Development of Environmental Education Field Trip Guides for Elementary School Teachers in Cache Valley, Utah

Sandra T. Brown

Utah State University

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DEVELOPMENT OF ENVIRONMENTAL EDUCATION FIELD TRIP GUIDES
FOR ELEMENTARY SCHOOL TEACHERS IN
CACHE VALLEY, UTAH

by

Sandra T. Brown

A thesis submitted in partial fulfillment
of the requirements for the degree
of
MASTER OF SCIENCE
in
Forest Recreation

Approved:

UTAH STATE UNIVERSITY
Logan, Utah

1972
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ABSTRACT

Development of Environmental Education Field Trip Guides for Elementary School Teachers in Cache Valley, Utah

by

Sandra T. Brown, Master of Science
Utah State University, 1972

Major Professor: John D. Hunt
Department: Forest Science

The purpose of this study was two-fold. The first was the development of environmental education field trip guides to areas in Cache Valley for teachers in grades three through six that would provide learning activities that cannot be structured in the classroom. Six field trip guides to areas of Cache Valley with accompanying activities and discussion questions were constructed. The guides were tested in the field by three groups of teachers and students and teachers not participating in the field test evaluated the guides for difficulties they would encounter in using the guides.

The second study purpose was to determine constraints faced by Cache Valley elementary teachers in using such guides and conducting environmental education programs. This was accomplished by the use of a questionnaire which was given to elementary teachers in Logan City. Although a lack of environmental education guides and materials was apparent, major constraints listed were a lack of transportation and funds and inadequate student supervision.

(59 pages)
INTRODUCTION

Problem

One of the major goals of education is to help children prepare for their responsibilities in an adult society and to help them adapt to that society as comfortably and creatively as possible. In order to achieve this, educators have placed a great deal of importance on communication skills, mathematics, science, physical education, history, politics, and geography. But education has, for the most part, neglected to help children understand, appreciate, and assume responsibility for the natural and man-made environment to which they will need to adapt as adults.

In recent years, a comparatively new educational approach to this problem has been developed and implemented by many school districts throughout the Nation. Known as environmental education, its purpose is to sensitize people to their environment and make them increasingly aware of the ways in which the environment and man shape each other. An essential part of these programs is the extension of the formal classroom into an informal outdoor learning environment. Learning should take place in the kind of environment that is most conducive to a particular teaching and learning situation. This outdoor study situation provides unlimited opportunities to apply knowledge gained in the classroom as well as opportunities for development of conceptual thinking through problem finding, problem solving, and self-discovery experiences.

Cache Valley provides numerous possibilities for environmental education programs. However, local school system personnel are in need of materials and training in the area of environmental education. Their
ability to instill an ecologically responsible attitude and value system in our adult population of tomorrow is severely limited.

Several attempts have been made to fulfill this need. An environmental workshop seminar has been held the past two years for pre-service elementary teachers by the Utah State Board of Education, Utah State University Colleges of Education and Natural Resources, and the Edith Bowen School. A number of ten minute walks were outlined (Allred, Lawrence, and Mickelson, 1970) and given to student teachers who practiced the techniques on students. Professor Carl Johnson has catalogued specific examples of natural resource materials found in Cache Valley that can be used in improving the effectiveness of teaching (Johnson, 1963).

The U.S. Forest Service (1971) has developed several lesson plan outlines for environmental investigations into natural phenomena of the out-of-doors. Local Forest Service personnel utilize these outlines when requested to lead nature study or walks with school classes. The local Soil Conservation Service has conducted several environmental education teacher workshops for teachers in the area.

Logan City Schools have no program for environmental education and many of its teachers seem completely unaware of the field of environmental education and its importance. This year the Cache County School District has taken its first step toward such a program. An outline of behavioral objectives in ecology and conservation has been developed for kindergarten through senior high and should prove to be very helpful in integrating environmental education in the school curricula (Allred, Leonhardt, Hunsaker, 1972).
While these endeavors can contribute to a better environmental education program, Cache Valley is in need of a comprehensive outdoor education program. It is important to get the students out of the classroom and into the field if they are to fully understand and respect the unique features and complex relationships of their environment. Guides for environmental education field trips are one step toward achieving this goal.

Objectives

The objectives of the study are: (1) to develop environmental education field trip guides to Cache Valley for elementary school teachers in grades three through six that will provide learning activities which cannot be structured in the classroom, and (2) to determine the constraints faced by Cache Valley elementary teachers in using such guides and conducting environmental education programs.
PROCEDURE

A survey of available conservation-outdoor-environmental education programs and manuals was conducted to determine what has been done in this field and for ideas and materials which may be used in development of field trip guides. Six field trips were arbitrarily chosen as representatives of broad areas of environmental study and sites throughout the Valley were selected on the basis of their ability to serve well as outdoor environmental laboratories for the chosen studies. An inventory was conducted on each site in order to identify its resources appropriate to environmental education including ecological principles and concepts well illustrated by the particular sites. Preliminary guides were developed utilizing information taken directly from the study sites, ingredients of existing conservation-outdoor-environmental education programs and manuals, and knowledge gained from the author's own experience in conducting field trips.

Utility of the preliminary guides was tested in two ways. The first test was conducted by teachers and students in the Logan City Schools. Three elementary school teachers were asked to choose five students from his or her classroom to participate in a field test of the guides. At this time the teacher was given the guides and asked to study their content and consider the study sites in order to make changes, additions, or field trip preparations. The guides were reviewed with each teacher. The teacher assumed responsibility for each field trip and the author accompanied the group only as an observer, reference specialist, and chauffeur. The groups were taken separately
on each field trip (one a week). Teacher difficulties in the use of the guides and student interest were observed and recorded. After the field trips were completed the students were asked to list the field trip they liked best, the one they liked least, and reasons for their decisions.

The second test was an evaluation of the preliminary guides by 21 Logan City elementary school teachers in grades three through six. Included in this evaluation questionnaire were questions designed to determine the extent that environmental field trips were used in Logan City elementary schools and problems associated with them. (Appendix A)
EVALUATION AND USE OF FIELD GUIDES

Available conservation-outdoor-environmental education programs and manuals

Over the last few years the volume of literature that has been added to the field of environmental education is extensive. This may be attributed to the rising interest in ecology and conserving of our natural resources. Many areas throughout the United States have developed and set aside outdoor study areas with field manuals constructed to aid in effective educational use of the land. Particularly good examples of this are the Southeastern Pennsylvania Outdoor Education Center (undated), Northern Colorado Outdoor Nature Center (Bruner, 1970) (Bruner and Paul, undated), the Handicapped Children's Nature Center (Muscatine-Scott County School System, 1970), and Land Between the Lakes (Major and Cissell, 1971). The contents of these manuals may be adapted to other areas. The author found the Southeastern Pennsylvania Outdoor Education Center Field Activity Sheets (undated) and the Environmental Education Activity Booklet (Bruner and Paul, undated) especially helpful in development of field trip guides.

