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ABSTRACT

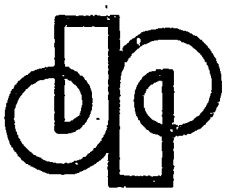
This teacher's guide, and accompanying set of 24 activity packets, is designed to direct outdoor learning experiences by students. Information is collected and then shared in large group classroom discussion. The 24 activity packets are divided into levels: Level I is recommended for grades 4-6 and Level II for grades 7-12. Each guide is a complete description of an investigation involving an environmental topic or issue. Each activity guide includes a synopsis, environmental goals, background, purpose, objectives, materials needed, introduction, and activity description. (RE)

we can help!

A TEACHER'S GUIDE TO ENVIROMENTAL EDUCATION ACTIVITIES

DEPARTMENT OF THE INTERIOR · U.S. FISH AND WILDLIFE SERVICE

We Can Help and the **Outdoor Classroom Guides** are part of a series of materials to help further community based environmental education. They were produced by the **Minnesota Environmental Sciences Foundation Inc.** under contract to the Fish and Wildlife Service, North Central Region, U.S. Department of the Interior. Work was done under the supervision of Peggy Charles, Environmental Education Specialist, U.S. Fish and Wildlife Service.



Jenny Publishing Company Inc.
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Designed and Produced by John T. Lenertz Art Studio, Minneapolis, Minn.

SECTION 1 START HERE

OUR PURPOSE

We would like to share our land and wildlife with you. The U S Fish and Wildlife Service can introduce you to study locations and teaching services which will stimulate your students They can help make your teaching easier

There are several ways to learn from a natural resource through recreation, photography, poetic expression, fishing, or eating wild foods. But to bring the use of natural resources closer to classroom teaching, we have devoted these outdoor investigation suggestions to the PROCESS OF INFORMATION GATHERING

You already have the teaching skills necessary to organize student activities. Students will do their own investigations, use skills and concepts which are common to many school subject areas.

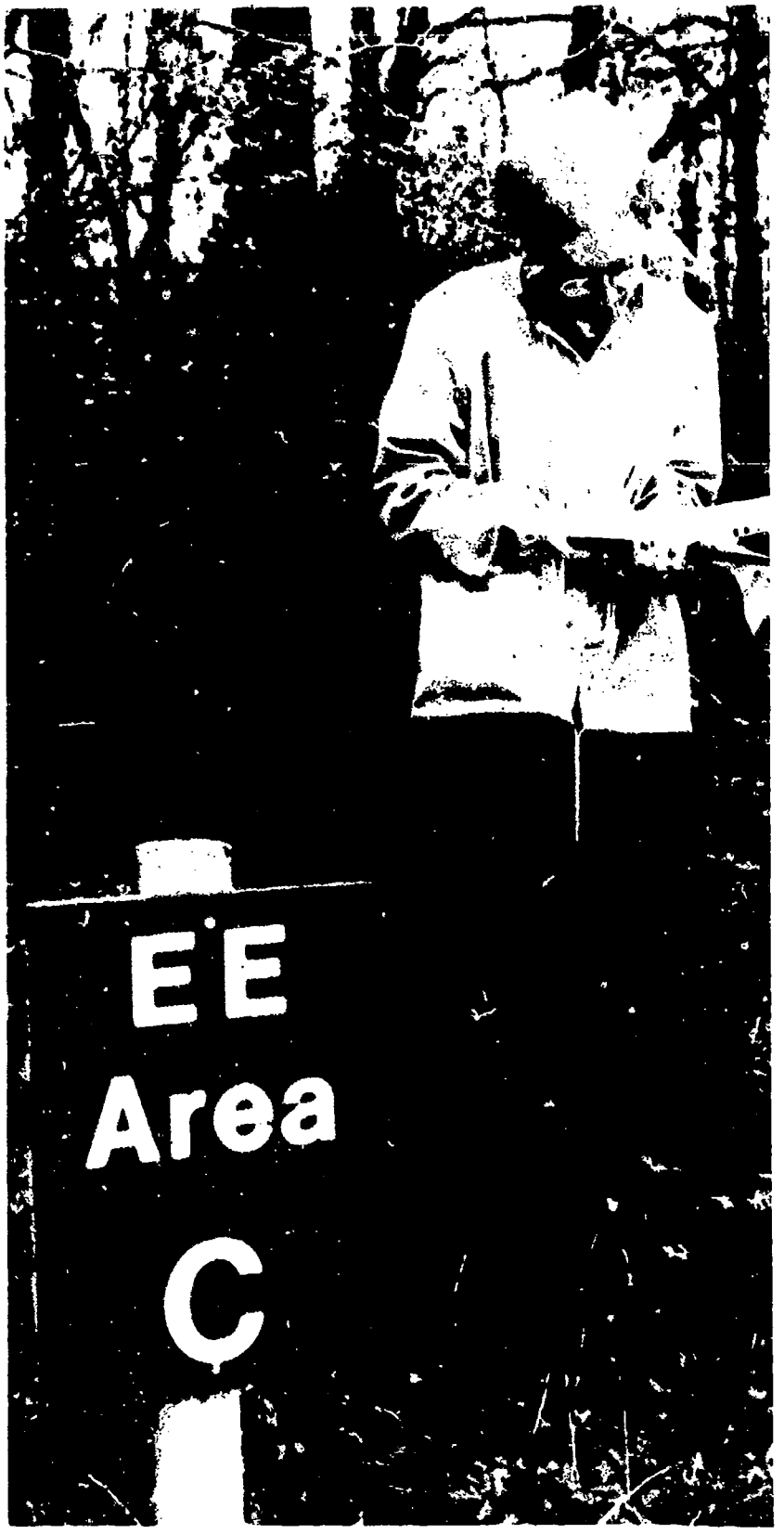
Your work of teaching will be easier. Simple preparation and skill practice for students before the investigation will relieve you of constant "on-the-spot" leadership. Greater stimulation and involvement will motivate your students to increased attention and learning. Enthusiasm spills over to other work in your classroom.

• OUR RESOURCES

Photo Tom Ramsay

Photo Ed Landin

Photo Ed Landin

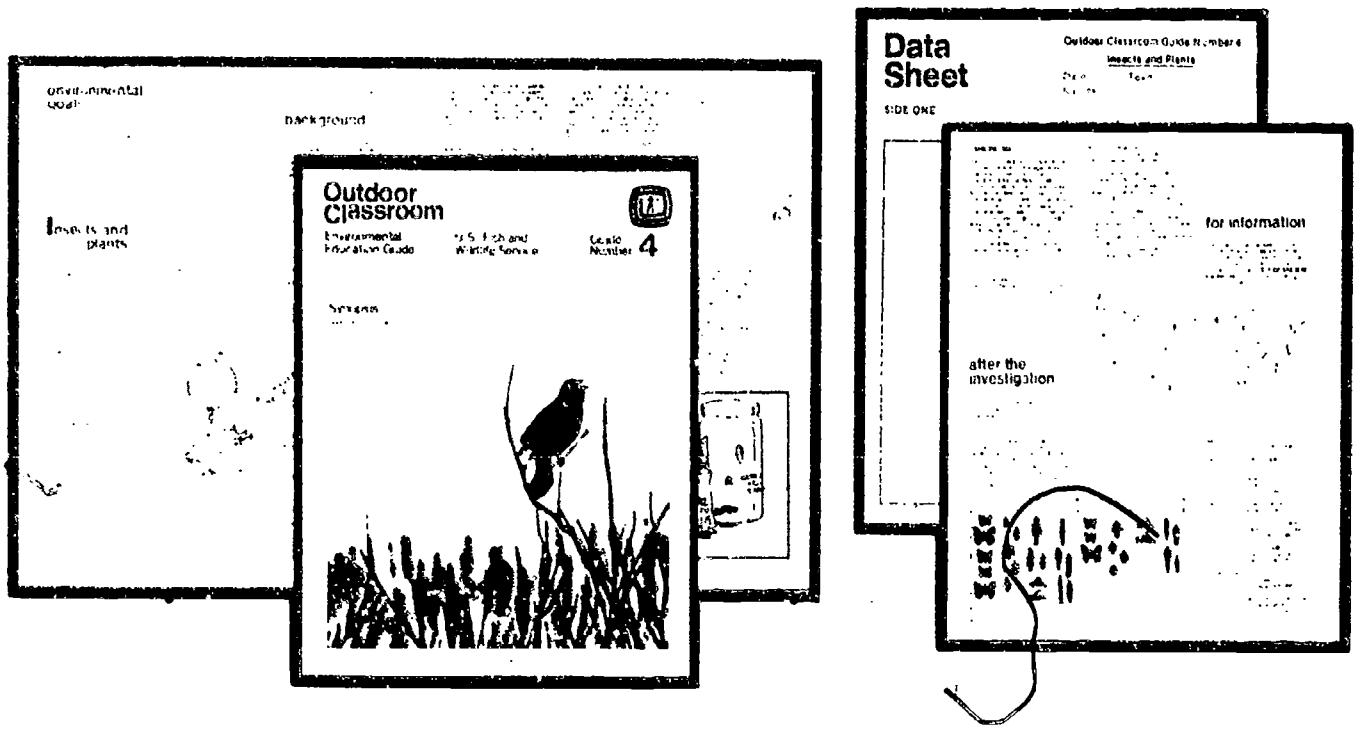


The Service can help match outdoor classroom sites to you and your students' needs. Although many of the activity guides have been developed for use on Service lands, they can be used in many kinds of outdoor locations if you are unable to make use of a wildlife refuge or fish hatchery. With these activity materials and the related study location, you are prepared to give your students an enjoyable and rewarding environmental experience.

Service people are relaxed and informal, although serious about the importance of the environment. Explain your teaching resource needs and discuss what can be provided for your students. You will find that the working relationship is as enjoyable as the natural resources from which your students will learn.

2 SECTION

ACTIVITIES



OUTDOOR CLASSROOM GUIDES

• WHAT ARE THEY?

Each guide is a complete description of an investigation involving an environmental topic or issue. Two levels have been developed: Level I is recommended for grades 4-6 and Level II for grades 7-12. The conceptual information and process skills in the guides are common to teaching programs in other areas. Most guides can be completed in one day or less.

• WHAT'S THEIR PURPOSE?

The guides provide direct outdoor learning experiences. Information collected by small groups or teams is shared and becomes the basis for large group discussion and interpretation. This process can help develop learning skills and increase understanding. These experiences can lead to a positive attitude toward the environment.

• HOW ARE THEY USED?

The guides are developed so that data collection is carried out by small groups or teams. The data are then pooled and interpreted by the entire group or class. This process can involve everyone in all phases of the investigation, providing for multiple data input and allowing for large group discussion and decision making. However, it is also possible to use the guides for small group or independent projects. Most guides are written for an outdoor site, some are best accomplished at a wildlife refuge or fish hatchery, but more can take place on nearby sites such as a schoolyard, vacant lot or park.

• OUTDOOR CLASSROOM GUIDE TITLES

LEVEL 1

1. Plants and Places
2. Water Flow and Impoundment
3. A Population of Pocket Gophers
4. Insects and Plants
5. Snow Temperatures
6. Snow Depth and Snow Melt
7. Social History Cemetery Study
8. Old Ponds and Young Ponds
12. Wildlife/Wildlands Photography
13. Careers
17. Muskrats
21. Fish Hatcheries

Level I — recommended for grades 4-6

LEVEL 2

9. Deer Food Survey
10. Water Quality Analysis
11. Public Use of Public Land
14. Foreign Language
15. Waterfowl Nest Structures
16. Fire Ecology
18. Wetlands and Wildlife
19. Fish Populations
20. Public Survey
22. Farming and Wildlife
23. Redwinged Blackbird
24. Endangered Species: Mystery Birds

Level II — recommended for grades 7-12

SYNOPSIS:

A brief description of the activity.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 4

Synopsis

INSECTS AND PLANTS
In this activity students gain some understanding of the link between plant diversity and insect diversity by comparing the variety of plants and insects found in a semi-natural "weedy" area with those found in a lawn. They collect and display samples of each.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

BACKGROUND:

A discussion of supporting information related to the general content of the activity.

PURPOSE:

This section identifies general areas of information and skills contained in the investigation.

OBJECTIVES:

Activity goals achievable by the student who participates in the investigation.

MATERIALS REQUIREMENTS:

A list of equipment and supplies necessary to complete the investigation.

INTRODUCTION:

A discussion of information related directly to the activity with suggestions for assistance, if needed.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Did you ever wonder why there are so many different kinds of the same thing? There are numerous kinds of flys, beetles, worms, algae, bacteria, trees, snakes, frogs, fishes, birds and mammals.

It may seem that animals of the same kind, such as sparrows, all behave about the same way. This is not true.

Insects and plants

A. **Purpose:** This activity will acquaint students with—

1. The variety of plants and insects that exists in semi-natural "weedy" area.
2. The variety of plants and insects that exists on a lawn.
3. A way to collect, display, and compare samples of plants and insects.
4. The construction of an insect net.

B. **Objectives:** During this activity students will—

1. Compare an area where plants and insects are diverse with an area where they are not.
2. Make inferences about what causes this diversity.
3. Make a display of plants and insects to illustrate the concept of diversity.

C. **Activity requirements:** Each student, or pair of students, will need—

1. Materials to make an insect net: broom handle or equivalent; panty hose, coat hanger, pliers, needle and thread, extra wire.
2. Killing jars: baby food jars with caps, cotton soaked in fingernail polish remover or alcohol.
3. Grocery bag to contain plants.

The class will need—

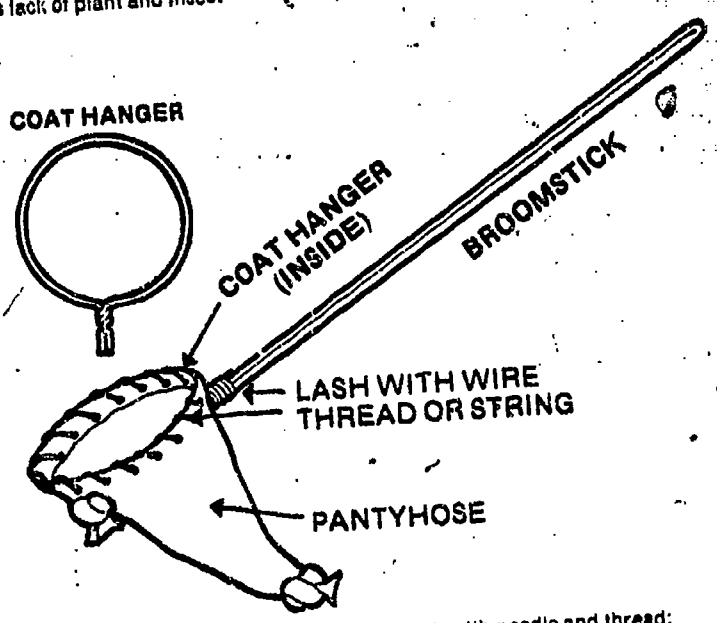
1. Large pieces of white paper for displaying insects and plants.
2. White glue.
3. Felt-tipped markers.
4. Golden Series on Insects.

Introduction

On a local scale the concept of diversity can be studied and understood by students. This activity suggests a way to compare an unmanaged, weedy roadside with its plant and insect life and a managed and manicured lawn with its lack of plant and insect diversity.

Before You Begin

Each student can make a net, or if students will be working in teams of two they might make one net for each pair. (See illustration.) Follow this procedure:



- Remove the elastic waistband from the pantyhose;
- bend the coat hanger into a circle of at least 10 inches in diameter, and twist the ends around each other securely;
- fold the upper edge of the hose over the circle at least 1 inch and whip stitch with needle and thread;
- knot one leg tightly at the very top and cut it off below the knot;
- knot the other leg at the knee or below;
- lash the twisted ends of the coat hanger to the broom handle (or stick) with an extra length of wire.

When one observes different species of sparrows, it is discovered that each species behaves differently than the others. It may differ in when and what it sings; what, when and how it eats, when and how it nests; how it flys and walks; etc.

Because of the diversity of plant and animal life in the environment, each species of sparrow has been able to "put together" a unique composite of behaviors or niche. Since the niche of each species of sparrow is unique, sparrows of different species are not competing directly with each other. This allows several different kinds of sparrows to live in the same place.

And so it is with most animal life — a diverse environment with diverse plant life allows for a diverse animal life. Diversity then, creates a complex fabric of interrelationships among the environment, plants and animals. This fabric is both flexible and durable. Even in the face of disaster caused by floods or fires or hurricanes, some of the fabric remains to begin again.

Many things can affect the natural diversity of the environment. Modern agriculture has turned the diverse native prairie into a domestic prairie of corn and wheat. What effects has this had on prairie animal life? This activity may help answer this question.

Planning the Activity

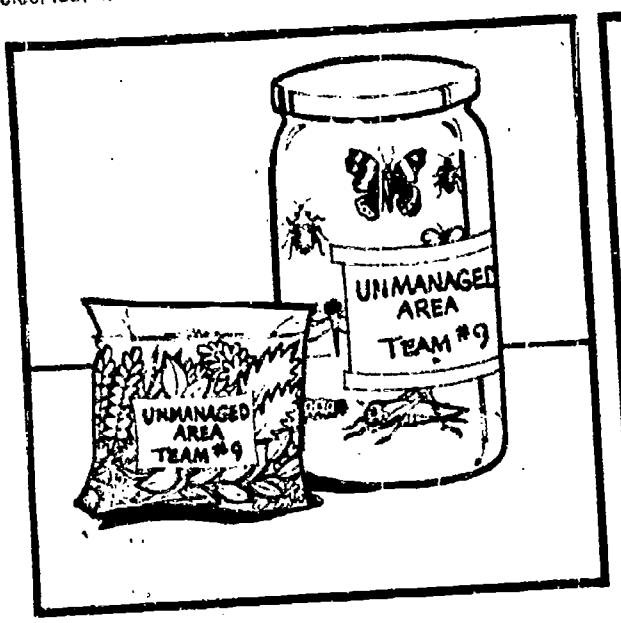
Locate two areas to compare with one another; one managed by people and one unmanaged, weedy, and large enough to allow the class to work in teams of two with plenty of space for each team. An undisturbed roadside or railroad right-of-way are good possibilities. The managed area might be a grassy area of the school grounds.

In order that comparisons between the two areas be accurate, the class should decide how many sweeps with their net each team will make in each of the two areas (4 or 5 sweeps is suggested). Decide, too, how much time will be spent looking on the ground in each area for crawling insects (5 minutes is suggested). Finally, decide how many different plants to collect at each area (5-10 is suggested).

Activity Description

When the class arrives at the weedy area, assign each team to a generous space. First teams should collect one example of each of 5 or 10 plants, pick the plants at ground level, place them in a bag, and mark the bag with their names. Then they should make the agreed upon number of sweeps with their nets, being careful to sweep at a different level and a different place each time. Next examine the ground for crawling insects, and collect them for the length of time agreed upon. Transfer all insects to killing jars, and mark the jars with team names and location. Leave the insects in the jars for at least an hour.

The procedure can be repeated when the class moves to the school lawn. Here, all sweeps will have to be made at grasstop level. Spend the same amount of time collecting crawling insects. Again, transfer to killing jars and mark the jars. In collecting plants, it may be impossible to locate 5 to 10 different kinds. Perhaps students will have to collect 5 to 10 grass plants.



ACTIVITY DESCRIPTION:

The investigation is described in enough detail so that the user can follow the procedure step-by-step. If pre-activity planning is necessary, that process is also described here. Brief introductory activities may also be included.

