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ABSTRACT

Over the past 50 years the U.S. population has shifted from rural to urban areas. Most of the students in U.S. schools today live in urban environments. As a result of this, most students have little knowledge of natural resources and their management. Since these students are the future decision-makers of the country, it is important that they have an understanding of the environment and its interaction with all factors, natural or man-made. It is because of this concern for the future that this activity guide was developed. The activities in the guide include a variety of disciplines including science, math, art, communications, and social studies. Designed for teachers, the guide includes a rationale for the process and problem-solving approach to learning that is used in these activities, and gives a detailed explanation as to its most effective usage in the development of lesson plans. Most of the activities, with some modification, can be adapted for most grade levels, though they are appropriate for older students in original form. Role-playing activities and a simulation game are included. A bibliography and materials list are given in the back of the guide. (MA)

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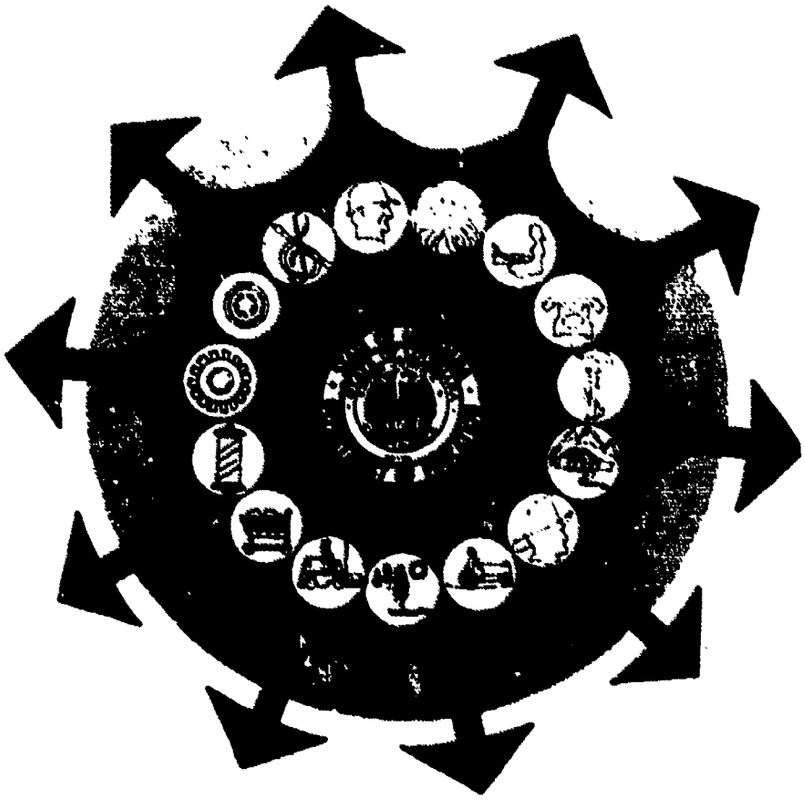

NATURAL RESOURCES ACTIVITY GUIDE

1973

LOUISIANA STATE DEPARTMENT OF EDUCATION
LOUIS J. MICHOT, SUPERINTENDENT

TO: LOUISIANA TEACHERS

This manual has been compiled by members of the State Natural Resources Education Committee and is aimed toward helping you to use your school site as an extension of your classroom. It is intended that this manual be used in conjunction with Environmental Education Teacher Workshops.

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WHY ENVIRONMENTAL EDUCATION?

Within the past fifty years, the United States has become a predominantly urban nation, both in thought and in physical character. Large and middle-sized communities, many within complex urban regions, have evolved to where over seventy percent of this country's population resides on one and one-half percent of the nation's land surface. By 1980, eight out of ten Americans will probably live in an urban environment. Consequently, the independent rural-oriented living that once characterized this country's social and political heritage is no longer a dominating influence in the lives of most Americans.

In rural surroundings, direct daily contact with the basic natural resources was prevalent, especially within man's immediate environment. As man became progressively urbanized, his intimate association and interaction with natural resources diminished, and with it his awareness of his dependency on them. Yet, it is imperative that man, wherever he lives, comprehend that his welfare is dependent upon the "proper" management and use of these resources.

Man should also have an awareness and understanding of his community and its associated problems. Our communities are being plagued with problems such as lack of comprehensive environmental planning, indiscriminate use of pesticides, community blight, air and water pollution, traffic congestion, and lack of institutional arrangements needed to cope effectively with environmental problems. While these problems are legitimate concerns of community governmental officials and planners, the responsibility for their solution rests, to a large extent, with citizens.

To an increasing extent citizens are being asked to make decisions that affect (directly and indirectly) their environment. Specifically, citizens make these decisions as they cast votes on community issues; as they elect representatives to policy-making bodies; and as they directly act upon the environment itself. Citizens can be effective in influencing sound policy in other ways. They can ask informed questions, at the proper time, of the right people. They can serve on advisory and policy-making committees. They can support sound legislation directed at resolving environmental problems. To perform these tasks effectively, it is vital that the citizenry be knowledgeable concerning their biophysical environment and associated problems, be aware of how they can help solve these problems, and be motivated to work toward effective solutions.

Most current programs in conservation education are oriented primarily to basic resources; they do not focus on the community environment and its associated problems. Furthermore, few programs emphasize the role of the citizen in working, both individually and collectively, toward the solution of problems that affect our well-being. There is a vital need for an educational approach that effectively educates man regarding his relationship to the total environment.

The Supreme Court decision regarding the one-man, one-vote concept that has enabled the increasing urban majority to acquire greater powers in decision-making, makes it imperative that programs developed for urbanites be designed with them in mind. It is important to assist each individual, whether urbanite or ruralite, to obtain a fuller understanding of the environment, the problems that confront it, the interrelationship between the community and surrounding land, and opportunities for the individual to be effective in working toward the solution of environmental problems.

This new approach, designed to reach citizens of all ages, is called "environmental education." We define it in this way:

> Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, is aware of how to help solve these problems, and is motivated to work toward their solution.

The major objectives of environmental education are to help the individuals acquire:

1. A clear understanding that man is an inseparable part of a system consisting of man, culture, and the biophysical environment, and that man has the ability to alter the interrelationships of this system.

   The principal feature of the philosophy of environmental education is that man is an integral part of a system from which he cannot be separated. Specifically, this system consists of three components: man, culture, and the biophysical environment. Culture, in this context, incorporates organizational strategies, technological processes, and social arrangements (political, legal, managerial, educational, etc.) through which man interacts with the biophysical environment. The biophysical environment designates both the natural and man-made components of the environment.

   The fundamental relationship between the integral parts of the system is man's interaction, through culture, on the biophysical environment to produce or obtain the goods and services that he needs.

Within the system, man has the ability either to strengthen, weaken or maintain the interrelationships between the system's major components. The ultimate goal of environmental education is the development and maintenance of a high-quality system in which man interacts, through culture, on the biophysical environment to advance human welfare.

2. A broad understanding of the biophysical environment, both natural and man-made, and its role in contemporary society.

The existence of any civilization is dependent upon man's use of natural resources. Resources are defined as those parts of the biophysical environment which are appraised by man as being immediately or potentially useful to him.

A basic understanding of natural resources ideally includes their characteristics, distribution, status, interrelationships, and their present and potential uses. Natural resources serve man in many ways, whether in a relatively undisturbed condition or in the highly altered utilitarian forms of the man-made biophysical environment. A strong understanding of how these resources are used require knowledge of the social, political, economic, technological processes; institutional arrangements; and aesthetic considerations which govern their utilization.

The man-made component of the biophysical environment results from man's use of natural resources. An understanding of this aspect is also essential. It should ideally include familiarity with urban and rural design, including transportation systems, spatial patterns of development, and aesthetic qualities which have a major impact on the functioning of society. Fundamental to these understandings should be the realization that the development of the man-made environment should strive for a high-quality system which improves human welfare in relation to the natural environment.

3. A fundamental understanding of the biophysical environmental problems confronting man, how these problems can be solved, and the responsibility of citizens and government to work toward their solution.

Biophysical environmental problems result from the interactions between man, culture, and the biophysical environment. Pollution, the inefficient utilization and management of natural resources, the indiscriminate use of pesticides, urban blight, and transportation congestion are just a few biophysical environmental problems. These problems, caused by a complex set of biological, physical and social factors, affect the total environmental system.

Citizens need to understand how to work toward solutions of biophysical environmental problems through laws, public policies planning, resource management, research, technological developments, and institutional arrangements.

Citizens should realize that the responsibility for solutions to these problems belongs to them and the governments which represent them.

4. Attitudes of concern for the quality of the biophysical environment which will motivate citizens to participate in biophysical environmental problem solving.

The word "attitude" used in this context implies more than simply the knowledge of a body of factual information.

Instead, it implies a combination of factual knowledge and motivating emotional concern which results in a tendency to act. Further, it is understood that clusters of attitudes about similar environmental conditions will motivate individuals to express their attitudes.

Therefore, for environmental education to achieve its greatest impact, it must: (1) provide factual information which will lead to an understanding of the total biophysical environment; (2) develop a concern for environmental quality which will motivate citizens to work toward solutions to biophysical environmental problems; and (3) inform citizens as to how they can play an effective role in achieving the goals derived from their attitudes.

INVESTIGATING YOUR ENVIRONMENT

INTRODUCTION

The environmental investigations in this series are designed to help you take an in-depth look at different component parts of your environment. The investigations were developed after several years of field-testing with teachers, resource people, and students for use in environmental education training courses for teachers and resource people.

The lesson plans provide a structure to learning in that one activity builds on others and leads to some concluding environmental interactions. It also provides freedom within the structure for the student to observe, collect and record meaningful information at his own pace through the use of the self-directed task cards. This changes the role of the teacher from that of a dispenser of facts and information to that of a facilitator, motivator, and learner along with the student.

You will notice that in most cases charts and tables are provided for the student to interpret his own information on data collected.

These lessons also provide for a maximum of student response and summary because of the discussion and questions sections.

The processes used in these lessons can be replicated and are transferable in any environment. (Collecting observable data, making inferences, setting up investigations to check our inferences, communicating feelings and awareness.)

The activities used are not replicable in all environments. You will have to develop activities appropriate to the environment which you are investigating.

The authors of these lesson plans felt it was important to include the following elements:

Processes

The processes of both data collecting and group problem solving are the first steps toward understanding important generalizations and big ideas about the environment.

Self-Directed Task Cards

Self-directed task cards are used to accomplish certain activities without the aid of the instructor. Some could be removed from the rest of the lesson plan and used as isolated activities for shorter periods of time.

Discussion Questions

Discussion questions are used as introduction to activities or as summary follow-up to activities. (This minimizes instructor explanations and involves the participants in contributing their thoughts and information.)

Analyzing Charts and Tables

These are provided so the student can interpret his own data collected and check out his inferences made during the investigations.

Summarizing Questions

The summary questions used at the end of certain tasks and at the end of the session are one of the most exciting and important parts of each lesson. These questions are designed to:

1. ALLOW PARTICIPANTS TO DISCUSS THE IMPLICATIONS OF WHAT THEY LEARNED TO THE MANAGEMENT OF THE ENVIRONMENT.
2. ALLOW PARTICIPANTS TO GENERATE THEIR OWN CONCEPTS AND GENERALIZATIONS ABOUT WHAT THEY HAVE DONE.

Behavioral Outcomes

The behavioral outcomes for each lesson indicate some minimal expectations in acquiring new knowledge and skills and indicate the nature of expected outcomes in feelings, awareness, values and actions about the environment.

IMPLEMENTING THE INVESTIGATIONS

The guidelines listed below are designed to help you involve people in environmental investigations. They are in no way "sure fire." You may have to change some of them to adapt to your situation and you may want to add to or delete from the list.

Make sure you have all your materials and equipment ready and that you have visited the necessary parts of the environment you will use in your investigations. Is there sufficient amount of equipment and is all in working order? How are you going to check it out and make sure you get it all back? (See guideline 4.)

Before you leave for the study area with your group, be sure you have discussed possible hazards and rules of the road with them.

Some guidelines:

1. Go over quickly with your students what will take place during your session so they will know what to expect.

2. Use the lesson plan outline as a guide involving questioning strategies and self-directed investigations. Revise as necessary to fit your situation.

3. Minimize teacher talk and/or lecture (refer to and use question and discussion sections of outline - these work in eliciting responses).

4. Plan and pace your session so that what you do is done thoroughly and well. For example, it is okay to give them some data to solve a problem instead of letting the class gather it, if time is a problem. Don't have your lesson so rushed that you have to give out data all the time. If you have a time restriction, make sure you decide ahead of time which TASKS you are going to eliminate.

5. The summarizing question and discussion area of how this relates to man and the management of the environment is so important that you should plan to start the summarizing and discussion area of the session at least one-half hour before dismissal.

6. Conclude the session with the summarizing questions or equivalent at the end of the lesson plan. (This is one of the most important parts of the activity.) This will give you an evaluation tool to see what generalizations or concepts students can generate.

7. Have class discuss and list in small groups ways in which the study activities can help change attitudes. Groups may share ideas.

8. Assign one or two students to be accountable for equipment at the beginning of each session. (Have the same people be responsible for cleaning up the equipment at the end of each session.)

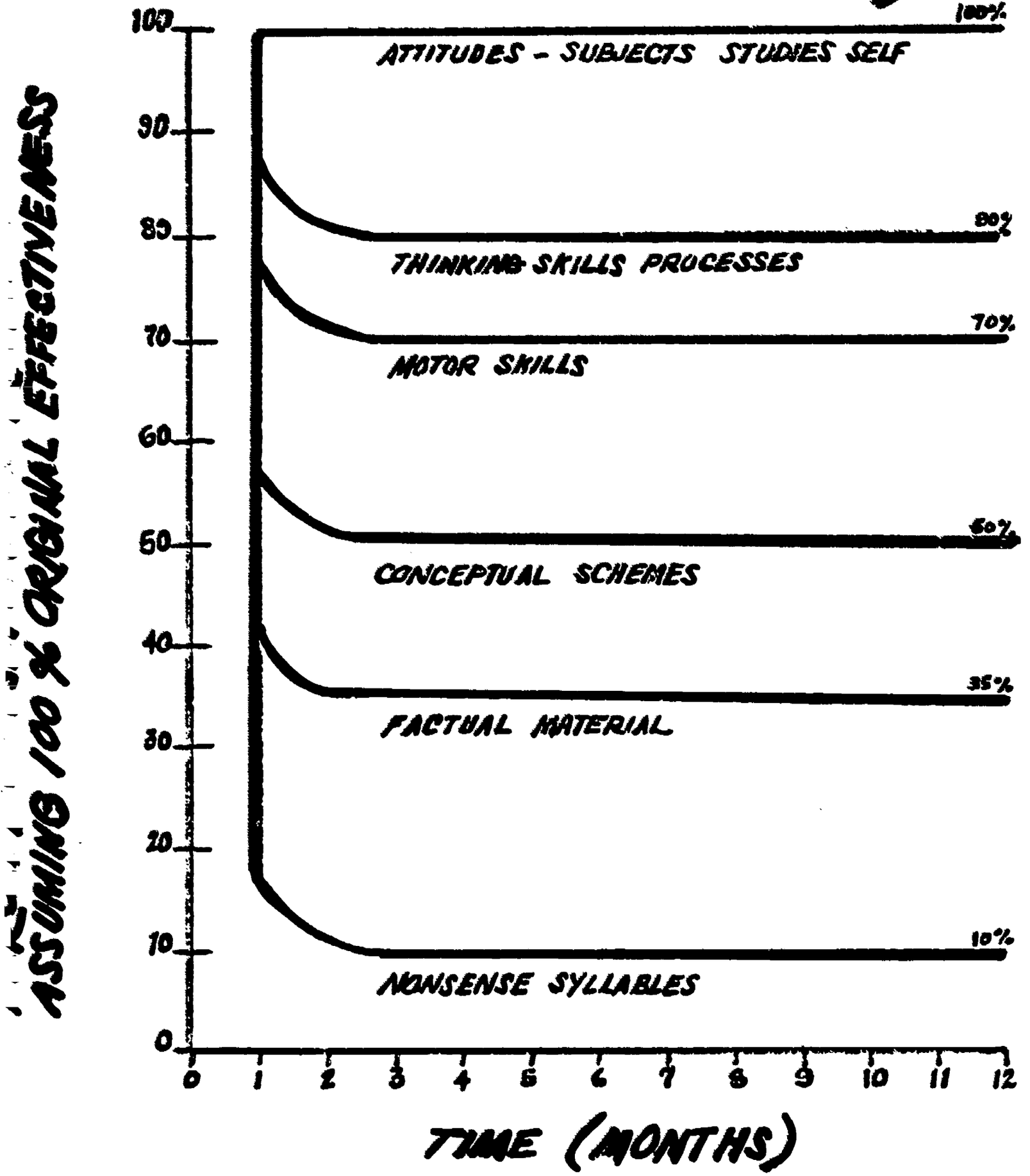
9. Be thinking of ways your lesson can be integrated into the curriculum when you return to the classroom. What kind and how much follow-up are you going to do?

10. When your session is finished, jot down strengths and weaknesses so you can revise your lesson in order to make it better next time.

The authors also feel the ideas written here will suggest new ways of using your environment for learning, and that the activities and ideas will never really come to life until you have modified and changed them to fit your needs. So if you use the lesson plans exactly as they are written here, you will be using them incorrectly.

As in any important learning experience, the instructor should go through the lesson plan and the environment in which the activity will take place before introducing it to the students.

Survival Values in Learning



GROUP ROLE PLAYING

INTRODUCTION

In order to more effectively work with groups it is important to recognize some of the roles people assume in groups. Some are productive and some are non-productive. Many times people are not aware that they play certain roles.

There are many roles; let's look at just four.

Role A - Placator--always soothes over the discussion.
"Everything in due time."
"The sun will shine tomorrow."

Role B - Attacker--always attacks ideas presented or will be negative.
"You know the administration will never go along with that."
"People don't care; our group would never do that without pay."

Role C - Irrelevant--ideas given that do not relate to the topic (evader).
"Did you see the movie last night?"
"Who's bringing the coffee for the next meeting?"

Role D - Sensible--always tries to be as sensible as possible.
"Let's review where we are ."
"Why don't we get back to the purpose of the meeting?"

TASK: 10 minutes

1. Get into groups of four.
2. Each person in the group assumes one of the four roles above.
3. Each person will play one of the four roles as convincingly as he can.
4. The problem:
   It is 90° outside--your group wants to go on a picnic--it is 2:30 p.m. The person with role "D" (Sensible) starts the plans for the picnic.

DISCUSSION: 10 minutes

1. Some roles might be easier to play than others.
   Which were easiest to play?
   Which were easiest to identify?

2. Other roles in groups include those listed--the Role-Playing Techniques Sheet (Help or Hinder roles).

3. List some instances where you have seen these behaviors in
   a. Others (1)
      (2)
      (3)

b. Yourself (1)
(2)
(3)

4. What are some ways to deal with non-productive behaviors in a group?

(DO IN SMALL GROUPS AND THEN HAVE WHOLE GROUPS DISCUSS.)

a.
b.
c.

ROLE-PLAYING TECHNIQUES

Productive Roles--which people assume to share in solving a problem or making a decision.

1. Initiator--suggests an idea, proposes a solution, says "Let's do this."

2. Energizer--prods the group to decision and/or action, stimulates the group, reminds them of the purpose of the group or meeting.

3. Information Seeker--asks for facts, for background information, for clarification, helps group see need for sufficient information for decision making.

4. Orienter--helps group define its position in relation to its goals (where are we now?), points to departures from goals or objectives, and raises questions about the direction the group is moving (where are we going?).

5. Summarizer--pulls together ideas, suggestions, comments on relevant information to help group understand where it is in its thinking or action process. (Gets us back on the right track.)

Productive Roles--which people assume in order to make things run smoothly.

6. Encourager--accepts and praises contributions of others, sets atmosphere of friendly acceptance, tries to arrange for everyone to contribute, gently urges group forward. "Let's work together." Aids approval of idea.

7. Harmonizer--points out similarities instead of differences, helps keep group on problems and away from personalities, works toward consensus. "It seems both your ideas are about the same." "That's a good idea but don't you think we ought to consider what Mary just added?"