The U.S. Forest Service and Soil Conservation Service have been instrumental in developing guidelines for conservation and environmental education. The lesson plan outlines and activities suggested in the materials are not designed for use in a particular area but may be adapted for use in many places. The "Investigating Your Environment Series" (U.S. Department of Agriculture, 1971a) was used in the development of one preliminary guide.
"Naturealm" (Barnhart, 1968) is a guide that contains ten teaching units dealing with physical and biological aspects ranging from weather to animals. It contains excellent and extensive background information pertaining to each unit. However, it is principally a classroom tool. The Environmental Science Center (1970) in Minneapolis, Minnesota has developed environmental education units concerned with methods of introducing ecology to elementary and kindergarten students. The units are designed around the schoolyard and classroom and include a transect study, projects for using natural objects in art, lesson plans on population variation, and succession and vacant lot studies.

Preliminary guides

The six field trip studies chosen were: the study of trees in Spring Hollow, Logan Canyon; the study of animals and their environment at a river bottom site in West Fields; a stream and stream organism study at Temple Fork, Logan Canyon; a land use study in the Hidden Village residential area, Logan City; a study of garbage disposal at the Logan City Sanitary Landfill and a local supermarket; and the study of Logan City's water supply and sewage disposal systems.

A guide for each field trip was developed utilizing site resources, ingredients of existing conservation-outdoor-environmental education programs and manuals and knowledge gained from the author's experiences in conducting field trips. References to materials found useful were included in the developed field trip guides. (During tests of the preliminary guides, few changes were found to be necessary. For this reason, only the final guides have been included. See Appendix B.)
Evaluation of preliminary guides

Field test

Before contacting teachers or students in Logan City Schools for help in field testing the preliminary guides, permission had to be granted by a Research Review Board composed of school employees. Although the request was made in August, this Board did not meet until the last week of September and consequently the field test was undesirably late in starting.

Four elementary schools were contacted and three teachers volunteered their help; two sixth grade teachers and one fifth grade teacher. Each teacher chose five students from the classroom to take on the field trips and parental permission was secured for their participation.

The study of trees at Spring Hollow was the first field trip. The guide was followed closely by all teachers. The only difficulties encountered centered around differentiating between simple and compound leaves. The teachers indicated that a revision of the leaf arrangement illustration labels in the guide would increase their understanding. This was done for the final guide. One of the teachers explained to the students how to find the age of twigs or saplings by counting terminal bud scars. This was received so well that an activity sheet for aging twigs was added to the final guide. The students appeared highly motivated and asked many questions. The proposed activity on leaf identification was highly successful. It is understood that several of these students have since done special projects on leaf identification in school.

A study of animal habitats in West Fields at a river bottom site was the second field trip. No major difficulties in the use of the
guide were encountered as the exercise was largely a simple study in observation. The books *Insects* (Zim and Cottam, 1956) and *Birds of North America* (Robbins, Brunn, and Zim, 1966) which were taken on the trip were enthusiastically utilized in identifying insects and birds. The use of such books has been suggested in the final guide. This trip was undertaken too late in the year to see much animal life but many signs were still visible. The students appeared to thoroughly enjoy the freedom of searching by themselves during this trip. They did not stand around, as was expected by the teachers, but "dug right in".

By the third week of field trips it was becoming very chilly and wet. Consequently, in the interest of time, the units on garbage disposal and water and sewage systems were combined. The trips were accomplished in close to two hours by omitting the trip to Dewitt Spring and rearranging the order of stops. No problems were encountered at the sewage ponds. The guide contained enough background information for the teachers. In addition, large numbers of ducks, geese, and herons added to the visit.

At the Logan City Sanitary Landfill each teacher explained (from the guide) the way a landfill should function. However, it was soon discovered that contrary to its name, Logan's disposal site does not fulfill the criteria for a good sanitary landfill. The students saw areas of ground water and a large number of seagulls and crows picking at the uncovered garbage. The discussion questions in the final guide were rewritten to compensate for these problems. Unfortunately, the teachers put little emphasis on problems of disposal of plastics and other non-biodegradable materials. In addition, little attention was given to reducing the amount of garbage that leaves the homes.
The preliminary guide included a stop at a local supermarket to study excessive packaging, non-returnable containers, and so forth. The field test of this visit indicated that a stop of this nature would be infeasible with a class of 30 or more students. This portion of the exercise was omitted from the final guide and a visit to an open dump was added for comparison with the sanitary landfill.

The following week the weather would not permit a field trip. Therefore the stream study and land use planning field trips were not conducted. It was hoped that the teacher evaluation would yield enough information on the feasibility of these field trips.

Two weeks after the last field trip the students were asked to list the field trip they liked best, the one they liked least, and reasons for their decisions.

Table 1. Student field trip preference

<table>
<thead>
<tr>
<th>Field trip</th>
<th>Liked best</th>
<th>Liked least</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees - Spring Hollow</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Animals - West Fields</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Sewage and water systems, garbage disposal</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Reasons given for preferring the trip on trees at Spring Hollow were: liked learning about leaves (2), thought it was most interesting (2), and no reason given (1). Those preferring the study of animals in West Fields liked the freedom of the exercise (2), liked learning about animals (1), and gave no reason (1). The sewage and water and garbage disposal field trips were preferred because: saw alot of birds (2),
interested in how water is cleaned (2), and visited more places (1).

Four students declined from listing a field trip they liked least, stating that they liked them all. Students liking the study of trees in Spring Hollow least indicated it was too cold (1) and that they like animals more than trees (1). Those listing the study of animals in West Fields as the least enjoyable trip indicated that it was too swampy (1), wasn't as interesting as the others (2), and gave no reason (1). Reasons given for liking the sewage and water and garbage disposal studies least were that the sewage ponds smelled "rotton" (1) and that it wasn't as interesting as the other trips (2).

The students were well divided in their opinions about favorite and least favorite field trips. As a whole, they were enthusiastic about all the trips and expressed a special interest in learning more about animals at such places as the Fish Hatchery, Hardware Ranch, and the Bear River Bird Refuge.

**Teacher evaluation**

Twenty-one Logan City elementary school teachers in grades three through six evaluated the preliminary guides by listing difficulties or additions they would like to see made and ways which they would utilize the guides.

