for several minutes have the students remove their sample and examine it again under the microscope and prepare a diagram. What differences did you notice in the nylon. How many nylon threads were broken in your sample? What was the average for the class? Did you notice any other changes in the appearance of the nylon after exposure? What would happen if we put some other material in the box? Do you think there is enough SO_2 in the atmosphere here to cause this same deterioration in our clothes? Where would this most likely happen? When do you suppose it would be most serious? Does what we demonstrated here have anything to do with our personal economy in buying clothes? In what ways?

Particulate Matter

Examine the petroleum jelly-covered slides that were exposed to the atmosphere at various places, under the microscope. Have the students examine the slides at various powers of magnification and identify the following:

1. Number of Kinds of Particulate Matter
2. How they distinguished among different kinds?
3. What are the different kinds observed?
4. How many particles observed in the field of view under low power Is the quantity the same for all areas sampled? Where was the greatest amount collected? The least amount collected? Why? (See Data Sheet)

Effects of pollutants on plant health

Discuss the reaction of SO_2 (Sulfur Dioxide) with atmospheric water vapor in the formation of Sulfuric Acid. In what ways could the acid affect the plant? Would the acid be taked into the plant? How would it enter? Does the plant have any natural protection against the pollutant? Do all plants react the same to a pollutant? What conclusios could you draw about the location of the plant and the amount of SO_2 in the atmosphere?

Have the students examine the plants in the terrarium which have been subjected to Sulfur Dioxide and water vapor atmosphere for several days. Ask them to observe the leaves and stems for any signs of damage and compare the general appearance of the experimental plant with the appearance of the control plant. Ask them to record any differences they feel are the result of the air pollutant. (See data sheet for questions)

Instruct the students to remove a small portion of a leaf and examine under the microscope. Have them diagram the appearance and generally describe any effects noticed as a result of the pollutant. This should be recorded on the data sheet. Instruct the students to examine the control plant in the same way. (See data sheet)

Temperature Inversions

Set up the Inversion box. Place some ice in the bottom of the box to cool the air within the lower chamber. Introduce warm air into the upper chamber using a hair-dryer. Introduce smoke into the lower chamber. As the lower chamber becomes smoke filled, remove the dividing plate. Instruct the students to observe the two areas within the chamber. Why does mixing not occur? Can this same thing happen in cities? Under what circumstances? Why would this be dangerous to the plants and animals in the city? What would happen if we heated the air in the lower chamber? As students respond, heat the plate in the bottom of the inversion box with a candle. Instruct the students to observe what happens as the air in the bottom is heated. What change has occurred? How can we explain this change? What is this process of warm air layering over cold air and trapping pollutants called?

Follow - up Activities.

1. Test the effects of pollutants on various types of material.
2. Measure the effects of pollutants on alfalfa or tomato seedlings.
3. Construct a smog box and demonstrate the production of smog.
4. Measure the pollutants produced from auto exhaust and research the health hazards associated with the pollutants.
5. Research the National, State, Local controls for air pollution control.
6. Devise a list of actions citizens can take to protect themselves from air pollution in the home.

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ACTIVITY 602-S PAGES 5

LEARNING EXPERIENCE: Plot Study

CURRICULUM AREAS : Life Science
Agricultural Science
Biology
Math

GRADE LEVEL : 7th
8th
9th

CONCEPTUAL THEME : Physical and Biotic characteristics determine what kinds of plants and animals can live together in a small natural community environment.

OBJECTIVES

Upon completion of this activity students will be able to:

1. Study a natural area, in an organized way, to learn what kinds of plants and animals can live together.

2. List at least three physical factors and three biotic factors and describe verbally how each has contributed to the development of the total environment of the biome.

3. Identify, by writing, the dominant, sub-dominant and predominant plants in the biome.

4. Identify the effect of the dominant species in controlling the growth of other plant forms by describing in writing the conditions established by the dominant species.

5. Identify some common animal inhabitants and their homes in the area studied by relating their physical requirements and adaptations to the area studied.