8. Follower--goes along with the group, passively accepts ideas of others, provides an audience for active members, supports through his presence. "I'll go along with that."

Non-productive Roles--which people assume to stop action. Roles that attempt to satisfy individual needs first.

9. Dominator--tries to get his own way without regard for others; uses flattery, authoritative behavior, sarcasm, etc.; downgrades others' contributions.

10. Blocker--tries to prevent something from heppening, argues, openly rejects ideas, deals in personalities, interferes with progress by going on tangents, personal experiences on unrelated things, argues unnecessarily on a point, rejects ideas without all facts, may weaken an issue.

11. Special Interest Pleader--tries to gain decision or action favorable to a special group or project regardless of group wishes, uses stereotyped phrases or cliches, appeals to emotion, cites precendents, usually refuses to compromise, etc., states own biases, a special program for his personal gain.

12. Playboy--makes a display of his lack of involvement in the group's efforts and activities; indulges in horseplay, unrelated jokes or comments, pen clicking or rubber-band snapping, or other attention-getting behaviors. "Anyone want some gum?" "Have you seen the new TV show?"

A LESSON PLAN FOR A PROCESS AND PROBLEM-SOLVING APPROACH TO LEARNING

In this session we are concerned with techniques and process of involving people in problem-solving activities. The success of these activities will be measured by the application of group interaction and problem-solving skill to the environmental investigation that we do later.

We are concerned, then, about how to transfer the process of involving people in environmental investigations.

I. SOLVING A PROBLEM THROUGH GROUP INTERACTION

Question and Discussion

1. Have audience arrange themselves in groups of six, or have chairs grouped that way ahead of time.
2. Pass out the "6 bits of information" problem, one bit of information to each person (use problem on page 9).
3. Tell audience that there is a problem to solve; they may tell their group what is on their paper but they may not show it to others.
4. As the problem-solving session progresses:
   a. 5-8 minutes into problem write on the board - Trust
   b. 8-12 minutes into problem write on the board - Visual Display
   c. 12-15 minutes into problem write on the board - Matrix

Task A Identify and solve the problem in the "6 bits activity."

Questions and Discussion (After all groups have finished)

1. What kept you from solving the problem to begin with?
2. What helped you to solve the problem later?
3. What were some characteristics of this problem-solving exercise?

(LIST COMMENTS FROM GROUP AND DISCUSS)

4. The people who developed the problem-solving exercise feel that it contains elements of involvement that most groups go through; it also illustrates the way groups work together on common problems.

   They hypothesized that the following things would take place during the problem-solving exercise: (Write each item on the board, or have a chart made up with each item listed.)

   a. TRUST (will develop). Must trust that the instructor gave you a solvable problem. Must trust each other.

   b. RITUALISTIC LISTENING (will take place). This is a kind of polite liteming--really without caring too much, because the data offered has no relevance at that time.

   c. REAL LISTENING (will take place). When statements become more meaningful. (Data means something). When people interrupt and say, "Say that again!"

      QUESTION: When in your group did you change from ritualistic listening to real listening?

      When real listening occurs, two things will change:

      Vision: Participants will begin to vision the listening by...
      really looking at other people
      ...constructing a Visual Display (writing data in a common place) helps make inferences
      don't have to listen to everything.

      Space: Space factors will change
      people will usually move closer together
      people will sometimes change places or move around the table.

5. Using this type of activity at the beginning of a session is important for these reasons.

   a. The problem could not be solved without the contributions of each person in the group.
   b. People feel more committed to a session if they contribute by saying something - the earlier the better.

c. It's easier to talk to each other in a small group than to talk to one instructor in front of a large group.
d. This exercise illustrates that each person in a group brings information and skills that can be used by the entire group to solve common problems. THE PIECE OF PAPER REPRESENTED THE INFORMATION AND SKILLS THAT EACH OF YOU BROUGHT TO THE GROUP.

6. We will be concerned in this workshop with providing ways for each person to contribute knowledge and information and skills to the solving of common problems. The content and activity itself is not always most important. What is important is the idea that you can use different techniques to get people talking to each other and contributing as a group.

6 BITS OF INFORMATION PROBLEM
by Dr. Michael Giammatteo

$B_2 1$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

The Dinosaurs had Tom for a teacher during the third period.

Dick and Belinda did not get along well and so they did not work together.

During the first period the Team Leader taught the group that Harry liked best.

$B_2 2$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

All teachers taught at the same time and exchanged groups at the end of each period.

Each teacher liked a different group best. During the second period each teacher taught the group he liked best.

Each teacher taught every group during one of the first four periods of the day.

$B_2 3$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

The Freznel Elementary School Intermediate Unit had two teacher's aides, four teachers, and four instructional groups of students.

Each instructional group had chosen its own name.

Sybil was the Team Leader for the Intermediate Unit.

$B_2 4$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

Your group members have all the information needed to find the answer to the following question. Only one answer is correct. You can prove it.

IN WHAT SEQUENCE DID THE APES HAVE THE VARIOUS TEACHERS DURING THE FIRST FOUR PERIODS?

Some of the information your group has is irrelevant and will not help solve the problem.

$B_2 5$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

Belinda and Ralph disagreed about how it would be best to handle the Bombers who always had trouble settling down to work.

Dick preferred to work with the Champs over all other groups.

Although the Team Leader had been at Freznel School for five years, this was a shorter period of time than for the other team members.

$B_2 6$

Although you may tell your group what is on this slip, you may not pass it around for others to read.

Information:

The Team Leader taught the Dinosaurs the second period.

Harry worked with the Bombers in the third period.

Sybil had been at Freznel School a shorter period of time than any of the other teachers in the Intermediate Unit.

II. OBSERVING AND CLASSIFYING TREE LEAVES

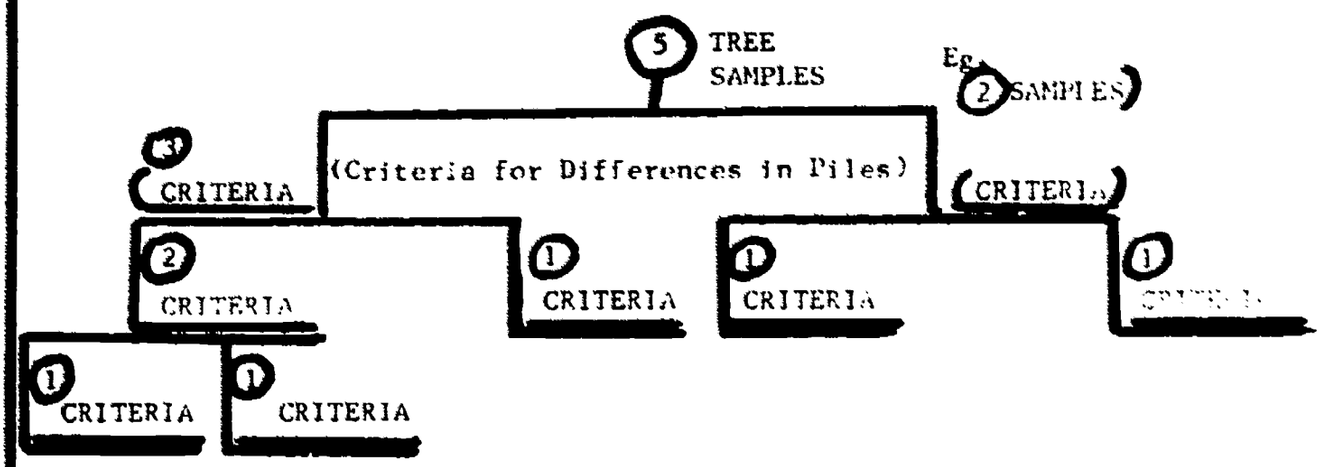
Questions and discussion

Let's transfer some of the problem-solving approaches to another activity. (Distribute six different tree specimens, a different one to each person in the group.)

1. Look at your own leaf specimen for 1-2 minutes and look for its observable characteristics.
2. Now each person share what they observed about the characteristics of their sample with other members of the group.
3. Each group put all of the leaf specimens into two piles based on the major likenesses and differences of their leaf characteristics. Write down the criteria or reason you used to do it.
4. Ask each group to tell the reasons used as you list on the board. Point out that some groups used different starting points.
5. Your next task is for each group to construct a dichotomous key. What does dichotomous mean? (You may want to draw a simple key on the board to illustrate.)

GIVE EACH GROUP A PIECE OF PAPER AND FELT PEN. TELL EACH GROUP TO CONSTRUCT ITS KEY SO EVERYONE CAN SEE IT.

Task B Construct a dicohtomous key using your own criteria or starting point for putting the samples into two piles. Divide each pile into two more piles of samples based on the major likenesses and differences of their leaf characteristics. Continue dividing piles until you have one specimen left in each pile. (This is one way to make a key; you may want to use another.)



III. COMMUNICATING ABOUT THE TREE SPECIMENS

Task C

Now that you have finished your key, as a group select one sample and using the words in the key that describe that sample, write a description of it in sentence form.

Questions and Discussion (After most or all have finished constructing their keys)

1. Have each group read its description and have the other groups select and hold up the sample they think is being described; have the members of the group that read their description check the other groups to see if they selected the right sample. (You may have to ask people to hurry so as not to drag out this part. It is important, though, for each group to read its description.) Ask each group how well the other groups selected the right specimen.
2. After #1 say: "I noticed that not all groups selected the sample being described and that not all groups started at the same point. If we assume we have as many different societies in this room as groups (each with its own way of working as a group, and each with its own language), then how could we use this classification activity to increase and improve the communication between societies?" (Committee-common vocabulary, etc.)
3. What else can we do with this key now that we've built it? Discuss groups' suggestions.
    a. Demonstrate ability to use the key by adding a new tree sample. See if it fits into your key. Yes - no - why?
    b. Describe the difference between your key and another one. (Change keys with the group next to you. See if you can match up the samples and then compare the two keys - yours and theirs.)
    c. Take the key outside and use it to find trees where they are growing. (This is security for teacher and student - the student builds a tool and skill in the classroom and gets to use that tool and skill in the outdoor classroom; the teacher doesn't need to know the names of trees to provide a meaningful learning experience for the student.)
4. Do you know more about the specimens now than when we started? We haven't even talked about names of these trees yet. Names may not be important to begin with. This classification problem allows us to become familiar with observable characteristics of the specimens. Now we are ready to use another written or picture tree key to associate our descriptions with others and to find a name that society has labeled the tree.

    (USE BOOKS LIKE LOUISIANA TREES.)

IV. DESCRIBING CURRICULUM RELATIONSHIP WITH TREE PARTS

Task D

Describe other parts of trees we can classify, list curricular area in which that part of the tree could be used, and describe in what ways.

PART OF TREE	CURRICULAR AREA USED (Art, Math, S.S., Sc. etc.)	HOW USED
Bark	Art	Construct mosaic. Classify different textures, compare texture, patterns and designs of different kinds of bark

Questions and Discussion (Task D)

1. Many people feel that classifying is strictly a science process, and can't or shouldn't be used in other subjects. We have just disproved that theory by showing we use the processes continuously in order to learn more about things.
2. What other things (e.g., shoes, people, rocks, communities, animals, etc.) in the environment can be classified?

V. DESCRIBING VALUES AND PROCESSES

1. Describe the values of classifying things in the environment.

Task E (10 minutes)

2. Mark the processes we used in this activity and give an example of how they were used.

Task F (15 minutes)

Mark the processes used in this activity and give an example of how they were used. (Discuss in small group)

Process	Example of How Used
Observing	
Classifying	
Measuring	
Predicting	
Inferring	
Communicating	
Formulating Hypotheses	
Experimenting	
Interpreting Data	

Observing — Using all of the senses: hearing, seeing, tasting, smelling, and feeling.

Classifying — Identifying objects or ideas and classifying them into groups according to similarities and differences. Students are encouraged to invent their own systems.

Measuring — Using both standard units of measurements or invented units, students should have experience in measuring quantities (length, weight, volume, time, temperature, etc.)

Predicting — Many students guess with little difficulty. Prediction, however, requires a higher level of thinking. Predictions are also based on some known data or evidence. Simple graphs and charts are helpful for students to use as a basis for prediction.

Inferring — The ability to infer is basic to the formulation of hypotheses. Students can learn to infer when they can distinguish between an observation itself and an inference about an observation.

THIS LIST WAS TAKEN FROM "SCIENCE IN OREGON SCHOOLS," OREGON STATE DEPARTMENT OF EDUCATION, AND WAS ADAPTED FROM MATERIALS DEVELOPED BY THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE FOR THE PROJECT AAAS COMMISSION ON SCIENCE EDUCATION.

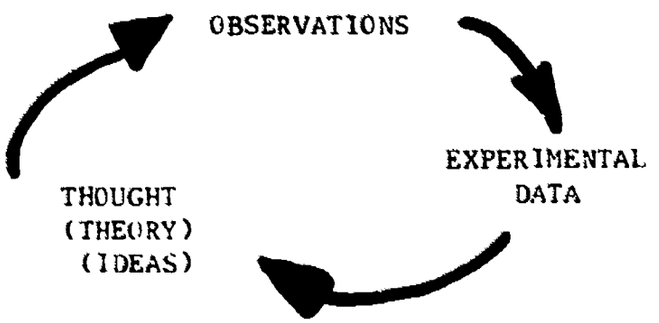
Task F (Continued)

Communicating — Clear and precise communication is essential in science. There should be many opportunities to communicate orally, with graphs, with pictures, and, when able, in their writings.

Formulating Hypotheses — Answers to many inquiries are simple. Many questions may be answered by asking an authority or by referring to the proper book or reference material. Answers to other inquiries require much further scrutiny. The student's initial general observations and informal manipulations may result in an attempt to investigate further or to experiment. A hypothesis based on his preliminary experience and his inferences is necessary to establish the direction of his efforts. Formulating intelligent hypotheses takes practice.

Experimenting — Experimenting, as opposed to verifying, indicates a quest for an understanding of an uncertain phenomenon or an answer to an unsolved problem. The organization of this task is usually complex and takes many forms. One important aspect of such activity is the setting up of controls with which experimental results may be compared.

Interpreting Data — Through observation and measurement, students will collect data. Can they organize and interpret these findings? True inquiry may begin with theory, observations, or experimental data, but the logical investigator always goes "full circle" regardless of his starting point.



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3. What were some processes of group interaction used in this activity?
4. Give an example of how you could adapt this activity and use it in a teaching situation.

Summary Questions

1. What did we find out about problem-solving techniques in this session?
2. How can we summarize our discussions and investigations?

Task G

How did you feel about our session today?

Equipment needed:

Bleckboard and chalk or easal - newsprint and magic marker
6 bits of information problem sheets cut up
Tree leaf samples in sets of 6 for _____number of groups

This section has been revised to fit Louisiana conditions. It is suggested that people using it change or adapt it to fit their own situations.

A LESSON PLAN FOR INVESTIGATING A FOREST ENVIRONMENT

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next four hours we are going to make some inferences of why we think some things are the way they are, based on observations. We will test out these inferences by experimentation, collect and interpret past events in this experiment, and explore ways that we can improve the efficiency of energy cycles. (You might want to read the behavioral objectives at the end of the lesson and refer to them as evaluation of the session.)

The following activities may help you look for observable changes, relationships, patterns and trends, in order to interpret past events, understand present relationships, and indicate future trends in the forest environment.

The processes used in this lesson plan can be replicated in any environment. Some of the activities used cannot. In environments other than a forest, you may have to develop activities appropriate to the area.

I. OBSERVING AND INFERRING WITH CROSS SECTIONS. (As an example of using observable evidences to infer past events in a forest.)

Distribute cross sections and task cards. Cross sections of trees can be 4-6" in diameter or larger, and should show a variety of growth patterns and influences (fire, insects, etc.).

Task A (on cards)
(5-10 minutes)

Work with 1 or 2 other people.
Write down some things you notice about the cross sections.

Questions and discussion:

1. What are some things you noticed about the cross sections?
   (Accept all comments from group. List on board or chart.)

2. Focus on 2 or 3 items for discussion:
   Why did you say . . .(your cross section had evidence of fire)?
   (examples)
   What could account for . . .(the rings being irregular)?
   What are some things that could account for. . .?

Task B (on cards)
(10 minutes)

Work with 1 or 2 other people.
Select three observations about the cross sections from the group list.
List possible reasons for these observations.
List ways you could set up an investigation to find out more about your observations and inferences.

Observations (What You Noticed)	Inferences (Possible Reasons For This)	Investigations (How We Could Find Out)
1.		
2.		
3.		

Questions and discussion:

1. Ask for reports on the above chart from several groups (as time allows).
2. Which of these investigations could be carried out in this environment?
3. Keep your lists of observations and inferences for reference at the end of this session.
4. What could tree rings from this forest tell us about past and present events in this environment?

II. COLLECTING AND INTERPRETING DATA ABOUT TREE GROWTH RATE AND COMPETITION

Task C (with tree cores) requires preparation by the instructor before the session.

A tree stand should be selected for study, 4-5 trees tagged (trees should be selected that show effects of environmental conditions--injury, overcrowding, lack of sunlight, etc.). The tagged trees should be bored with an increment borer by the instructor ahead of time. (Cores should be numbered corresponding to numbers on the tree.) Putting tree cores in see-through plastic straws and then taping to a cardboard will help keep them longer if liquid resin is not available. In any event, keep the cores and labeled trees to use again. This eliminates the necessity of reboring the trees.

NOTE: Maybe you can find and use stumps of trees that grew under a variety of competition influences instead of tree cores.

Task C (Part 1) (15-20 minutes) Work in groups of 4-5 people.

Observe the tree core your group has been given and record the following information: (See drawing of tree core to help interpret the tree core you have been given.)

Tree #	# Dark Rings From Center to Bark (Approx. Age)	# Dark Rings in Last Inch	Remarks About the Pattern of the Rings

2. When your group has the above information, one person from the group should record this information on the blackboard or easel board. (Chart to be like TASK C, part 2.)

DRAWING OF TYPICAL TREE CORE

Task C (Part 2) (10-15 minutes) Work in small groups.

Record the following information about tree cores from the master chart. (Instructor will provide the diameter information.)

Tree #	# Dark Rings From Center to Bark (Approx. Age)	Diameter of Tree Trunk (Circle ÷ 3)	# Dark Rings in Last Inch	Remarks About the Ring Pattern
1				
2				
3				
4				
5				
6				

Questions and discussion:

1. What similarities do you notice in the data about the trees?
2. What differences do you notice in the data about the trees?

Task C (Part 3) (20-30 minutes) Work in small groups.

Set up an investigation to find out reasons for some of the differences in the data.

1. Select 2-3 trees from the list that show differences in growth rate.

2. Which trees did you select? (Indicate by number)_____

3. Why did you select these trees?_____

_____

Go with your group to the site of the trees you selected for investigation and do Part 4.

Task C (Part 4) (30-40 minutes) Work in small groups.

Collecting and Recording Data

Record your observations:

Interpreting Data

Record possible interpretations of the above data:

Summarizing your Investigation

Write your group's summary below, including:
what you were trying to find out;
what data you collected about it;and
what interpretations you made.
What other data would you collect about your investigation?

Questions and discussion:

1. Ask for 2-3 minute summaries from several groups (as time allows).
2. What problems did you encounter in this task?
3. What other data could you collect about your investigation?
4. What does the information tell us about the past events of this environment?
5. How would you summarize the major factors affecting the growth of this forest?

Task D (30-40 minutes)

Look for evidence of change (natural and man-made) in the environment. Record and fill out other columns.

Evidence of Changes in the Environment	What Might Have Caused Them?	Effect on the Environment

Describe the way the area around you looked:

25 years ago

Describe the way the area around you might look:

25 years from now

Questions and discussion:

1. What evidence of change did you find?
2. What might have caused this?
3. What was the effect of_____(this change) on the environment? Allow time for interchange of ideas between group members. The same changes may have been noticed, and there may be many interpretations of their causes and their effects.
4. What do you think this area looked like 25 years ago?
5. How do you think this area will look 25 years from now?

Task E (10 minutes)

Describe in writing how you feel about the changes in this environment.