Four teachers indicated that they had too many students to handle such trips while five indicated that transportation would be their major problem. One third grade teacher said she had been told by a principal to keep children away from water and areas where there is alot of litter or garbage. Another thought Spring Hollow and Temple Fork had too many wood ticks and snakes to be safe. A sixth grade teacher thought that the contents did not seem to be of sixth grade interest.
When asked what additions should be made to the guides one teacher requested specific things written for children to look for on an individual basis. A list of references for environmental education information was asked for by two teachers and one teacher wanted more on trees, rocks, lakes, and rivers in Utah and Cache County.

Nineteen (90 percent) of the teachers believed the guides would be of use to them, but in varying degrees. Eight (38 percent) indicated they would use them as field trip guides while 13 (62 percent) would use them as supplementary material and lesson and discussion guides in the classroom.

When asked to rate the value of the guides as an aid to teaching and student interest, 12 (58 percent) rated it above average, eight (30 percent) average, and one (5 percent) rated it below average.

Two (10 percent) indicated that they would be interested in submitting environmental education ideas, activities, or field trips to be compiled for use of teachers in the area. Sixteen (76 percent) were definitely not interested and three (14 percent) gave a "maybe".

Two teachers admitted to not having looked at the guides before filling out the questionnaire and there is evidence that many more also avoided them. Specific problems that would be encountered in using the guides and additions that should be made to them were desired but few were listed. Problems with transportation and lack of supervision are real. Encounters with snakes and wood ticks are possible but if these discourage the teachers from outdoor study how are the students to learn about their natural environment? Certainly some discretion should be used in choosing areas for outdoor study but teachers should not become overly protective or they will hamper the learning experience. The
comment of a sixth grade teacher ("The contents don't seem to be of sixth grade interest.") was not borne out in the field test. Ten sixth grade students appeared highly interested in the four trips in which they participated and there is reason to believe that they would have been equally interested in the two untested field trips. Two teachers requested references for environmental education information. A list of conservation-outdoor-environmental education documents was included with the final field trip guides.

It was disappointing that more teachers did not wish to use the guides for the field trip purpose and that the guides were not rated higher in value. It is believed that since these teachers have had only limited experience with field trips, especially to natural areas, they will probably need some training and incentive before they will develop an interest and appreciation for guides of this type.

The fact that 16 (76 percent) of the teachers were not interested in submitting material for guides such as the ones proposed, suggests a general lack of interest and concern for environmental matters. Successful use of the guides depends on teachers exchanging ideas and adding supplemental activities in order to keep them viable. It is hoped that as the value of environmental education becomes more widely understood teachers will take an interest in sharing and creating activities that will increase the students' understanding of their environment.

Reviewers of the field trip guides have expressed the concern that many teachers would have a difficult time with several of the discussion questions and that perhaps more background information should be included. However, for one reason or another, the teachers did not
indicate a need for more information in order to effectively utilize the guides. Consequently, further information was not added.

**Use of environmental education field trips and materials by Logan City Schools**

The 21 teachers that evaluated the guides were also asked to answer several questions about their experience with field trips and environmental education. The following is a summary of their answers taken from the questionnaire. (Appendix A)

Grades three through five were represented by five teachers each and grade six was represented by six teachers. Two of these teachers had one to three years of teaching experience, eight had four to eight years, five had nine to 14 years, and six had fifteen years or more years teaching experience.

Ten of these teachers (48 percent) did not take their students on a field trip last year. Five indicated taking one trip, four conducted two field trips, one conducted three trips, and one teacher took the class on four field trips last year. When asked where they had taken students on field trips the teachers supplied the following information: 26 percent of the field trips were to various parts of Utah State University, 8 percent were to city parks and the Temple Grounds, 16 percent were to city offices (newspaper, telephone, and post offices), 5 percent to Logan sewage ponds, 3 percent to West Fields, 8 percent were taken to Spring Hollow, 5 percent to city variety stores, 5 percent to Cache Valley Breeders Association, 3 percent to a lumber yard, 3 percent to a bakery, 10 percent to a candy factory, 5 percent were to a dairy, and 3 percent of the field trips were taken to the D.U.P. Museum.
Fifteen (71 percent) teachers indicated using no environmental education books or guides in teaching and 6 (29 percent) listed one or two of the following resource materials: U.S. Forest Service booklets, School Times material, World of Work Guides, class material from Carl Johnson's "Conservation Education" class at Utah State University, Common Native Trees of Utah by Carl Johnson, and "Ten Minute Walks" distributed by the Utah State Board of Education.

Table 2. Major difficulties teachers encounter on field trips and reasons for not conducting more field trips

<table>
<thead>
<tr>
<th>Problems</th>
<th>Major difficulties</th>
<th>Reasons for not conducting more field trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>transportation</td>
<td>37</td>
<td>34</td>
</tr>
<tr>
<td>lack of funds</td>
<td>17</td>
<td>25</td>
</tr>
<tr>
<td>lack of discipline</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>lack of supervision</td>
<td>40</td>
<td>28</td>
</tr>
<tr>
<td>difficult to get approval of superintendent</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td>risk of accident</td>
<td>--</td>
<td>3</td>
</tr>
</tbody>
</table>

It appears that the main problems Logan City School District teachers have with field trips are associated with transportation (which may include lack of funds) and inadequate supervision of the class (Table 2). The school district does not own any school buses but is presently in the process of purchasing two. This should greatly lessen the problems of transportation. Teacher aids are becoming more numerous and with the help of interested parents, the supervision problem could be reduced. The largest number of field trips (76 percent) which
have been undertaken were to education and business institutions where the students were given talks. The field trips outlined in the proposed guides are to natural areas where less supervision would be needed because the student is actively engaged in activities.

Only a few of the teachers indicated using environmental education books or guides (29 percent). It is believed that this may be a primary reason for the infrequency of outdoor field trips. These teachers appear unaware of materials and methods available to help them plan and carry through field trips.

**Final guides**

The primary guides were changed as problems associated with them appeared in the field test and teacher evaluations. These changes consisted of a revision of leaf arrangement labels in the study of trees and leaves and the deletion of the stop at a local supermarket in the study of garbage disposal. Additions made were: (1) a section on how to find the age of twigs and saplings in the study of trees and leaves; (2) a stop at an open dump in the garbage disposal study; (3) the addition of available conservation-environmental-outdoor education materials at the end of the guides. (Appendix B)
CONCLUSIONS

Six environmental education field trip guides were developed and tested for use by elementary school teachers in grades three through six throughout Cache Valley. Although the lack of such material seemed to discourage environmental education programs other constraints were listed by teachers. It appears that the principal difficulties associated with incorporating environmental field trips in the local school system are three fold. First, the teachers have a lack of training and interest in environmental education. They must be educated to the importance of environmental education and given training in its techniques. Second, the classes are too large for one educator to effectively handle. Teacher aids and interested parents should be utilized more frequently. Third, the teachers must receive encouragement from school administrators in the form of transportation and funds if environmental education is to be effective. Only when these problems are overcome, will the students develop an understanding and appreciation of man's place in the natural world.
BIBLIOGRAPHY


APPENDIXES
Appendix A

Questionnaire

Dear Teacher,

I am working on environmental education field trip guides for elementary school teachers in the area as partial fulfillment of my master's degree at Utah State University.