DATA SHEET:

A removable sheet on which students record their findings. These may be duplicated.

Data Sheet

Outdoor Classroom Guide Number 4

Insects and Plants

Date _____ Team _____

Names _____

_____

Collecting Area _____

SIDE ONE

	Ant Types	Beetle Types	Grass-hopper and Cricket Types	Fly Types	Bee Types	Dragon-fly Types	Butter-fly and Moth Types	Other Critters Spiders Worms
PLANTS								

USING THE DATA:

Data collected during the investigation are used in various ways for discussion and interpretation. Discussion questions are included.

Using the Data

Back in the classroom, make two large displays: one of unmanaged area plants and insects, and one of managed area plants and insects. Cover two tables (one for each area) with white paper, and draw columns on the paper as illustrated on the Data Sheet. It will not be necessary to know the varieties of insects by name. Divide the entire class collection from each area on the basis of look-alikes, e.g. ants, beetle-types, butterfly and moth-types, etc. Line them up in the columnar areas. On the other half of the table, arrange the plants collected from the same area.

This process could be followed first by individual teams and then a group display could be made using all of the information from the entire class.

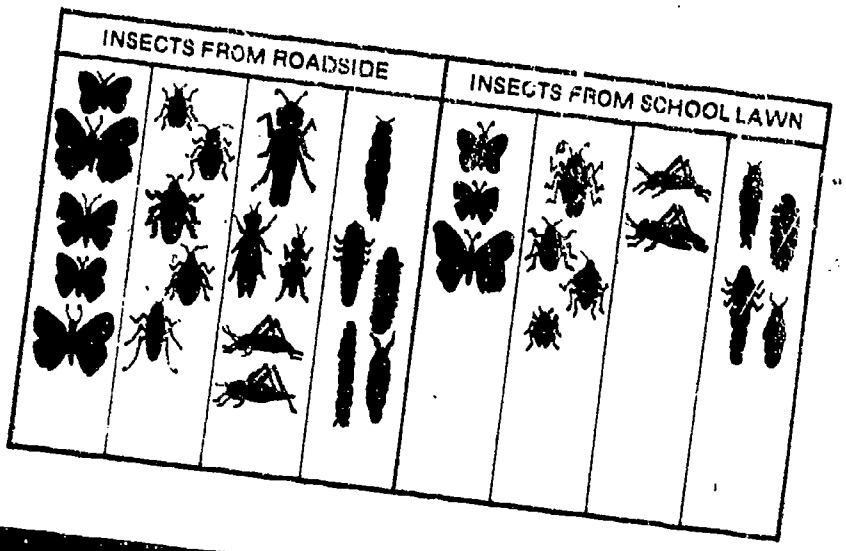
With this visualization of diversity in front of them, students can begin to ask themselves some questions:

- Which area shows more insect diversity; plant diversity?
- What could attract insects to an area? Is it variety? Plant height and size? Plant color? Might it be food supply? Shelter? Temperature? A combination of reasons?
- If this great diversity exists when people leave an area alone to grow and develop naturally, what do you think the plant and insect life was like here 150 years ago?
- What effect on insect variety does a cultivated flower garden have? A field of corn?

after the investigation

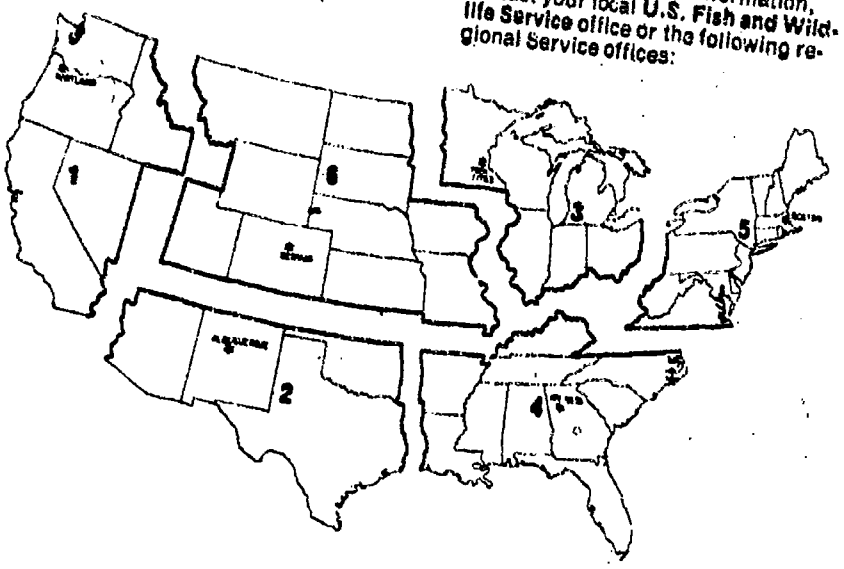
Students might be interested in knowing what the names of their insects are. If so, they could use a field guide to insects to identify and label them.

They might make a more permanent display of their collection which could be designed in such a way that it would be artistic, while still illustrating the concept of diversity. Plants and insects could be glued to heavy paper in an approximation of their natural appearance, like this:



for information

Many Service land areas provide shelter, toilet facilities and limited equipment for your use. For trip reservations and further information, contact your local U.S. Fish and Wildlife Service office or the following regional Service offices:



Region I — P.O. Box 3737, Portland, OR 97208

Region II — P.O. Box 1306, Albuquerque, NM 87103

Region III — Federal Building, Ft. Snelling, Twin Cities, MN 55111

Region IV — 17 Executive Pk. Dr. NE, Atlanta, GA 30329

Region V — John W. McCormack Post Office and Courthouse, Boston, MA 02109

Region VI — P.O. Box 25486, Denver Federal Center, Denver, CO 80225

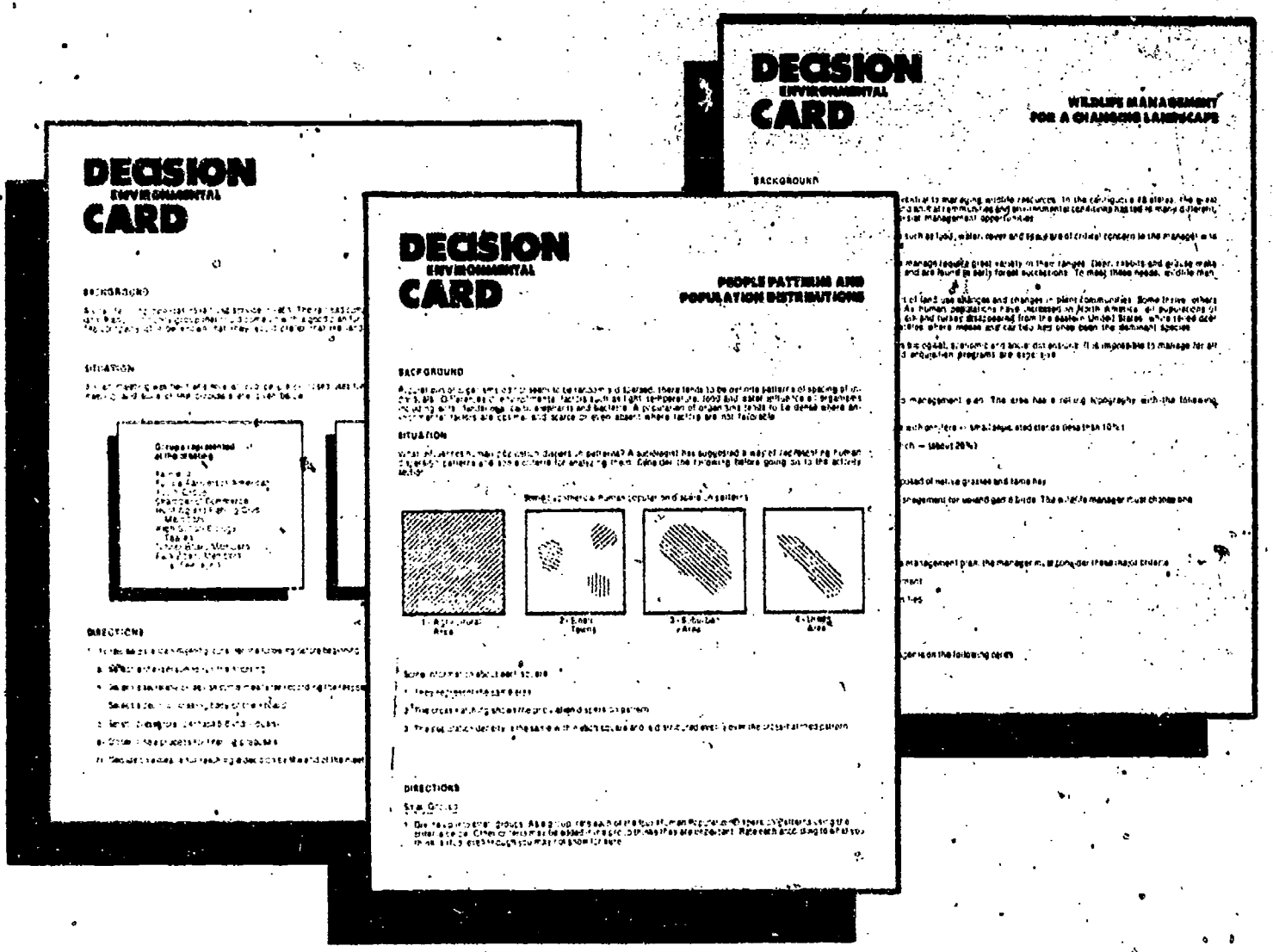
Alaska Area Office — 813 D Street, Anchorage, AK 99501

This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

AFTER THE INVESTIGATION:

Suggestions for further activities to develop the investigation further for the entire class, or provide independent study material for students with continuing interest.

ENVIRONMENTAL DECISION CARDS



RECOMMENDED FOR GRADES SEVEN-TWELVE

• WHAT ARE THEY?

Each card is a one to two-hour problem-solving activity concerning a land-use or wildlife management issue. The issue is described along with conflicting or opposing viewpoints. Role playing and small group discussion are used to consider the viewpoints before arriving at a decision.

• WHAT'S THEIR PURPOSE?

These cards were written to help build skills in problem solving. The process of reaching a decision when opposing viewpoints and alternative solutions are considered provides practice in group communication and objective thinking. These cards are also useful as introductory activities to the investigative Outdoor Classroom Guides.

• HOW ARE THEY USED?

The cards are not developed as teacher-presented materials. Instead, a small group of students should be able to carry out the activities on an independent basis. It is suggested that several small groups deal with the same activity and then share their decisions with the entire group. This should result in a free exchange of ideas and a better understanding of the issue.

BACKGROUND:
A brief description of the issue and pertinent background information.

DECISION ENVIRONMENTAL CARD

PEOPLE PATTERNS AND POPULATION DISTRIBUTIONS

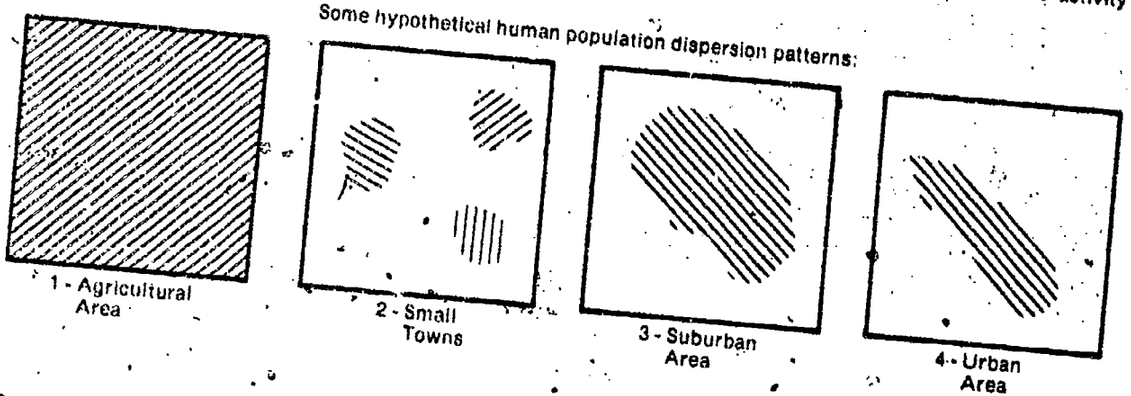
BACKGROUND

Populations of organisms do not seem to be randomly dispersed; there tends to be definite patterns of spacing of individuals. Differences in environmental factors such as light, temperature, food and water influence all organisms including ants, dandelions, cacti, elephants and bacteria. A population of organisms tends to be dense where environmental factors are optimal and scarce or even absent where factors are not favorable.

SITUATION

What influences human population dispersion patterns? A sociologist has suggested a way of representing human dispersion patterns and some criteria for analyzing them. Consider the following before going on to the activity section.

Some hypothetical human population dispersion patterns:



Some information about each square:

1. They represent the same area.
2. The cross-hatching shows the population dispersion pattern.
3. The population density is the same within each square and is distributed evenly over the cross-hatched pattern.

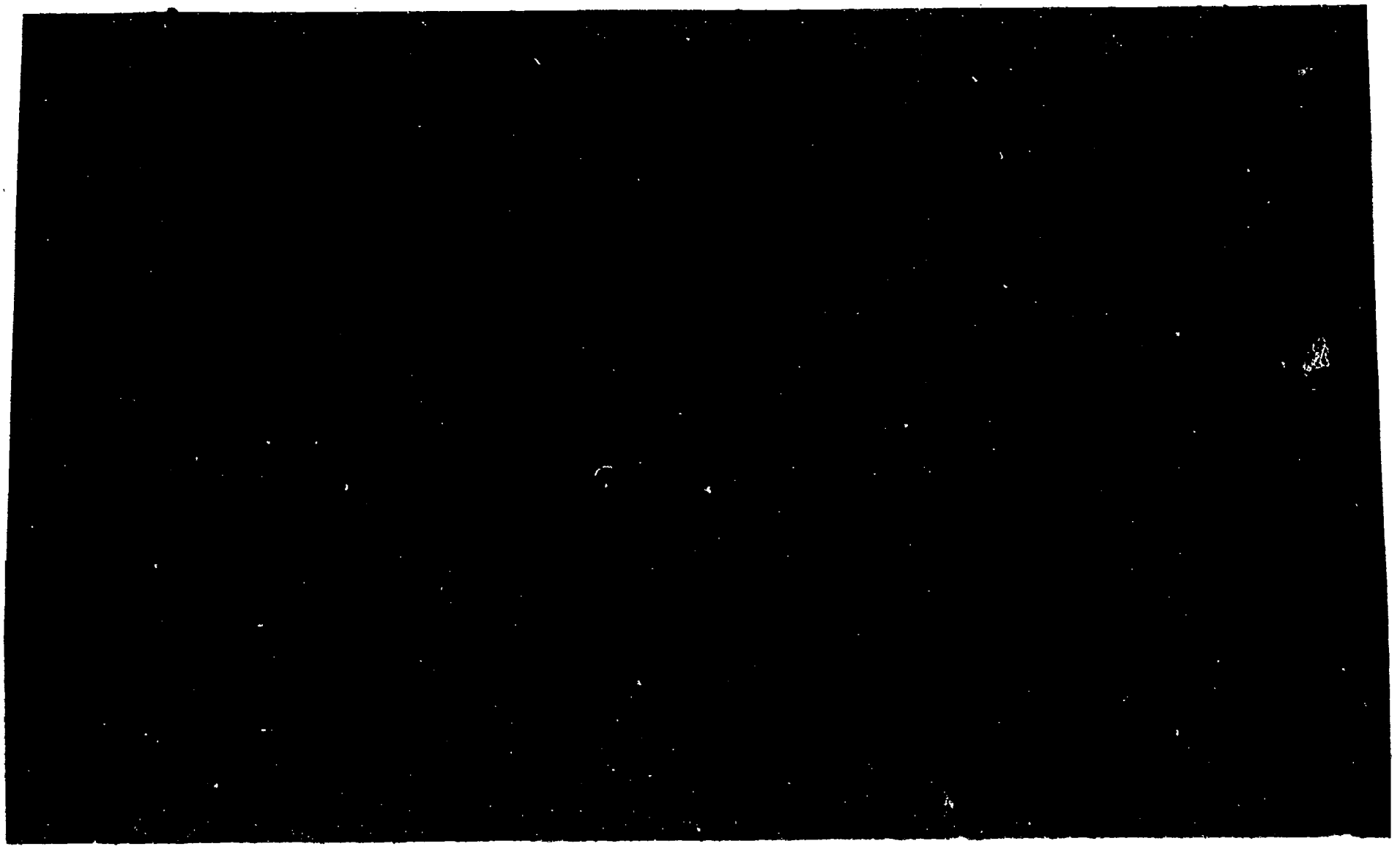
DIRECTIONS

Small Groups:

1. Divide up into small groups. As a group, rate each of the four Human Population Dispersion Patterns using the criteria below. Other criteria may be added if the group thinks they are important. Rate each according to what you think is true, even though you may not know for sure.

SITUATION:
The specific problem which creates the need for decision.

DIRECTIONS:
A step-by-step procedure for the activity with discussion questions.



DECISION ENVIRONMENTAL CARD

1.

WILDLIFE MANAGEMENT FOR A CHANGING LANDSCAPE

BACKGROUND

Problems of land and water use are central to managing wildlife resources. In the contiguous 48 states, the great variation in the composition of plant and animal communities and environmental conditions has led to many different, challenging and sometimes controversial management opportunities.

Factors which limit population growth such as food, water, cover and space are of critical concern to the manager who seeks to lessen their adverse effects.

Many species of wildlife for which we manage require great variety in their ranges. Deer, rabbits and grouse make extensive use of openings and edges, and are found in early forest successions. To meet these needs, wildlife managers mix habitat types.

Animal populations change as a result of land-use changes and changes in plant communities. Some thrive; others become scarce and even disappear. As human populations have increased in North America, all populations of animals have been affected. Wolves, elk and turkey disappeared from the eastern United States; white-tailed deer extended their range into the lake states where moose and caribou had once been the dominant species.

The question of management includes biological, economic and social dimensions. It is impossible to manage for all species. Habitat restoration and land acquisition programs are expensive.

SITUATION

A large land area requires a wildlife management plan. The area has a rolling topography with the following description:

Medium age stands of hardwoods with conifers — small separated stands (less than 10%)

Mixed age stands of aspen and birch — (about 20%)

Woody shrubs — (over 50%)

Clearings — (about 10%) — composed of native grasses and tame hay.

One aspect of the plan must include management for upland game birds. The wildlife manager must choose one species from these three possibilities:

a) Prairie Chicken
b) Sharptail Grouse
c) Ruffed Grouse

In choosing a species and developing a management plan, the manager must consider these major criteria:

1) The economics of land management

2) The economics of local communities

3) Public recreational needs

4) Public concerns

The information collected by the manager is on the following cards.

DIRECTIONS

Small Groups:

1. Form groups of six. Each participant gets one information card; each group must have all six cards.

2. Based on the information cards, decide which game bird should be managed for, and the reasons.

Large Group:

1. Each small group discusses their choice and rationale with the entire group.

2. Based on the small group presentations, develop one management plan for the entire group, choosing one upland game bird.

CARD A

(1) Ideal Sharptail Grouse habitat consists of about 50% brush land for roosting, nesting, and feeding; and about 10% open grassy areas for loafing, mating display and foraging.
(2) The Ruffed Grouse is a favored game bird among hunters.
(3) It will take at least 30 years of intensive land management to turn this area into good Prairie Chicken habitat.
(4) The amount of money spent on managing the area is critical. The management budget is limited.