IV. INFERRING CHANGES IN A ROTTEN LOG OR STUMP

Find a rotten stump or log.
Questions and discussion:

1. What things about this stump give us clues about the past events that have taken place?
2. What factors caused these things to happen?

Task F (15-20 minutes) Work in groups or by yourself.

NOTE: DO NOT TEAR THE STUMP APART! Discuss why.

What things are changing the rotten stump now? Record below:

*Living Things	Effect on Stump

*Non-Living Things	Effect on Stump

Questions and discussion:

1. What cycles are taking place in the rotten log or stump?
2. In the space below, construct a diagram of one of the cycles taking place in the rotten log or stump.

Task G (15 minutes) Work in groups.

Construct a diagram of one of the cycles taking place in the rotten log or stump.

V. TRANSFERRING THE PROCESS TO OTHER ENVIRONMENTS

Questions and Discussion:

1. What are some other <u>things</u> in this environment that could help us further interpret the landscape and <u>what can it tell us about the landscape</u>? List on board.

2. Using one of the items listed on the board, or another you can think of, do TASK H.

<u>Task H</u> (30 minutes)

Describe in writing an alternative activity you could have done to establish a time sequence for the past events in this environment.

Describe in writing an activity you could do in a <u>city environment</u> to establish a time sequence for the past events in the environment.

<u>Activity</u>	What it would tell you about the <u>past events in the area</u>

Describe an activity you could do in the area around your school to establish a time sequence for the past events in the area.

<u>Activity</u>	What it would tell you about the <u>past events in the area</u>

VI. COMMUNICATING FEELINGS OF AWARENESS THROUGH SKETCHING

Distribute sketching paper and pieces of charcoal from a campfire or fireplace.

Task 1 (Give these directions verbally)

(Use sketching paper)
Construct a sketch using charcoal from a campfire or fireplace.
Other art materials will be given to you as you work.

NOTE: Subject of sketch depends on the environment.
It can be anything that is significant about the area:
rotten log, stump, or snag
an old homestead, fence, or barn
a city building, transmission tower, or freeway

While people are sketching, go around and give them:
rotten wood - brown dandelion leaves - green dandelion flowers - yellow
other goodies, in season
If you're not in the woods, IMPROVISE!

VII. COMMUNICATING FEELINGS OF AWARENESS AND VALUES THROUGH WRITING

NOTE: Begin this part when about half the people finish their sketch.

Task 2 (Give these directions verbally)

Use your pencil or pen.
Find a place on your sketch (across the bottom, or down the side) to write some things.

Write two descriptive words about the stump.
(Words that tell what it looks like)

Write three action words about the stump.
(Words that describe processes or changes taking place, or things happening to it)

Write a short phrase (4-5 words) that tells how the stump affects the rest of the environment. (A phrase to describe its value or usefulness [illegible] you might have about the stump)

Write one word that sums up everything about the stump.
(A word that suggests a comparison, an analogy, or synonym)

Option 1:
Now, if you like, go back and give a title to what you have written.

Option 2: Have you written a poem about the stump or [illegible]

NOTE: Pace the preceding directions to the needs of the group.
People shouldn't feel pressure while writing this--be casual.
(It's good to mention that they may not wish to write something for every direction that is given.)
Review the directions now and then for people still thinking.

Have people read their writings if they wish.

Question to think about:

In what ways does this description show your feelings and awareness of the environment?

SUMMARY QUESTIONS

1. What did we find out about the environment in our session today? (List on chart, if time permits)
2. Why are these things important to the way we manage the environment?
3. How can we summarize our discussion? (or investigation) (What are some big ideas that would sum up what we've just said?)
4. What methods and processes did we use in our investigations?

Task K

5. Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

List at least three observations about the cross sections provided, and infer possible reasons for each observation.

Describe ways to set up an investigation to find out more about the above observations and inferences.

Set up an investigation (collect and record data) to find out reasons for growth rate differences in a given stand of trees.

Describe activities appropriate to other environments for interpreting the landscape.

Identify and list at least three evidences of change in the environment, and infer the cause-and-effect relationships of those changes.

Construct a diagram of a cycle in a rotten stump.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe how you feel about one change in this environment.

Communicate feelings of awareness by constructing a sketch of a given object in the environment, using natural materials.

Communicate feelings, awareness, and values by describing in writing the effect of a given object on the environment.

EQUIPMENT NEEDED

30 cross sections of trees
6 increment cores (preferably in plastic) from numbered trees
30 hand lenses (optional)
30 pieces sketching paper
lab sheets
task cards
natural materials for sketching

This lesson plan was developed for use in teacher workshops by:

Martha Neyland, Stevenson, Washington
Jeannie Williams, Salem, Oregon
Charline McDonald, Portland, Oregon

It has been slightly revised by Dr. Alden C. Main, LSU Cooperative Extension Service, Baton Rouge, in November, 1972. It is suggested by the writers that continuous revision take place by people who use the ideas.

HOW TO TREAT CROSS SECTIONS OF TREES TO PREVENT SPLITTING, CHECKING, AND WARPING

Soak fresh-cut disks in a solution of polyethylene glycol-1000. Fresh-cut wood should be wrapped in plastic or immersed in water to keep in green condition. If cross sections from dead tree trunks are to be treated, they should be soaked in water two or three days before treating.

To make a treatment solution, dissolve ten pounds of polyethylene glycol in 4.8 qt. of water. Use a plastic glass or earthenware container for a treating vat. Metals react with the wood extractives and discolor the wood.

After the disk is placed in the vat, it should be supported by a few narrow strips of wood to permit free circulation of the solution beneath the disk; it should be weighted down with a rock. Stones or bricks can be nested in irregular or empty spaces to raise the solution level. Growth of molds, bacteria and fungi during the treatment can be prevented by adding a small amount of borax.

It takes about 10 days to treat a nine-inch diameter, one-inch thick wood pine disk at room temperature. A hardwood disk takes about fifteen days.

Dry the disks for a few days in a warm room. The surface then may be sanded. If the grit loads up with waxy sawdust, clean the sandpaper with a wire brush. Finish with a finer sandpaper.

Disks may then be bleached by painting the wood with a solution of two heaping tablespoons of oxalic acid crystals in a half glass of water. After an hour or so, neutralize with a diluted solution of household ammonia.

After drying for a day or so the disk may be finished with a moisture-cure-type of polyurethane resin varnish.

A LESSON PLAN OUTLINE FOR MEASURING SOME WATER QUALITY CRITERIA

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next four hours we will investigate evidences of aquatic life in this stream, infer stream temperature, O_2 and pH from that life, and then check out our inferences through experimentation. We'll determine the streamflow of the stream and discuss ecological, social, and political concerns of using such water. (You might want to read the behavioral objectives at end of lesson and refer to them as an evaluation of the session.)

I. DETERMINING WATERSHED BOUNDARIES

Distribute maps of the area, one for every person.

Task A (15 minutes) Work in small groups.

Find_____Creek on the map. Find your location.
Where does the water in this stream come from?
(Trace upstream to its source)
Draw lines around the boundaries of our watershed. (We're in the _____Creek watershed.)

II. OBSERVING THE STREAM ENVIRONMENT

Assign Task B for recording observations of the stream environment. Walk to stream.

Task B (10-15 minutes) Work by yourself or in small groups.

As you approach the stream, observe and record your observations about the stream environment (can be done visually and verbally):

Plants _____

Animals _____

Air _____

Rocks _____

Water _____

Questions and discussion:

1. What did you notice about the stream environment?
2. What plants were growing on the gravel bar?
3. Why aren't large trees growing on the gravel bar?
4. What did you notice about the rocks?
5. Where did you see the bigger rocks? The smaller?

III. OBSERVING AQUATIC ANIMALS

Questions and discussion:

1. What did you notice about the water in the stream?
2. What do animals need to live in water?
3. Where would you expect to find animals in the water?
4. What guidelines need to be developed by our group as we collect animals from the stream?
   (Discuss what to do with animals to keep for observation, what to do with rocks that are overturned, what to do with animals when the session is over.)

Task C (30-40 minutes) Work by yourself or in groups.

Using collecting equipment (screens, jelly cups, etc.) collect as many types of aquatic animals as possible.
Put them in the white dishpans for observation by the group. (Keep the pan in a cool place.)

Contact the instructor when you've finished, to receive the next task.

Note to instructor: Go from group to group to see how they're doing.

IV. IDENTIFYING AND RECORDING AQUATIC ANIMALS

Task D (20-30 minutes) Work by yourself or in groups.

Using the Golden Nature Guide Pond Life books and attached picture keys, generally identify the specimens you found.

List or sketch the animals you found below:

Description of where found	Type (name or sketch)	No.

Return animals to water as soon as finished.

Questions and discussion:

1. What animals did you find?
   Compile a group list (preferably on a chart). Each person should record the group list on his lab sheet.
2. Where did you find most of the specimens?
3. What similarities are there among the specimens?
4. What differences did you find?
5. What classification system could we use to classify the aquatic animals we found?
6. What other life would you expect to find in this stream?
7. Would we be likely to find the same specimens in a different aquatic environment? Why or why not?

V. PREDICTING WATER CHARACTERISTICS FROM AQUATIC ANIMALS FOUND

What were the things we said animals needed in order to live in the water? (Review earlier discussion.)

ASSIGN THE FOLLOWING TASK:

Task E (15-20 minutes) Work by yourself.

Based on the aquatic animals you found, and the chart below in the Analyzing Data Section, predict the following characteristics of this stream:

I predict:

The water temperature will be_____because_____
The air temperature will be_____because_____
The pH number will be_____because_____
The dissolved O_2 count will be_____because_____

KEEP THESE PREDICTIONS FOR YOUR OWN REFERENCE.

Analyzing Data

pH RANGES THAT SUPPORT AQUATIC LIFE

	MOST ACID 1 2 3 4 5	6 7 8	NEUTRAL 9 10 11	12 13 14 MOST ALKALINE
Bacteria	1,0			13,0
Plants (algae, rooted, etc.)		6,5		12, 0
Carp, suckers, catfish some insects		6,0	9,0	
Bass, crappie		6,5	8,5	
Snails, clams, mussels		7,0	9,0	
Largest variety of animals (trout, mayfly, stonefly, caddis fly)				

DISSOLVED OXYGEN REQUIREMENTS FOR NATIVE FISH AND OTHER AQUATIC LIFE

	D. O. in parts per million
Cold-Water Organisms (including salmon and trout) (below 68°)	
Spawning	7 ppm and above
Growing and well-being	6 ppm and above
Warm-Water Organisms (including game fish such as bass, crappie) (above 68°)	
Growth and well-being	2-3 ppm and above

TEMPERATURE RANGES (APPROXIMATE) REQUIRED FOR GROWTH OF CERTAIN ORGANISMS:

Temperature		Examples of Life
Greater than 68° (warm water)		Much plant life, many fish diseases. (1) Most bass, crappie, bluegill, carp, catfish, caddis fly
Less than 68° (cold water)	Upper range (55-68)	Some plant life, some fish diseases. (1) Salmon, trout Stonefly, mayfly, caddis fly, water beetles, striders
	Lower range (Less than 55)	Trout, caddis fly, stonefly, mayfly

(1) Warm water does not necessarily insure fish diseases; they may be present and can be more abundant at higher temperatures than lower temperatures, but because a stream is warm doesn't mean it is disease-ridden.

Questions and discussion:

1. As a group, discuss the range of predictions.
2. What criteria did you use to arrive at your predictions?
3. How can we test our predictions?

VI. MEASURING AND RECORDING WATER CHARACTERISTICS TO TEST PREDICTIONS

Directions to group:

We can test the predictions we just made, using these kits (Hach O_2 pH Testing Kit or equivalent) (Open up kit. Mention that instructions are inside lid.)
There are lots of jobs to be done in testing (clipping, squirting, swirling, dipping, counting, reading, etc.), so make sure everyone in the group has a job to do.
Work in groups of 5-6 people each. Each group takes a kit. (Send groups to different parts of the stream.)

Note to Instructor: Not necessary to demonstrate the use of the kit. Let them do it. (This task could be taped somewhere on the water test kit.)

Task F (20-30 minutes) Work in groups of 4-6 people.
(This task could be taped somewhere on the water test kit.)

MAKE SURE EVERYONE IN YOUR GROUP GETS INVOLVED IN THE TESTING.
Using the water test kit, determine the water temperature, air temperature, dissolved oxygen count, and pH of the stream.
Record the data below: (also record predictions from Task E to compare)

Location of water sample (Edge or middle of stream)	Time Taken	Temperature				pH		Useable Oxygen (ppm)	
		Water		Air					
		My Pred.	Act Test	My Pred.	Act. Test	My Pred.	Act. Test	My Predic.	Act. Test

Questions and discussion:

Have each group report the results of their tests to the entire group. Compare results.

1. What might account for any differences in results from each group?

2. How did your test results compare with your predictions?
3. Is it necessary to have sophisticated equipment to determine temperature, oxygen, pH,etc.? (We could use our inferences made from the animals found in the stream.)
4. What can we say about the quality of the water in this stream?
5. What else would we need to know to decide whether or not to drink this water?
6. Under what conditions might we expect to get different test results than we did today?

VII. MEASURING STREAMFLOW (Use if investigation is being made along a stream.)

Questions and discussion:

1. What measurements do we need to know in order to determine the amount of water in this stream? (Discuss how to make different measurements.)
2. Predict the number of people who could live off the water in this stream._____

Task G (45 minutes)

DETERMINATION OF STREAMFLOW

Instructions for collecting and recording streamflow measurements.

a. Measure and mark a 100-foot distance along a straight section of your stream. If you can't find a 100' section, use 25' or 50'. Throw a stick (2 or 3 inches long) in the water above the upstream marker. Record the number of seconds it takes to float downstream between the markers. Record below. Now divide the 100' distance by the total seconds it took the stick to float between the stakes.

100 ft. ÷ _____ = _____ ft. per second
(distance) (total seconds) (no. of feet stick floated)
to float 100 ft. (each second)

b. Find the average width of your section of the stream. Measure the width of the stream at three places within the 100-foot area. Divide the total by three to get the average width of the stream.

First measurement_____feet
Second measurement_____feet
Third measurement_____feet

Total _____feet ÷ 3 = _____ft. (average width)

c. Find the average depth of your section of the stream. Measure the depth of the stream in at least three places across the stream in a straight line.
Divide the total by three to get the average depth of the stream.

First measurement_____feet
Second measurement_____feet
Third measurement_____feet

Total _____feet ÷ 3 = _____ft. (average depth)

Task G (continued) (45 minutes)

d. Find the cubic feet of water per second. Multiply the average width, average depth and the number of feet the stick floated each second.

_____ ft.	X	_____ ft.	X	_____	=	_____
Average Width		Average Depth		Number of Feet per Second		Cubic feet of water Flowing per Second

Note: A cubic foot of water is the water in a container one foot wide, one foot high and 1 foot long and contains 7.48 gallons.

In order to find out the number of people who could live from the water in this stream, complete the following calculations:

_____	X	7.48	=	_____
Stream flow in cu. ft. per sec.		Gallons in 1 cu. ft. of water		Gallons of water per second

_____	X	60	=	_____
Gallons per second		Sec. in minute		Gallons of water per minute

_____	X	1440	=	_____	÷	*200 Gals.	=	_____
Gallons of water per min.		No. minutes in a day		Total gallons water per day		Amount of water one person uses per day		Total no. people who could live from water in this st

*The average person uses about 200 gallons of water a day for home use. This does not reflect each person's share of water used for industrial, public services, and commercial.

Questions and discussions:

1. How many people in your community could live off the water in this stream?
2. What would happen to this environment if we piped all the water out of the stream at this point to your community?
3. If we were going to use this water, how much water should be left to flow downstream. Why?
4. Does this stream always have this amount of water in it? Why?
5. What are some problems you encountered during this task?

VII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES ABOUT WATER

Questions and discussion:

How important is this stream to us?

Task H (10-15 minutes) Work by yourself.

1. Describe in writing how you feel about man's effect on the aquatic environment at this site:

2. Describe at least one action you can take in your everyday life to help improve the way water is managed:

   a) in your home:_____

   b) in your community:_____

   c) in your consumer habits:_____

3. Describe the benefits of each action in #2.

SUMMARY QUESTIONS

1. What did you find out about water from our investigations today?
2. Why is water important to the ecosystem?
3. How can we summarize our discussions and investigations?
4. What methods and processes did we use in our investigations today?

Task I

Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

Identify the boundaries of the_____Creek watershed on the map provided.

Using the list of aquatic animals found and the water interpretation charts provided, predict the pH, temperature, and dissolved oxygen count of the stream.

Demonstrate the ability to test the above predictions using the water testing kit.

Measure the cubic feet of water per second flowing in the stream, and determine what size community of people could live off the water in the stream.

Describe three ways this stream is important to the surrounding environment.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe in writing how you feel about man's effect on the aquatic environment at this site.

Describe at least one action you can take in your everyday life to help improve the way water is managed:

a) in your home
b) in your community
c) in your consumer habits

Describe the benefits of each of the above actions.

EQUIPMENT NEEDED: (for a class of 30 people)

4 water testing kits (Hach Co. or equivalent)
4 thermometers
4 white dishpans
30 sets of lab sheets
30 jelly cups
30 hand lenses
15 Pond Life books (Golden Nature Guides)
30 maps of the area
4 50' or 100' tapes
4 screens (optional)
magic markers
chart paper

This lesson plan was developed for use in teacher workshops by:
Diane Brownfield, Milwaukie, Oregon
Jim Unterwegner, Randle, Washington
Charline McDonald, Portland, Oregon
Fred Olin, Port Orchard, Washin
Cliff Nelson, Seattle, Washingt

The lesson plan was revised slightly to fit Louisiana conditions. It is sugges by the writers that continuous revision take place by people who use the ideas.

LESSON PLAN OUTLINE FOR INVESTIGATING ENVIRONMENTAL HABITATS

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next four hours we will investigate several environmental habitats; infer how animals fit into food chains and energy cycle, and how they are important to the environment; record changes in habitats and discuss what we can do as citizens to improve the biological interactions in our environment. (You might want to read the behavioral objectives at end of lesson and refer to them as an evaluation of session.)

I. OBSERVING AND MEASURING ANIMAL SIGHTING AND EVIDENCES

Questions and discussion (10 minutes)

1. What animals would we expect to find living in this area? (vertebrate, invertebrate)
2. What are the needs of these animals?
3. What are some names of the places where animals live?
4. Where would you look for animals around here?
5. Describe and pass out TASK A and B cards.

Task A (30 minutes) Work in small groups

1. Explore as many places (environments or habitats) as you can from _____to_____, and record animals that you see or any evidence of animals. As you inventory the animals or their evidences, figure out some way of recording amounts of evidences and animals seen.

2. Look for the list evidence (signs) of animals (partly consumed foods, excrement, homes, bird nests, feather, etc.).

3. Observe and list different habitats for wildlife in area. (Grass, cultivated field, hedges, swamp, etc.).

4. Observe and list animal foods in area.

Task B (30 minutes) Work in small groups

Select three different habitats and compare the number of animal organisms and the characteristics in each.

Habitat I	Habitat II	Habitat III
Characteristics of Habitat I	Characteristics of Habitat II	Characteristics of Habitat III

Questions and discussion :

1. What animals did you find in each habitat?
2. Which habitat had the most animals? Why?
3. What were the characteristics of each habitat?
4. What could account for the differences and similarities of the habitats?
5. What factors made one habitat more desirable than another?
6. Pass out TASK C.

Task C (15 minutes)

Build a food pyramid showing the comparative amounts of animal and animal evidences seen.

Questions and discussion:(15 minutes)

1. What did you find?
2. How many habitats did you investigate?
3. Which animals around here have the largest habita., the smallest?
4. What was the largest group of animals found?
5. What do you think their main function in the environment might be?

Discuss terminology and definitions of herbivores, carnivores, omnivores, decomposers.

Pass out TASK D

Task D (10 minutes)

List the animals you have seen or their evidences in the appropriate places in this diagram. Put in arrows. What other words and ways can you think of to illustrate a similar cycle?