It is hoped that these initial guides will be followed by idea exchange between teachers, and more importantly, the development of a comprehensive program of environmental education for the area.

I would appreciate your help in filling out the following questions.

Thank you,

_Sandra J. Brown_

1. Grade taught ______.
2. Years of teaching experience ______.
3. How many times did you take a class on a field trip last year? _____
4. Where have you taken students on field trips?
5. What major difficulties have you encountered on field trips?
6. Would you like to take your students on more field trips? _____
   If so, what prevents you from doing it?
7. If you have utilized any environmental education books or guides will you please list them and how they were used.
8. After reading through the included field trips, list any difficulties you would have in using them and additions you would like to see made. Please be specific.
9. Would a guide such as this be of use to you? _____
   In what ways would you use it?
10. How would you rate the value of this guide as an aid to teaching and student interest? (Rate from 1, very high to 5 for very low.)
   
   1   2   3   4   5
11. Would you be interested in submitting environmental education ideas, activities, or field trips to be compiled for the use of teachers in the area? _____
Appendix B

Guides

ENVIRONMENTAL EDUCATION
FIELD TRIP GUIDES
FOR
ELEMENTARY SCHOOLS IN CACHE VALLEY

by
Sandra Thorne Brown
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INTRODUCTION

This booklet has been developed to provide teachers with an outline of possible environmental education field trips in Cache Valley.

It is hoped that these initial guides will lead to idea exchange between teachers, and more importantly, to development of a comprehensive program of environmental education for the Cache Valley area.

The field trips in this booklet have been written for grades three through six. However, they may be adapted for other grade levels. Many of the environmental education materials listed in this booklet would be useful in developing activities and projects on all grade levels.

To help in the understanding of environmental terminology, the following definitions are included.

1. Conservation: This topic relates to the care and use of natural resources. Efforts in conservation require prior experience with ecology or environmental education. Without an understanding of interrelationships it is difficult to know how, what, or in which way resources should be conserved.

2. Outdoor Education: This involves learners in outdoor setting. The studies undertaken are to develop an awareness of and appreciation for the outdoor environment. More recently the outdoor education programs have not only included rural or "natural" settings, but a study of urban outdoor environments.

3. Ecology: This term is derived from the Greek term oikos (house), and logy (reasoning). It has been considered to be a biological study, but it also encompasses many other fields. Commonly defined, it is the study of the interrelationships between organisms and their environment. Of the terms defined here, ecology and environmental education are more closely correlated.

4. Environment: All of one's surroundings.

5. Environmental Education: The educational process which encompasses an understanding of most all aspects of the environment. The purpose is to develop an awareness of and appreciation for the environment. Some would contend that it goes beyond those purposes to actively engage students in constructive environmental endeavors.

TREES, LEAVES, AND TWIGS

STUDY SITE: Upper Spring Hollow, Logan Canyon

PURPOSE: Help students develop an awareness of variation between trees, their adaptations, and a sense for the classification of organisms.

MATERIALS: Collection bags, identification sheets, paper, and pencils.

PROCEDURE:

The area of study is centered around Upper Spring Hollow group area. There is a well-defined trail that leads up from this area, across the bridge. This is where the nature hike and study should begin. This trail, from the bridge to the sign for Crimson Trail, should be long enough for the hike but it could be carried further up.

NATURE WALK AND STUDY
1. Observe how leaves are arranged on stems or twigs. Discuss the idea that the leaves tend not to shade one another, and in this way get the most possible energy from the sun. Try to find examples of alternate (birch & chokecherry) and opposite leaves (dogwood). (The first page of the leaf identification booklet illustrates opposite and alternate leaf arrangement and compound and simple leaves.)
2. Observe the margins of the leaves. The edges of some leaves are notched so that the sunlight can reach the lower leaves. Find examples of smooth (dogwood), toothed (box elder), and lobed (maple) margins.
3. Observe the shape of the plant.
   a. The stalks of the lower leaves are longer than the stalks of the upper leaves, so that all can reach light.
   b. Plants grow at the tips all their lives. Lower leaves are the oldest and the upper leaves the youngest.
4. Leaf surfaces.
   a. Evergreen leaves have a cold resistant covering. They can live up to two years or more.
   b. Other leaves we find in this part of the country usually live only one growing season.
5. Leaf adaptations such as tendrils of a vine, thorns or spines, or sword-like leaves may be observed. Discuss reasons for these adaptations.
6. Observe the difference between simple and compound leaves. Examples of simple leaves would be chokecherry and maple while compound leaves would be found on elderberry, wildrose, and box elder plants.
7. Veins, the tubes through which water and dissolved minerals are pumped up into the plant and through which food is carried to all parts of the plant are interesting. Observe:
   a. Palmately veined leaves (big-tooth maple)
   b. Pinnately veined (birch, wildrose, aspen, etc.)
8. Observe where plants are found, e.g. in stream, growing out of rocks by stream, along streambank, in understory, in open area, etc. Discuss why plants are found where they are.

9. Compare the type of trees found on the south facing and north facing mountainsides. Discuss why there would be so much difference in the type and quantity of trees on the two slopes.

10. Observe the terminal bud scars on twigs or saplings and discuss how trees grow. The students may wish to estimate the age of twigs or saplings by counting the terminal bud scars. (See enclosed sheet on twig age.)

ACTIVITY
Hand out leaf identification sheet of leaves to be found on or from the trees in the area. Have the students attempt to find leaves illustrated on the sheets. They should make a note about the approximate size, general description of the plant from which they obtained the leaf, and its location (to water, in shade, etc.)

After about 20 or 30 minutes have the students return to the group picnic area to determine the accuracy of their findings. They may want to arrange the leaves in order of likeness, associate tree forms and leaf shapes, observe seasonal coloration of leaves, or use a reference to identify other leaves.