CARD B

(1) The area is changing (succession) towards a forest cover. To hold back the natural succession that is occurring, the land managers could use controlled burning. It is an inexpensive method and one the budget will allow.
(2) The community consists mostly of retired farmers. There is a small Prairie Chicken population which they remember from their youth.
(3) Ideal Ruffed Grouse habitat consists of areas that have grown over to hardwood-brushland composed of mixed age stands of aspen and birch and mixed density of understory shrubs.
(4) Economics of the area would respond favorably to increased revenue from license fees, food, beverage and lodging sales due to an influx of hunters from surrounding regions.

CARD C

(1) If the land is used for Prairie Chickens it could not be disturbed, as the birds are quite sensitive. Therefore, the land could not be used for any other recreational needs.
(2) Good Prairie Chicken habitat consists of broad expanses of native grasses. Until these grasses are established, the land manager must reseed for native prairie grasses.
(3) Sharptail Grouse habitat is disappearing because of natural succession which will eventually replace the brush lands with trees. If we want to save a huntable population of Sharptail Grouse, it must be through land management.
(4) Managing for Prairie Chickens will never produce a huntable population.

CARD D

(1) This is the only land in public ownership in the vicinity. It must meet a variety of public recreational needs.
(2) The land managers budget prohibits cultivation grains as a food supply.
(3) Studies have shown that controlled burning does not cause the amount of air pollution of which it is suspected. A good public information program can help the community understand this.
(4) This parcel of land will eventually become good Ruffed Grouse habitat through the natural process of succession.

CARD E

(1) Controlled burning is totally unacceptable to the community because of the smoke and consequent air pollution.
(2) Aerial spray to clear an area is very effective. It only needs doing once every 20 years. In the long run it would prove to be the most economical
(3) To manage for Sharptail Grouse, land managers would have to clear different parts of the land on a continuous rotation once every five years to maintain shrub areas.
(4) Native prairie grasses are needed as a staple in the Prairie Chicken diet. The farm community could oppose this.

CARD F

(1) Clearing the land by clear cutting is a slow and expensive method. However, the community from which the manpower would be drawn would find this very favorable. Therefore, high degree of employment.
(2) Land managers and public alike are concerned about aerial spraying because of suspected effect on wildlife.
(3) The present choices of wildlife to manage for are: Prairie Chicken, Sharptail Grouse. Ruffed Grouse.
(4) A huntable population of Sharptail and Ruffed Grouse could be produced on the amount of land available.

DECISION ENVIRONMENTAL CARD

2.

PEOPLE PATTERNS AND POPULATION DISTRIBUTIONS

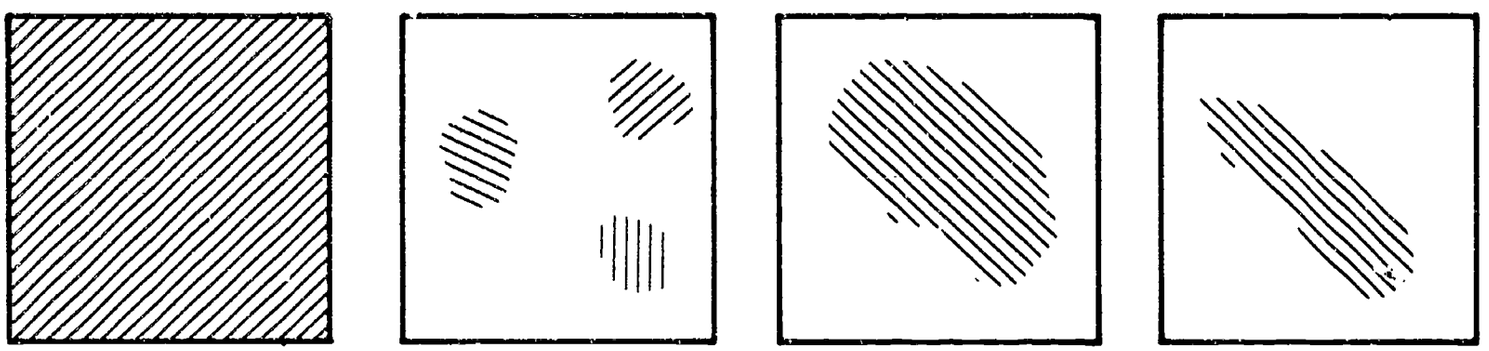
BACKGROUND

Populations of organisms do not seem to be randomly dispersed; there tends to be definite patterns of spacing of individuals. Differences in environmental factors such as light, temperature, food and water influence all organisms including ants, dandelions, cacti, elephants and bacteria. A population of organisms tends to be dense where environmental factors are optimal and scarce or even absent where factors are not favorable.

SITUATION

What influences human population dispersion patterns? A sociologist has suggested a way of representing human dispersion patterns and some criteria for analyzing them. Consider the following before going on to the activity section.

Some hypothetical human population dispersion patterns:



1 - Agricultural Area

2 - Small Towns

3 - Suburban Area

4 - Urban Area

Some information about each square:

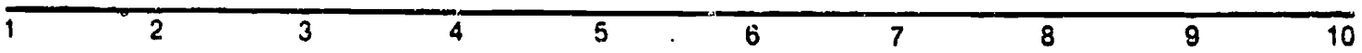
1. They represent the same area
2. The cross-hatching shows the population dispersion pattern.
3. The population density is the same within each square and is distributed evenly over the cross-hatched pattern.

DIRECTIONS

Small Groups

1. Divide up into small groups. As a group, rate each of the four Human Population Dispersion Patterns using the criteria below. Other criteria may be added if the group thinks they are important. Rate each according to what you think is true, even though you may not know for sure.

Criteria Scale:



low medium high

CRITERIA

1. Dwellings
   a. density of single-family dwelling
   b. cost of single-family dwelling
2. Crime rate
3. Amount of open space
4. Availability of social/cultural facilities
5. Quality of education
6. Job opportunities
7. Pollution levels
8. Availability of energy
9. Availability of transportation
10. Availability of goods and services

2. As a group, use the ratings to construct a dispersion pattern which represents an ideal for a quality living environment. Other criteria could also be considered. Sketch the pattern on a large sheet of paper and be prepared to defend your ideal pattern based on the criteria.

Large Group.

1. Each small group presents their ideal dispersion pattern, and describes how it meets the criteria.
2. Construct a single dispersion pattern based on the products from the small groups.

Idea for an Option Activity

What influences population dispersion patterns of people, plants and other animals?

Obtain a map showing human population distribution in the U.S.A. and several **Golden Nature Guides**, or similar publications, showing distribution maps of plant and animal groups. Note the distribution patterns of people across the U.S.A. and those of specific species of plants and other animals. How do environmental factors, such as food, light, temperature and water affect these patterns? Are there some factors that influence people distribution patterns which do not seem to effect other organisms?

Consider people distribution patterns in your own community. What factors seem to be of greatest influence? Are socio-economic factors important? How?

DECISION ENVIRONMENTAL CARD

3.

SCHOOL SITE DEVELOPMENT

BACKGROUND

The way we occupy and use space is a major environmental issue. Freeways bisect communities. Suburbs cover over productive agricultural land. Developers pay almost no attention to the natural features of the landscape. Anonymous corporations and loose collections of land speculators control vast sections of land with the hope, as communities grow, of making a substantial financial gain at costs to the environment which cannot be caluculated.

A response to these insults has been the development of all kinds of land use plans. They range in size from yards, parks, communities, regions, to states, and include recommendations for national land use plans. Some of these include considerations which are clearly for experts. Some regional planning and coastal planning, for example, are so complex that they appear to be a no person's land. Others, however, are smaller and much more manageable.

SITUATION

Dealing with a land use planning problem for the local school ground will provide you with some of the same experiences and frustrations of a professional planner, an opportunity to deal with opposing points of view, thinking through and presenting an idea, and perhaps even doing something about it.

DIRECTIONS

Small groups:

1. Divide up into small groups. Pick a piece of land on the school ground that you would like to see changed. Brainstorm all the ideas you can think of for use. Pick two or three that you especially like, and rank them from most liked to least liked.

2. Collect some opinions about your idea from persons who are likely to be affected by your plan. This might include administrators, custodians, neighbors, school staff, teachers, kids, etc. How do you plan to collect this information?

3. After you have collected these data, use them to help you make a decision. Is it go or no go? What are the reasons for your choice?

Large group:

1 Each small group presents their choice and the rationale for it with the entire group. The class must decide whether the plan is possible.

2. Pick one or two of the ideas which you feel good about and which seem possible.

3 Rank order these two plans and decide whether the plan which ranks highest is worth doing something about

4 If you are committed to the plan, try to do something about it. Develop a detailed plan and submit it to the appropriate channels. The plan should probably contain a description of what you are going to do, when you are going to do it, and how much the project is going to cost.

FOR DISCUSSION

1. What determined the final course of action that you took? Would you call it a success or failure? How do you decide whether it is a success or failure? Does a plan have to be carried out to be rated a success?

2. What kinds of resistance, if any, did your small groups observe when they tried to collect opinions about the area?

3. What reasons can the large group give to support the land use change that you support?

4. Suppose you decide to leave the school ground as it is. What are the advantages and disadvantages?

5. What are experts? What kinds of things do you need to know to plan a neighborhood?

6. What evidence do you have that can help you decide whether your school grounds were "planned"?

DECISION ENVIRONMENTAL CARD

4.

LAND DONATION

BACKGROUND

A small farming town lost its railroad service in 1963. The railroad company offered to sell the 13-mile strip of railway land to any community group that could come up with a good plan for use of the land. The purchase price was $1.00. The company let it be known that they would prefer that the land have a conservation use.

SITUATION

A town meeting was held and several local people proposed uses for the land. A list of groups represented at the meeting and some of the proposals are given below.

Groups represented at the meeting

Farmers
Future Farmers of American
Youth Group
Chamber of Commerce
Hunting and Fishing Club Members
High School Biology Teacher
School Board Members
Park Board Members
Local Teenagers

Land-Use Proposals

Drag Strip
Reserved for future parkland
Shelter belt
Reserved for school site
Natural History Area for environmental education
Industrial Park
Wildlife Production Area
Teen Center
Playground

DIRECTIONS

1 To recreate the town meeting, consider the following before beginning:

a) Select a chairperson to run the meeting.

b) Select a secretary or devise some means for recording the responses.

c) Select a decision-making body or town board.

d) Select presentors (perhaps 6-8 individuals).

e) Determine a process for hearing proposals.

f) Decide on a means for reaching a decision by the end of the meeting

2. Individuals should prepare a 5-minute role play presentation using one of the groups and proposals listed above or an original.

3. After several proposals have been presented, the merits of each should be discussed and a decision made. How do you make such a decision? What are advantages and disadvantages?

4. The class may want to discuss a town meeting as a decision-making process, considering both its positive and negative points. What are the positive and negative points of a town meeting as a decision-making body?

5. What arguments could groups develop for use of an area which appears contrary to the intent of the land-use offer?

DECISION ENVIRONMENTAL CARD

5.

PREDATOR CONTROL

BACKGROUND

Hunting is a popular form of outdoor recreation. Several state and federal agencies are charged with the responsibility of maintaining healthy populations of game animals. Game animals are those species highly valued by hunters for which there are regulated seasons and/or limits. Thus humans distinguish between game animals and non-game animals. Some game and non-game animals are called predators — animals which prey upon other animals for food. Regardless of how they are classified, all animals must find food, water, shelter, and living space in order to survive. In some situations hunters and predators are competing — one for food and sport, and the other for survival.

SITUATION

The ring-necked pheasant is a popular upland game bird in agricultural areas of the United States. It is a native bird of Asia and was introduced in this country in the late 1800's. The habitat must provide these basic requirements:

1. **Nesting cover.** Hen pheasants require nesting areas with a moderate density of vegetation. Mixtures of grasses, legumes and weeds provide optimum nest sites.

2. **Winter food.** Corn, small grains and native weed seeds are ideal winter foods.

3. **Winter cover.** Dense vegetation not covered by snow near food sources is ideal.

Most of the agricultural areas offered superb habitat. By the mid 1940's pheasants numbered in the tens of millions. However, by 1945, the pheasant popoulation began to decline from a density of one pheasant per 5 acres in the early 1940's to one pheasant per 50 acres in the early 1960's. It was generally believed that pheasant populations would increase, if predator populations were decreased.

DIRECTIONS

A Before forming small discussion groups, put these statements on the blackboard and formulate a class response for each of them.

1 A predator is

2 A game species is

3 Predators should be

4 Game species should be

B **Divide up into small groups.** Consider the following predator-control experiment conducted in a Midwestern state from 1960-62

C The experiment

1 Two similar areas were identified. Major pheasant predators were systematically controlled in the experimental area whereas in the control area there was no predator elimination program.

2. Each area consists of large farms intensively tilled for corn and soybeans. There is an increasing tendency for large, clean fields.

3. Major pheasant nest predators were: raccoons, crows, and skunks.

4. Results of the Experiment

Experimental Area	**Control Area**
1960-1962 — 434 predators were removed.	1960-62 — no predators were removed.
Results: 1962 hatching success = 36%	1962 hatching success = 16%

5. Important Fact!

Population continues to decline in both areas!

As a group, prepare a plausible explanation for pheasant populations continuing to decline in both areas. Be able to defend your explanation to the entire group.

If your group was responsible for managing the pheasant population in these areas, what would you recommend?

Large Group

Each small group should present their explanation for declining populations and recommendations for increasing the pheasant population.

After discussing the small group presentation, reconsider these four statements and make changes, if necessary.

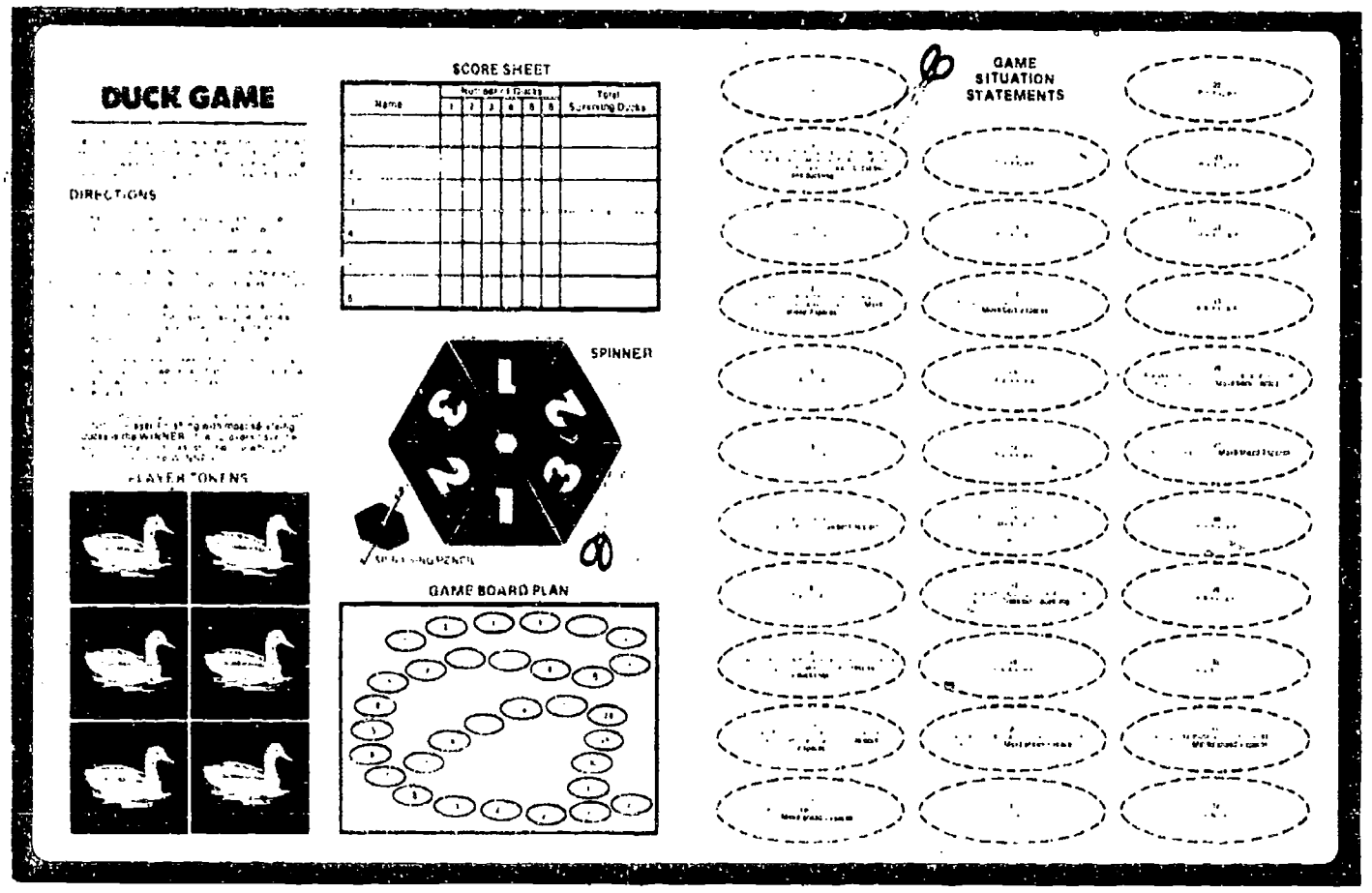
1 A predator is

2 A game species is

3 Predators should be

4 Game species should be

WILDLIFE
SURVIVAL GAMES



RECOMMENDED FOR GRADES 4-6

• WHAT ARE THEY?

These are five independent indoor activities for small groups of 2-6 players. Each game is complete and consists of a game board, a sheet of game materials and a reproducible direction and score sheet. The games depict some environmental factors which influence the lives of five wildlife species: the fox, the eagle, the white-tailed deer, the squirrel and the duck. The players start the game with an equal number of one of the wildlife species. As they move along the game board according to the numbers on a spinner, positive and negative environmental factors are encountered. The player who finishes with the greatest number of individuals remaining is the winner.

• WHAT'S THEIR PURPOSE?

While playing the games, students become acquainted with some of the interactions between living things and the environment. These interactions include predator-prey relationships, the need for shelter, accidents, the effects of pollution, and the activities of humans. This information is related to the content of some of the Level I Outdoor Classroom Guides. This provides for learning continuity from the indoor activities to the more complex, outdoor investigations.

• HOW ARE THEY USED?

It is recommended that the games be set up as independent activities. If students can read the directions they should be able to play the games without adult assistance. The situations depicted in each game are factual and relate to a particular concept or problem. Many of the situations could serve as the basis for discussion once students have completed a game. The games may also serve as pre-activities to the Outdoor Classroom Guides.

SAMPLE SCORE SHEET:

Using this example, students will be able to make up their own score sheets.

SPINNER:

This can be traced or photo-copied and glued to a piece of cardboard.

DUCK GAME

There are several duck nests near the pond. Each nest produced six ducklings. The ducklings must get to the water and find food and shelter to live. There are many dangers in the lives of ducks.