Light 

Plants

Nutrients

Herbivores (plant eaters)

Decomposers
(bacteria-fungus)

Death

Carnivores (meat eaters)

What would happen if one group were eliminated?
If_____group were eliminated, I think the following would happen:_____

Questions and discussion:(5 minutes)

1. What is the function of each part of the energy cycle?
2. What would happen if the decomposers were removed from this ecosystem?
3. How does the energy cycle relate to a food chain?
4. What is a food chain? (Who eats whom?)

Pass out Task E.

Task E (10 minutes)

Construct a 5-stage food chain using specific animals seen so far.

II. OBSERVING AND RECORDING CHANGES IN ANIMAL HABITATS

Questions and discussion:(10 minutes)

1. How did your food chain relate to the energy cycle in Task D?
2. What is difference between food chain and food web?
3. Look at your food chain and see if you can construct a web out of it.
4. What evidences of influences can you name that have affected this environment?

Pass out Task F

Task F (20 minutes

Describe in writing, three influences that you observed that have changed the habitats in this area, and the cause-and-effect relationships that occurred.
Consider:

a. Evidence of change; influence that made it.
b. What area probably looked like before change occurred, and animals that lived then.
c. What area looks like now, and animals that live here.
d. How the change affected the habitat, and animal species that did and do live here.

Questions and discussion:(10 minutes)

1. Have individuals read their descriptions, and compare different descriptions.

2. What evidences did you find that show man's influence in this area?

III. COMMUNICATING FEELINGS, AWARENESS AND VALUES ABOUT THE ENVIRONMENT

Task G (10 minutes)

Describe how you feel about man's effect on one animal habitat you observed.

Questions and discussion:

1. Discuss results of #G with group.
2. What are some things that man has done to affect the efficiency of the energy cycle?

Task H (15 minutes)

Describe in writing three things you can do in your everyday life to make the energy cycle more efficient and cause the least amount of harm to the ecosystem.

Select the one you think would be your best contribution. Describe the benefits of this action.

a. Where you live
b. In your consumer habits

Discuss results of Task H

Summary Questions:

1. What did we find out about animals in our field study session today?
2. Why are animals important in the ecosystem?
3. How can we summarize our investigations today?
4. What processes and methods did we use to find these things out?
5. Which of the behavioral outcomes did we accomplish in this session? (Read and discuss)

Task I

Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

Identify and describe six different animal habitats.

Construct a diagram of an energy cycle, using the evidences and sightings of animal life observed at the site.

Describe at least four cause-and-effect relationships of the role of the decomposers in the energy cycle.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES AND ACTIONS

Describe how you feel about man's effect on one animal habitat observed at the site.

Describe three things you can do in your everyday life to make the energy cycle more efficient, and cause the least amount of harm to the ecosystem where you live and in your consumer habitats.

This lesson plan was developed for use in teacher workshops by:
Pete hinds, Milwaukie, Oregon
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The lesson plan was revised to fit Louisiana conditions. It is suggested by the writers that continuous revision take place by people who use the ideas.

A LESSON PLAN FOR SOIL INVESTIGATIONS IN LAND USE PLANNING

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next four hours we will develop some skills and apply them to collecting and interpreting data about the soil environment and then apply that data to making some decisions about what the best uses of this land might be. (You might want to read the behavioral objectives at the end of the lesson and refer to them as an evaluation of the session.)

I. DESCRIBING SOIL

When you first meet the group, have them sit down and do Task A:

Task A (5 minutes) Work by yourself.

Write a description of soil (use your own words)
Keep this description for your own reference at the end of the session.

II. OBSERVING AND RECORDING THINGS IN THE SOIL

Distribute Task B cards and have class work in groups of 3 or 4 and report findings in 15 minutes.

Task B (15 minutes) Work in small groups.

1. Predict what things you will find in the top few inches of this forest floor. List your predictions.

2. Stake out an area 2 or 3 feet square on the forest floor and sift through the top three inches of the soil, recording the evidence of plants and animals you observe.

Name or Description of Item in the Soil	Quantity	Possible Effect on Soil

(Continued)

Task B - (continued)

3. The following three terms are used to describe organic matter at the top of the soil--litter, duff, humus. From your study, complete the following chart:

Term and definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter - compacted)		
Humus (almost completely decomposed non-identifiable organic matter)		

Questions and discussion:

1. What did you find?
2. When would you expect to find more organisms? Different organisms?
3. How do the organisms you found benefit the soil?
4. What are some reasons for odors in the soil?

III. DEVELOPING THE SKILLS TO COLLECT SOIL DATA

Questions and discussion:

1. Move group around to the soil profile.
2. What can we see as we look at this cross section or profile of soil?
3. What are some things that would be important to find out about it? (Accept all comments)

The observable characteristics of color, texture, structure, temperature and the acidity or alkalinity (pH) of a soil are indications of some soil conditions important in land use planning.

We are going to collect and record some of this information. For the next few minutes we will stay together as a group to develop skills in collecting soil data. After that, you will be working on your own.

Note to instructor: Quickly (10 minutes) go over the techniques for collecting the data with the participants. This instructional session is extremely import The participants will use the skills they develop in this session when they collect data for the micromonolith.

Examples: (not necessary to discuss in this order)

1. Soil layers (horizons)
   Mark where the soil changes color and looks. Many soils have three major layers or horizons; i.e., top soil, subsoil, and parent material. Because soil formation has many variables, you may find more or less. (Measure and record the depth of each major layer.)

2. Color
   Describe and record the texture of each major layer.
   (Have participants pick their own description of color.)

3. Texture (How the soil feels)
   Determine and record the texture of each major layer.

   Texture is determined by feel. Use these broad categories.
   Coarse - sand and loamy sand.
   Medium - loam, silt loam, silt, and sandy loam.
   Moderately fine - silty clay loam, clay loam, sandy clay loam.
   Fine - clay and silty clay.

   Soil samples should be moist, not wet. To estimate texture by feel, the following is recommended:

   1. Moisten a sample of soil the size of a marble. Use just enough water so that the sample has about the consistency of workable putty.
   2. Hold the sample between the thumb and forefinger. Then gradually press the thumb foward, forming the soil into a ribbon.
   3. If a ribbon forms easily and remains as a long flexible ribbon, the sample is probably clay or silty clay and would be termed fine in texture. Soils in this group are sticky and plastic.
   4. If a ribbon forms but breaks easily, barely sustaining its own weight, it is probably a clay loam or silty clay loam and would be termed moderately fine. Soils in this group are moderately sticky and plastic.
   5. If a ribbon is not formed, the sample is probably a loam, silt loam or sand. This would place it in either the coarse or medium grouping.
   6. The next thing is to decide if there is a predominance of either sand or silt. If there is a marked gritty feel and a lack of smoothness, sand likely predominates and the soil would be termed coarse.
   7. If there is a lack of gritty feel and there is a smooth talc-like feel, silt predominates and the soil would be a silt loam termed medium in texture.
   8. If there is a slightly gritty feel, yet fairly smooth, the soil is probably a loam and would also be included in the medium grouping.

Note: Have samples of sand, silt, and clay in cans. Have participants practice with these samples to find out what the textures feel like before determining textures of the soil profile.

4. Temperature
   Determine and record the temperature of each layer. Plant's growth depends upon soil temperatures during the growing season. Find out your growing season before lesson.

5. pH (acidity or alkalinity)
   Determine and record the pH of each major layer. Plants need many soil nutrients to grow well. The degree of pH affects how plants grow.

   Note to instructor: Dmonstrate how to use pH kit in front of whole group. Use some foreign material like cigar ashes. Mention not to compact the sample in the porcelain dish, use just enough pH reagent to saturate soil sample, match color at the edge of the soil sample and porcelain dish with pH color chart.

IV. CONSTRUCTING A SOIL MICROMONOLITH

We are going to use the skills we just developed to construct a soil micromonolith. (Explain: a micromonolith is a small cross section of this profile. You can make one by just sketching the layers on the profile sketch in Task C, or putting samples of each layer in a baby food jar, etc.)
Notice there is a place to check or record the data you collect, and a place to sketch what the soil looks like.

Task C (20-30 minutes) Work in small groups or by yourself.

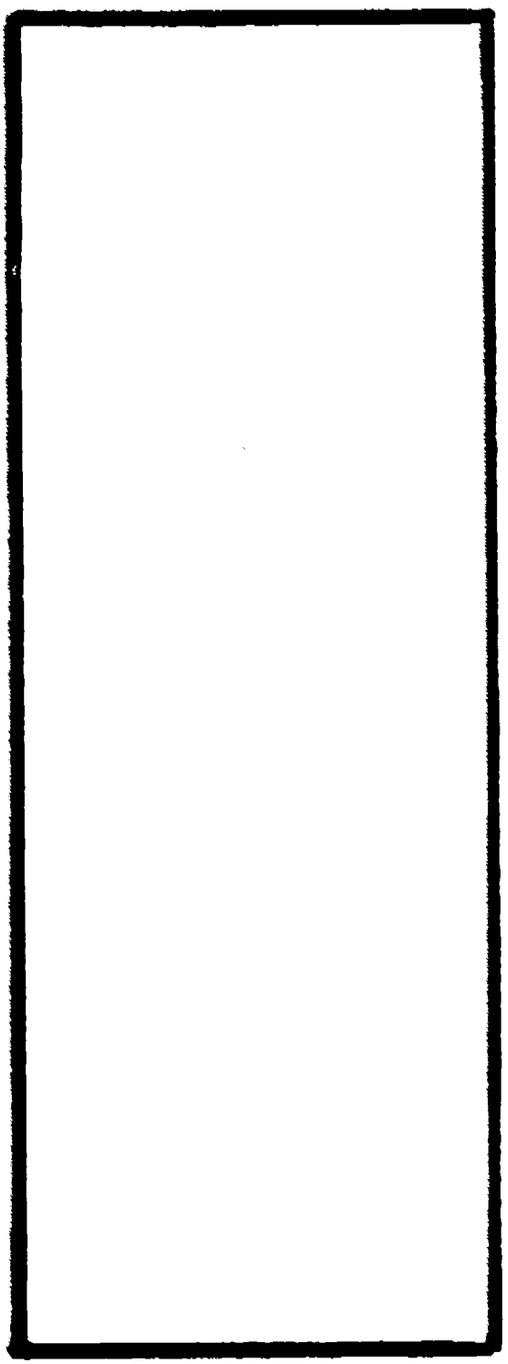
Using the skills you have just developed, and the available equipment, construct a soil micromonolith of this soil profile.
Record your observations on the soil micromonolith lab sheet.
You may want to make a micromonolith using the cards and jelly cups; if so, ask your instructor.

When finished with this task, report to the instructor to receive Task D.

Air temperature 3 ft. above soil surface	
Air temperature just above soil surface	

Sketch your soil profile, label the layers or horizons, and record the data.

PROFILE SKETCH



DATA

Contents of material above soil:_____

_____,Depth____" to____".

Topsoil: Depth____" to ____", Color____

Texture: Sand____, Silt____, Clay_____

Coarse____, Medium____, Med. Fine_____,

Fine____, pH____, Temp.____^{o}F

Plant Roots Visible_____.

Record below the same information above for the rest of the layers.

Describe type of rock in the bedrock (if present)_____

Task D (20-30 minutes) Work in small groups or by yourself.

Use the soil data you collected and the following tables to answer the following questions:

Effect of Soil Depth on Plant Growth and Water Storage

Deep Soil (over 43")	Excellent water storage and plant growth
Mod. Deep Soil (20"-42")	Good water storage and plant growth
Shallow Soil (20" and under)	Poor water storage and plant growth

The potential of my soil for water storage and plant growth is:
excellent_____good_____poor_____
Why?_____

Some Relationships of Color to Soil Conditions

Top Soil Condition	Dark (dark grey, brown to black)	Moderately Dark (dark brown to yellow-brown)	Light (Pale brown, to yellow)
Amount of organic material	Excellent	Good	Low
Available nitrogen	Excellent	Good	Low

Subsurface Soil Color (B Horizon)	Condition
Yellow, red-brown, brown	Well drained soils
Mottled grey	Somewhat poorly drained soils
Dull Grey	Poorly drained, or water-logged soils

a. What can you say about the amount of organic material based on the color of the top soil, or A horizon?

_____

b. What can you say about the drainage in the B horizon, based on color?

_____

c. What can you say about the water table based on color of B horizon?

_____

Task D - (continued)

Effect of texture on texture	Water-holding capacity	Looseness of soil
Coarse	Poor	Loose to very loose
Medium	Good to excellent	Good
Mod. Fine	Good to High	Good
Fine	High	Tight

My soil texture	Soil water-holding capacity	Looseness
Topsoil (A)		
Subsoil (B)		

1 — 4.5 — 6.5 — 7 — 8.5 — 14

(1 to 4.5 is too acid for most plants) (Most plants do best here) (8.5 to 14 is too alkaline for most plants)

Example of plants in pH range:
- pH 4.5 - 5.5: camellias, azaleas, ferns, broom sage
- pH 5.5 - 6.5: most forest trees, snapbeans, cotton, mustard, soybeans
- pH 6.5 - 7.5: clover

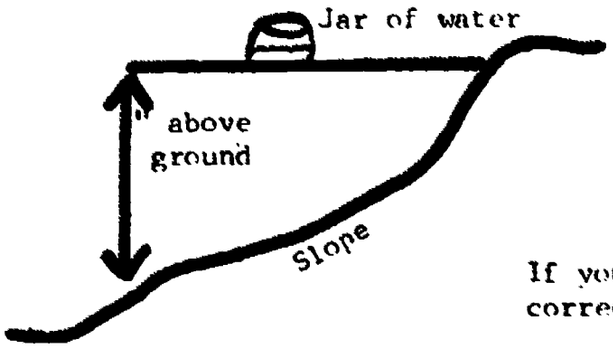
Using the pH ranges you recorded and the table, "Examples of Plants in pH Range," complete the following chart:

Some Plants That Could Grow Here Based on the pH and Chart	Some Plants Actually Observed Growing Here

Task E

Determining the Slope of the Land

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100" stick on the slope you want to measure. Hold outright to be about level.
3. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until level.
4. Measure the number of inches the free end of the stick is off the ground.
5. The number of inches is the slope of the land in percent.



If you use a different length stick, then correct by using the conversion table below.

Conversion Table

Length Stick Used	No. inches the end of the stick is above the ground		Multiply by conversion factor		% Land
100"	_____	X	1	=	
50"	_____	X	2	=	
25"	_____	X	4	=	

LAND USE CHART

This is a chart for soils in one kind of land, climate and plants. Other areas may require a different set of criteria.

Agricultural Uses	Slope	Erosion Hazard	Soil Depth	Drainage	Texture
Farm crops-cultivation good soil mngmt, practices	0-1%	None	Deep	Well drained	Loam or silt loam
Farm crops-few to several special cultivation practices	1-5%	Slight to moderate	Med. deep	Somewhat poor	Sandy loam or silty clay
Occasional cultivation many special practices	5-12%	Severe	Shallow	Poor	Sand or clay
Pasture, timber growing, woodland, wildlife, no cultivation machinery	12-30%	Very severe	Deep to shallow	Well to poor	Sandy, silty, clayey or rocky
Wildlife, recreation	All	None to extreme	Deep to shallow	Excessive to poor	All

The most limiting soil factor will determine the best agricultural use of the land.

Occupancy land uses by man

Man's valued uses of land have demanded criteria, in addition to agricultural uses, to determine proper management practices for living on the land. (Examples of others include: prescriptions for aesthetic management, soil site indexes for growing timber, criteria for greenbelt., etc.)

Some Uses & Factors Affecting Uses	Slight Limitation	Moderate Limitation	Severe Limitation
Roads and Streets			
Slopes	0-8%	8-15%	Over 15%
Depth	Over 40"	20-40"	Less than 20"
Drainage	Well	Somewhat	Poor
Building Sites			
Slopes	0-8%	8-15%	Over 15%
Depth	Over 40"	20-40"	Less than 20"
Drainage	Well	Somewhat	Poor
Septic Tank Filter Fields			
Slope	0-8%	8-15%	Over 15%
Depth	Over 6'	4-6'	Less than 4'
Drainage	Well	Somewhat	Poor

Some Uses and Factors Affecting Uses	Slight Limitation	Moderate Limitation	Severe limitation
Picnic and Camp Areas			
Slopes	0-8%	8-15%	Over 15%
Drainage	Well	Somewhat	Poor

Task F (20 minutes) Work in small groups.

Using the data from Task D, Task E, and the land-use chart, answer the following questions:

According to the agriculture and occupancy land-use charts, this land could be used for:

Agricultural use:
(list and explain why)

Occupancy: (yes or no and with what limitations)

Roads and streets

Building sites

Septic tank filter fields

Picnic and camp areas

I feel the best uses of this land would be: (justify your answer)

Questions and discussion:

1. How have you classified this land?
2. Based on your observations and the data you collected, do you feel this land is being properly used?
3. In your estimation, have man's activities affected the classification of this land?
4. Could man improve the capability of this area? How?
5. How could man reduce the capability of this area?

Task G (10 minutes) Work by yourself.

Using the words from the data you collected and recorded on the soil micromonolith card, write a description of the soil in your soil study. Compare the description with the one you wrote at the beginning of the session.

Questions and discussion:

1. What are some factors that contribute to soil formation?
2. What evidences of geological changes have you noticed in this area?
3. What other factors might affect uses of the land? (climate, growing season, needs of community, economic, past history of uses, etc.)

VII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES ABOUT SOIL

Task H (10 minutes)

Describe what you can do to improve the use of the soil: In your backyard
In your community

Ask for individual descriptions and have group discuss. Relate comments to questions after Task F.

What types of community action can we take to identify and help solve soil and land management problems in our community? How do these relate to zoning laws, planning commissions, local and state political discussion-making?

Take this data or processes of collecting data and identify a local land-use problem and develop a simulation game similar to the Center Place game. (See Lesson Plan Outline for an Environmental Land Use Simulation Game.)

SUMMARY QUESTIONS

1. What did we find out about the environment in our study today?
2. How are soil characteristics important in environmental management?
3. How can we summarize our discussions and investigations?
4. What processes and methods did we use in our investigation today?
5. Let's review the behavioral outcomes for this session to see if we achieved our objectives. (Read list and have group comment.)

(Point out that the evaluation and testing was built into the task-oriented jobs that demanded the learner to do something.) Distribute lesson plan outlines and other materials.

Task 1

Describe in writing how you feel about our session today. (Evaluation)

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

Describe 3 ways in which the living organisms in the top part of the soil affect the soil.

Construct a soil micromonolith of an assigned soil profile; determine and record texture, structure, pH, temperature, and color of each layer.

Construct a written description of a soil you studied, using the words you recorded about that soil on your micromonolith.

Demonstrate the ability to determine the best uses of the land in this area, using the data from your soil micromonolith and the land capability charts.

Describe three things that man does to determine the proper management of the soil resource.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe how you feel about man's effect on this soil environment.
Describe how you feel about man's effect on the soil environment where you live.

Describe what you can do to improve the use of the soil:
in your backyard:
in your community:

EQUIPMENT NEEDED: (for a class of 30 people)

6 La Motte soil pH kits	100 jelly cups and lids	3 staplers
30 micromonolith cards	3 soil thermometers	1 box staples
6 tape measures	2 #10 cans of water	2 shovels
30 sets of lab sheets	30 hand lenses	3 yardsticks
3 sticks (50" or 100" long)	3 baby food jars, ½-full of water	
labels to differentiate soil horizons		

This lesson plan was developed for use in teacher workshops by:
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Don Cannard, Vancouver, Washington
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The lesson plan was revised to fit Louisiana conditions. It is suggested by the writers that continuous revision take place by people who use the ideas.

LEADING CHILDREN IN THE OUT-OF-DOORS

Before going outside

Prepare yourself -

Have an objective.
Know the subject or activity you plan to use.
Be familiar with the area you will be using.

Prepare your students -

Create an objective. (What, Where, Why?)
Build anticipation.
Familiarize them with any skills needed.

During the outside activity

Keep students behind you when walking to activity site.

Use silent hand signals for control. (Raised hand for quiet, etc.)

Establish a base from which to operate.