QUESTIONS AND DISCUSSION
1. What value do leaves have in terms of classification of species? Why classify?
2. Would any kind of tree grow in this area? Why?
3. Why does man plant trees?
4. Would you say that a tree or plant can almost always be identified by its leaves? What must we look for in leaves in order to identify the plant?
5. If the field trip is taken in the fall:
   Why are there leaves on some trees and not on others? What makes you think this? Do all leaves fall from trees at the same time? Do all leaves fall from trees? What would happen if none of the leaves fell to the ground? What might be some of the things that cause leaves to fall?
   What species of trees change their leaf color first in the fall? What trees are late to change their leaf color? What trees don't change color at all?
   What sounds do you hear on a walk through the fields and forest in the fall? Would you hear the same sounds in all seasons? How would the sounds be different?

ADDITIONAL AREA STUDY
There is an excellent fossil bed to the north side of the trail where any child can find a fossil. It would lend itself well to a study of geology.

The spring should not be overlooked as a possible study of water and water organisms.

A soil study could easily be conducted here by digging a shallow soil pit or profile on a mountain slope.
(Ideas for this field trip were taken from "Environmental Education Activity Booklet", Poudre R-1 School District, Fort Collins, Colorado. The sheet of twig age was taken from "Field Activity Sheets", S.E. Penn. Outdoor Education Center, Ridley Creek State Park, Media, Penn. And the sheet on leaf arrangement was taken from Mountain Plants of Northeastern Utah by Berniece A. Anderson and Arthur H. Holmgren, Utah State University Extension Services, Logan, Utah.)
HOW OLD IS IT?

How old is this portion of this twig?

You can find the answer by counting the spaces between the terminal bud scars. (These are the "rings" that go all the way around the twig.)

Can you find a sapling as old as you are but not as tall as you?

Younger than you but taller?

Exactly your age and exactly the same height?

Do all twigs on a tree grow the same amount each year?

What are some of the other marks on twigs besides terminal bud scars?

If a sapling's bark is furrowed estimate age as above.
LEAF ARRANGEMENT

Simple leaf

Pinnately compound: Leaflets arranged on both sides of the petiole.

Palmately compound: Spreading from the tip of the stem like fingers from the palm of a hand.

Opposite: Two leaves to a node.

Alternate: One leaf to a node.

Whorl: A circle of leaves at the same node.
WILD ROSE
(pinnately compound leaves)

DOGWOOD
(opposite leaves)
QUAKING ASPEN
(alternate leaves)

BOX ELDER
(pinnately compound leaves)
CHOKECHERRY
(alternate leaves)

BIG-TOOTH MAPLE
(opposite leaves)
RUSSIAN OLIVE
(alternate leaves)

MOUNTAIN MAHOGANY
(alternate leaves)

RIVER BIRCH
(alternate leaves)
UTAH HONEYSUCKLE
(opposite leaves)

ELDERBERRY (1/2 normal size)
(pinnately compound leaves)
DOUGLAS-FIR
(needle-like leaves)

JUNIPER
(scale-like leaves)
ANIMALS AND THEIR ENVIRONMENT

SITE: 3.8 miles west of Yeates Coal and Oil on the south side of Valley View Highway.

PURPOSE: Give students an exercise in observation and foster an awareness of the interdependence of living things.

MATERIALS: Collection bags, paper, pencils, and animal identification books.

PROCEDURE:

ACTIVITY
The study plot has been divided into three separate areas; open area, wooded area, and river area. (Illustrated on map.)

First, each student should search out every creature possible in the wooded area. Small animals or signs of animals such as feathers or scats should be put in collection bags and larger animals or signs difficult to get (bird song, magpie nest) should be noted on paper.

In about fifteen minutes return to the group and compare and discuss observations noting numbers and kinds of animals found in the area. You may wish to list the findings in broad categories such as birds, mammals, insects, fish, etc.

Repeat this for the open and river areas allowing about 15 minutes for each.

After each area has been searched, compare numbers and kinds of animals found in each site with the other sites.

Hints on where and how to look
1. Look on grass stems, in flowers, on leaves, under leaves, in pods, on and under bark, on the ground, in the ground, in roots, in and on water.
2. Note scats (animal droppings), tracks, nests, runways, chewed stems, and chewed leaves.
3. Look directly above -- vegetation above is also a part of the investigation zone.
4. Look under logs, stones, and matted vegetation.

QUESTIONS AND DISCUSSION
1. How many different kinds of animals did we find?
2. What signs of animals did you see or hear? How did you know what kind of animal was there?
3. Were there more animals under the trees than in the open area? Than in the water area? Why or why not?
4. Why does this animal live here? How are its needs met? (You may wish to introduce the terms habitat and niche. The habitat of an organism is where it lives or could be found. The niche of an organism is its status or position within its community. So the ecological niche of an
organism depends not only on where it lives but also on what it does. It may be said that the habitat is the organisms' "address", and the niche is its "profession".

5. How does each animal relate to the other animals and its environment?

6. Why do carp live in this water and not trout?

7. Did you see any signs of mimicry or camouflage?

8. Has man affected this area? How?

9. Why are there so few different kinds of plants in the open area? Do you suppose there would be different kinds of plants here if cattle didn't graze the area? Why? Is this situation good? How could it be helped?

10. What do you think this area was like before white man came?

11. Do you think this change is good or bad? Why?

12. How will fall affect the animals living in this habitat? Do all animals remain in this area year 'round? What makes you think this? Which animals do you think will stay? Leave? What do you think will happen to the animals which do not remain? What makes you think this?
A STREAM STUDY

STUDY SITE: Temple Fork

PURPOSE: To give the student an understanding of stream communities and methods of measuring stream flow.

MATERIALS: White dishpans, jars, screens, hand lenses, thermometers, measuring tapes and sticks, books on aquatic animals (Golden Nature Guide Pond Life books are good), paper, writing surfaces, and pencils.

PROCEDURE:

I. Observing the Stream Environment

ACTIVITY

As the students approach the stream, they should observe and record observations about the stream environment including plants, animals, air, water, rocks, etc.

QUESTIONS AND DISCUSSION

1. What plants are growing along the stream?
2. What type of plants can you see in the stream?
3. Are these plants found away from the stream also?
4. What did you notice about the water in the stream?
5. What do animals need to live in water?
6. Where would you expect to find animals in the water?
7. What guidelines need to be developed by our group as we collect animals from the stream? (Discuss what to do with rocks that are overturned, and what to do with animals when the session is over.)

II. Observing Aquatic Animals

ACTIVITY

Using collecting equipment (screens and jars) collect as many types of aquatic animals as possible. Put them in white dishpans for observation.

Using identification books and picture keys, the students should generally identify the specimens found. List or sketch these animals and note where they were found and the number of each type found.