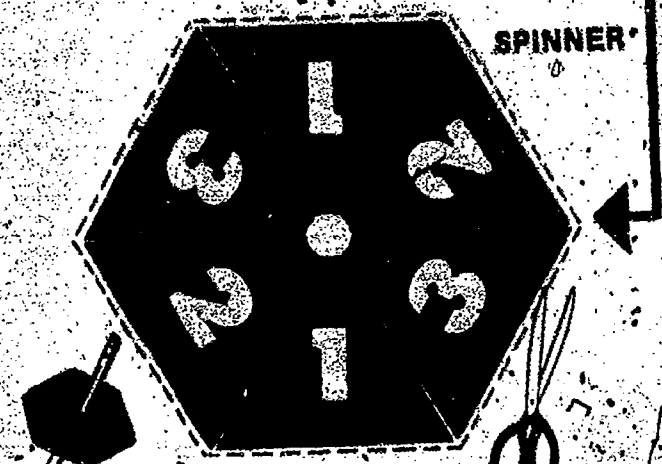
DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on. The player may go either way around the pond when the token lands on the step labeled "Caution: Snapping Turtle."
5. Each time a player loses a duck, cross out one duck on score sheet after that player's name. A player who loses all six ducks must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with most surviving ducks is the WINNER. If two players have the same number of ducks left, the one who got to FINISH first is the WINNER.

SCORE SHEET

Name	Number of Ducks						Total Surviving Ducks
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER



SPIN USING PENCIL

PLAYER DIRECTIONS

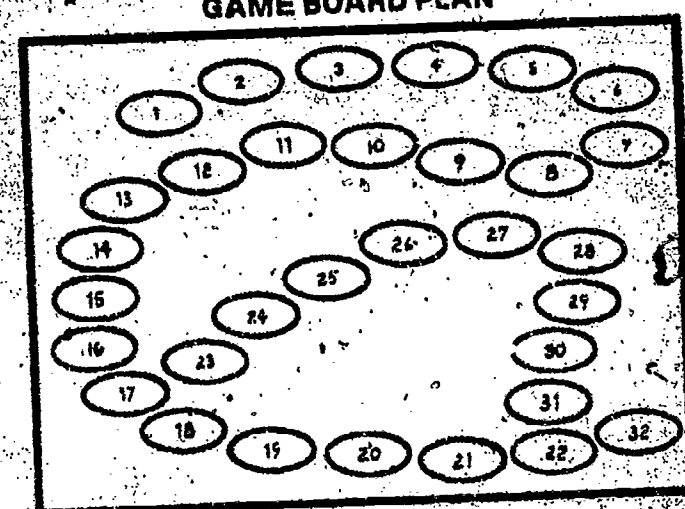
These are similar for all five games so that after learning how to play one game, students will be able to play the others.

PLAYER TOKENS:

These can be traced or photo-copied and glued to a piece of cardbpard.

PLAYER TOKENS

GAME BOARD PLAN



GAME BOARD PLAN:

This plan shows one way of arranging the game situation statements on a large piece of paper or cardboard.

DIRECTIONS TO MAKING YOUR OWN GAMES

These are do-it-yourself games. All of the parts and the directions to complete each game are given on the following pages.

Students will need some assistance with constructing the first game. However, they should be able to complete the others without difficulty. This task will provide opportunities for using techniques and skills found in art, geometry and design. Some students may also get some ideas for new games depicting the lives of other animals.

The following list describes each of the parts and gives directions for constructing the game:

GAME SITUATION STATEMENTS

1
START

2
Soon after the ducklings hatch, a house cat finds the nest and takes one duckling before the mother duck scares it away. **Cross out one duckling.**

3.
Blank space

4
Tall grass protects the mother duck and ducklings on their way to the pond. **Move ahead 2 spaces.**

5.
Blank space

6
Blank space

7
The pond has been drained for crops. They must find another pond. **Go back to start**

8.
Blank space

9
Two ducklings are chased and caught by a [illegible]. **Cross out 2 ducklings**

10
[illegible] and wait for several days [illegible] insects [illegible]. **Go back 2 spaces**

11
[illegible] **Move ahead 2 spaces**

12.
Blank space

13.
Blank space

14.
Spraying for mosquitos kills many insects. **Move back 2 spaces.**

15.
Blank space

16.
Blank space

17.
Caution Snapping Turtle
Take a chance
or
Detour

18.
Eaten by a large snapping turtle which lives in the pond. **Cross out 1 duckling.**

19.
Blank space

20.
Cattails and other plants in the pond protect the ducklings. **Move ahead 1 space**

21
Blank space

22.
Blank space.

23.
Blank space.

24.
Blank space.

25.
Blank space.

26.
A grass fire burns some of the cattails on the edge of the pond. **Move back 1 space.**

27.
Grain crop near pond. **Move ahead 3 spaces.**

28.
Blank space.

29.
Blank space.

30.
Blank space.

31.
Ducklings use muskrat houses for resting in the sun. **Moved ahead 2 spaces.**

32
FINISH

GAME SITUATION STATEMENTS:

These are to be photocopied, cut out and arranged on a game board according to the sequence shown on the Game Board Plan.

29

Photo Ed Hessler

Portions of each Wildlife Survival Game need to be photo-copied before they can be assembled.

GO

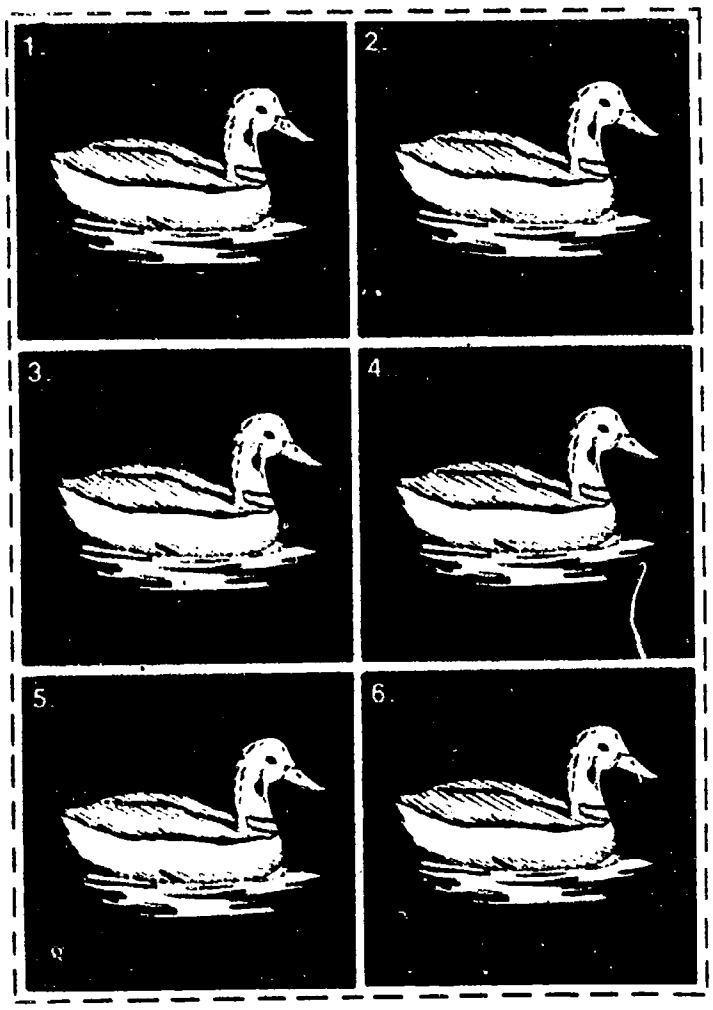
DUCK GAME

There are several duck nests near the pond. Each nest produced six ducklings. The ducklings must get to the water and find food and shelter to live. There are many dangers in the lives of ducks.

DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on. The player may go either way around the pond when the token lands on the step labeled "Caution: Snapping Turtle."
5. Each time a player loses a duck, cross out one duck on score sheet after that player's name. A player who loses all six ducks must drop out of the game.
6. Continue playing until all players have reached FINISH. **Player finishing with most surviving ducks is the WINNER.** If two players have the same number of ducks left, the one who got to FINISH first is the WINNER.

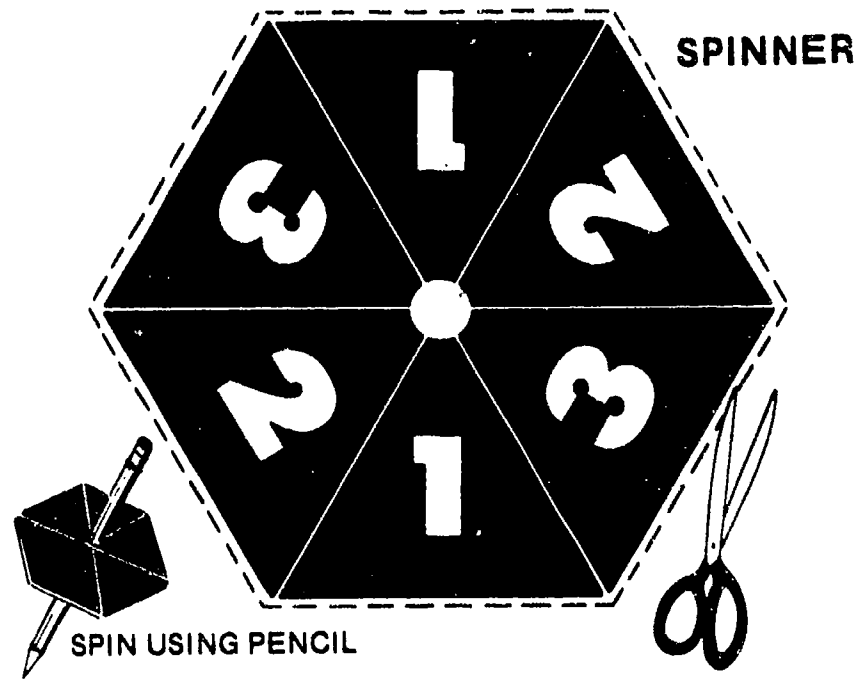
PLAYER TOKENS



SCORE SHEET

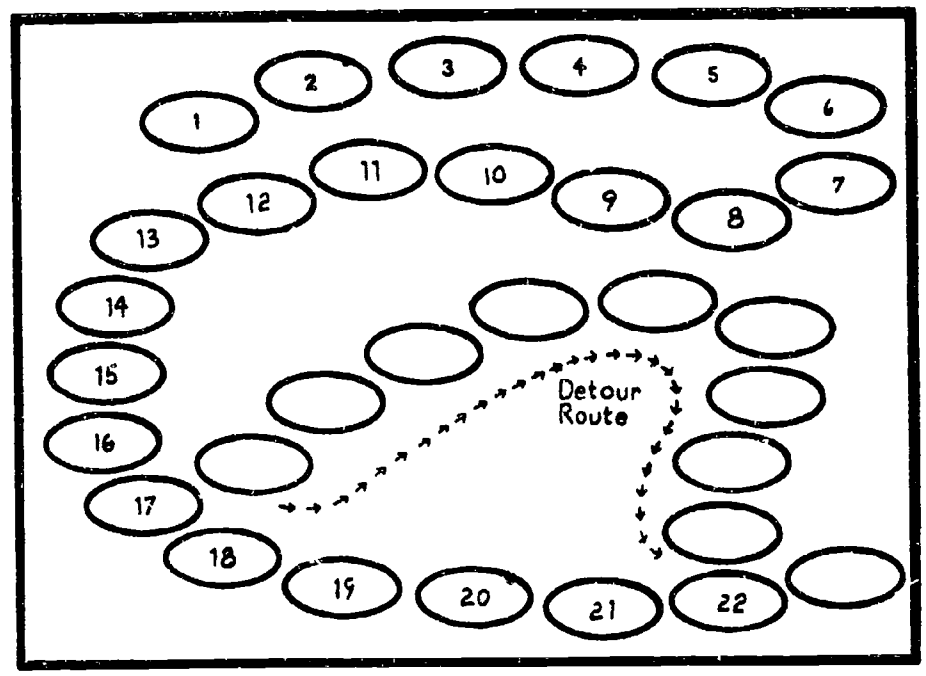
Name	Number of Ducks						Total Surviving Ducks
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER



SPIN USING PENCIL

GAME BOARD PLAN



GAME SITUATION STATEMENTS

1.
START

2.
Soon after the ducklings hatch, a house cat finds the nest and takes one duckling before the mother duck scares it away **Cross out one duckling.**

3.
Blank space

4.
Tall grass protects the mother duck and ducklings on their way to the pond **Move ahead 2 spaces.**

5.
Blank space

6.
Blank space

7
The pond has been drained for crops they must find another pond **Go back to start.**

8.
Blank space

9.
Two ducklings are chased and caught by a boy and girl and taken home **Cross out 2 ducklings.**

10.
The weather is cold and wet for several days, not many insects are hatching **Go back 2 spaces**

11
There are many insects for the ducklings to eat **Move ahead 2 spaces**

12.
Blank space.

13.
Blank space

14.
Spraying for mosquitos kills many insects **Move back 2 spaces.**

15.
Blank space

16.
Blank space.

17.
Danger Route
Caution snapping turtle ahead
take a chance or detour
Move ahead 1 space

18.
Blank space

19.
Blank space

20.
Eaten by a large snapping turtle which lives in the pond **Cross out 1 duckling.**

21
Blank space

22.
A grass fire burns some of the cattails on the edge of the pond. **Move back 1 space.**

FINISH

Detour

Detour

Detour

Detour

Detour
Cattails and other plants in the pond protect the ducklings. **Move ahead 1 space.**

Detour

Detour

Detour

Detour

Detour

DEER GAME

The large area shown on the game board is "home" for several deer. Here the deer must find food, water and shelter in order to survive. There are many dangers in the lives of deer and many do not survive. This may seem bad at first, but it is important to know that if some deer didn't die there would soon be too many deer in the area. When this happens they can starve or become sick.

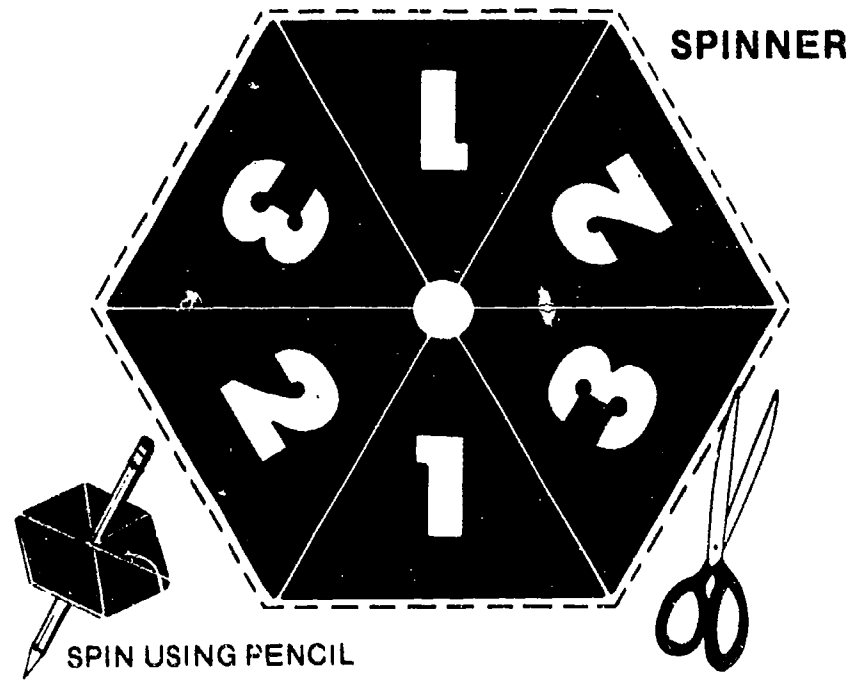
DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put player's names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on.
5. Each time a player loses a deer, cross out one deer on score sheet after that players name. A player who loses all 10 deer must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with most surviving deer is the WINNER. If two players have the same number of deer left, the one who got to FINISH first is the WINNER.

SCORE SHEET

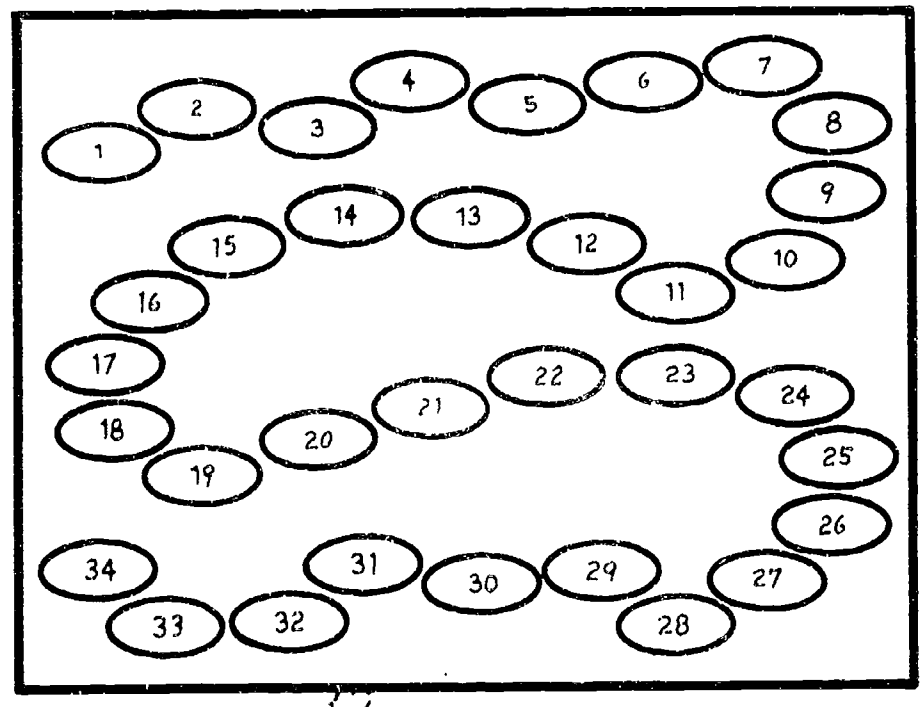
Name	Number of Deer										Total Surviving Deer
	1	2	3	4	5	6	7	8	9	10	
1.											
2.											
3.											
4.											
5.											
6.											