Divide children into several small groups with individual assignments, if appropriate.

Be sure children understand what they are to do.

Use all senses.

Take advantage of unexpected opportunities.

Encourage discovery.

Relate activities to what children are familiar with.

Be spontaneous.

Set a time limit for activity. (Signal end of time with non-verbal signal such as a whistle.)

Watch the length .

Be prepared for surprises!

THE SCHOOL SITE

For the purpose of this manual, consider your school site to extend beyond the actual school property and the fence that may surround it. Think of the school site as including the immediate neighborhood and its many resources. Listed below are some of the more common areas and their resources that you may find near your school. Perhaps your site has other resources which will suit your needs even better than these. Use your imagination and ingenuity. The children know the area well. Ask them for suggestions.

1. School site

    a. Grass or lawn areas
    b. Blacktop areas
    c. Trees
    d. School buildings
    e. Storm gutter and fences
    f. Sidewalks
    g. Flower beds and bushes
    h. Litter

2. Nearby playground, field, vacant lot, or park

    a. Grass play area
    b. Landscaping
    c. Litter
    d. People

3. Neighborhood street

    a. Houses and yards
    b. Trees and grass parking strips
    c. Streets and sidewalks
    d. Gutters
    e. People

4. Business district

    a. Grocery store
    b. Drug store
    c. Service station
    d. People

5. Cemetery

   a. Grounds (grass, trees, roads, etc.)
   b. Headstones
   c. Wildlife

6. Overlook (view of city, lake, or other resource)

The activities listed in this manual have been chosen to fit the above type resources. In a few cases a particular type of resource is recommended, but for most activities you are free to choose the resource that you find most convenient or appropriate.

COMMUNICATIONS UNIT

Lesson Suggestions

The pre-site lesson might center on the many different kinds of communication: animal and human nonverbal communication; human languages, oral and written; and the great variety of invented languages (deaf-and-dumb sign languages, espionage codes, etc.). How are these varieties of communications similar? Why do we need to communicate? How does our environment communicate with us?

The outdoor lesson can be a look-and-listen research project, directing the students' attention to the many kinds of communication that are transpiring at the site. These should be nonverbal as well as verbal, animal as well as human, from nonliving as well as living objects.

Example:

> Discuss with the children how they learn by reading books, and suggest that they can "read" the book of the outdoors by using all of their senses. Then help them organize their experiences in relation to each of the senses.
>
> Have each child put headings on five small sheets of paper -- one for each of the five senses -- and allow time during an outdoor experience to jot down the learnings gained and communications received from each method of observation.
>
> Learning by tasting should be done under supervision. It may be eliminated entirely or suggested as something to do at home using familiar foods.
>
> Later, encourage the children to take time to insert descriptive words in their notes to tell more about their sensations. The record of the class may be combined on a chart or charts.
>
> This same activity can be tried at two different seasons and the results compared.
>
> The post-site lesson back in the classroom can explore the many factors that hinder good communication.

Questions for Student Discussion:

How many ways can one pick up environmental communications (seeing, hearing, touching, smelling, tasting)?

How many different feelings do the physical perceptions of the environment convey to the aware observer (pleasure, joy, thoughtfulness, fear, hope)?

How many different sounds can be heard on the site? Are they all the same? How are they different? How can they be identified? What emotions do they suggest?

Do inanimate (vegetable and mineral) objects in the environment communicate with us? How?

What danger signals can you read from the environment which tell you the land has been misused?

Practicing Listening

In activities outdoors, encourage the practice of good listening habits: attention, appropriate response, and readiness to ask pertinent questions.

Seek to provide a well-understood signal for beginning to listen (even little children can understand and respond to a raised-hand signal), surroundings that are conducive to listening, and a voice quality or volume of sound that everyone can hear.

On even a short trip in the outdoors, at least a few minutes can be well spent in just listening. One way to make the development of listening skill dramatic is to have the group of children stand with eyes and fists closed. Then a fist may be opened, one finger at a time, as sounds are heard.

Perhaps at first only one or two sounds will be heard in the brief period allowed; but as training in listening is continued, the children will develop the ability to hear more sounds in a very few minutes.

Discussion can lead to the limitation of sounds that are heard but not recognized. This, in turn, will lead to more alert listening and more personal interpretation of the sounds heard every day.

Describing Sounds in Writing

Have each child listen carefully to sounds in the outdoors. Then have him write in his own words the best phrase or short description that will convey to others what each sound is like to him and the impression it makes on him. He should strive to increase not only his awareness of sounds, but his power of communicating and intepreting --conveying a feeling or a mood as he describes the sound.

For example, a bird's call might impress him as "a shrill scream, warning of danger hiding in the mysterious green unknown, high above the floor of the forest." Or the bird's call might be "a brooding note of sadness echoing over the otherwise silent enchantment of the darkened woods."

Sounds may be twigs breaking under foot, the scurrying of small animals, rain, the movement of leaves in the wind, water trickling over rocks -- these and other sounds provide opportunities for practice in description.

Each child should come to recognize creative writing as writing that provides a vivid portrayal of impressions. It is writing that conveys a personal "coloring" and feeling that make others sense and feel and react in the way that the writer wishes them to.

Have the children compare their descriptions of sounds. Help them to note and to appreciate words or phrases that are especially effective in conveying impressions and feelings. And point out the differences in the impressions that the same sound may make on different people. Above all, lead the children to see that in gaining word power they are gaining power to transmit their thoughts and feelings to others and thus to influence the ideas and attitudes of other people.

Review the five senses. Find a natural item on or near the school grounds. Using the five senses, write a riddle describing the object. It may be a rhyme or prose.

Example: This object is about the size of a small child's fist. It feels something like a scouring sponge, but it smells better than that. It smells like warm straw, and crackles when I squeeze it by my ear. It's sort of a yellowish-green. I didn't want to taste it. What is it? A fir cone.

Taking a "Martian" Viewpoint

Have the children pretend that they are scientists from another planet who have just landed on earth. They are to try to describe an object (tree, shrub, flower) so that another scientist from their planet could identify the same object. However, they are not allowed to use the words that we commonly associate with such objects --trunk, stem, leaf, flower, root, bark, and so on. They are to substitute descriptive words or phrases such as "three Martians high," "flat like a sheet of metal," "slender as the antenna of our space ship."

After the children have finished their descriptions, have them exchange their papers within their group. Then let them try to find the object using their classmate's description. This can be done individually or as a group.

Communicate Feelings of Awareness and Values Through Writing (Cinquain)

While outside on the school site, or after a trip outside, ask children to describe a particular object in the following manner:

Write two descriptive words about the object
(Words that tell what it looks like)

Write three action words about the object
(Words that describe processes or changes taking place, or things happening to it)

Write a short phrase (4-5 words) that tells how it affects the rest of the environment. (A phrase to describe its value or usefulness or a phrase describing any thought you have about it)

Write one word that sums up everything about the object
(A word that suggests a comparison, an analogy, or a synonym)

Optional:
Now, if you wish, go back and give a title to what you have written.

Congratulations. You have just written a cinquain (five-line poem).

Note: Pace the above directions to the needs of the group. People shouldn't feel pressure while writing this --be casual. (It's good to mention that they may not wish to write something for every direction that is given.) Review the directions now and later for those who are still thinking.

Have people read their Cinquains if they wish.

Questions to think about: In what ways does this description show your feelings and awareness of the environment?

Making Labels for a Nature Trail

A temporary nature trail on your school site, with descriptive trail labels written by individuals who have traveled the trail, might be marked out with a series of two-sentence or three-sentence descriptions of interesting sights. Each description could be mounted on cardboard and attached to the object for the people following the trail to read.

Using "Living Labels" to Mark Trails

If the class needs oral language experience, each child might be a "living label" for a tree or some other object and be stationed near it to give oral information about it when asked. Another class, as guests, could be divided into small groups to stop with their guide to "read" each label.

Listening and Classifying Descriptive Words

List five or six adjectives that might apply to objects seen, heard, smelled, felt, or tasted. Have the children copy the list and use it as a basis for discoveries of natural objects found on the school site to which the adjectives would apply.

A combined list of the objects to which each adjective might be applied could be made. For example:

Soft -- moss, dandelion "parachutes," fog, piles of clouds, steps of an ant.

Rough -- elm bark, gravel road, wind, chatter of a squirrel

Sharp -- wood smoke, pointed grass, blue jay's scream, locust tree thorn

Interpreting Sounds in Your Environment

Listening to and interpreting the variety of animal and human sounds will help to accustom children to noticing the various moods expressed in music.

Have the children answer questions such as the following: Is the wren's song a happy one? Why do you think so? How does it differ from the warning cry of the blue jay? Why is the chatter of a squirrel or a chipmunk often called "scolding"? How do the soft sounds that birds make at twilight differ from their hungry twitterings?

Encourage the children to listen for other sounds of living creatures and to try to interpret the mood and feeling being expressed.

Noun Treasure Hunt or "Thing" Hunt

Provide children with a small bag. Let them find as many "nouns" around the school grounds as they can in a certain amount of time. Tell a story about one of the nouns.

Seeing Likenesses

Use the child's interest in pretty leaves to help him gain readiness for reading. For the less mature children, matching leaves of quite different colors may be a step in readiness. Other children can be taught to see the likenesses and differences in shapes.

On a walk near the school, have each child in the group collect two (later three or four) different leaves (elm and maple, for example). Play a game of "Simon Says" in which the leader holds up one leaf and calls, "Simon says, 'Hold up a leaf like this.'"

Later, children will be ready to note that the leaves of a tree are of similar shape, but of many sizes. The matching may then include two things to think about -- a large (or small) leaf that looks like a certain small (or large) one.

GENERAL SCIENCE

Blacktop Activities

Wildlife:

1. Look for insects that live on the blacktop.
2. Look for insects that visit the blacktop.
3. Look for evidence that indicates other animals or birds have been here.
4. Place food in certain areas on the blacktop and check the next day.

Plant:

1. Look for evidence of plant life.
2. Discuss what will happen as blacktop gets older if you only have new blacktop. If there is an old blacktop area, compare the new with the old.

Charting "Regions" on a School Map

The school grounds may provide several different kinds of "regions" in miniature -- areas covered with grass and vegetation; dry, rough, grassless areas on a playground; sections of moist earth always in the shade; and other regions. Have the children sketch a map of the school grounds to show the areas that are similar to forests, prairies, arid land, cultivated land, moist land, and other special regions.

Studying Rocks

Have each child find a rock and discover as many things about it as he can from observation. Is it round or flat, rough or smooth, composed of more than one kind of material, grainy or full of crystals, similar to or different from the other rocks with which it was found? Reports and discussions can follow the observations.

An interesting game might be played by the group in connection with this rock study. One child might start to describe his rock. All others who think they have similar rocks could raise their hands and keep them raised as long as the description being given fits their rocks. At the end of the description, the rocks of those children whose hands are still raised could be compared.

Making Simple Rock Groupings

An exact scientific identification of rocks would be very difficult for children. However, children can gain some valuable experience through grouping rocks by simple characteristics. Keen observation of rock characteristics should be encouraged.

Notes may be written by each child, comparisons may be made, and a class list may be worked out for reference in sorting and grouping rocks. Some or all of the following rock characteristics may be helpful as items for this list. (The items at the bottom of the list should be used only with older children.)

Color
Shape
Texture (grainy or smooth)
Material (mixed or uniform)
Weight (heavy or light)
Durability (hard or soft, firm or crumbly)
Structure (layered or layerless)
Chemical action (acid or base)
Deductions (Example: The rock was probably rounded by water action in a stream.)

As rocks are collected and examined, they can be divided into groups; first, according to one of the characteristics in the list just given; then further divisions of the rocks can be made as one after another of the listed characteristics is considered. The final groupings should contain rocks having very similar characteristics.

Watching the Work of Insects

Many insects are strong and energetic, and watching them at work can hold the attention of children for long periods. In an outdoor activity, each child should find an insect or a spider (spiders are not insects) and, without disturbing it, take notes on its activities. Where did it come from? Where is it going? Does it have work to do? How fast does it move? Can it be turned from its path or distracted from its purpose? (Sticks or other objects should be used here -- not fingers.) Do any insects work and eat at the same time? If so, what do they eat?

Sound Recognition

How many different sounds can you "tune-in" in one minute? Have children remain absolutely silent. The challenge is to distinguish one sound from another. Naming of animals is not as important as the recognition of their different sounds.

The Best Outdoorsman

The group sits in a semicircle. In turn, each person mentions something he can see or hear or smell or feel from where he is sitting -- daisy, dandelion, grass, maple tree, dead oak leaf, ant, blue sky, clouds, smoke, fly, bird singing, flying insect, tree branch creaking, etc. No one can repeat what another has said. If he does repeat or cannot think of anything, he moves back of the semicircle. The one who stays in the game the longest is the Best Outdoorsman.

Root Structures

Pull some weeds from dry and moist sites. Examine and compare root structures. Weeds growing close together will show interlocking of roots.

Leaf Classification

Take leaves back to the classroom to classify.
For best results, have students put all leaves into two groups on some basis. Then ask them to break each of the two groups into two subgroups on some basis. Continue in this fashion. As a sharing activity, students could describe their leaves with words while the class tries to pick which it is.

Leaf Pores

Spread vaseline over surface of one leaf on a plant. Examine at intervals to note what happens when leaf pores are closed to air.

Soil is Alive!

Measure off an area one-foot square and collect the soil to a depth of two or three inches. Do this at several different sites. Put the soil on light-colored oilcloth. Use hand lens to locate and observe organisms. Record findings and compare which soil was richest in life. Why?

Plant Diversity

Understanding: There are many kinds of plants; these plants differ in their color, texture, shape, size, and structural parts.

Rationale: Consider just the plants found on your school ground, such as mosses, ferns, flowering plants, shrubs, trees.

Instructional Procedures:

1. Ask the children to bring a plant (no previous discussion). Teacher provides a "whole" plant whose parts are easily seen. Discuss and label parts: roots, stems, leaves, flowers, seeds.

2. Look for these parts in the plants found on the school ground. Which parts are easily seen? Which are not?

3. Use a hula hoop or mark off a small area with a jump rope. Have children count the several kinds of plants within that designated area.

4. Compare and contrast the leaves, stems, flowers, and seeds of several different plants.

5. Compare and contrast the sizes of several different plants; find the tallest plant, the smallest or shortest, those that are the same size.

6. Play Feel It. Place several parts of several different plants in a drawstring bag or pass these objects to a circle of children seated with eyes closed and hands behind their backs. Encourage the children to identify the part just by feeling. Specimens to use might include: Mullein leaf, staghorn sumac twig, apple, nuts, seed pods, fir cone, fir branch, a flower, roots of dandelion, etc.

THE 'DANDY LYIN'" IN THE SIDEWALK CRACK

Understanding: A dandelion, a typical plant, is adapted for successful life in its surroundings.

Rationale: The common dandelion can be used for a most fascinating study of adaptations for survival. The abundance of this plant and its long growing season make it an ideal plant for children to study. They will be surprised to learn that one dandelion is really a "bouquet" of flowers.

Objectives: When the student has completed this lesson, he should be able to perform the following tasks:

1. To point out on a diagram (young students) or to label on a diagram (older children) the following parts of a dandelion: Flower cluster, single flower, stigma, braces, root, stem, and leaf.

2. To draw and tell (young children) or to write an explanation (older students) of how the dandelion has adapted for these things: food storage, absorption of sunlight, cross-pollinization, protection from enemies, and insurance of survival of some of its young.

3. To apply what he knows about dandelion parts and adaptations in making generalizations, based on direct observations, about other flowering plants.

Instructional Procedures --Resources:

1. Roots are strong and well-stored with food.

   a. Try to pull plant up. The root anchors it in place.
   b. Dig root out and note fleshy root somewhat like a carrot or parsnip. Food is stored in the root. It is this stored food that the plant uses to get such an early start in the spring. Often it blooms in the winter if in a sheltered spot. Dandelions seem determined to get their young established before the competition with other plants becomes keen.

2. Leaves cuddle together for warmth -- they are arranged to get plenty of needed sunshine for growth.

   a. Observe how leaves are arranged. They appear in a rosette, lying close to the ground. Thus they prevent loss of heat and keep warm enough to do their work even when the air is so chilly most other plants are inactive.

b. Observe how the leaves are shaped to obtain ample sunlight. They appear to spring from the top of the root, but really begin from a very short stem. They radiate from this point so their tips form a circle. Broad leaves in such an arrangement would overlap and cut each other off from essential sunlight. The dandelion leaves are narrowly shaped wedges, tapering toward the stem. Even so they would get in each other's way if the margins of the leaves were not cut deeply into jagged lobes. In this way light gets down between the upper leaves to the lower ones. The lobes have an outline somewhat like that of the teeth on a lion's jaw, hence the French name dent de lion, the tooth of a lion.

3. In sunshiny weather the dandelion holds its matured blossoms high and advertises for insect visitors to insure cross-pollination.

a. Break apart a dandelion blossom and remove the smallest strap. This is one complete flower. What you first picked was really a dandelion cluster.

b. Find these parts:

1) Test your eyesight -- how many "teeth" are there on the end of the strap? This number indicates how many petals the ancestral dandelion had.
2) Find the two "horns" at the top of the flower. These are the stigmas which catch the pollen brought from other dandelion clusters by insects.
3) Just below the stigmas is a collar of stamens. Use a hand lens to count them. There are ten. Touch the stamens with your fingers and you'll discover where the insects get their pollen.
4) Examine the green things on the outside of the blossom. These are called bracts.

The heads, while the blossoms are maturing lie hidden in the grass -- each at the end of its hollow stalk. Then some sunny morning each head is carried up as its stem is erected, the protecting bracts curl back and the dandelion cluster advertises for insect visitors. Let clouds come and threaten rain, and the clusters close up again and are carried by the movements of the stems down into the protection of the grass. The pollen might be washed off by the pelting rain. Besides, insects are not visiting but are themselves hiding from the shower.

After pollination has been accomplished and the fruits are forming, the cluster closes, resumes its recumbent position, and remains close to the ground until the fruits are mature. Then it rises again, the bracts curl back, and the cluster of fruits appears as the familiar blowball.

c. Single out several plants to observe through this period of development.

d. Use a camera to record these events and display photographs on a bulletin board.

4. The bitter taste of a dandelion protects it from being eaten by browsing animals and insects.

Besides the bitter taste, the sticky, milky juice gums up the jaws of such creatures.

Make some rubber: Place some of the milk from the root on your thumb. The milk is called lactic acid and is like the lactic secretion from the rubber tree. Now rub the sticky lactic acid with your forefinger and you will soon have some black rubber that is elastic.

5. A dandelion's stem is strong and capable of varied movements.

Pick a stem, split it slightly at one end, and continue to split it as the several portions curl tightly. The long fibers of the stem that strengthen it would all curl up if each one were not opposed by its opposite fellow. The stem is thus braced by these paired springs. With a minimum of weight and hollow so as to conserve building material, a dandelion's stem is strong, yet capable of considerable movement.

6. Each dandelion fruit has a "balloon" for sailing and a "grappling hook" for fastening itself where it can grow -- wide dispersal is thus insured.

a. Take the oldest seed you can find. Let it float in the air. Which part of the parachute hits the ground first?

b. Examine another seed. Which end has hooks? Look again. Which way do these hooks point? How would this help insure the "planting" of the seed?

c. Why are there so many seeds in one cluster? Who might feed upon them. What are the dandelion's competitors? Will all seeds land on a site suitable for growth?

Competency Measure: Plan a bulletin board of photographs, drawings, and diagrams telling the story of the growth and development of a dandelion.

Plan a time for conducting a review as indicated in Objectives 1 and 2.

Locate other flowering plants on or near the school site. Have children identify plant parts and investigate their adaptations for survival. By referring often to what they already know about the dandelion, the teacher can guide their discoveries.