QUESTIONS AND DISCUSSION

1. What animals did you find? (Compile a group list)
2. Where did you find the most animals?
3. How are the animals alike?
4. How are they different?
5. How are these animals able to live in the stream?
6. How do they keep from floating away?
7. What other types of life would you expect to find here?
8. Would we expect to find the same animals in a different type of aquatic environment? Why or why not?
III. Measuring Streamflow

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 how many people could live off water in this stream.

ACTIVITY

Divide into two or three groups with the following instructions for measuring stream flow:

a. Measure and stake a distance along a straight section of the stream - 50 ft. or 100 ft.

b. Determine rate of stream flow by throwing a stick in above the upper stake and timing how long it takes to reach the lower stake - ______ seconds. Divide distance by total seconds to determine how many feet the stick floated each second - ______ ft./sec.

\[
\text{number of feet per second the stick floated, or rate of flow.} = \frac{\text{measured distance}}{\text{total seconds}}
\]

c. Measure average width of stream by measuring from edge to edge in three places in staked areas:

first ______ feet
second ______ feet
third ______ feet

Total ______ feet divided by 3 = ______ feet (average width)

d. Measure average depth of stream by taking depth measurements in three places, across the stream in a straight line:

first ______ feet
second ______ feet
third ______ feet

Total ______ feet divided by 3 = ______ feet (average depth)

e. Determine cu. ft. of water per second flowing in stream:

\[
\text{cu. ft./sec} = \frac{\text{ft.} \times \text{ft.} \times \text{ft/sec}}{\text{ft.} \times \text{ft} \times \text{ft/sec}}
\]

(average width) (average depth) (rate of flow (cu. ft. of water in ft. per sec) flowing per sec.)
Water Conversion Table:

A flow of 1 cu. ft./sec. = 448.83 gal/min.
1 cu. ft. of water = 7.48 gal.
1 cu. ft. of water = 62.4 lbs.

How many gallons of water are flowing in the stream each minute?

___ cu. ft/sec. \times 7.48 \text{ gal/cu. ft.} \times 60 \text{ sec.} = \_\_\_\_\_\_\_\_ gal/min.

On the average, each person in a community uses 150 gallons of water per day. How many people will the water in this stream support?

\_\_\_\_\_\_\_\_ gal/min. \times 1440 = \_\_\_\_\_\_\_\_ \text{gal/day} \div 150 \text{ gal} = \text{ Total people stream will support}

QUESTIONS AND DISCUSSION
1. How many people in your community could live off 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. Does this stream always have this amount of water in it? Why or why not?

IV. Water Characteristics
A further study may include the determination of:

<table>
<thead>
<tr>
<th>Estimate</th>
<th>Actual Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. water temperature</td>
<td>_______</td>
</tr>
<tr>
<td>b. air temperature</td>
<td>_______</td>
</tr>
<tr>
<td>c. water pH</td>
<td>_______</td>
</tr>
<tr>
<td>d. dissolved O2 count</td>
<td>_______ ppm</td>
</tr>
</tbody>
</table>

Hach O₂-pH Testing Kits or the equivalent should be used for these measurements. These kits are relatively inexpensive and simple to use. It is suggested that each school have several of these kits as part of their teaching equipment.

QUESTIONS AND DISCUSSION
2. How did your test results compare to your predictions?
3. What else would we need to know to decide whether or
not to drink this water?

4. Under what conditions might we expect to get different test results than we did today?

SUMMARY QUESTIONS
1. What did you find out about water from our study today?
2. Why is water important?
3. Has man affected the aquatic environment at this site? If so, how?
4. What can you do in your everyday life to help improve the way water is managed?

Note: Some of the computations on stream flow may be too difficult for the younger students. You may wish to restrict this to measurements only or center the entire unit around aquatic animals.

(Information for this study was taken, in part, from "Investigating Your Environment Series", U.S. Forest Service, and "Field Exercises: Stream Study" by Carl Johnson at Utah State University.)
AQUATIC INSECTS

HEMIPTERA
(true bugs)

ODONATA
(dragon flies)

PLECOPTERA
(stone flies)

EPHEMEROPTERA
(mayflies)

DIPTERA
(flies, mosquitoes, midges)

NEUROPTERA
(spongilla flies)

MEGALOPTERA
(alderflies, dobsonflies, fishflies)

TRICHOPTERA
(caddis flies)

LEPIDOPTERA
(aquatic caterpillars)

COLEOPTERA
(beetles)
LAND USE PLANNING

SITE: Undeveloped area along Logan River north of Riverside Elementary school.

PURPOSE: To give students an understanding of the problems and complexities of land use planning and its importance to a community.

MATERIALS: Maps of area, paper, and pencils.

PROCEDURE:

ACTIVITY
Tell the students they are all members of a town council which will be making a decision as to how this undeveloped piece of land should be used. In order to make a good decision, they should first become acquainted with the area. Armed with pencil and a rough map of the area, the students should spend 15 or 30 minutes walking through the plot. They should notice the surrounding development and natural features of the undeveloped land.

After the students have gotten a "feeling" for the area, form a circle under the trees.

The students are now at a town meeting listening to opinions from residents on how the land should be used. (You could read the opinions or let the students each take a role or make up their own parts.)

George Grand - President, Whitney Construction Co.
"My architects and engineers have drawn up an exciting plan for this land. We'd like to create a new neighborhood of single family homes. We're prepared to build apartment buildings, of course, if that's what the city really wants. But apartments don't always attract the kind of people that we want in a city like ours. We will build only high-quality homes - the kind of homes that will mean a big increase in the city's property taxes."

Shirley Denton - Chairman, Slum Clean-up Committee
"We don't care what they build on it - as long as it contains housing for us. The city says our homes are slums and have to be torn down. Fine. All we want is someplace else to go. And I'll tell you this - we need this land more than bluejays and a bunch of peeping birdwatchers. It's okay for some people to say it ought to be left to the birds and snakes. But those people have a decent place to live."

Ted Harker - Chairman, City Recreation Committee
"Why not turn this land into the kind of public recreation area that this city should have built years ago? It's the only place left where we could build things like a swimming pool, tennis courts, or pony stables. And we could put in picnic tables, fireplaces, and camping sites. I can promise you that the teen-agers would cause less trouble if we gave them some place where they could have fun."
Alan Balsom - Owner of a small Main Street grocery store
"You'll see. Put up apartment buildings and we'll have slums out there in five years. I say build a shopping center. And give us downtown merchants first crack at renting the new stores. The way it is now, Main Street is so clogged with traffic that customers can't get to our stores. A new shopping center on the land could park 3,000 cars. That's what we need."