SPINNER



SPIN USING PENCIL

GAME BOARD PLAN



GAME SITUATION STATEMENTS

1.
START

2.
Blank space

3.
The deer population is too large for the food supply. Three deer are taken during the hunting season. **Stay where you are.**

4.
Many fawns have survived the summer there are too many deer in the area. **Go back 2 spaces.**

5.
A farmer doesn't pick all of his corn, leaving some for wildlife food. **Move ahead 2 spaces.**

6.
Blank space

7.
Blank space

8.
Dense evergreen trees provide protection from winter winds. **Move ahead 2 spaces.**

9
In the winter, deer depend on the woody twigs of certain trees and shrubs for food. There is an abundance of these trees and shrubs in the area. **Move ahead 3 spaces.**

10.
Blank space

11
Blank space

12.
Blank space

13.
The snow is too deep for the deer to uncover food on the ground. **Go back 2 spaces.**

14.
Two deer are chased and killed by dogs. **Cross out 2 deer.**

15.
Deer are chased by snowmobilers. **Go back 3 spaces.**

16.
There are too many deer in the area; they begin to run out of food. **Cross out 3 deer.**

17.
Cold, wet weather weakens a fawn and it dies of sickness and parasites. **Cross out 1 deer.**

18.
There is an abundance of early green growth for food. **Move ahead 2 spaces.**

19.
Blank space

20.
Blank space

21.
A doe is killed by a car, her fawn cannot survive alone and dies also. **Cross out 2 deer.**

22.
Many fawns are born in the area. **Stay where you are.**

23.
Blank space.

24.
Blank space.

25.
Deer use dense underbrush for protection; several acres burn near the river bank. **Go back 1 space.**

26.
Blank space.

27.
Blank space.

28.
Deer eat acorns for food. A large grove of oak trees is bulldozed to make a new farm field. **Go back 2 spaces.**

29.
A large farm field is no longer plowed. Small trees and shrubs begin to take over. **Move ahead 1 space.**

30.
Blank space

31.
A new highway opens and deer must cross it to get to their food source. Two deer are killed while crossing the highway. **Cross out 2 deer.**

32.
Deer make use of several agricultural crops for food. **Move ahead 2 spaces.**

33.
Blank space

34.
FINISH

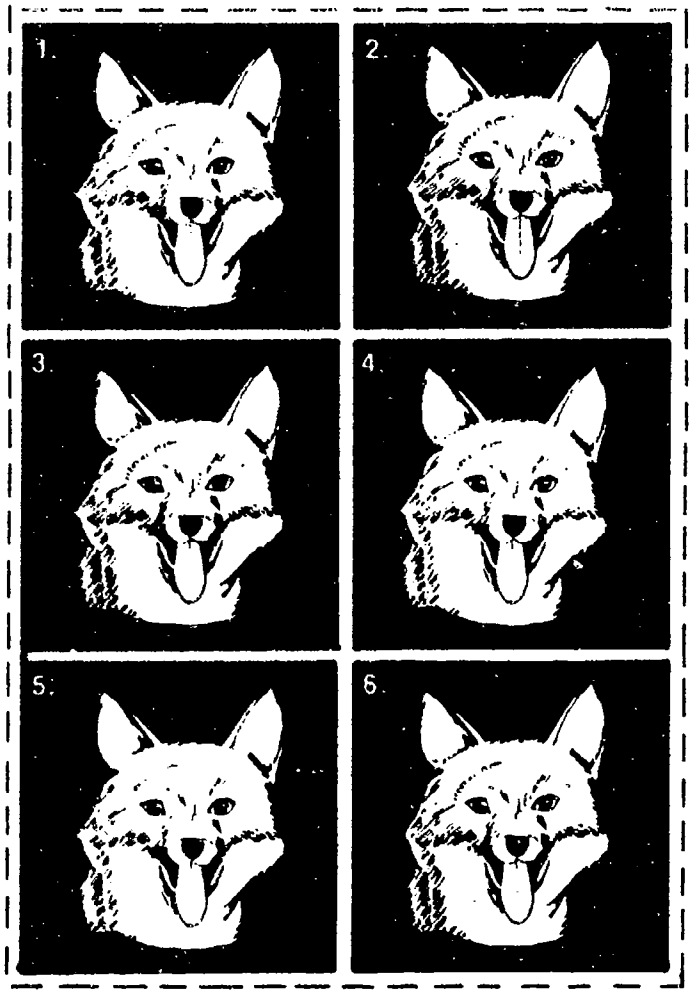
FOX GAME

The red fox must live where it can find food, water and shelter. It eats a great variety of animals and some plants. The number of foxes in an area depends on the abundance of food and other factors which effect its survival. Play the game and find out how many of your young foxes survive.

DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Play must follow directions on step which token lands on.
5. Each time a player loses a fox, cross out one fox on score sheet after that player's name. A player who loses all six foxes must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing **with most surviving** foxes is the WINNER. If two players have the same number of foxes left, the one who got to FINISH first is the WINNER.

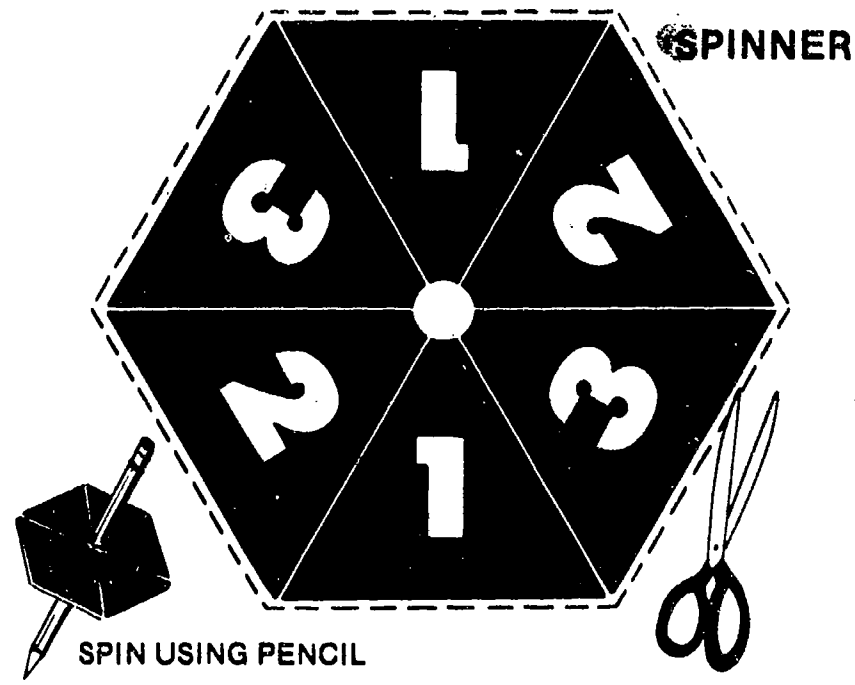
PLAYER TOKENS



SCORE SHEET

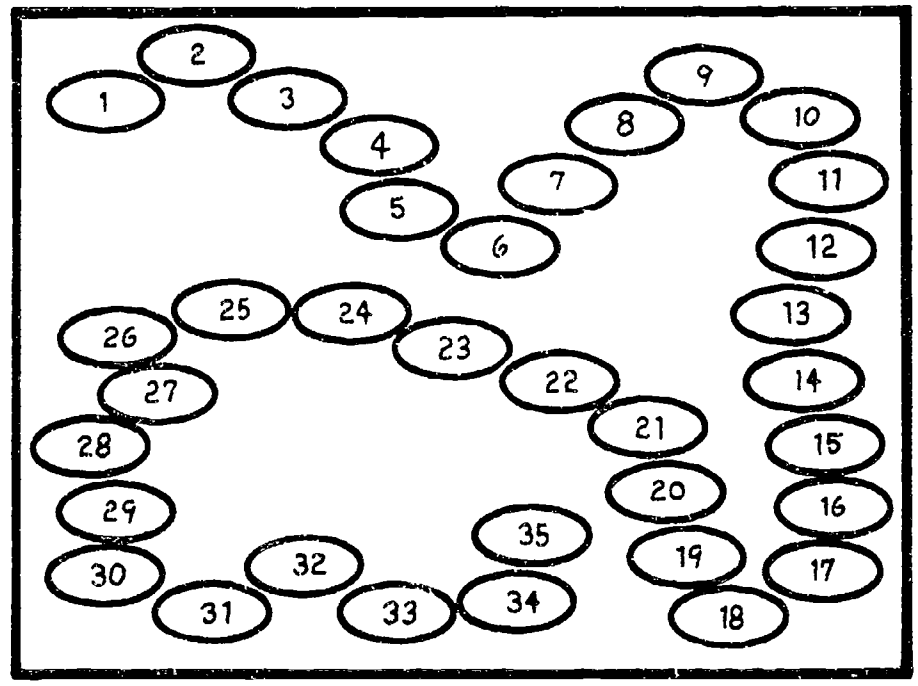
Name	Number of Foxes						Total Surviving Foxes
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER



SPIN USING PENCIL

GAME BOARD PLAN



GAME SITUATION STATEMENTS

1.
START

2.
Field mice population has exploded! Plenty to eat. **Move ahead 3 spaces.**

3.
Blank space.

4.
Farmers conduct a den hunt and destroy fox pups. **Cross out 1 fox.**

5.
Blank space.

6.
Good den locations. Brushy cover, sandy soil, woods and field. **Move ahead 4 spaces.**

7.
Blank space

8.
Blank space

9.
Food needs increase as pups are born **Go back 1.**

10
Blank space

11.
Grasshoppers and other insects killed by pesticides. **Go back 1**

12.
Roadside wild fruits and berries killed by poison sprays. **Go back 4.**

13.
Blank space.

14.
Population of foxes too large and disease sets in. Lose 1 fox to rabies. **Cross out 1 fox.**

15.
Blank space.

16.
Plenty of berries. Living is easy. **Move ahead 2.**

17.
Blank space.

18.
Blank space.

19.
Scavenging of road kills provides good addition to diet. **Move ahead 2.**

20.
June bugs and grasshoppers are plentiful. Together with fruits and berries they satisfy hunger. **Move ahead 4.**

21.
Blank space

22.
Young foxes are forced out of their parents' territory. Lose 1 fox hit by a car as it crosses unfamiliar road. **Cross out 1 fox.**

23.
Price for fox pelts soars! Trapping increases. **Cross out 1 fox.**

24.
Blank space.

25.
Great fall fruit and insect crop. Won't have to chase speedy cottontail! **Move ahead 3 spaces.**

26.
The ground in the apple orchard is covered with apples. **Move ahead 4 spaces.**

27.
Blank space.

28.
Blank space.

29.
Blank space.

30.
Blank space.

31.
Winter of little snow helps fox escape hunters. **Move ahead 1 space.**

32.
Blank space.

33.
Abundant snow cover aids fox hunters. Foxes cannot run fast in deep snow. **Cross out 1 fox.**

34.
High rabbit population. Plenty of winter food. **Move ahead 1 space.**

35.
FINISH

EAGLE GAME

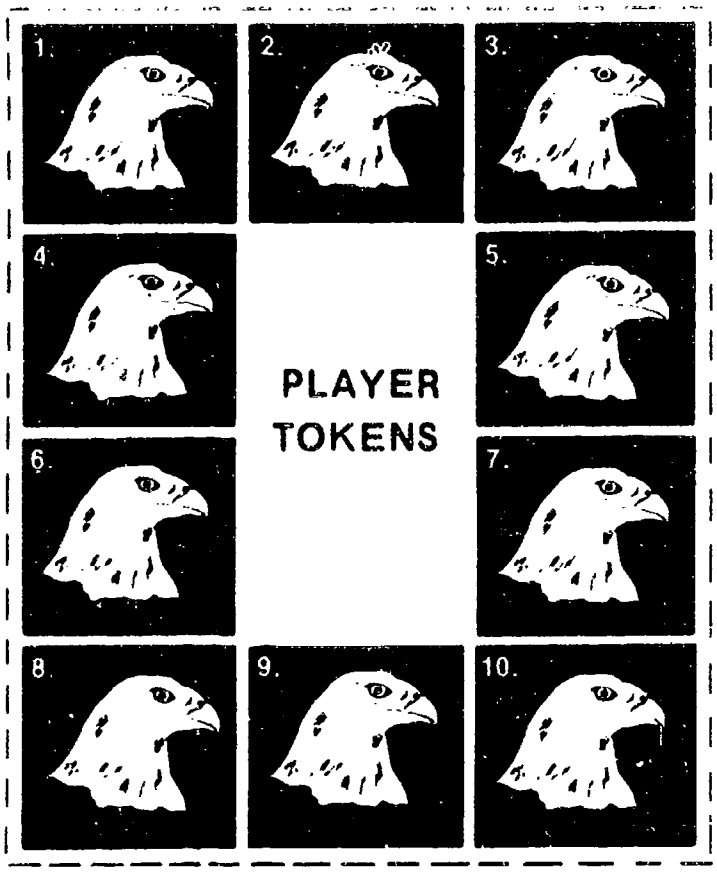
The bald eagle lives only in North America. It is the second largest North American bird of prey, weighing up to 16 pounds with a wing span of from six to eight feet.

Primarily fish-eating birds, they are found along the coasts of North America and along inland lakes and rivers from the Gulf of Mexico to the Arctic.

Today the bald eagle is fighting for its life. Most of the remaining bald eagles nest in Canada or Alaska. Only about 750 pairs still nest south of the Canadian border.

DIRECTIONS:

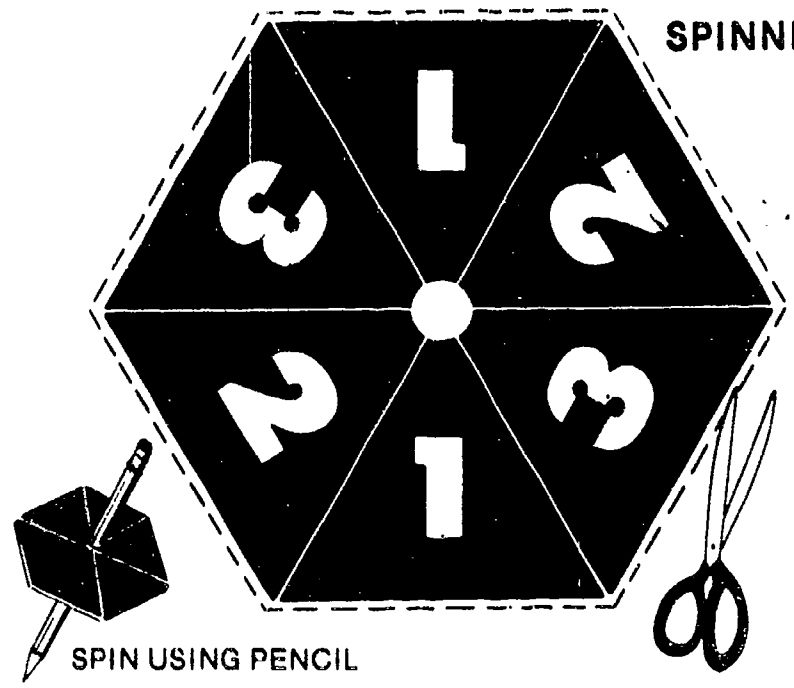
1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step which token lands on.
5. Each time a player loses an eagle, cross out one eagle on the score sheet after that player's name. A player who loses all 10 eagles must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with most surviving eagles is the WINNER. If two players have the same number of eagles left, the WINNER is the one who came to FINISH first.



SCORE SHEET

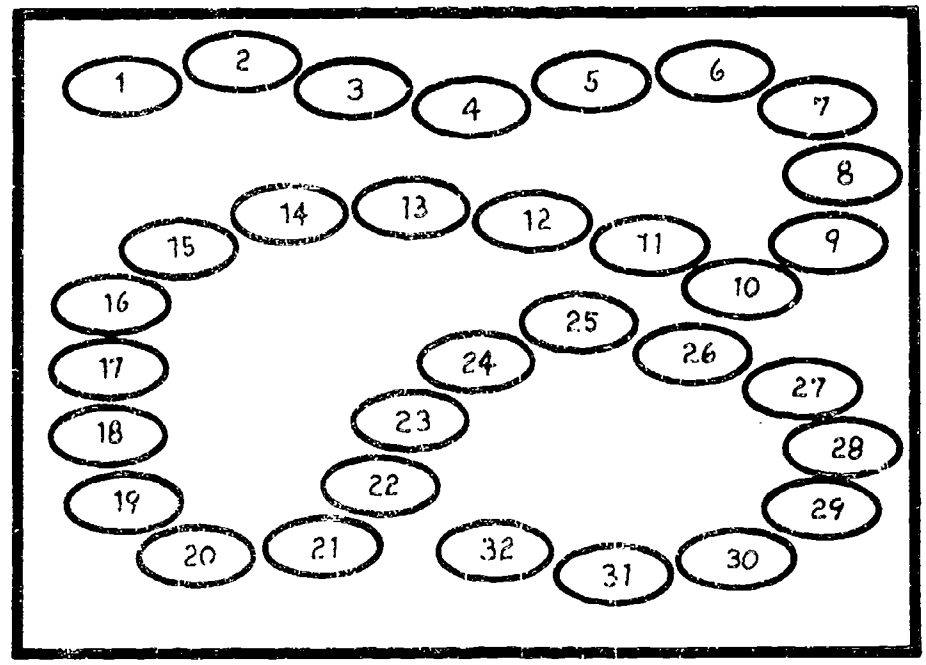
Name	Number of Eagles 1	2	3	4	5	6	7	8	9	10	Total Surviving Eagles
1.											
2.											
3.											
4.											
5.											
6.											

SPINNER



SPIN USING PENCIL

GAME BOARD PLAN



GAME SITUATION STATEMENTS

1.
START

2.
From 1917 through 1952, Alaska offered a bounty for bald eagles. **Cross out 3 eagles.**

3.
Alaska enters union in 1959 and federal law forbids killing eagles. **Move ahead 3 spaces.**

4.
Blank space

5.
Blank space

6.
Blank space

7.
Bald eagles do not get their white heads and tails until they are 3½-4½ years old. A hunter shoots a young eagle because he thought it was a "big brown hawk." (It's also illegal to shoot hawks!) **Cross out 2 eagles.**

8
Clearcutting (removing of all trees from an area) eliminates nesting sites.
Go back 2 spaces

9
Strong winds destroy several nest trees.
Go back 4 spaces

10
Blank space

11
Blank space

12.
The uses of long-lasting pesticides such as DDT increase greatly since 1947. These pesticides are passed on through food chains and build up to high levels in the bodies of meat eaters such as eagles.
Go back 6 spaces.

13.
Federal regulations in the 1970's ban use of predator poisons on federal lands and restrict use on private land.
Move ahead 2 spaces.

14.
Blank space

15.
Blank space.

16.
A hunter shoots an eagle because his grand-daddy told him they would carry off sheep and even young children. (It's impossible for an eagle to carry more than it's weight, which is 8-16 pounds!) **Cross out 2 eagles.**

17.
Law enacted in 1970's makes shooting wildlife from aircraft unlawful.
Move ahead 2 spaces.

18.
Blank space

19
Blank space

20.
An increased number of people are using eagle nesting areas for recreation. This disturbance often causes eagles to abandon their nests. **Go back to start.**

21
Bald Eagle Protection Act amended in the 1970's making penalty for killing bald eagles $5,000 and/or up to one year in prison.
Go ahead 3 spaces.

22.
Blank space

23.
Persistent pesticides other than DDT are still being used. **Cross out 3 eagles.**

24.
Blank space.

25.
Development of waterfront land increases taking much natural bald eagle habitat.
Go back 3 spaces.

26.
Conservation groups secure cooperation of utility companies to modify existing power lines and put safeguards on new lines to stop electrocution of bald eagles.
Go ahead 2 spaces.

27.
Blank space

28.
Blank space.

29.
High levels of pesticides in the bodies of female eagles may kill the developing embryos in the eggs. **Cross out 5 eagles.**

30.
Most uses of DDT are banned in 1972.
Go ahead 2 spaces.

31.
Blank space

32.
FINISH

SQUIRREL GAME

Many squirrels live in wooded city parks. The squirrels must find food and shelter here in order to survive. There are many dangers in the lives of squirrels.