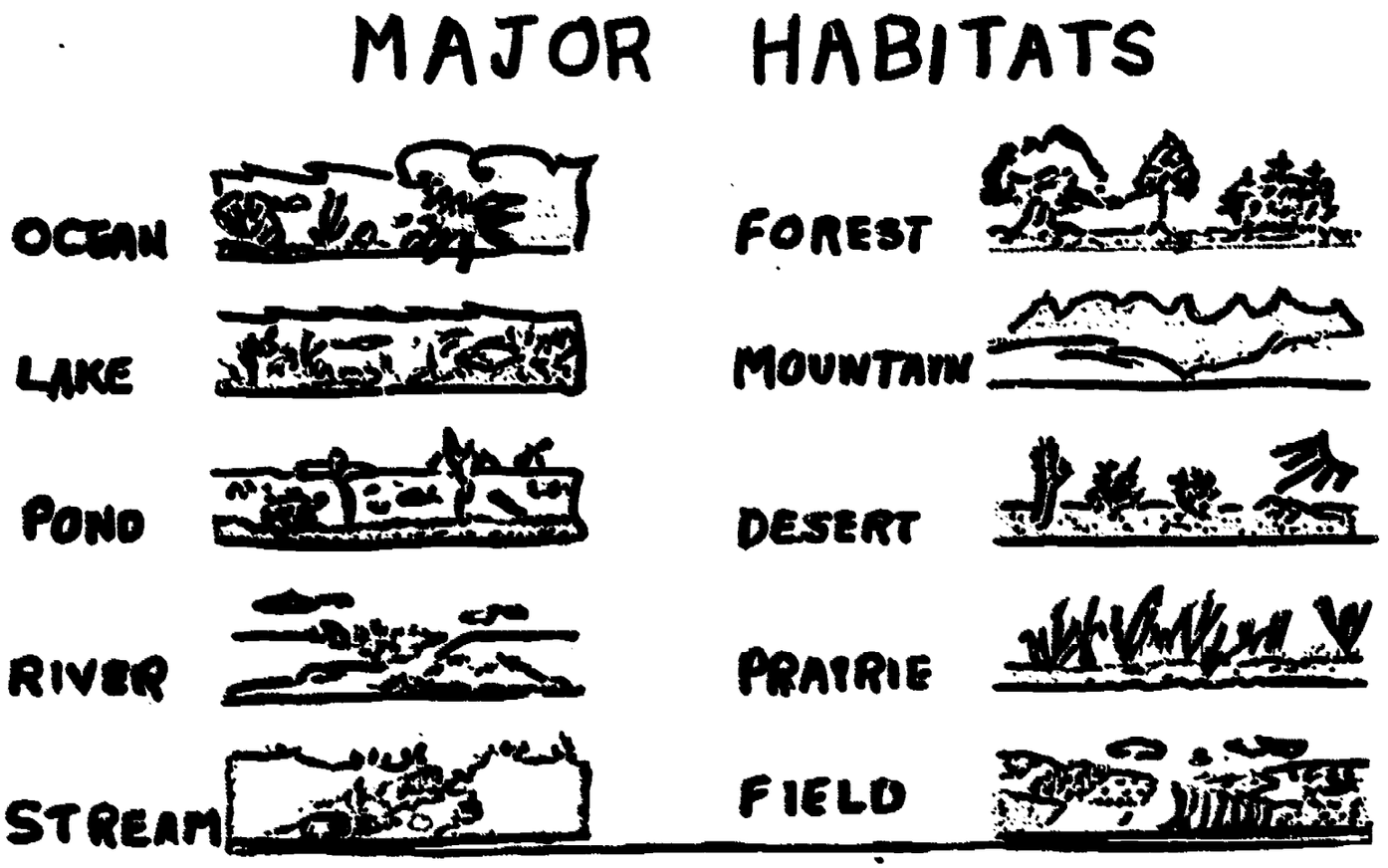
Elementary Environmental Studies Curriculum Committee, Vancouver Public Schools, District No. 37. Environmental Education Curriculum Guide K-6. 1970.

HABITAT STUDIES

Habitat might be explained as the home environment of living things. Habitats are of many forms such as deserts, oceans, rivers, lakes, marshes, grasslands, forests and swamps. Within each of these are many sub-forms. Among the major components of habitat are factors such as water, weather, climate and land composition.

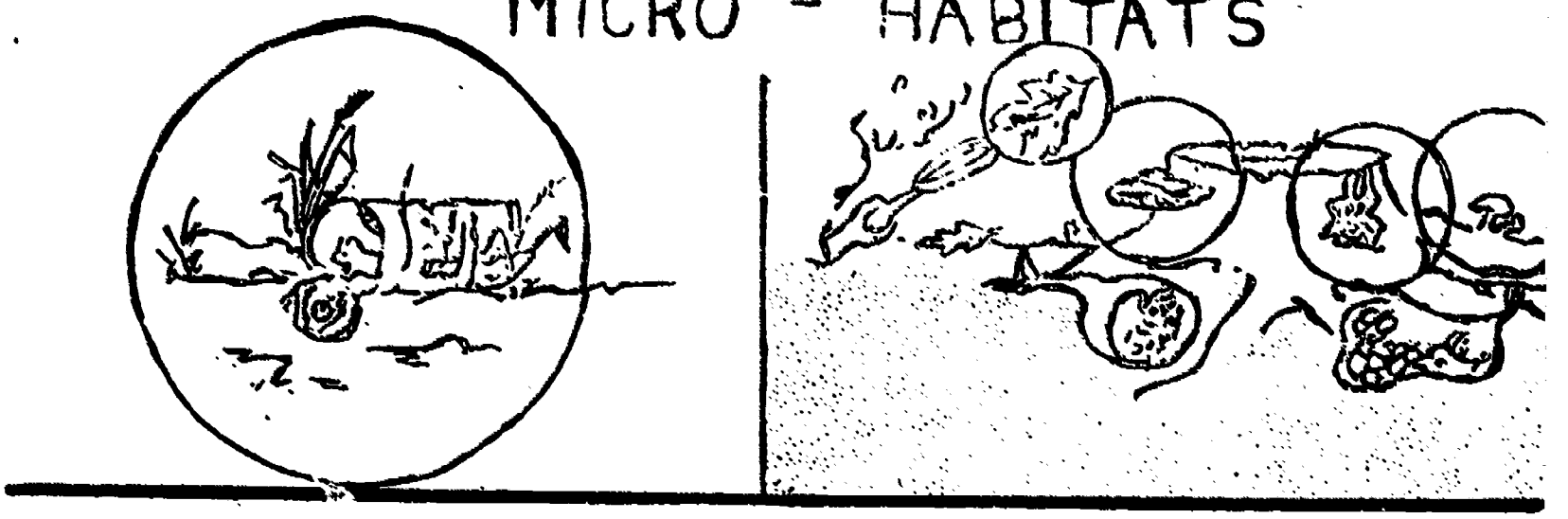
Habitat is an important concept in ecological studies for living things adapt to one or more habitat forms. If their habitat is disturbed, the inter-relationships of the organisms dwelling there are disturbed, and the ensuing "ripple" effect can have long-range implications extending far beyond the affected area. Man is a notorious habitat disrupter who is affecting the earth to such an extent that he is endangering his own existence.

Lake Erie is becoming a biologically dead lake largely because of pollution. Oil seepage has destroyed marine life along miles of the California coast and years may pass before it returns to its former balance. Pollution of the air in cities appears to be destroying many forms of life in that habitat. Air pollution is becoming so great that the change in the earth's total atmosphere may affect living things for centuries to come.



Modern farming practices have created other changes. Forms of life have been endangered by the use of the great prairies of the Midwest. Pesticides have been developed and used on certain "pests" in order to protect agricultural crops Often many of the natural predators of these pests have also been destroyed in the process, thus creating demands for more chemicals for control. This has affected many other forms of life -- birds, fish, insects, mammals, etc. Because such problems persist and continue to increase in importance, the need for children to study ecological implications and to gain more knowledge about habitat increases.

Look around the school and nearby community. Find different types of habitats. Types of "micro-habitats" on most school sites include blacktop, concrete and gravel areas, grass, exposed soil, ditches, shrubs, flowers, trees, etc. Examine the kinds of life found in each area. Are some types of life found in several of these micro habitats? After exploring the readily visible areas, look below the surface to find other forms (parts of plants, worms, insects, etc.). Place a sheet of newspaper under the branches of shrubs and trees and shake to see what drops off. Examine the cracks of concrete and blacktop surfaces, and bark and leaves of trees and other plants to see what lives there.



In areas having major habitat formations, such as forests and fields, develop the concept of "edge." Edge areas contain evidence of life that can subsist in either habitat, or both. Edge areas actually are an additional form of habitat with their own unique forms of life.

Take a small area (square foot and/or square yard) and disturb it to learn what happens over a period of a few days, weeks or months. Does it return to its original state or does it undergo a significant change that appears to be permanent?

Weather studies should also be included when examining habitats. Note differences in temperature and light intensity in various areas. Where are the cooler spots, the warmer spots, and so on? At what temperature and moisture ranges do you observe the greatest plant growth or amount of animal activity?

There are many exciting activities that stem from habitat studies. Taking children outside to examine habitats is one way to develop greater understanding of our world and man's role in destroying or improving the quality of his own habitat.

WILDLIFE -- PROVIDING SUITABLE ENVIRONMENT

Concept: Living things will reproduce themselves and develop in a given environment.

Purpose of Lesson: To help students understand how the environment affects the wildlife population of the area.

Introducing the Concept: Prior to going outside, discuss with the students the importance of food and cover to animals. Show the importance of food and cover to birds, and benefits they can get from soil and water conservation measures.

Developing the Concept: Take pupils on a walk through the school site and immediate neighborhood, park or cemetery. Stop at areas that provide good habitat for wildlife. Students will not be able to actually see much of the wildlife but they are encouraged to look for signs of the existence of certain wildlife in the area. Why do certain areas have more wildlife than others? The teacher acts as a guide, by asking questions such as:

1. What are the environmental factors existing in one area but not in another that encourage wildlife?

2. What environmental factor discourages wildlife? Why?

3. What evidence do we find that wildlife lives here? (Nest, burroughs, wastes, tracks, empty shells, furs, bones.)

Extending the Concept: During the lesson, pupils have been asked to observe different environments and the extent of the existence of wildlife in these areas. They are asked:

1. What are some factors that influence the environment that are controlled by nature? By man?

2. What are some things that can be done to improve the environment by nature? By man?

3. Who has the responsibility to see that this is done?

4. What is the responsibility of the citizen in wildlife conservation?

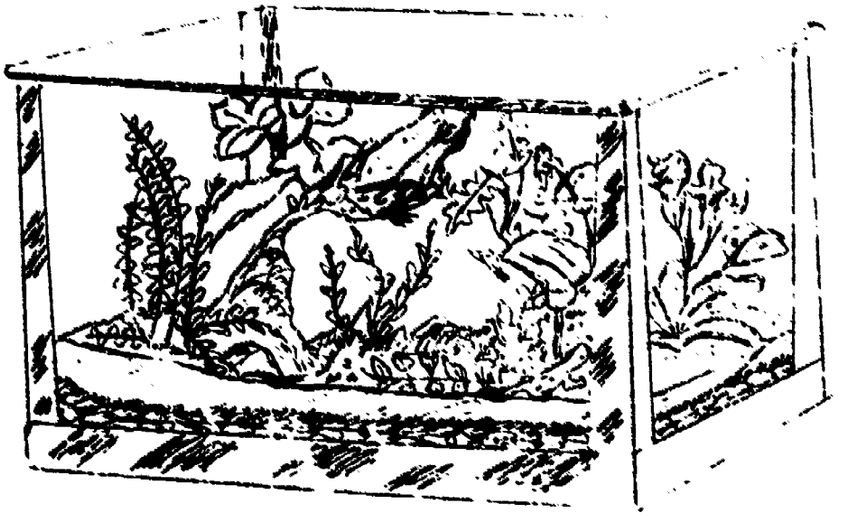
5. What is the effect of industrialization of the country on wildlife?

6. How does the rapid growth of our country with respect to housing developments and superhighways affect wildlife in this country?

Fixing the Concept: The class discusses what needs to be done to help provide habitat for wildlife. Topics for discussion may be:

1. What city, state, or other officials can do to help provide for wildlife.

2. What you can do at school and at home to conserve wildlife.



BUILDING AND USING A
CLASSROOM TERRARIUM

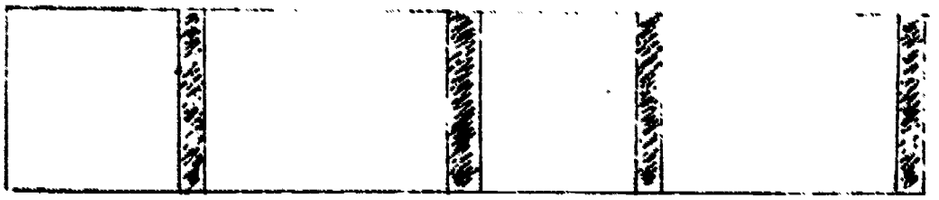
Using a terrarium or "garden under glass" in your classroom can be an exciting and enriching experience for both you and your students. The discoveries and learning experiences resulting from the use of a classroom terrarium will enrich your regular indoor activities as well as provide a bit of nature in your classroom during the lean months between October and April.

A terrarium is a minature habitat. It displays living plants and animals typical of one environment and provides the opportunity to observe adaptations and interrelationships existing among some of the living things that make up a natural habitat. Conservation of moisture, protection against sudden changes in temperature, and provision for light are the basic principles of a terrarium. The plants thrive because the water that transpires from their leaves and evaporates from the soil condenses and keeps the moisture content constant.

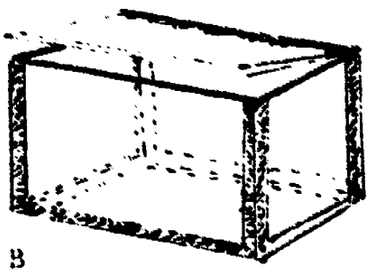
Almost any glass or clear plastic container that can be made fairly air-tight can be converted into a terrarium. Size can vary from a tiny jar or plastic cocktail glass to a three-or four-foot commercial terrarium. Probably the most satisfactory container for terraria are straight-sided tanks such as are used for aquaria. The rectangular tanks are easy to plant and to care for; they provide sufficient air space; and they permit an undistorted view of the plants inside.

Simple, inexpensive containers may be constructed in the school room by using panes of single strength window glass taped together to form a glass box. The simplest type would be an all glass container constructed as shown in diagrams A and B. A more substantial container can be made by taping the glass panels together at the ends and then setting the glass

sides into plaster of Paris in a baking pan as shown in diagrams A and C.



A



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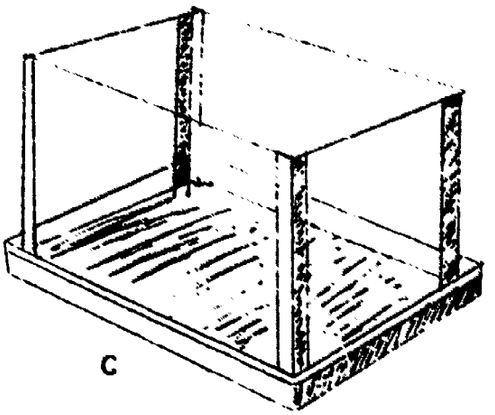


C

Have two pieces of glass cut so that they fit the long dimension of the bottom of the pan by 10 inches high. Then have two shorter pieces cut to fit between the long pieces, and also 10 inches high; locate them one at each end of the pan. (These two shorter pieces will be substantially equal to the width of the bottom of the pan minus twice the thickness of the glass used.) Make a rectangle by taping the four pieces of glass at the corners. Fill the pan two-thirds full of plaster of Paris and put in the rectangle of taped glass. Allow the plaster to harden. For a cover use a piece of glass slightly larger than the opening so that it will not fall in and damage the plants and animals. Place tape on all exposed edges of glass, including cover.

With the container secured, you are ready for the satisfying job of planting. You have a choice of many different habitats, depending upon your location and interests. You may choose a woodland habitat, a desert habitat, or even a cultivated garden habitat. Whichever type

or habitat you choose, the soil preparation is basically the same. Begin by placing a two-inch layer of gravel or pebbles in the bottom for drainage. Mix in a bit of charcoal if you like to keep the terrarium "sweet." On top of this put a couple of inches of slightly dampened soil. Then put in the plants that your students have chosen, arranging them in a pleasing, natural manner, with the taller plants at the back.

After your terrarium is planted, moderately wet the soil and clean the inside glass. Then cover it with the sheet of glass to prevent evaporation and to preserve a more even temperature. The cover should fit loosely enough to allow air to circulate. Your terrarium will do best if kept in a cool place in good light but not direct sunlight. If much condensation appears on the glass in the morning, lift the cover for an hour or two. However, if the plants begin to look dry and little condensation appears, the garden needs a light spraying.

There are some special ways that you can help your students develop a deeper awareness of their environment, using the classroom terrarium. A few are listed below. You or your students may think of many others.

GRAB-BAG TERRARIUM

If it is wintertime when you decide to build the terrarium, do not be discouraged because there are no plants growing at that time. Build the glass box anyway and fill it with sand, charcoal, and soil.

Then with a flat spade or shovel, find a place that looks like it may have seeds or dormant plants in the soil. A weed patch would be fine. Carefully dig up a section of soil slightly smaller than the terrarium and about an inch deep. Carefully place the soil in the terrarium, disturbing it as little as possible. Sprinkle a little water on the soil from time to time. Plants will begin to grow. Keep the top on, though, and watch for worms and insects as well as plants. You cannot tell what will be in the soil. This type of terrarium may be more interesting than one in which you have handpicked the plants.

COMMUNITY STUDY

This terrarium project provides an opportunity to study the various soil communities found around your school site and to observe the interrelationships between soil, plants, animals, and man. Cover the bottom of your terrarium with one inch of gravel. Place on top of this a three-inch-thick sod of grass cut to the size of the terrarium. Make every effort to keep the sod intact while putting it in.

Sprinkle it thoroughly with water. Cover and keep it in semishade in a fairly cool spot. See what develops. You will discover much animal life, in addition to plant life, in your survey terrarium. Keep a record of the insects -- centipedes, spiders, mites, and others -- that may emerge.

record any relationships that you observe. Try altering the environment and record what happens.

INDIVIDUAL TERRARIUM

An especially popular terrarium project involves using clear plastic glasses as individual terrariums. The glasses are available from most bar supply companies. The 14-oz. size works best and only costs about six cents each. Besides the glasses, you will need some small gravel, charcoal (briquettes would work fine if crushed), plastic wrap, and rubber bands.

Have the students place about one-half inch of gravel in the bottom of the glass. A few small pieces of charcoal may be added next. Then each child should obtain a small amount of soil (about one to two inches in the glass) and place it on top of the gravel and charcoal.

The next step is for each child to select two or three small plants or weeds and carefully transplant them into his terrarium, making sure that he gets the plant's roots as well as the plant. A stone, piece of wood, or small clump of moss may be added for effect. The student may also add a small insect, such as an ant, if he wishes. After the terrarium is completed, it should be moderately watered, but not soaked.

The final step is to cover the glass with clear plastic wrap, fastening the wrap against the sides by placing a rubber band around the glass. The terrarium should be marked with the child's name and then placed in a cool, semi-lighted area. They should not be in direct sunlight. The children will become deeply involved in the project as the plants in their terrariums either thrive or die. The differences in results will lead to many stimulating discussions. This will be especially true if each child keeps records of what and how much of each item he puts into his terrarium and its day-to-day development.

For variety, you might try making two identical terrariums and before sealing them put some sort of pollution in one (auto exhaust, oil, insecticide, etc.) and then record any differences you notice. You might also try poking a hole in the plastic cover of one terrarium and leaving the other sealed. Record differences, if any.

SOIL COMMUNITIES

Write down your description of "soil."

Choose one of the following types of areas on or near your school site, or you may find a type that is not listed.

( ) Flower bed (with thick growth)
( ) Flower bed (open)
( ) Lawn (out in open)
( ) Lawn (under tree)
( ) Sidewalk with large cracks
( ) Soil with board or other cover
( ) Dirt pathway
( ) Blacktop with large cracks
( ) Soil with weeds
( )
( )
( )

Take an ordinary coat hanger and bend it into a circle. Place this wire circle on the ground in the area you have chosen. The area inside the circle is your study plot for this exercise.

Make the following observations in your study area.