Everett Bickard - Chairman, City Redevelopment Commission
"Industry. That's the only answer for the land. We could bring in good clean industries that don't cause pollution - like insurance companies and book publishers. Think of the benefits to the town. More tax income. More jobs. There's no doubt in my mind. This land is the perfect site for an industrial park."

Anne Whiting - Vice-President, City Conservation Club
"Did you know that the land contains rare flora dating back to the last Ice Age? Did you know that those acres contain more than 500 varieties of plants - and nearly as many kinds of bird and animal life? It should remain wild. It should be preserved and cherished as the city's link to nature. Let it be a place where generations of children can go to learn about and enjoy nature."

Michael Earning - President, Universal Rubber Co.
"As you know, Universal Rubber Co. is a growing business. We're growing so fast, in fact, that we're running out of room. That's why we want to lease the land in question from the city. It would be a perfect location for our new warehouse and shipping plant. And it's the only site in town that's available. We're the city's largest employer and taxpayer, and we want to stay here. But if we have to, we'll move our entire operation to a city that will give us room to grow."

Ralph Manning - Owner, Suburban Development Corporation
"Let's face it. This town is a dull place to live. I'm ready to construct a complete entertainment center on the land. Two movie theaters, a big modern bowling alley, miniature golf, a good family restaurant - I'd build all the things a growing city needs. People shouldn't have to drive 40 miles when they want a night out."

Jane Thurston - Chairman, Rustic Village Neighborhood Committee
"We have a nice respectable community. Many of us have worked for years for a home in Rustic Village. And the land in question is practically in our backyards. So we think the residents of Rustic Village have a right to approve what is done with the land. We will fight any proposal that will reduce our property values or make our neighborhood a less desirable place to live."

Joe Stone - President of Students for Power, City College
"This land belongs to the people, man. If the pigs start deciding what they're going to do with it, it will be up to the people to free the land. And I will lead that movement, man. Dig? The revolution is here, man. The people will decide what to do with
the land. Because the land belongs to the people. Dig?"

Jim Potter - Chairman, Equal Opportunities for All
"I'm thinking a lot of the poor people. I ask myself what these people need most. And there's only one answer - jobs. If industry comes to this piece of land, we'll get the jobs we need. I know that a lot of people are afraid that industry will cause more pollution. Well, I don't like pollution, either. But if pollution is the price we have to pay for jobs and dignity as human beings, that's fine. We'll be glad to pay that price."

QUESTIONS
1. Are all of these opinions well-founded? Why or why not?
2. What must we consider before deciding how the land should be used?
3. Is the decision very complex? Why?

ACTIVITY
The students should now decide individually what they think should be done with the land, based on what they have seen and heard. Give them time to make their decision and list reasons for it. They may wish to make a rough design of their plan on the map.

Group together again and give each student a turn to present his or her decision and reasons for it.

QUESTIONS
1. Are any of us right or wrong in our decisions? Why or why not?
2. How do communities settle differences like this?
3. Do you think you should have a say in how the land in your community is used?
4. How can you go about being heard?

ADDITIONAL QUESTIONS AND STUDY
1. What is meant by zoning?
2. Why is our community zoned?
3. How is our community zoned?

Note: Part of this land is owned by the Logan City Board of Education, but the majority of it is owned by a building contractor. Perhaps the student should not be left with the idea that the city owns this particular piece of land and is making a decision as to its use.

(Resident opinions given in this study were taken largely from "Mike's World Your World, A Look At Our Environment", published by Education Ventures, Inc., Middletown, Connecticut.)
WATER AND SEWAGE SYSTEMS

PURPOSE: Acquaint students with their city's water and sewage systems and how they are dependent on these systems.

PROCEDURE:

STOP #1. Dewitt Spring

Water enters this shelter directly from the spring and is then piped to several reservoirs at the east end of Logan City.

QUESTIONS AND DISCUSSION
1. Have you ever seen a spring? Have you tasted the water from it?
2. Why is spring water usually so clean?
3. What is the purpose of the shelter over the spring?
4. Where does spring water come from?
5. Is this why mountains are often called "watersheds"?

STOP #2. City Well, Canyon Road and Crockett Avenue

This is one of two wells in Logan which provide the city with water in addition to Dewitt Spring. Two more wells are being developed to provide water as the city grows.

QUESTIONS AND DISCUSSION
1. What is a well?
2. How is the water brought to the surface?
3. Do you suppose the noise you hear is a pump?

As you drive through Logan on the way to stop #3, discuss the water system leading to homes and the sewage system leading away from homes.

STOP #3. Logan City Sewage Ponds

Drive to the east end where the sewage enters the ponds. Discuss (illustration will help) how the sewage moves slowly from pond to pond while it is worked on by algae and bacteria. These bacteria (largely purple sulphur) and algae obtain their energy while breaking down the sewage into other kinds of materials that are not as polluting to the water. (You may wish to explain this in the form of a "food chain"). The cleansed water emerges from the ponds in the southwest corner. Compare this water with the first pond's. This water is cleaner than the Logan River water that it eventually joins. The Logan River joins the Bear River which terminates at the Bear River Bird Refuge.

QUESTIONS AND DISCUSSION
1. Does this seem to be a good method of sewage disposal? Why or why not?
2. How do other cities handle their sewage? (The students may want to research this.)

3. What can we do about reducing pollution of water that passes through our homes?
   (Use low-phosphate detergents. Phosphates "fertilize" algae and vegetation that help make the green scum that increasingly borders our lakes and rivers.)
   (Don't flush oil or grease down the toilet...the bacteria can't break this down. Grease and oil are easily visible on these sewage ponds.) etc.

4. How can we help conserve our water?
   (Turn off taps as soon as you're through with them... don't let the water drip.)
   (Place a brick in the flush tank of your toilet. This may reduce the amount of water your home uses up to 3 gallons a day.) etc.

5. Discuss the water cycle.

6. How many different kinds of birds can you see? Why are they here?

Note: A key to the sewage ponds can be obtained by contacting the Logan City Engineer.
GARBAGE DISPOSAL

PURPOSE: Acquaint students with their city's garbage disposal system and what they can do to help.

PROCEDURE:

STOP #1. Open and Burning Dump (Wellsville, Smithfield, Hyrum, etc.)

There are still 22 open dumps in the valley. Open dumps contribute to air and water pollution and are sources of food for insects, rodents, birds, and other wildlife that may act as disease carriers.

Give the students 5 or 10 minutes to become acquainted with the dump and record all signs of pollution that they can see.