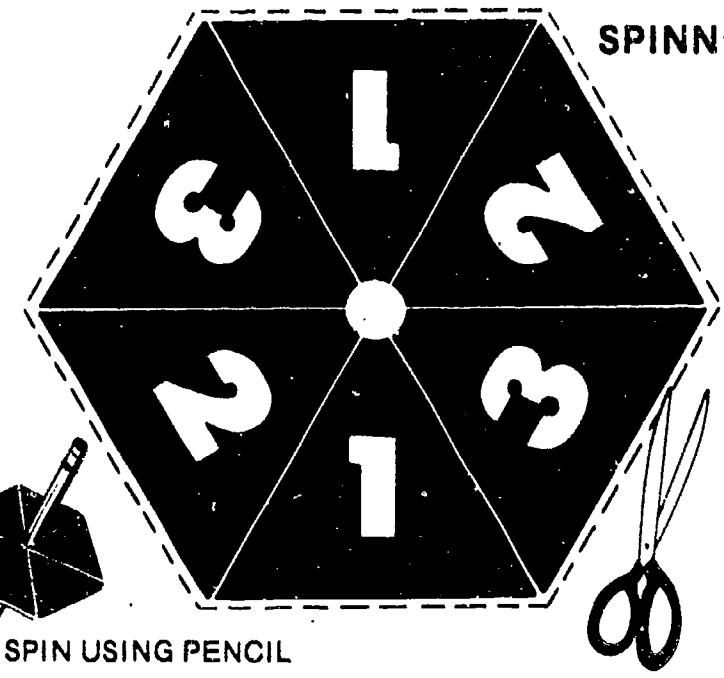
DIRECTIONS

1. Use one spinner and a playing token for each player. Insert pencil in spinner as shown.
2. Put players' names on score sheet below.
3. Player with token No. 1 spins first. Side which lands on table shows number of spaces to move.
4. Player must follow directions on step token lands on.
5. Each time a player loses a squirrel, cross out one squirrel on score sheet after that player's name. A player who loses all six squirrels must drop out of the game.
6. Continue playing until all players have reached FINISH. Player finishing with **most surviving squirrels** is the WINNER. If two players have the same number of squirrels left, the one who got to FINISH first is the WINNER.

SCORE SHEET

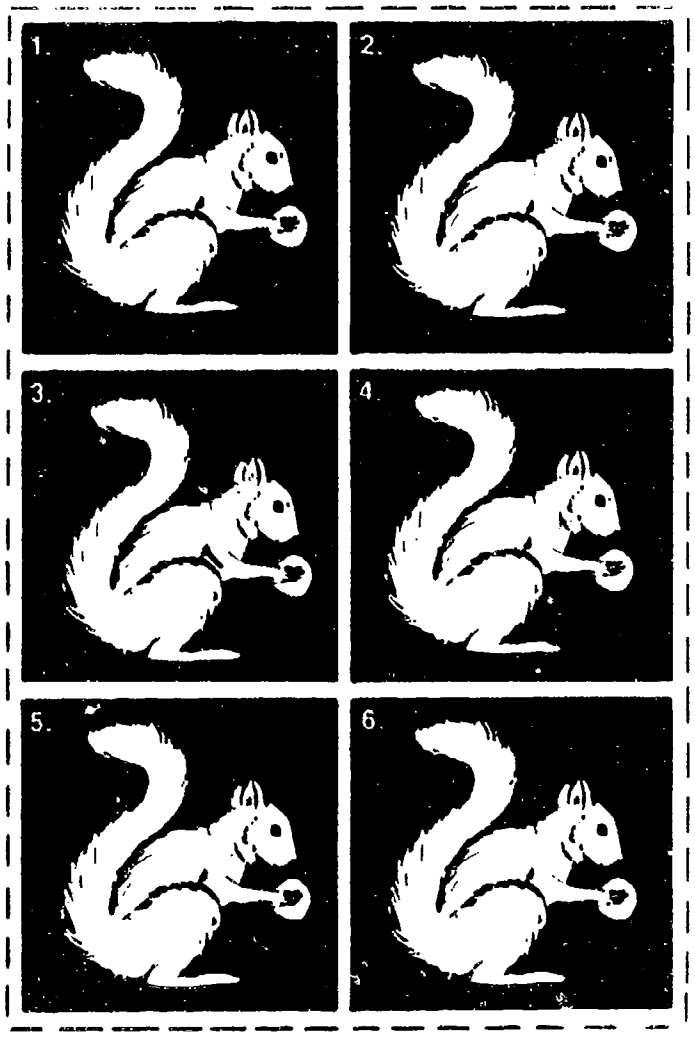
Name	Number of Squirrels						Total Surviving Squirrels
	1	2	3	4	5	6	
1.							
2.							
3.							
4.							
5.							
6.							

SPINNER

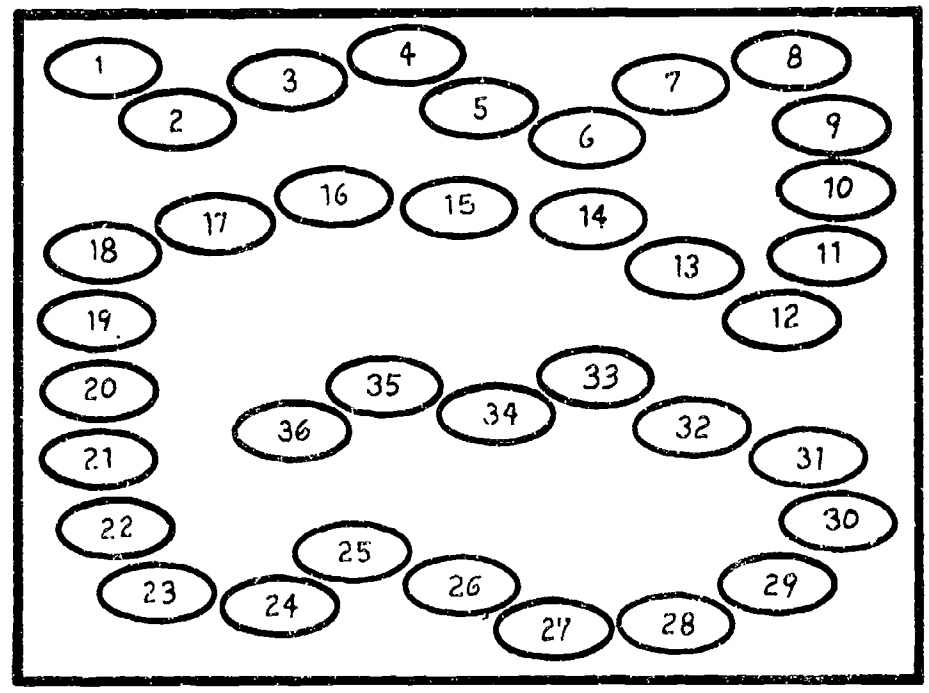


SPIN USING PENCIL

PLAYER TOKENS



GAME BOARD PLAN



GAME SITUATION STATEMENTS

1.
START

2.
A squirrel sees the jerking tail of an alarmed squirrel followed by warning bark and is able to escape a house cat **Move ahead 1 space.**

3.
Blank space

4.
Squirrels eat corn scattered by people in the park neighborhood People quit giving squirrels corn because they decided squirrels were a nuisance **Cross out 1 squirrel.**

5.
A squirrel's body is designed so it can jump from great heights without injury A squirrel jumps 40 feet to the ground to escape a house cat **Move ahead 2 spaces.**

6.
Squirrels are a favorite target for kids and adults armed with sling shots air rifles BB guns and rocks **Cross out 1 squirrel.**

7
Blank space

8
Squirrels find a plentiful supply of insects in the tree bark and soil **Move ahead 2 spaces**

9
Kids try to raise a baby squirrel they caught in the spring They don't know what to feed it **Cross out 1 squirrel**

10
Blank space

11
There are not enough den trees to go around
Go back to START

12
Early August brings a good crop of nuts Squirrels begin to gather and bury them
Move ahead 1 space

13.
Blank space.

14.
Community members organize and stop the destruction of a large grove of oak trees. Squirrel homes and food are saved. **Move ahead 3 spaces.**

15.
There are few predators that are very good at hunting squirrels. However, a weasel is small enough to get in the den door and it kills a squirrel. **Cross out 1 squirrel.**

16.
Blank space.

17.
Blank space.

18.
There are plenty of hardwood trees to provide shelter and escape route for squirrels. **Move ahead 2 spaces.**

19.
Squirrels depend on their sense of smell to find buried nuts when hungry. Slightly moist soil conducts scents best During a drought year they have difficulty finding buried nuts.
Go back 2 spaces.

20.
Blank space

21.
Plenty of oak and hickory trees provide food and places for nests **Move ahead 3 spaces.**

22.
It has been a long winter with little food Some squirrels develop mange and other diseases **Cross out 1 squirrel.**

23.
This park has several ideal den trees These were formed in old white oaks whose dead limbs hold their bark, absorb moisture and rot quickly, forming safe dens **Move ahead 2 spaces.**

24
Blank space

25.
Blank space.

26.
Nuts from last fall are gone. Squirrels search for fruits, berries, and early spring greenery and find very little. **Go back 2 spaces.**

27.
Community members realize that leaving some underbrush in their oak covered park provides shelter for squirrels. **Move ahead 3 spaces.**

28.
Blank space.

29.
Blank space.

30.
Blank space.

31.
Squirrel runs into street and is killed by a car
Cross out 1 squirrel.

32.
It is spring and the nuts stored last fall have been dug up and eaten. Because the community left part of the park "wild", there are plenty of fruits and berries. **Move ahead 1 space.**

33.
Blank space.

34.
Blank space.

35.
Over-population causes squirrels to migrate Now there is more food for those that remain
Move ahead 1 space.

36.
FINISH


WATERFOWL

3

SECTION

MATCHING ACTIVITIES TO YOUR PROGRAM

•CHOOSING WHAT YOU NEED

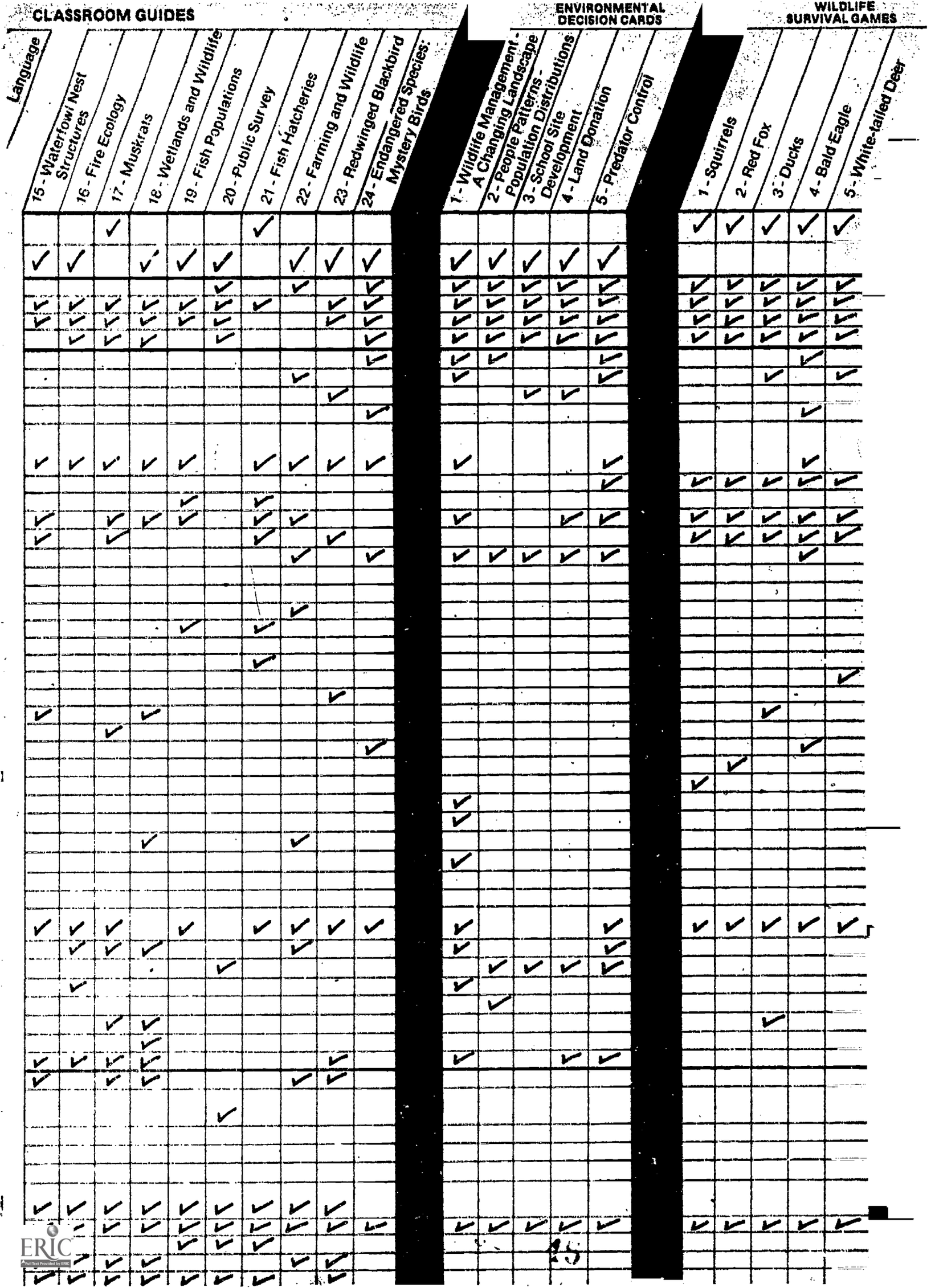
We have developed these activities using content topics and skills which are common to many programs, whether school-based or not. To help you select the activities that best fit your needs, we have classified the materials into categories. The chart below classifies the three major clusters of materials according to where they are used and appropriate age levels.

	OUTDOOR MATERIALS	INDOOR MATERIALS		
	OUTDOOR CLASSROOM GUIDES	ENV. DECISION CARDS	WILDLIFE SURVIVAL GAMES	
LEVEL I (GRADES 4-6)	✓		✓	LEVEL I (GRADES 4-6)
LEVEL II (GRADES 7-12)	✓	✓		LEVEL II (GRADES 7-12)

According to the chart there are **Outdoor Classroom Guides** for levels I and II and [illegible] activities. **Environmental Decision Cards** for level II and **Wildlife Survival Games** for level I. This helps classify each major cluster of materials but does not [illegible] individual activities within each cluster. To describe each activity and to [illegible] different clusters relate to each other, three new categories [illegible] the chart. They are **Seasonal Requirements**, **Content Topics** and **Process Skills**. [illegible] in each cluster have been classified according to these [illegible] the following [illegible] pages. This makes up a classification chart from [illegible] description of a single activity or find relationships [illegible] As an example, the Outdoor Classroom Guide [illegible]

ACTIVITY CLASSIFICATION CHART

		1 - Plants and Places	2 - Water Flow and Impoundment	3 - A Population of Pocket Gophers	4 - Insects and Plants	5 - Snow Temperatures	6 - Snow Depth and Snow Melt	7 - Social History Cemetery Study	8 - Old Ponds and Young Ponds	9 - Deer Food Survey	10 - Water Quality Analysis	11 - Public Use of Public Land	12 - Wildlife/Wildlands Photography	13 - Careers	14 - Foreign
GRADE RANGES	Level I (Grades 4-6)	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	
	Level II (Grades 7-12)									✓	✓	✓			✓
SEASONAL REQUIREMENTS	Winter					✓	✓	✓		✓		✓	✓	✓	✓
	Spring	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
	Summer	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓
	Fall	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓
CONTENT TOPICS	ADAPTATION AND TOLERANCES	✓													
	AGRICULTURE														
	COMMUNICATION												✓	✓	
	ENDANGERED SPECIES														
	ENVIRONMENTAL FACTORS (water, food, temperature, light, disease)	✓		✓	✓	✓	✓	✓	✓	✓	✓				
	PREDATION														
	FISH MANAGEMENT														
	HABITAT	✓							✓						
	LIFE CYCLES														
	MAN AND SOCIAL HISTORY							✓	✓						
	ORGANISMS														
	Insects				✓										
	Small Mammals					✓									
	Fish														
	Gophers			✓											
	Aquatic Organisms							✓		✓					
	Deer								✓						
	Redwinged Blackbird														
	Waterfowl														
	Muskrat														
	Bald Eagle														
	Red Fox														
	Gray Squirrel														
	Ruffed Grouse														
	Prairie Chicken														
	Ring-necked Pheasant														
	Sharp-tailed Grouse														
	PHOTOGRAPHY												✓		
	POETRY														✓
	POPULATIONS (diversity, density)	✓		✓	✓			✓	✓	✓	✓				
	VEGETATION	✓		✓	✓				✓	✓					
	RECREATION											✓	✓		
	SUCCESSION								✓						
	TERRITORIALITY														
	WETLANDS														
	WATERSHED		✓				✓				✓				
	WILDLIFE MANAGEMENT														
PROCESS SKILLS	CLASSIFICATION	✓			✓		✓	✓	✓	✓					
	CONSTRUCTING:														
	An Interview													✓	
	A Questionnaire											✓			
	Models		✓			✓									
	Equipment		✓		✓		✓					✓			
	DATA:														
	Collection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Interpretation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	GRAPHING	✓				✓		✓				✓			


CLASSROOM GUIDES
ENVIRONMENTAL DECISION CARDS
WILDLIFE SURVIVAL GAMES
Language
15 - Waterfowl Nest Structures
16 - Fire Ecology
17 - Muskrats
18 - Wetlands and Wildlife
19 - Fish Populations
20 - Public Survey
21 - Fish Hatcheries
22 - Farming and Wildlife
23 - Redwinged Blackbird
24 - Endangered Species: Mystery Birds
1 - Wildlife Management - A Changing Landscape
2 - People Patterns - Population Distributions
3 - School Site Development
4 - Land Donation
5 - Predator Control
1 - Squirrels
2 - Red Fox
3 - Ducks
4 - Bald Eagle
5 - White-tailed Deer

Outdoor Classroom

18

WETLANDS AND WILDLIFE
Level II

- Spring, Summer, Fall
- Environmental factors
- Habitat
- Waterfowl
- Wetlands
- Watershed
- Wildlife management
- Classification
- Data collection
- Interpretation
- Mapping
- Measurement/mathematics

Outdoor Classroom

22

FARMING AND WILDLIFE
Level II

- Winter
- Agriculture
- Environmental factors
- Habitat
- Man and his social history
- Populations - diversity
- Wildlife management
- Classification
- Data collection
- Interpretation
- Mapping
- Measurement/mathematics

MATCHING ACTIVITIES TO YOUR NEEDS

To decide which cluster of materials to begin with you will need to consider site (indoor vs. outdoor), grade-range and seasonal requirement. Next, scan the Content Topics and Process Skills lists until you find some categories which match your program needs. Identify which activities deal with these categories by linking the check marks to specific activity titles at the top of the chart.

CHECK YOUR STUDENTS FOR INVESTIGATION SKILLS

Students must be able to use certain investigation skills in order to complete each **Outdoor Classroom Guide** activity. This may require learning or practicing these skills before beginning an **Outdoor Classroom Guide** activity. Check the section, **Learning Investigation Skills**, for activities developed to help students with several important skills.

These descriptions indicate that both activities involve investigation of wildlife and habitat. Although the habitats and wildlife species are different, both involve investigations of the relationships between land and wildlife. Using the **Classification Chart** in this way helps you select several related experiences which could take place over several days or weeks.

This chart is also useful for finding relationships between two or more activities among the three major clusters of materials. An indoor activity such as one of the Wildlife Survival Games deals with some of the same content topics as some of the Outdoor Classroom Guides. As an example, the **Duck Game** deals with some of the same content topics as some of the Outdoor Classroom Guides. As an example, the **Duck Game** deals with some of the same environmental factors found in the Outdoor Classroom Guide, **Fish Hatcheries**. This provides a way of relating indoor and outdoor learning experiences. This same process could be used in relating an Environmental Decision Card to an Outdoor Classroom Guide activity.

LEARNING INVESTIGATION SKILLS

• COLLECTING INFORMATION

The learning outcome of each Outdoor Classroom activity will be dependent on the success of the participants in collecting and using information.

Collecting information is usually best done on an individual or small group basis. These skills often involve using simple measuring devices such as rulers or thermometers, recording information on a data sheet, making a map and making observations and population estimates using small sample plots. When each individual is involved in collecting information, the background for individuals making their own best guesses has been established.