Observe and record the kinds of plants in your study area. (Include evidence of plants.)

DESCRIPTION	SIZE	ALIVE	DEAD	WHERE FOUND	FEW	MANY	

Do the same for animals and evidence of animals.

DESCRIPTION	NUMBER	WHERE FOUND	WHAT IS IT DOING

Dig down into the soil two or three inches and sift through it. Place a few handfuls on a piece of white paper and examine it using a hand lens. Add any plants or animals you find to the above chart.

How does the soil feel? (Texture)

Describe the smell.

What color is the soil?

Determine and record the pH.

Soil temperature at depth of two to three inches._____

Air temperature just above soil surface. _____

Air temperature three feet above soil surface _____

Using the data you have recorded from your observations, and the information on the last page of this exercise, write a description of the soil in your study plot.

Compare this description with the one you wrote at the beginning of the session.

Describe what you think it would be like to be a tiny insect living in the soil community (3" above to 3" below soil surface) you have just studied.

What similarities do you see between this small community and the community that you live in?

What new understanding or concepts might your students receive from an activity such as this?

The information on this page will help you interpret the data collected from this activity.

SOIL COLOR

Soil Surface Color A Horizon	Amount of Organic Material	Erosion Factor	Aeration	Available Nitrogen	Fertility
Dark (dark grey, greyish brown to black)	Excellent	Low	Excellent	Excellent	Excellent
Moderately Dark (dark grey, dark brown to dark yellow-brown)	Good	Medium	Good	Good	Good
Light (pale brown, yellow-brown to yellow)	Low	High	Low	Low	low

SOIL TEXTURE

	Soil water-holding capacity	Looseness
Sandy	Poor	Good
Silt	Best	Good
Clay	High (low availability to plants)	Poor

SOIL pH

Plants need more food elements in order to grow well. These elements include nitrogen, phosphorus, potash and sulphur. The amount of pH affects how readily plants can get these elements.

1 — 4.5 — 6.5 — 7 — 8.5 — 14

(1 to 4.5 is too acid for most plants) (Most plants do best here) (8.5 to 14 is too alkaline for most plants)

Examples of plants in pH range:

pH 4.0 - 5.0: rhododendrons, camellias, azaleas, blueberries, fern
pH 5.0 - 6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow
pH 6.0 - 7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce
pH 7.0 - 8.0: beech, mock orange, asparagus

SOIL TEMPERATURE

Plants do not grow well when the soils are too cold or hot during the growing season. The following chart of temperatures applies to most of the temperate zone.

Soil Temperature	Growing Conditions
Less than 40° F	No growth, soil bacteria and fungi not very active
40° F to 65° F	Some growth
65° F to 70° F	Fastest growth
70° F to 85° F	Some growth
Above 85° F	No growth

ART

Discovering Shape and Form

Have the children look for shape and form in natural objects. Ask questions such as the following: Which leaves are egg-shaped, and which are heart-shaped? How many triangles can you find in seed pods? What shapes are found in honeycombs? In flowers? In snowflakes? Have you noticed that the edge of an acorn cap forms a circle? Have you observed the square cross section of new blue ash twigs and of the stems of the plants of the mint family? How many different forms and shapes can you find in natural objects?

Children will find many new ideas for artistic patterns and designs as they discover the variety of shapes and forms in nature.

"Sketching" Sounds and Movements

Children can increase their awareness of things about them and at the same time find pleasure in making sketches of their impressions of sounds. For example:

A wren's chatter ----------

A peewee's call ----------

Such sketches may be used in a design pattern or as the basis of a phantasy picture.

Patterns of animal movements and of bird flights can be sketched and used in a similar manner.

A Big Look at Little Things

Choose a very small section of some plant. This could be a spear of grass, a twig from an evergreen, chickweed, thistle, etc. Imagine how this would look if it were very much larger. Use a mangifying glass or microscope if possible and actually look to discover patterns.

Draw this section very large. Try to make a lovely design. The color does not have to be the actual color of the plant section.

Bark Pattern Rubbings

Rub the side of a fat dark crayon on a piece of tracing paper held firmly on/around the trunk of a tree. This will show you the pattern of the bark. Make bark rubbings of several kinds of trees. Exchange the rubbings and try to match these with the trees from which they were made.

Exercise in Developing Visual Perception

Have your class draw what it sees from the school ground or on the school ground. Is the vista beautiful? Worth caring for? Could it be improved? Have them draw what might be changed. Does this suggest some activities? A clean-up, a drive to get litter containers? Personal responsibility? Window boxes? Some change in land use and priorities? Might this activity initiate some changes?

Nature's Materials

Sketch a picture of an object on the school site, on heavy paper, using only natural materials. Grasses, leaves, charcoal, dandelions, red bark from rotted stumps can be used for colors.

Observing Colors

Schedule a hike for the purpose of observing colors in both natural and man-made objects. At most times of the year, a great deal of color is visible outdoors. Many shades of green are apparent in grass, trees, bushes and shrubs. Tree trunks and branches offer grays, greens, and reds. The seeds and fruits and vegetables in the autumn cover the whole color spectrum, and the leaves set the landscape ablaze with color. All of these are in addition, of course, to the hordes of flowers to be seen in the spring and summer.

The children might enjoy making charts or lists showing where various colors appear in the materials and objects observed or collected.

SOIL PAINTING

Purpose of Activity: To help children understand that there are many types and colors of soil, depending upon depth, location, etc.

A. Materials

1. Main soils and sands of as many colors as possible, collected from around the school site.
2. Baggies to hold the soil.
3. White glue.
4. Container for glue mixture.
5. Brushes - two sizes, both small - 1/2 inch and 1 inch.
6. Wood or cardboard (consider the weight of the piece of wood since you may wish to frame and hang your final results). (If you used a piece of wood with an interesting wood grain, you can incorporate the wood grain into the scene.)

B. Preparation

1. Gathering soils

   a. Where - on or near school site. Emphasize necessity of gathering many different types and colors. Ask children to carefully note where each type was found. Discuss.
   b. What

      (1) Sands
      (2) Garden soil
      (3) Peat
      (4) Clay
      (5) Crumbled rock.

2. Preparing the glue

   a. Fill a jar or glass half full of white glue.
   b. Add enough water to fill the container.
   c. Keep some glue in the original container at full strength.

3. Planning

   a. Plan scene, design, or picture.
   b. Sketch plan on cardboard or wood.

C. Soil Painting

1. Using a paint brush, stroke on the glue solution where you want one type of soil.

2. Sprinkle on soil.

3. Brush glue on another area of your picture, not adjacent to the drying area.

4. Continue until the scene is complete.

5. Suggestions:

a. For blending colors, work beside each other when glue is wet.
b. For sharp color distinctions, wait for drying.
c. For sharp and narrow lines, apply glue in full strength directly from bottle, sprinkle soil, and shake off excess immediately.
d. For any raised line, apply glue in full strength directly.
e. For a heavy raised object, mix your soil with plaster of Paris and apply immediately. Mix a small amount with a great deal of soil in it because it dries lighter than it goes on.

D. Preserving

1. When the soil has completely dried, stand the picture on a slide and the loose particles will fall off.

2. Repair any areas that need it.

3. Spray with plastic.

4. Frame if you wish.

Air Pollution

Air pollution can become a topic for a class study. Jet planes emit 88 pounds of pollutants per takeoff. Have class count number of planes flying over school in one hour. Do this several times at different hours of day to get an idea. Calculate what occurs within a 24-hour period. Perhaps the class would like to publish and distribute findings. Similar studies could be done with automobiles passing school. One auto emits 500 pounds of pollutants per year.

Measuring Tree Height

Measure the height of a tree by the shadow it casts. Take a stick whose length you know (yardstick). Measure its shadow. Measure the shadow cast by the tree. Using a ratio, calculate the height of the tree.

$$\frac{\text{shadow of stick}}{\text{stick height}} = \frac{\text{shadow of tree}}{\text{tree height}}$$

Studying the Strength of Insects

Have the children watch for evidence of the strength of insects. It will probably be easy to find and observe an ant pushing or dragging an object larger than itself. The children should note that if a child had comparable strength he could move a boulder weighing several tons.

Have the children solve problems such as the following:

1. If a man weighing 200 pounds could move 20 times his own weight, how many tons could he move? (4,000 pounds or 2 tons)

2. A stag beetle can lift 120 times its weight. At the same weight ratio, how much could each child lift? (For a 100-pound child, 12,000 pounds, or 6 tons)

3. If a bee flies eight miles per hour, how long would it take it to make six round trips to flowers half a mile from the beehive, not counting times at the beehive or at the flowers? (22-1/2 minutes)

Studying the Travel Rate of Ants

[illegible] them measure the distance it travels for a short period of time, perhaps a minute. Then direct them to measure the ant and find how many of its body lengths were represented by the distance it traveled in the period of time that it was observed.

Have the children determine how far they would go if they traveled the same number of their own body lengths in the same period of time. Then have them find the rate of speed (in miles per hour) that this would represent.

Some interesting ratio work can be carried out by comparing body lengths of ants and of human beings, together with relative distances traveled and rates of speed (in body lengths per minute). The children may want to see how far they can run on the playground in one minute to get a basis for comparison. This can lead to further experience in measuring and timing, and calculating rates of speed. It can also provide data for making graphs.

Observing Mathematics in Leaf Formation

In the early spring, when leaves are quite small, hold a branch of a tree down so that each child can examine the leaves. Let the children discover that each little group of leaves has grown out of one bud. (Choose a time when not all buds are completely open.)

Have each child count and remember the number of leaves in a certain chosen bud group. Several children can be counting at one time.

After all the children have told how many leaves they have chosen, call attention to the number spoken most often: four, six, eight, ten. Even some first graders will recognize these as numbers they say when they count by twos.

Let them arrange themselves in twos and count themselves. Have them look at the leaves to see if they are arranged in twos.

This provides a good chance to teach the word "opposite," which will lead to further investigation to find out whether all the leaves that grow in twos grow opposite each other.

Using Number and Size Concepts on the Playground

All children can be active in number work at the same time by following directions such as these:

1. Take three steps forward. Take five steps to the left.

2. Pick up six leaves (or pebbles). See how many ways you can arrange them in different kinds of groups.

3. Arrange seven leaves (or pebbles) in order of size, with the largest one first and the smallest one last.

4. Pick a long blade of grass and a very short one. Find three other blades of grass whose length is between that of the long blade and the short one.

Making the Concept of an Acre "Come Alive"

Children often wonder what an acre is when they hear about land measure. Encourage the whole class to discover the size of an acre by pacing off lines in a field, the school grounds (if large enough), or along the streets of a good-sized city block.

An acre contains 43,560 square feet. Of course, its length and width can be selected in different ways, but their produce must be 43,560 square feet. One of the following sets of dimensions (given correct to the nearest foot) might be used, the choice depending upon the shape of the school grounds, field, or other space available: 209 feet by 209 feet; 150 feet by 290 feet; 100 feet by 436 feet.

If space and circumstances permit, the children might start out as a group, and a child might be left standing as a marker or "fence post" as each 50 feet (or other distance) is paced off. In this case, when the measuring is complete, the perimeter will be outlined by living markers, and the whole concept of the size of an acre will have "come alive" for the children.

DETERMINING LENGTH OF STEP

Walk (in a normal step) a 100-foot distance two times. Record number of steps you took each time.

Number of feet in distance walked _____
Number of steps 1st time _____
Number of steps 2nd time _____

Total steps _____

Now divide total number of steps into total distance.

_____	÷	_____	=	_____
Total distance walked		Total steps taken		Number of feet in each step

Note: Round the length of your step to nearest whole foot or half foot. (Example: 2.0'; 2.5'; 3.0'; 3.5'; etc.)

MEASURING AN UNKNOWN DISTANCE

To determine an unknown distance, walk it in a normal step both ways. Then divide total number of steps by 2. This will give you the average number of steps you took in that particular distance.

Then multiply average number of steps by number of feet in your step. This will give you the unknown distance in feet.

Example:

Number of steps both ways in unknown distance - 250

250 ÷ 2 = 125 (Your average number of steps in unknown distance)

125 steps X 3.0 (number of feet in your step) = 375 feet

Unknown distance is 375 feet

MAPPING A SCHOOL YARD USING A PLANE TABLE

A plane table is a device for mapping an area without using a compass or much measuring. Only one measurement is needed -- that of a base line. All objects to be mapped are then located by triangulation or the intersection of two lines.

Equipment needed

Two medium-sized cardboard boxes (should be approximately 3' high when placed on end, one on top of the other)
12" wooden ruler
Masking tape
Map tacks (2)
Small nails (2)
Paper (standard size unlined paper is fine)
Pencil with eraser
Wooden stakes or other station markers (2)

Preparations

Plane Table Construction

a. Place cardboard boxes one on top of the other. Thread boxes together with stout cord.

b. Tape paper to the top of the box.

c. The 12" ruler will be used as a sighting guide. Drive a small nail into the ruler at each end making sure the nails are equidistant from one edge of the ruler.

Use of a Plane Table

a. A minimum of two people should be used.

b. Pick the two objects to be included in the map that are the farthest apart. Set up your boxes near one of these objects to be included in the map.

c. Drive a stake at the base of the boxes. Then pace the longest distance that must be mapped and drive in the other stake. On the way back to the plane table, pace the distance. THIS IS THE ONLY MEASUREMENT NEEDED.

d. Orient your map in the direction of this line. Draw this line on your map -- remember to make a scale. For instance --

1" = 100' Then on a paper 8" wide, a space 800' wide can be mapped.
1" = 40' On a paper 8" wide, a space 320' wide can be mapped.
1" = 20' Space 160' wide can be mapped.

e. Label the location of your box "station 1." Label the far one "station 2." Place a map tack at each station on your paper.

f. Lay the ruler so that one edge is along the points on the paper. Now turn the box so the nails on the ruler sight from point 1 to point 2. This orients the plane table correctly with the base line. The map must continue to be aligned with this base line during all future mapping.

g. Keeping one end of the ruler at point 1, rotate the far end as you sight along the nails until you see the object to be mapped (tree, building corner, telephone pole, etc.). Draw a line along the ruler extending to the edge of the paper. Label this line what you sighted.

h. Repeat until you have sighted all the objects you want from point 1. You will, on your map, have a number of lines radiating from point 1. Include at least five objects.

i. Now move to point 2 on the ground and orient your map back to point 1. Make sure map, box and you are at point 2 looking at point 1.

j. Take sights on objects sighted at point 1. Where they intersect, you can draw the object (tree, corner of building, etc.).

When you have finished, add the following to complete your map:

Scale	Title
Date	Legend
North arrow	Map makers

Check -- As a check of your accuracy you may want to pace to a couple of objects and check your map scale to see if they are the same.

How could you use this method to measure the width of a stream that is too deep for you to wade across?

SOCIAL STUDIES

Transportation Study (to be done at a viewpoint overlooking your city).

Is transportation important to a city?

How many tools of transportation can you observe from here? (Water, boats, railroad, freeway, etc.)

Research into transportation history of your city.

What types of buildings do you find around the water?

What types of boats come into the harbor?

What sounds can you hear that relate to transportation?

What transportation tools are used to bring in the things you need to live on?

What type of transportation is most common? (Automobiles)

What will the freeway look like in a few years if there are twice as many automobiles as there are now?

Should we make twice as many freeways to carry the automobiles?

Recycling

Early man tossed his garbage and litter out. What remains of it today?

Fasten samples of 20th century garbage and litter down with pegs on the school ground. Observe it for several weeks or months. What disappears? Why? What remains? Do ants, flies and fungi take on new importance? Are polyethylene bags and aluminum cans comparable to any of the rubbish of 100 years ago? How can mechanical recycling help?

Communities

Outline a community on the ground with a piece of string. Count the number of things inside the string. Divide into living and nonliving things. Decide how you know something is living. (The wind moves. Is it living? Why?)

Toothpick Hunt

Dye wooden toothpicks various colors --brown, red, yellow, orange, green, and black. Scatter in forest duff. Know the exact number of each color. Ask class to pick them up. Limit time for this. Which colors were hardest to find? Relate to animal camouflage.

Patterns of Change

Patterns of change can be noted by having children relate (sketches, descriptive phrases, etc.) the following at an outdoor site:

a. What would you see, hear, feel, taste, and smell at this spot at 6 a.m., at 12 noon, at 6 p.m. and at 12 midnight.

b. What would you see, hear, feel, taste, and smell at this spot in the fall, in the winter, in spring, and in summer.

Follow this activity with a creative writing experience in a diamante form which requires the contrasting of two things.

Be an Animal Home Detective

Divide the class into teams of four or five members each. Give each team five minutes to see how many animal homes they can find. The homes are not to be disturbed! At the end of five minutes all teams return and then each team in turn leads the other teams to the homes it found. We usually call any kind of animal "nursery" a home--an apple with an insect larva in it, an insect gall, ant nest, spider egg case, underside of a stone (often a home for sow bugs), a bird's nest, a wasp nest, etc. Sometimes we call a spider web a "home" (at least the spider gets her lunch there). Other homes might be a snail shell, clam shell, a leaf with insect eggs on it, bark with eggs on it, a cocoon.

Neighborhood Survey

1. Many types of people live in your neighborhood. There are painters, doctors, school teachers, etc.

2. Take a survey on one block and find out who lives there.

3. What is the most common occupation?

4. Write a report on what one of them does.

Supermarket

(Point out that we depend on the supermarket to stock the food we need as the supermarket owner depends on us to buy for his livelihood.)

1. Can you find anything in a store that doesn't come from the natural environment?

2. Have children find as many examples of products that are sold in their natural state (lettuce, carrots, etc.).

3. Of those named, have them find out what part of the plant they eat (root, leaf, stem, seeds, etc.).

4. What items do they find that have been changed from their original condition (maple sugar, hairbrushes, etc.).

5. What items can they find that have been made of a certain product such as wood, cotton, etc.

Classroom Map Activity

Have the children draw a map of their classroom. They will have to decide on what symbols to use for the various features found in the room (desks, windows, etc.). Ask one child to leave the room and then have the rest of the class hide an object. On one of the maps, mark an X where the object can be found. Ask the child outside to find this hidden object by using the map.

This exercise will cause the children to begin to observe their surroundings more carefully; in this case their classroom. It will also help prepare them for mapping exercises in the out-of-doors.

Building Walk

1. Have students observe the variety of materials used in building their school.

2. What building materials are used for different purposes?

3. What are the different purposes (i.e., different uses of glass, wood, concrete, etc.)?

4. What changes occur in buildings (from weathering, wear, erosion, human abuse, etc.)?

5. What determines the use of certain kinds of building materials (hardness, transparency, beauty, cost, etc.)?

6. What materials are used in their natural state and what materials have been refashioned?

THE WEB OF LIFE GAME

Background Information: The aim of this lesson is to illustrate how living organisms depend upon natural resources for life and what happens when a resource is removed. Constructing a community web of string helps us to show how involved one factor such as water, soil, air, sun or even an organism can be, and how the balance is upset when such a factor is removed. Without a knowledge of the intricacies of the web of a community, man sometimes unwittingly upsets things, either by introducing a factor that was not present before, or by removing a factor that seemed unimportant until it was gone.

Materials Needed: Ball of string (or strong thread), 3 x 5 cards.

Activity: Give one labeled card to each of four students.

1. Sun 2. Air 3. Water 4. Soil

To each remaining member of the class distribute a card naming a common plant or animal such as grass, mouse, hawk, cow, man, earthworm, robin, garter snake, and so on. Remember to give some of the names of parasites, scavengers, and decay bacteria, too. Seat the class members in a circle. Now connect the child labeled sun with all the other children whose cards indicate a direct relationship with the sun. For example, a string should connect the sun with grass, mouse, hawk, man, earthworm, and so on. Continue doing the same for air, water, and soil. Consider what the web would be like if you added another ball of different colored string to represent indirect relationships (earthworm needs sunlight because it eats leaves and they need sunlight). To show all indirect relationships would be hard to handle, but it is worth considering and discussing. After the direct relationships are shown by string, think what would happen if one important factor were eliminated. In a marsh, draining would remove the water -- one of its most important sources of food and shelter. In the web constructed with the class, let one of the individuals (water for example) drop his strings and see what happens to the rest of the web. Can you see that a general collapse sets in? Discuss how other resources might be removed and what effect this would have on the web.