6. Relate the complexity of a natural community to the community in which they live.

7. Carry out a soil profile study measuring soil layers and chemical characteristics of the soil.

8. Relate soil characteristics to the plant forms found in the area.

9. Compare population dispersions of plants by competition among species.

CONCEPTS

1. The kinds of plants and animals living together in a small area are dependent upon the physical and biotic conditions of the area.

2. Physical factors such as light, temperature, relative humidity and soil type effect the kinds of life which can survive.

3. Recognition of biotic factors such as dominant, predominant and sub-dominant plant species and the abundance of animal life forms are keys to understanding the interrelatedness of the life forms present and their dependence on the environment for survival.

4. Soils are composed of organic and in-organic matter They are altered by life forms in the area and determine what plant and animals can survive.

5. Plants a animals within a given area must compete with one another for their survival.

MATERIALS NEEDED

Ball of string
Five (5) wood stakes (2 ft. long)
Yardsticks
Four (4) wood stakes (1 ft. long)
Field Identification Manuals - Trees; Shrubs; Insects; Spiders; Fungi; Weeds, Grasses.
2 hammers
Sling psychrometers
Garden trowels
Soil test kits (pH)
Soil augers
Data sheets
pencils

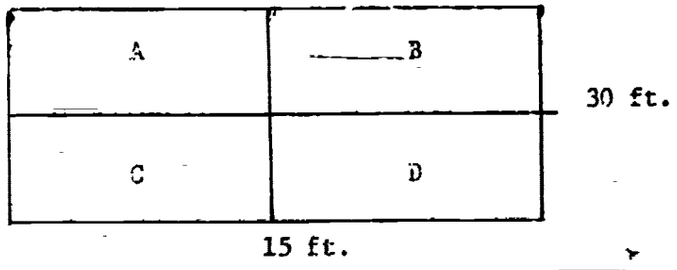
FIELD ACTIVITY

I. Procedure for laying out the Quadrat

Select a natural area - a field, wood lot, edge of the woods, near a stream, in a burned over area, etc.

Instruct the students to lay out a large square area within the location you have chosen. The area should be typical and representative of the larger area in which you are working. Use four of the stakes to mark the corners. Run the string along the stakes from corner to corner. Make sure the corners are square. Each side of the stringed area should be 10 yards long.

After the outside lines have been set up, lay out what is called a grid in your quadrat. Use the short stakes at intervals of 15 feet on each side and connect them using the string. The area should appear:



After the grid has been set up - divide the students into four groups. Assign each group (of approximately four students) to a different area within the quadrat (A,B,C, or D)

II. Identifying and Recording Plants in the Quadrat

Have the students try to identify as many plants in the quadrat as possible. Make sure all trees and shrubs are identified. As the trees or shrubs are identified, have the students locate and record them on the data sheet grid form. Have the students locate each plant, by number, on the grid which is a map of their quadrat. Once a plant is given a number, that number should be used only for that kind of plant over and over again, every time that kind is found. After all of the plants in the area have been numbered and recorded on the map, have the students make identifications of the plants, and total the number of them found in the area.

The Profile Diagram: is used to determine and record the kinds of trees and shrubs in each vertical layer of your Quadrat. The 'profile' should be done after the grid is finished. Trees and shrubs should be located in four layers:

canopy - roof top of the forest
understory - below the canopy to 10 feet above the ground
saplings - from 3 to 10 feet above the ground
seedlings - from ground level to 3 feet above the ground

Have the students record (only once) each plant identified in the left column on the Data Sheet; then, every time a plant of the same name is recorded place a stroke (1) in the layer column. When all the trees, shrubs, grasses are recorded, have the students total the strokes for each plant in eacy layer.

III. Identifying and Recording Animal Life in the Quatrat.

Now that the trees have been identified and located and a 'profile' has been completed, examine the area for signs of animal life. Examine the tree leaves, bark, shrubs, undersides of leaves, and look among the plants growing in the ground.