• USING INFORMATION

Using the information once it is collected is just as important as collecting it. Using information tends to be a large group activity where individuals or small groups share or pool information for the purpose of interpreting the results. This, too, requires some learning process skills. The information must be communicated such that it is understood by the entire group; this often involves discussion and questioning. To help interpret further, graphs, charts and other ways of displaying information are often needed. This helps participants understand the information and its use in making inferences and drawing conclusions.

A TRANSECT STUDY

This study will help students learn and practice investigation skills needed for the Outdoor Classroom Guide activities. Although this study is primarily for students in grades 4-9, it will be useful to consider it for other age levels. For students that do not require completing the entire study, individual skills can be selected where the need occurs.

HOW TO BEGIN

A transect study is a way of finding out about an area without having to investigate every square inch of it. A transect is a line established in such a way that it cuts through the area to be investigated. By collecting information at various points along the transect, characteristics of the area can be sampled. Through interpreting the information collected at the stations along the transect, inferences can be made about the nature of the entire area.

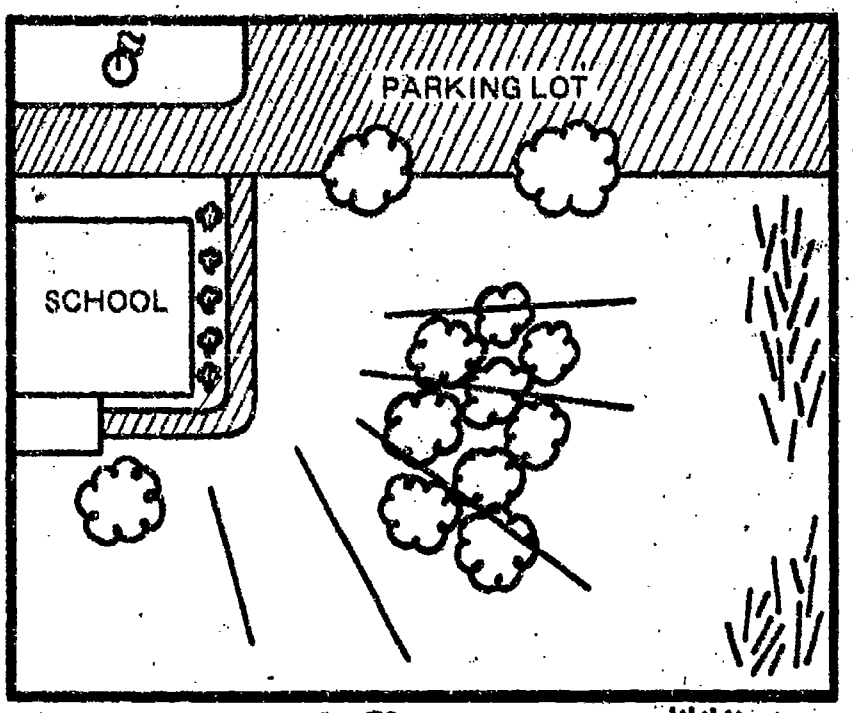
The following steps describe a transect study which can be conducted at almost any place.

Locate an area where several teams of two or three students can work without getting in each other's way. The area should include some diverse terrain such as a hillside, grove of trees, pond, creek, or even part of a lawn or parking lot. Once a general area has been selected you are ready to begin with step one.

STEP 1 MAPPING

SOME THINGS EACH TEAM SHOULD DO

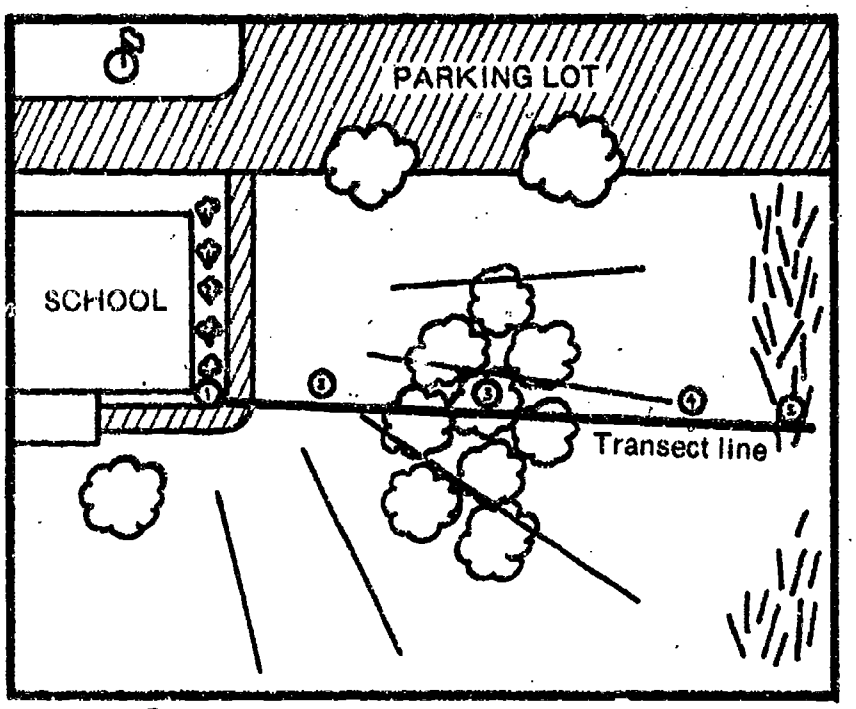
1. Get to know the general boundaries of the study area. Walk over the area — acquire a feel for land formations, natural and man-made structures.
2. Construct a working map of the area. (Decide on symbols before beginning so that the team maps will be understood by the entire group).
3. Describe team maps to the entire group.
4. Using individual team maps, a general map should be constructed to serve as the basis for Step 2



STEP 2 THE TRANSECT LINE/ INFORMATION COLLECTING STATIONS

A GENERAL MAP

1. Decide where the transect line should be.
2. Decide where the information collecting stations should be located along the line.
3. Outside on the study area, mark the transect line. (Wooden lath and ribbon make good markers.)
4. Locate each information collecting station, number and mark it. (Locate stations in areas along the transect line so that a representative cross-section of the area will be studied. Keep them far enough apart so that the teams will not interfere with each other when collecting information.)



① - ⑤ Locations of information collecting stations

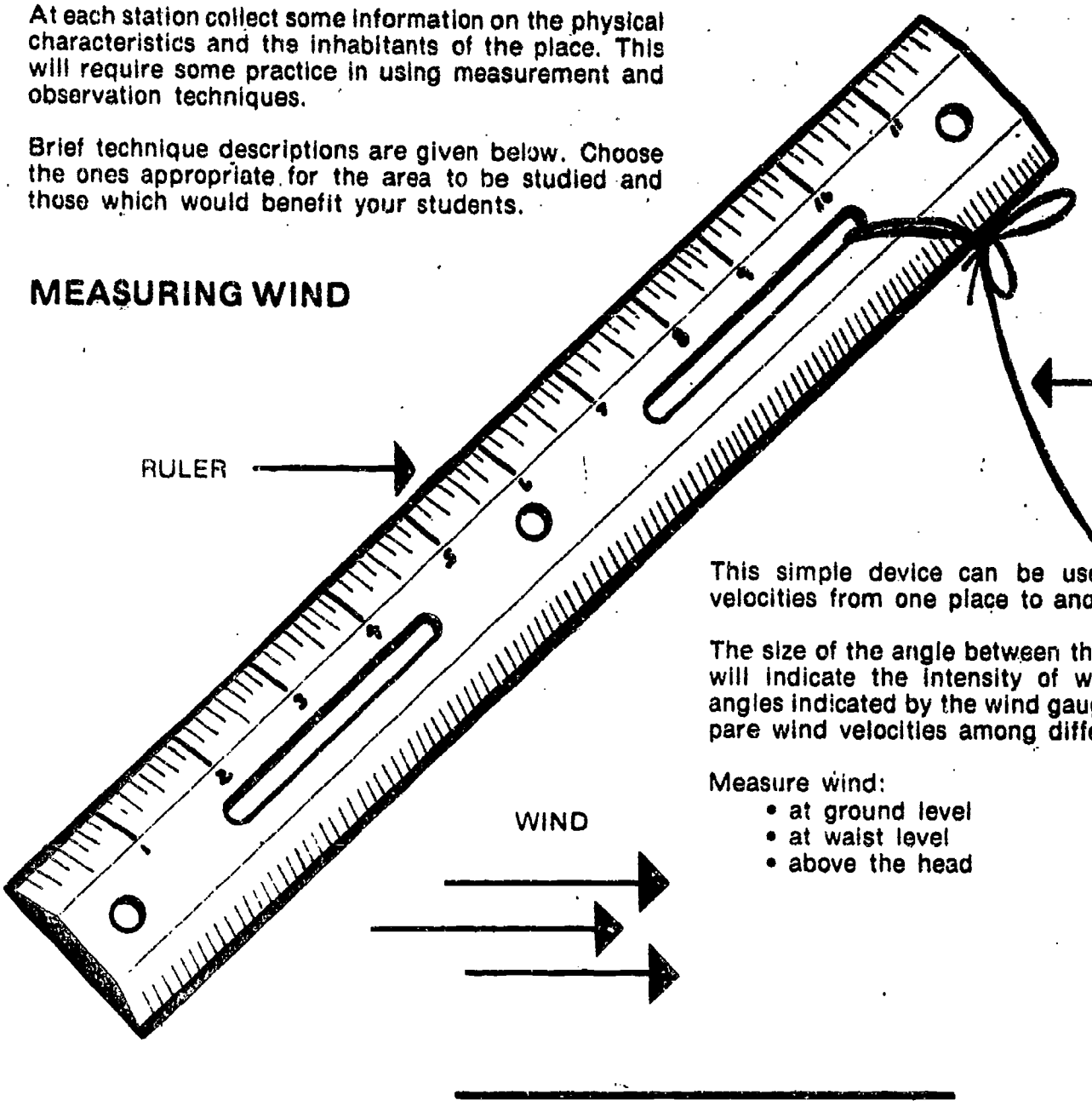
18

STEP 3 TECHNIQUES FOR COLLECTING INFORMATION

At each station collect some information on the physical characteristics and the inhabitants of the place. This will require some practice in using measurement and observation techniques.

Brief technique descriptions are given below. Choose the ones appropriate for the area to be studied and those which would benefit your students.

MEASURING WIND



This simple device can be used to compare wind velocities from one place to another.

The size of the angle between the string and the ruler will indicate the intensity of wind. By drawing the angles indicated by the wind gauge, students can compare wind velocities among different places.

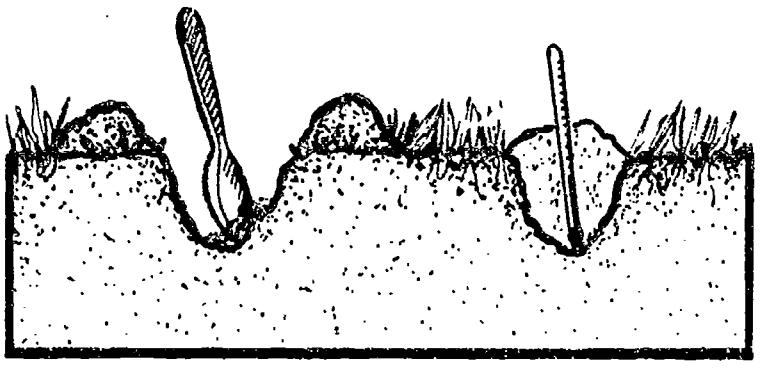
Measure wind:

- at ground level
- at waist level
- above the head

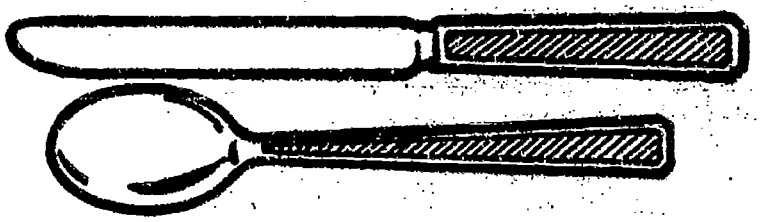
•TAKING TEMPERATURES

Use easy-to-read simple thermometers. It takes about three minutes for a reliable reading to register. Take temperatures at varying levels:

- air temperature, measure at shoulder height
- surface temperature, measure with the thermometer flat on the ground
- soil temperature, measure at about 4 inches below the surface. Use a spoon or knife to make a hole — then gently pack soil back around the thermometer bulb.



DESCRIBING SOIL



The only equipment needed is old spoons or table knives for shallow digging.

MOISTURE

Dry: falls apart and sifts between the fingers

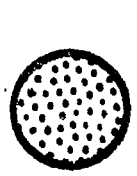
Slightly Moist: appears moist but does not stick together when squeezed

Moist: sticks in a clump when squeezed

Very Moist: squeezes freely and water is obvious

Wet: water drips

TEXTURE



Soil is usually a mixture of varying sizes of particles. The abundance of particles of a certain size helps define a soil type. Therefore, soil texture is a major characteristic used to separate soils into types or groups. The relative texture of basic soil types may be illustrated by the use of four grades of sandpaper. For example:

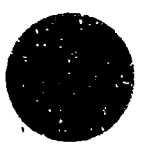
Sand — 3M (Sand Pak) Coarse #9003, coarse soil

Silt — 3M (Sand Pak) Fine #9001, fine soil particles

Clay — 3M (Sand Pak) Extra Fine #9000, extra fine soil particles

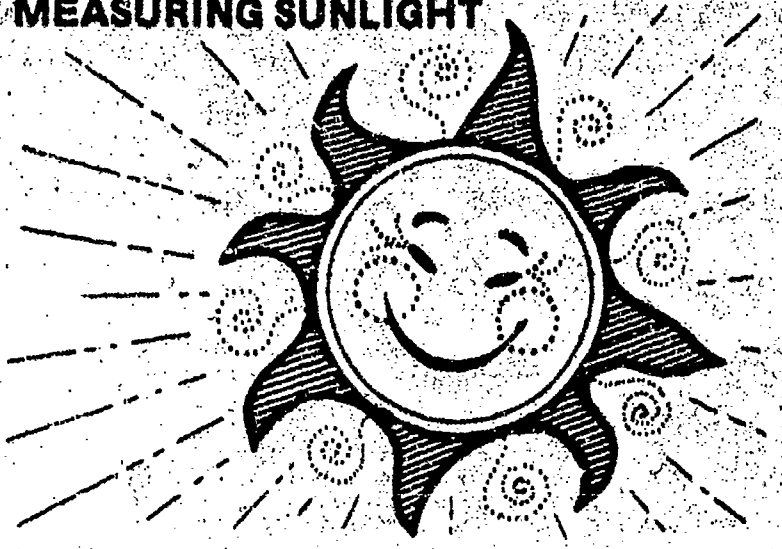
Loam — 3M (Sand Pak) Medium #9002, medium soil particles

COLOR

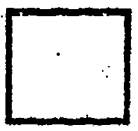


Also note soil color. Generally dark soils contain more decayed plant and animal remains than lighter soils.

MEASURING SUNLIGHT



An estimation of the proportions of shade and sunlight on the ground surface will usually be adequate. The scale given below will help students make estimates:



Very Sunny — most of the ground surface is covered by sunlight

Sunny — about ¾ of the ground surface is covered by sunlight

Moderately Sunny — equal amounts of sun and shade on the ground surface

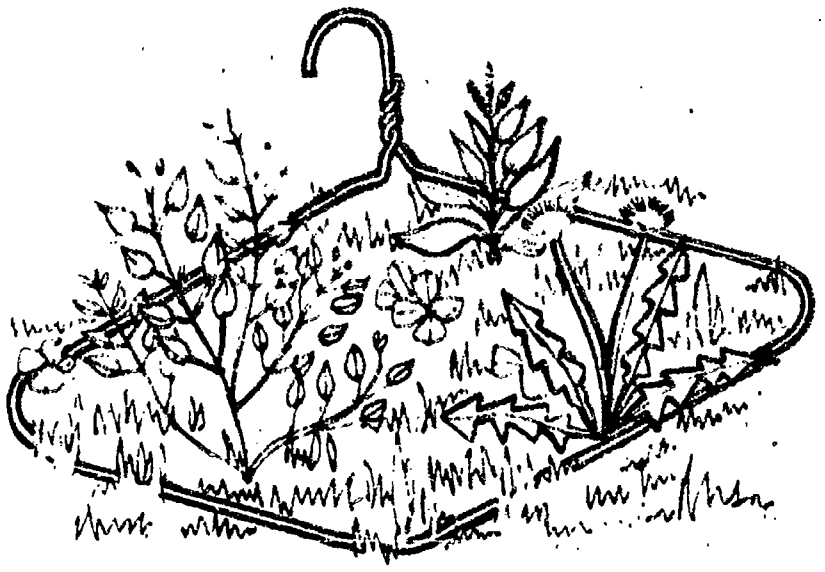
Shady — about ¾ of the ground surface is covered by shade

Very Shady — most of the ground surface is covered by shade

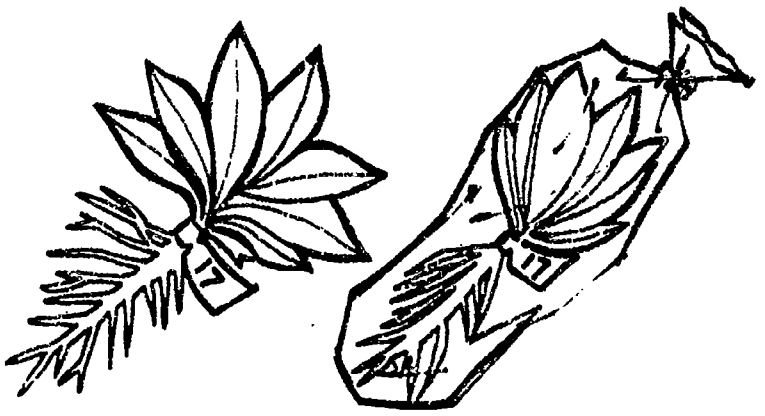
DESCRIBING THE INHABITANTS OF A PLACE

PLANTS

Ground cover plants: Use a coat hanger wire to isolate a sample plot anywhere within several feet of the station marker. Within the sample plot:

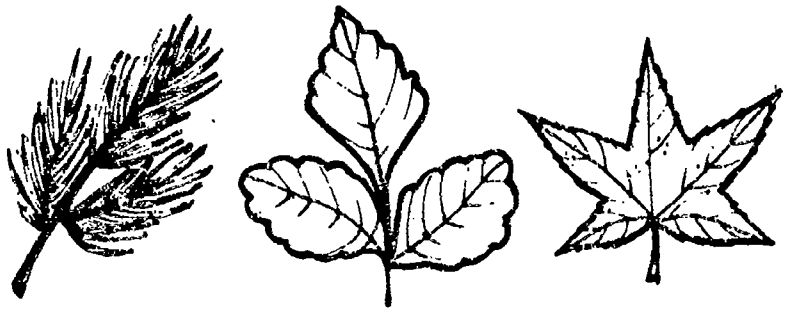


- Collect one of each different type of plant.
- Count the numbers of each type



- Wrap a piece of tape around each plant collected and put the number on the tape.
- Put the plants in a plastic bag.