Some Information About Simulation Games (Use as needed to set stage.)

Simulations are operating models of real life situations. They may be about physical or social situations.

Most simulations for classroom use involve role-playing--the roles being acted out to correspond to the functioning of some real process or system.

Most simulations for classroom use involve gaming (a game is defined as something enjoyable--however serious it might be--involving competition for specified objectives and observing rules).

Some simulation games are based on environmental issues. What are some benefits of using simulation games as an instructional technique for investigating environmental problems?

They're fun.
They get people involved.
They are a logistically easy way to prepare people for an environmental experience.
People analyze cause-and-effect relationships of environmental issues.
People are put in role-playing situations where they have to suggest alternative solutions to environmental concerns.

People are forced to evaluate the consequence of decisions in discussion or on paper before these decisions are carried out in reality. People interact with each other in the decision-making process.

So...simulation games not only:
develop understandings about problems in the environment and develop awareness and concern about those problems
but they
help people develop skills they need for citizen action and involvement in environmental management.

Introduction

The kind of techniques used for simulation games in school classrooms combine elements of simulations, games, and role-playing, where students assume the role of decision makers in a simulated environment and compete for certain objectives according to specified procedures or rules.

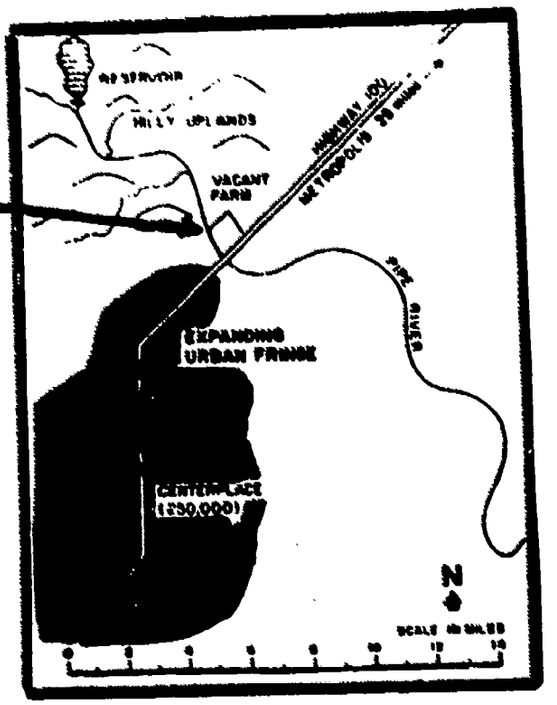
We are going to participate in a hypothetical simulation game, analyze what we've done and give you some ideas to develop your own simulation game based on local environmental issues or concerns.

1. INFERRING, RECORDING AND CLASSIFYING POSSIBLE USES OF LAND.
   Discussion
   A. Distribute TASK A, Centerplace City Land Use Problem.
   B. The problem to be decided: What are some possible uses for the one square mile (640 acres) of county farmland, four miles northeast of the city? It is now available for the city's use.

Task A (10 minutes) Work by yourself.

Read the background information for Centerplace City, and then list some possible uses of the vacant farmland.

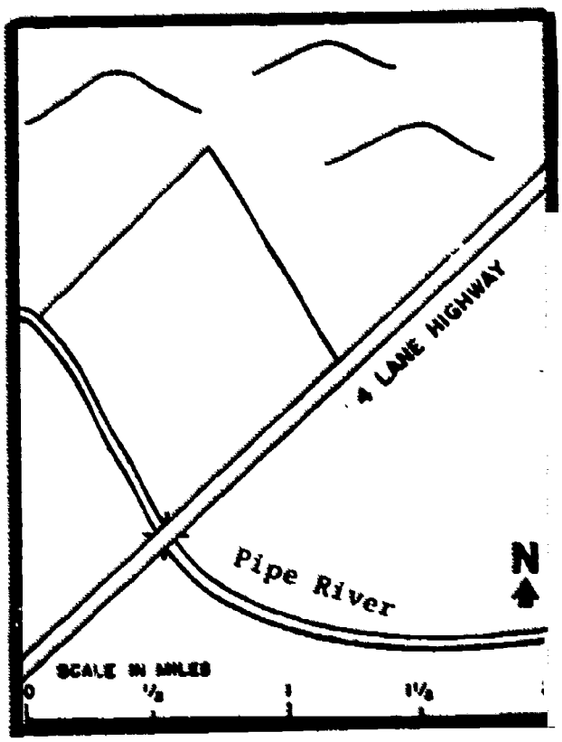
"One square mile of unused county farmland, four miles northeast of the city is now available for the city's use."



Background Information Sheet: Centerplace City

The population is 250,000 and rapidly increasing.
The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.

The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
The power for industrial uses, adequate public transportation, and a skilled labor force are available.
The city is located near forests, which are to the north.
The land to the east is devoted mainly to farming.
The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
The river is too small for freight transportation, but logs could be floated on it.
The gravel bed of the river is appropriate raw material for concrete manufacture.
The present sewage treatment plant and garbage disposal area are at maximum capacity.
The citizens of Centerplace are concerned about the maintainance of a scenic regional environment.
The County Board of Control is the authority for land zoning, and many citizens' groups are developing to influence zoning decisions.



List possible uses of the land below:

Questions and Discussion

Note: When most people have started to write down uses on Task A, go ahead with question #1.

1. "What are some possible uses for the undeveloped land?"
   (As people respond, write all comments on board, just as they say them. Don't paraphrase for them unless they are too wordy, in which case, ask: "How shall I write that on the chart?" If they give major categories right away, like Recreation or Industry, say, "Can you give me an example of that?")

   (Number the items as you go along--they can refer to them by number later.)

   (When you get 15 or 20 items, STOP.)

2. "Which of these uses are similar?" (Designate similar uses by letters--A by all of one group, B the next, etc.)
   When most are designated with a letter, or they seem to run out of thoughts, STOP. (It's okay to change these groups if they change their minds along the way in the above.)

3. "What label could we give to all the items in A?"
   (It's okay if they suggest more than one label for Group A; write them both down.)
   "What label could we give to Group B?", etc.
   (e. g., Recreation, Industrial, Utilities, Housing, Commercial)

DEVELOPING AND GIVING PRESENTATIONS.

1. Divide the class or group into the number of categories decided on in #3. (Shouldn't be more than 6 to 10 in each group), and assign each group to one of the use categories.

2. Each group is to represent the special user group assigned.

3. Pass out TASK B--you have 10 minutes to list and analyze possible uses for the vacant land in your assigned category. You may consider those listed on the board plus any other possible uses you can think of for your category.

Task B (10 minutes) Group #_____ Assigned Category of Land Use_____

Your task is to analyze and list possible consequences of different land uses within your assigned land use category.

Use	Advantages to land/people	Disadvantages to land/people

Discussion:
Tell Group:

1. Now go on to Task C--you have 20 minutes to plan a strategy and develop a three-minute presentation to be made to the Board of County Commissioners.
   a. This presentation will be a proposal for developing the undeveloped farmland.
   b. You must have a visual display such as a land use map drawing as a part of your presentation.
   c. More than one person in your group must help in making the presentation.

Task C (20 minutes)

Develop a strategy and presentation for presenting your plan of development to the County Board of Control.

Discussion and Questions

Note:

1. (If possible, have a staff person assigned to each group to make written observations about how the group was able to work together to solve the problem.)

2. 10 minutes into Task C, go around and select one person from each group to meet together as the County Board of Commissioners. Take the Board into another room and tell them they will be responsible for hearing the presentations and deciding upon the best one. Their job in the next ten minutes is to:

Board of County Commissioners

Task C_1 (10 minutes)

In the next 10 minutes you are to:

1. Select a chairman to call on the groups and to chair the board meeting.
2. Develop the criteria you will use in evaluating the proposal based on the needs of the people and characteristics of the land.
3. Develop some kind of matrix you can use in evaluating the presentations while they are being given.

Presentation	Criteria			

3. Twelve minutes after groups start planning Task C, remind them they have eight minutes left to have their verbal and visual presentations ready. Let groups have five more minutes to finish if needed.

4. Have Board of County Commissioners enter room and sit up front. Appoint a timekeeper to cut all presentations off at three minutes (give two-minute warning). Announce: Because of time, there will be no rebuttals or discussion. (The Board may want to ask questions or have rebuttal time after all presentations. However, allow only 5-10 minutes for this part so it won't get out of hand.)

5. After #4 is finished, the Board retires for 5-10 minutes to select the best proposal.

6. While Board is meeting, each group is to develop a list of criteria they think should be used in the decision.

7. County Board of Commissioners announces their decision and gives reasons why.

8. County Board of Commissioners reads their criteria aloud.

9. Did new leadership emerge during this session? What factors enabled this to happen? (Call on staff observers if used.)

10. Did your group work as a team? What did your group do to insure participation by all members of group?

11. What happened in the groups? How did you feel as a person? What about the criteria used? How did each observer see the interaction in the groups?

12. What additional data would you have liked to have had for your groups? List on board; e.g., topography, vegetation, economy of area, railroad, shopping center, adjacent land, climate, soil survey, historical information, flood plain, wildlife, interest of board of control, money available, educational needs, reg. by State, existing zoning, political climate,population (age, needs, race, jobs).
What groups might support each interest, etc.

(NOTE: This is one of the most important parts of the activity because it emphasizes that we need a variety of information and data before we can intelligently make a land management or environmental decision to best meet the needs of people and their environment. This list has all the elements that need to be considered in studying a local environmental issue or concern. It also includes elements of all the curriculum subject matter (social studies, science, language arts, etc.).

III. ANALYZING CHARACTERISTICS OF SIMULATION

1. "One group of people working with simulation games has identified <u>at least</u> three basic characteristics of most simulation games."

   -Ask: "What was the clearly defined problem in the Land Use Alternatives Simulation?"

   -Ask: "What factors influenced the decision in the Land Use Alternatives Simulation?"

   -Say or Tell: "We assigned groups to fit each role in the Land Use Alternatives Simulation, but we all helped develop that role by the items we listed on the chart."

2. <u>Optional</u> (<u>Note</u>: If the group is interested in a more in-depth analysis of the elements of simulations, use the following list. Have a copy for each person.)

   a. One important characteristic of a simulation is a <u>clearly defined problem</u>, including the choices available to the decision makers.

      (1) How would you formulate the problem or issue you were asked to decide upon?

      (2) Did the developer of this simulation simplify the choices?

      (3) If so, how did he do it?

   b. A second major characteristic of educational simulations is the <u>factors having an influence on the decision</u>. (Several <u>objective and subjective factors</u> to be considered in making a decision need to be clearly identified. These factors indicate the data that are relevant to each of the possible choices.)

      (1) What factors were selected as influences on the decision?

      (2) Which of these factors would you classify as objective?

      (3) Which of these factors would you classify as subjective?

   c. A third characteristic of educational simulations is the <u>way in which information about the problem and the variables is</u> presented. (In many simulations, <u>individual roles</u> or <u>group roles</u> are used to perform this function. A role can be planned to incorporate a limited number of factors that influence the choice to be made.)

IV. DEVELOPING YOUR OWN SIMULATION GAME

1. "The most exciting simulation games are ones people develop themselves, based on local environmental issues in their community, state or region."

2. Can you think of some current environmental issues in your community around which you could develop a game? Call for responses.

3. "For the next 30 minutes, you will work with one or two other people, developing the format for a simulation game based on a local land use issue described in a news article." (Have copies of current newspaper articles available if students want to use them.)

4. "At the end of that time, we would like to hear from several of you about what you have developed."

Task D (30 minutes)

Distribute lab sheet, "Developing a Simulation Game"

(See attached lab sheet)

Ask for reports from those who want to share.
Questions and Discussion

1. How can you use the techniques in this session in your job situation? Classroom?

2. How could a game like this develop decision-making skills in environmental management?

3. Ask for reports from people in the group who have used simulation games.

4. How can we take this process and use it to involve the public in social and political decision-making action projects in the community?

5. How can we summarize the use of simulation games in environmental interactions?

6. Which of the behavioral outcomes did we accomplish in this discussion? (Read and discuss)

Task E

Describe how you feel about our session today.

(Have commercial games such as Dirty Water, Ecology, Coca Cola Game. Pollution, etc., on display if possible.)

BEHAVIORAL OUTCOMES IN KNOWLEDGE.

1. Identify and describe three component parts of simulation games.
2. Construct your own simulation game based on a current environmental issue.
3. Name and describe at least ten important types of data needed before making a land management decision.
4. Identify cause-and-effect relationships that exist in environmental management.
5. Describe alternative solutions to solving specific problem.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION.

1. Describe how the information in #3 above affects your life, community, and the management of the environment.
2. Outline a plan of action to effect a solution or partial solution through the social and political decision-making process about the environmental issue you used in developing your own simulation.

Equipment needed

Blackboard or easel
Chalk or magic markers
Newsprint or butcher paper (enough for each group to make visual display)
Magic markers (4 colors for each group to make visual display)
Masking tape
Task cards
Commercial games on display

The Centerplace City problem has been adapted with permission from the May 1970 Journal of Geography from the Article "A Land Use Alternatives Model for Upper Elementary Environmental Education" by Dennis Asmussen and Richard Cole, University of Washington.

References:

There are many publications on simulation games. Two that may be of value to you are:

1. Games in Geography, Rex Walford, Longman group limited, London paperback.
2. Simulation Games for the Social Studies Classroom--from The Foreign Policy Association, 345 East 46th St., New York, N.Y. 10017. Library of Congress #68-24538.

This lesson plan was developed in February 1971 for use in teacher and resource workshops by Charline McDonald, Portland, Oregon.
Ernie McDonald, Portland, Oregon.

The lesson plan was revised to fit Louisiana conditions. It is suggested by the writers that continuous revision take place by people who use the ideas.

OTHERS

Dramatizing Action Observed Outdoors

Close observation is required to prepare for dramatizing movement or actions seen in the outdoors. Activities of animals or movements of plants or trees are some of the things that can be dramatized. Children have to watch, describe, and then act out these activities.

Point out to the children that before one can interpret something in dramatics, he must first observe and analyze it.

As one or more of the students dramatize something, the others can guess what is being portrayed and give some constructive criticisms or other interpretations

The outdoors is a good place to act verbs -- waddle, leap, drawl, etc. -- and for observers to think of the best words (adverbs) to describe the action.

Acting Out Nature's Ideas

Pretend to be a tree in a wind storm, a bud blooming in the spring, etc.

Let each child act his own nature idea out and let children guess what they were. Ask questions like: How did you know the wind was blowing? What did he do that made it seem real?

Reactions to Things -- Emotions and Feelings

Take the children out onto the school grounds and find a spider,insect, or possibly a garden snake. Discuss how you felt when you saw the object. Would you want to touch it, etc.? Why were you frightened? Some people like them and yet others can be very frightened. What things frighten you? Discuss why things frighten you.

Examples: Your parents might dislike the object. You have had an unpleasant experience with that object -- like someone put a frog in your bed, etc.

Discuss: Fear and joy are reactions. You react to things around you. Wild animals react in different ways. Look around and find ways that wild animals react to danger. Follow through by having the children write about the feelings they have experienced in which they were frightened.

Color Images

What is green? Develop your own color images from the outdoor environment. Green things you can see. What are the sounds of green? How does green feel? What are the tastes of green? How does green smell? Green is the feel of . . . . Green is the feeling of . . . .

SOME "AROUND THE SCHOOL YARD" ACTIVITIES

USING THE SENSES

Equipment Needed:

1 sheet of drawing paper (8½ x 11") (manila) per child.
Each child brings one dark crayon (green, black, brown, etc.).
Each adult leader should have a clipboard and paper and pencil.
List as many of the children's comments as possible for each activity.

Tell the children you are writing down their descriptions.

At intervals throughout the activity, read back their comments to them.

At the end of each activity, read what was said as a summary.

Group leaders should give the comments and descriptions to the teachers at the end of the field trip for use back at school to make experience charts and story-writing.

"Sound Hike" - (10-15 minutes)

Group leader takes students for walk.

Stop at intervals along the way. Have students close eyes and listen for thirty seconds. At the end of thirty seconds, students describe a sound they heard.

(Group leader should write down the way each student described his sound.)

Try to stop in different places so there will be a variety of sounds to be heard.

See how many different sounds your group can discover.

Ask: Which sounds did you like best?
Why?
Does it remind you of something else?
Which sound is the loudest? The quietest? The highest? The lowest?

Mini-Forest - (Approximately 15 minutes)
(Investigating an Arm-Circle of Grass)

1. Lie on the ground, face down.
2. Make a circle by stretching your arms out in front of you on the ground.
3. Find at least five different plants inside that circle made with your arms.
4. See if you can find any tiny animals crawling through the grass.
5. What else do you see? (Any dead leaves or twigs?)
6. Spread the grass apart and describe what you see.

Big Idea - Many plants and animals live together in a community.

Sketching - (15-20 minutes)

Find two trees with different shapes. Observe and sketch one tree at a time.

1. Look at the tree from a distance.
2. With your finger, "trace" (in the air) the shape of the tree. (Do this from the ground up to top and from top down to ground.)
3. Describe the shape of the tree.
4. Make a "telescope" with your hands. Look through this "telescope" at your tree from a distance.
5. Describe how the branches go out from the trunk. (Up? Out? Down?)
6. Hold out your arms to show how the branches grow out from the tree trunk.
7. Go closer to the tree. What else do you notice about it?
8. Get close to the trunk of the tree. Look up into the tree. What do you see?
9. Go to a comfortable place where you can see your tree. Sketch it with the crayon you brought.
10. Repeat procedure for second tree.

Add some of nature's color to your sketch.

Add some grass. Use it as a crayon. Rub it around on the paper to show where the green is on your tree.

Pick a yellow dandelion blossom. Use it as a crayon somewhere on your sketch.

"Touch and Feel"Hike - (Approximately 10-15 minutes)

Group leader takes class for a walk. Gives following directions at intervals along the walk. (Add others when appropriate.)

1. Find the hairiest leaf around. Bring back a tiny bit of it. Compare with your other group members.
2. Find the softest leaf.
3. Find the smoothest rock.
4. Find the roughest twig.
5. Find something cool.
6. Find something warm.
7. Find something bumpy.
8. Find something dry.

"Color"Hike

1. Look for things that are different colors of green. Bring back three or four green things.

   Arrange them in your hand according to lightest green to darkest green.

2. Find and describe things that are:
   yellow-pink-brown-grey.

EQUIPMENT LIST FOR EACH SCHOOL

This is a basic list of books and materials dealing specifically with data collecting and interpretation of environmental data that should be at each school.

Equipment Item	Source	Unit Cost
Silva Rambler Compass	Forestry Suppliers, Inc. Box 8397 205 W. Rankin Street Jackson, Mississippi 39204	$ 3.60
100' Tape	Hardware Store	5.00 ea.
Laboratory Thermometer (rectal) 0^{0} to 220^{0} F.	The Edwards Laboratory Soil Chemistry P. O. Box 318 Norwalk, Ohio	9.25 ea. approx.
Soil pH kits	Same as above	2.25 approx.
Water Test Kit Model CH-10 O_2CO_2pH	Hach Chemical Co. P. O. Box 907 713 South Duff Ames, Iowa 50010	28.50
Increment Borer	Jim & Gem Increment Borers Forestry Suppliers, Inc. Box 8397 205 W. Rankin Street Jackson, Mississippi 39204	35.00 approx.
6' Cloth Sewing Tapes (Diameter tapes)	Dime Store	.10 ea.
Green bamboo garden stakes (measure height)	Garden Store	.50 bdl.
Water thermometer	The Edwards Laboratory Soil Chemistry P. O. Box 318 Norwalk, Ohio	3.00 ea. approx.
Hand lens - 8X w/neck cords	Oregon Museum of Science and Industry 4015 S. W. Canyon Rd. Portland, Oregon	1.40 ea.
Shovel		
Hatchet		
Wooden stakes for compass game		

Each box of equipment must have itemized equipment list and instructions for care and use. Of particular importance is cleaning of increment borers.

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