Identify the animals that you can find as best you can. As the animals are discovered have the students record the following information on the 'Data Sheet'.

Kind
Color
Where it was found
Seedling understory
Sapling
canopy
Object on which it was found
number

IV. Microhabitats Study and Soil Analysis

Have the students select an area in the quadrat and measure off an area 1 yard by 1 yard, which is representative of the area in which they are working. Have them thoroughly investigate the area for kinds of plants and animals. Explain that the microhabitat area is to be treated the same as the Quadrat area, identifying plants and their locations in the 3' x 3' area. Ask them also to prepare the 'profile study' using the following areas (See Data Sheet)

Zone 1 - ground cover plants
Zone 2 - leaf litter layer
Zone 3 - decaying matter layer
Zone 4 - sub-soil layer

Have the students place in their Microhabitat Study the location of object such as animal home, rocks, sticks, decaying logs, moss, etc.

Instruct them that they are to remove materials from the 3' x 3' area as they study each zone and record the materials found. When the soil area is reached they should dig out the soil and sort through it for signs of animal life. This information should be recorded on the Data Sheet.

V. Physical Characteristics

Temperature - Have the students record temperatures of the air and soil and compute average temperatures.

Lighting - Ask the students to record a description of the lighting of the forest floor. The amount of direct sunlight reaching the floor and the amount of shading in various areas. If a light meter is available, read the number on the light meter and record for each area.

Relative Humidity - Relative humidity is an expression of the amount of moisture in the air compared to the amount that could be in the air at any given time. For example: 45% relative humidity would mean that the air was 45% full of water vapor at that temperature.

A Sling - psychrometer, an instrument used in measuring relative humidity, contains two thermometers, one of which has a gauze covering over the bulb. The gauze is saturated with water and then allowed both thermometers are twirled for several minutes to allow the water to evaporate. The two temperatures are then recorded and the relative humidity read from a chart.

Soil Analysis - There are three things you can easily find out about the soil in your quadrat.

1. The depth of different layers of soil.
2. The p^H of the different layers.
3. The temperature of the different layers.

1. Use the soil auger to remove a sample of soil. Only go down about one foot. You may easily see color changes from the top to the bottom of the sample. These colors help you find the different layers. Measure the depth of each layer and record it on the Data Sheet. Repeat the process in two other areas.

2. Follow instruction with soil p^H test kits. Have the students record the p^H of several layers.

3. Using the soil thermometer, record the temperature of the various layers of soil. It may be necessary to dig a hole. Be sure students replace all removed materials in this activity.

After all data has been collected:

What are three different physical factors effecting the life in the quadrat? As each is identified; How does this effect the plants? the animals?
What are some biological factors effecting the life in the quadrat? Some plants are called dominant because they set conditions that effect other plants and animals. Which plants are dominant in this quadrat? Why have they been dominant? Some are called predominant because they are the most numerous. Which plants are predominant here? Why do you suppose they are predominant? Could a plant be dominant and predominant at the same time? Some are sub-dominant because their population and growth is controlled by other plants. Which plants are sub-dominant in this area? Why are the sub-dominant and not dominant?
Which layer of the area had the most plants? Which had the fewest? How can you account for the difference? Were the plants evenly scattered throughout the area? Why? or Why not?
Where were most of the animals found? What reason can you give for their being more abundant in one area than in another? Did their color match their surroundings? How does this help them to survive?

Survey and review the results of the microhabitat study. Compare the results of the microhabitat to the Quadrat.

Survey and review the results of the physical characteristics. Relate the physical characteristics to the types of plants and animals found.

FOLLOW-UP ACTIVITIES

1. Conduct Quadrat studies in various areas. Compare results obtained and use them to identify types of biomes.

2. Establish a Herbarium collection representing and area surveyed.

3. Make season surveys of the same area periodically. Note changes that take place and use the information in a seasonal succession study.

4. Develop other techniques for measuring the animal life within an area and conduct biomes studies.