QUESTIONS AND DISCUSSION

1. What signs of pollution do you see here?
2. Is this a good situation? Can you think of any ways that it can be helped?
3. We average four pounds of garbage per person per day in the United States. How can we cut down on this?
4. What do you do with grocery or plastic bags, non-returnable bottles, cans, etc.? Can you think of ways that you can re-use these things or make things from them?
5. What is meant by "re-cycling"?
6. What is meant by "biodegradable"?
7. What is meant by "decomposition"?

Discuss garbage removal from the home to the garbage disposal site on the way to stop #2.

STOP #2. Logan City Sanitary Landfill

BACKGROUND INFORMATION

A sanitary landfill consists of four basic operations: (1) the solid wastes are deposited in a controlled manner in a prepared portion of the site; (2) the solid wastes are spread and compacted in thin layers; (3) the solid wastes are covered daily or more frequently, if necessary, with a layer of dirt; (4) the cover material is compacted daily. The final result can be a golf course, tennis court, botanical garden, or whatever not too heavy activity the community wants.

Air pollution caused by smoke should not occur. Burning is not permitted at a properly operated landfill. If an accidental fire does occur, it should be extinguished immediately.

If a landfill is intermittently or continuously in contact with ground water, it can become grossly polluted and unfit for domestic or irrigational use. So it should be located at a safe distance from streams, lakes, wells, etc.
Odors are usually the result of anaerobic micro-organisms digesting the materials. They are generally considered a nuisance but can be a public health hazard. Best control for odors is rapid and continuous cover of solid wastes and sealing surface cracks of completed areas of the landfill.

Birds and other wildlife are common at open burning dumps, but there is little exposed food to attract wildlife at sanitary landfills. If the site is kept clean, and solid wastes are covered promptly with earth, gulls and other wildlife will be at a minimum.

QUESTIONS AND DISCUSSION

1. How is an open dump different from a sanitary landfill?
2. After carefully observing this site, do you think it fulfills the criteria of a good sanitary landfill? Why or why not?
3. Does this landfill contribute to air pollution?
4. Why is the location of the landfill important in respect to water pollution? Do you think this landfill is located in a good place?
5. Do you see many birds or other wildlife? Why?
6. Could any of the pieces of garbage you see have been recycled or used for another purpose? How can you help?
7. Which pieces of garbage do you think would decompose rapidly and which would take years?
8. Do you think sanitary landfills are a good way to take care of our garbage? Why or why not?

(Background information on sanitary landfills was taken from Sanitary Landfill Facts, Sorg, Thomas J., and Hickman, H. Lanier, U.S. Department of Health, Education, and Welfare, 1970.)
ENVIRONMENTAL EDUCATION DOCUMENTS

The following list of conservation-outdoor-environmental education documents was compiled by the ERIC Information Analysis Center for Science and Mathematics Education. Teams of environmental education specialists have identified these as excellent curricular materials. The listing includes title of the document, the organization producing it, and the source to contact for obtaining it.

Curriculum Materials (39 units)

Golden Valley Environmental Science Center
Mr. Richard Myshak
5400 Glenwood Avenue
Minneapolis, Minnesota 55422

Environmental Education Program--Organization and Operation
Regional Environmental Education Program
Mr. John Wibby, Jr.
Yarmouth High School
Yarmouth, Maine 04096

Environments--Teacher's Guide
Populations--Teacher's Guide
Science Curriculum Improvement Study
Lawrence Hall of Science
University of California
Berkeley, California 94702

Field Trip Activity Sheets and Student Follow-Up Sheets

Single Topic Curriculum Units
Southeastern Pennsylvania Outdoor Education Center
Rose Tree Media School District (Administrator)
Box 66
Lima, Pennsylvania 19066

Man Against His Environment
State University of New York at Albany
State Education Department, Division of Educational Communications
Albany, New York 12224

Man and the Environment--Student Text
Man and the Environment--Teacher's Edition
Man and the Environment--Laboratory Supplement
Educational Research Council of America
Published by: Houghton Mifflin Company
110 Tremont Street
Boston, Massachusetts 02107

Our Man-Made Environment, Book Seven
Group for Environmental Education
1214 Arch Street
Philadelphia, Pennsylvania 19107
Curriculum Activities Guide to Water Pollution and Environmental Studies
Tilton School Water Pollution Program
Mr. Joseph H. Chadbourne
Tilton School
Tilton, New Hampshire 03276

A Guide For Teaching Conservation and Resource-Use Education in the Schools
of Louisiana -- Soils and Water
North Louisiana Supplementary Education Center
Mr. Howard McCollum
Natchitoches, Louisiana 71457

Communities -- Student Manual
Communities -- Teacher's Guide
Science Curriculum Improvement Study
Lawrence Hall of Science
University of California
Berkeley, California 94720

Environmental Education -- Objectives and Field Activities
Outdoor Education Project, West Kentucky
Mr. James M. Major
1000 Clark Street
Paducah, Kentucky 42001

Interdisciplinary Outdoor Education
Interdisciplinary Outdoor Education Program
Mr. Edward Osborn
Shoreline School District #412
Northeast 18th Street and 20th Avenue N.E.
Seattle, Washington 98155

Land-Use: Concern--Challenge--Commitment
Water Quality Monitoring Manual
Water -- The Waste of Plenty
Conservation and Environmental Science Center
Dr. Eugene Vivian
Box 2230, R.D. #2
Browns Mills, New Jersey 08015

Man and His Environment
High Rock Park Conservation Center
Mr. Harry F. Betros
Nevada Avenue
Staten Island, New York City, New York 10306

Naturealm (A Classroom Teaching and Resource Guide in Conservation Educ.)
Naturealm
Mr. Richard Bartholomew
1308 Third Avenue
Duncansville, Pennsylvania 16635
Teacher's Guide
Colorado State University Nature Center
Mr. Howard Bruner
Department of Education, Room 214, Liberal Arts
Colorado State University
Fort Collins, Colorado 80521
VITA
Sandra Thorne Brown
Candidate for the Degree of
Master of Science

Thesis: Development of Environmental Education Field Trip Guides for Elementary School Teachers in Cache Valley, Utah

Major Field: Forest Recreation

Biographical Information:


Education: Graduated from Logan High School, Logan, Utah in 1966; received the Bachelor of Science degree from Utah State University, with a major in Forest Science in 1970; completed requirements for the Master of Science degree, specializing in forest recreation, at Utah State University in 1972.

Professional Experience: summer 1969, forest technician, Uintah Primitive Area, Utah; summer 1970, public use specialist, Bear River Bird Refuge, Utah; summer 1971 and 1972, interpretive ranger, Cache National Forest, Utah.