SHRUBS AND TREES

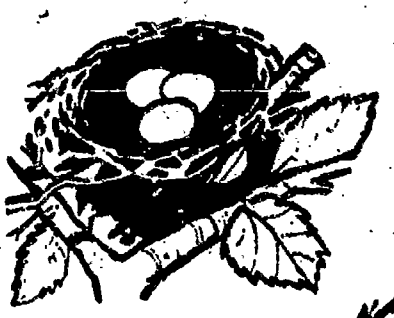


- Remove a twig with leaves from each of the most common plant types within several feet of the station marker.
- Count the numbers of each plant type and record whether they are trees or shrubs.
- Put the number on a piece of tape and wrap it around the twig.
- The twigs should be placed in a plastic bag.

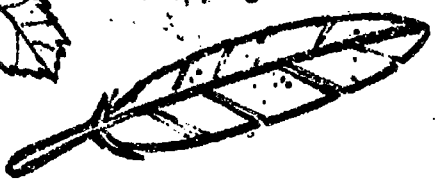
ANIMALS

The presence and activity of many forms of animal life can be inferred from many signs. Encourage students to investigate slowly and critically by looking under things, among leaves and twigs and by digging under the litter on the ground surface.

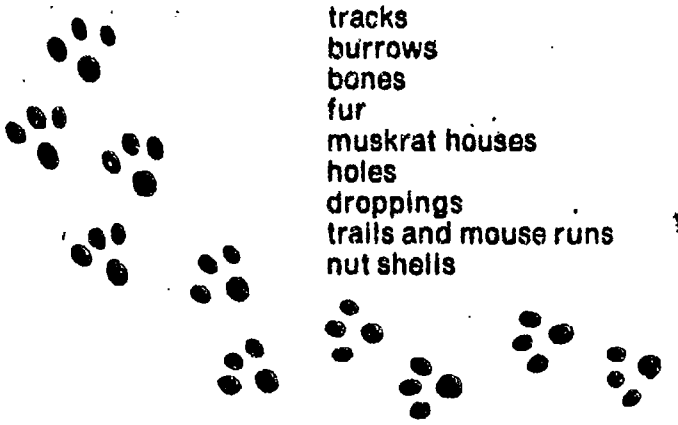
Birds: Songbirds, geese, ducks, herons, hawks and more



songs
egg shells
foot prints
bones
nests
feathers
half-eaten seeds
droppings



Mammals: deer, rabbits, cats, dogs, mice, muskrats, humans and more



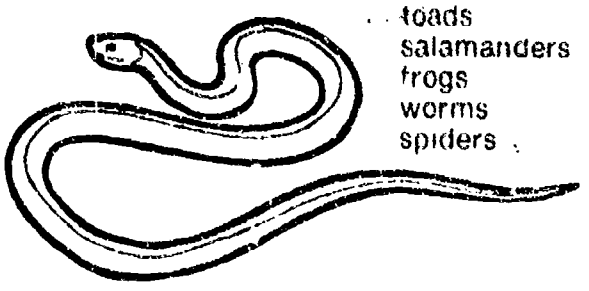
tracks
burrows
bones
fur
muskrat houses
holes
droppings
trails and mouse runs
nut shells

Insects: bees, ants, grasshoppers, butterflies,

gnats
ant hills
cocoon
caterpillars
chewed leaves

Other:

snakes
toads
salamanders
frogs
worms
spiders



STEP 4 RECORDING THE INFORMATION

Decide on the kinds of information to be collected.

Make up a DATA SHEET to be used by each team of students. (Make sure there is enough space for comments and sketches.)

Being able to put together a data sheet and recording the information as it is observed are important skills for investigating the environment. Discussion and inferences taking place later on will depend on how well each team is able to complete this step.

DATA SHEET

TRANSECT STUDY

Names _____

Date _____

Station Number _____

WIND

_____ Ground Level	_____ Waist Level	_____ Above Head

TEMPERATURE

Air Temperature _____

Surface Temperature _____

Soil Temperature _____

SUNLIGHT: (Circle One)
Very Sunny
Sunny
Moderately Sunny
Shady
Very Shady

SOIL

Moisture: (Circle One)
Dry
Slightly Moist
Moist
Very Moist
Wet

TYPE: (Circle One)
Sandy
Silt
Color
Clay
Loan

PLANTS: Describe or sketch your observations:

ANIMALS: Describe the animals or signs of animals you found in your area on the back side of this sheet.

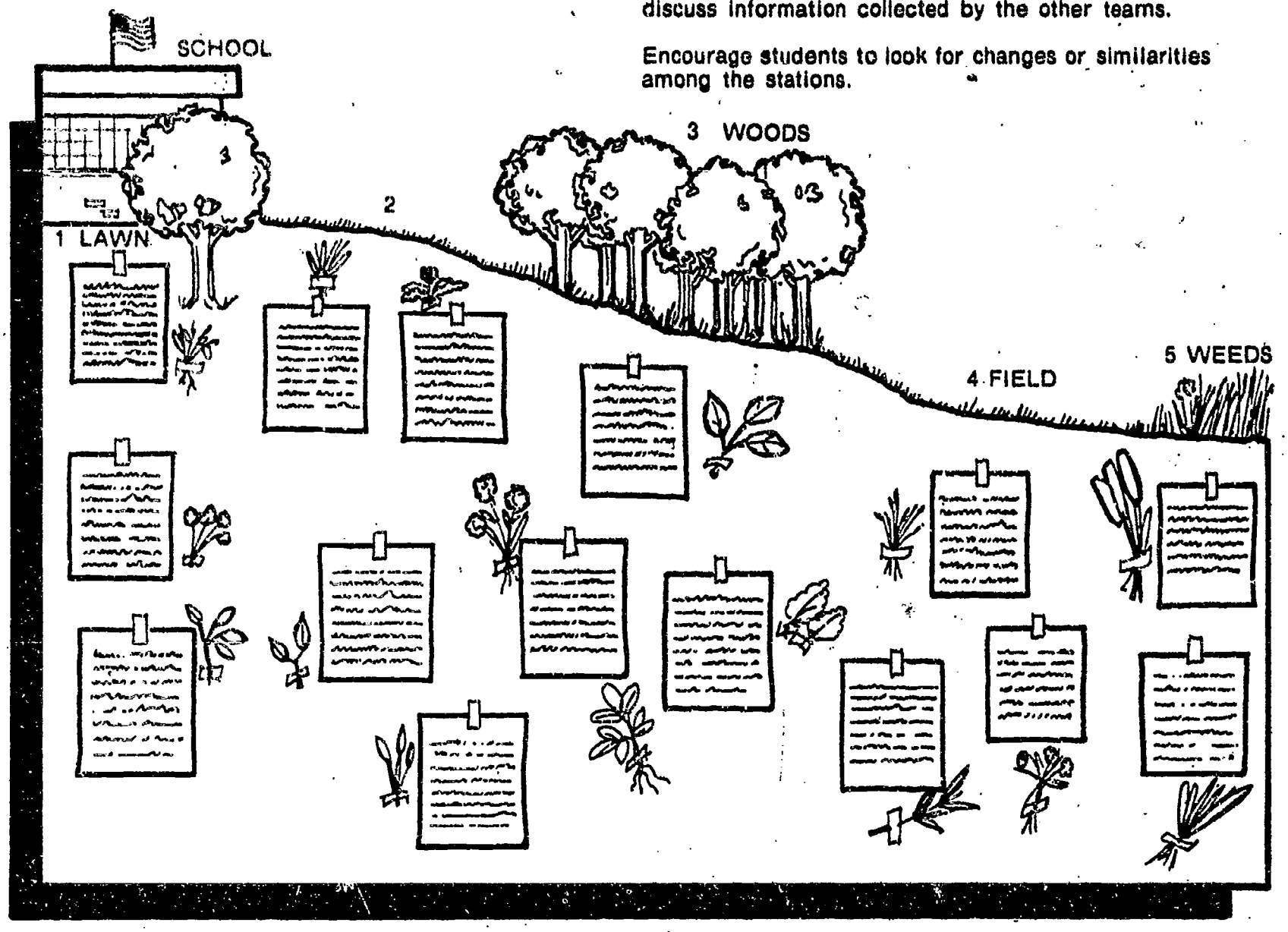
STEP 5 SHARING INFORMATION

On the blackboard or a large sheet of paper draw a picture of the study area. Show some of the topographic features and the locations of the collecting stations.

Each team should display their data sheet and plants by the station where each was collected.

Make sure students have the opportunity to read and discuss information collected by the other teams.

Encourage students to look for changes or similarities among the stations.



STEP 6 LOOKING AT THE INFORMATION

At first the students may find it difficult to think about the entire study area and the information collected at all the stations.

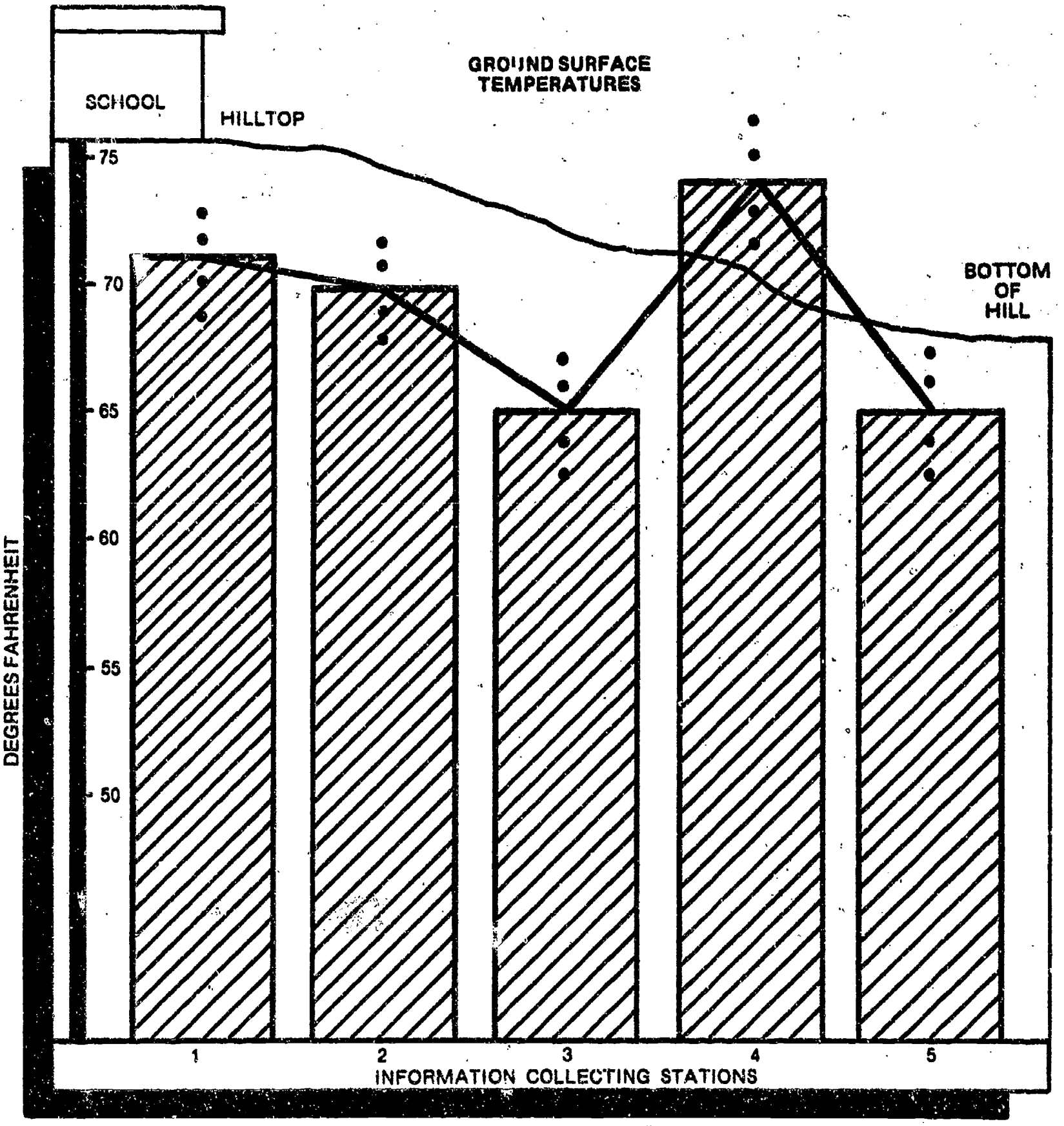
Review the process of how the information was collected and that the display of data sheets and plants are measurements and observations that help describe the study area.

Begin by looking for differences and similarities among the collecting stations. Single out one measurement such as ground surface temperature and follow it from

station to station. Using graphs, charts or tables will help students visualize the range of temperatures.

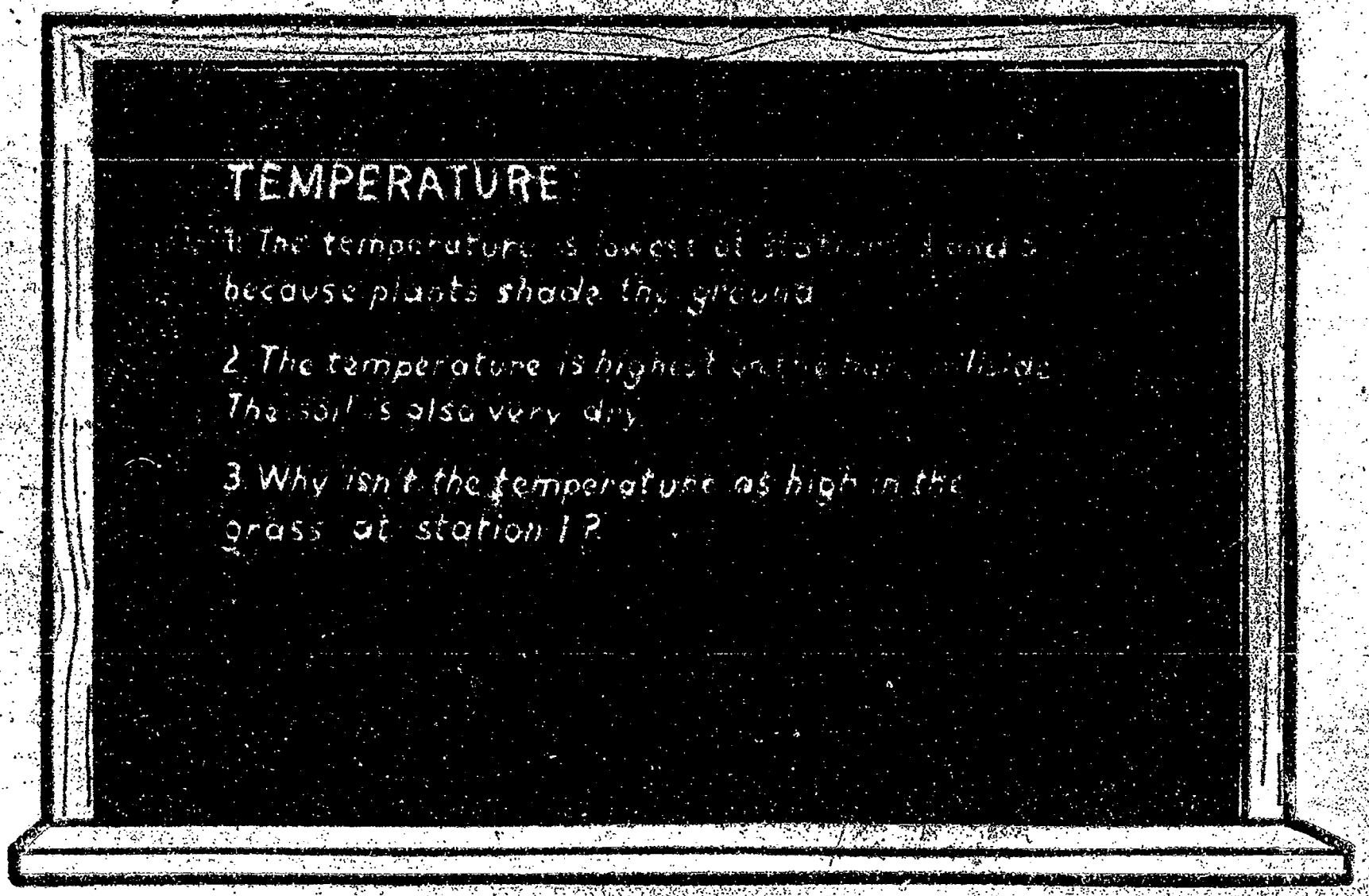
If there is more than one temperature reading for each station, the average reading for each station should be calculated. Make sure they understand the labels for each axis. Note how the ground surface temperature changes among the stations. Help students interpret what the graph shows.

Using charts, tables and sketches are some other ways of comparing information and may prove helpful for clarifying or uncovering relationships.



54

STEP 7 MAKING INFERENCES



Showing relationships within the information will help students ask questions about the study area. Some questions relating to the ground surface temperature graph might be:

- Why is the temperature lower among the trees at stations 3 and 5?
- Does plant cover affect the temperatures?
- Are there similar differences among the air and soil temperatures?

Questioning should be encouraged. However, students should realize that not all questions can be answered using the available information. Some questions may lead to the need to collect more information and further investigations.

In attempting to answer questions, students should be encouraged to make inferences based on the information collected. It is important to allow for individual differences among students in how the information is interpreted. Diverse inferences should be accepted and encouraged. Inferences will change with more and better information. Answers don't have to last forever.

And above all, the investigative approach should be one of shared responsibility and enjoyment. Students should not only look to you, the teacher, for support and help but to each other. Investigation is not just finding answers; it is also the opportunity to ask questions and share ideas.

Ground surface temperature:

1. The temperature is lowest at stations 3 and 5 because the plants shade the ground.

2. The temperature is highest on the bare hillside. The soil is also very dry.

3. Why isn't the temperature as high in the grass at station 1?

55

PRE-TRIP PLANNING

FOR USING REFUGE AND FISH HATCHERY SITES

Planning is essential for assuring a successful trip for you and your students. Once an activity has been selected follow these two steps to complete your plans.

• STEP ONE: MAKE ARRANGEMENTS

National Wildlife Refuges and National Fish Hatcheries are open for educational purposes at any time during the year. However, during some periods roads are closed due to snows or high water. Please check in advance to assure availability of a site.

A phone call is sufficient to reserve a site and time. You may want to make a special appointment with the refuge or hatchery manager to review the site before arriving with your students. This would also allow you to pick up maps or equipment which could then be reviewed with students before the trip. Be sure to discuss the activity with Fish and Wildlife Service personnel in order to identify equipment or any special assistance.

• STEP TWO: MAKE A CHECKLIST

FOR THE CLASS

- ☑ BUS ARRANGEMENTS.
- ☑ CLEARANCE WITH PROPER AUTHORITIES.
- ☑ SITE RESERVED AT THE REFUGE OR HATCHERY.
- ☑ INSURANCE AND PERMISSION FORMS
- ☑ SURVEY CLASS MEMBERS FOR EXTRA EQUIPMENT.
- ☑ LUNCHES AND DRINKS ARRANGED FOR (School lunches cancelled)
- ☑ FIRST AID KIT. (If school bus does not have one)
- ☑ PICK UP MAP, KEY (if necessary), AND EQUIPMENT FOR THE INVESTIGATION AT REFUGE HEADQUARTERS OR HATCHERY HEADQUARTERS

FOR EACH STUDENT

- ☑ WARM CLOTHING
- ☑ BOOTS OR OTHER WATERPROOF FOOTWEAR (In any weather).
- ☑ RAINGEAR. (If necessary)
- ☑ SUFFICIENT DATA SHEETS FOR EACH STUDENT.
- ☑ ONE PENCIL OR BALLPOINT PEN PER STUDENT.
- ☑ LIST THE EQUIPMENT FOR THE INVESTIGATION.

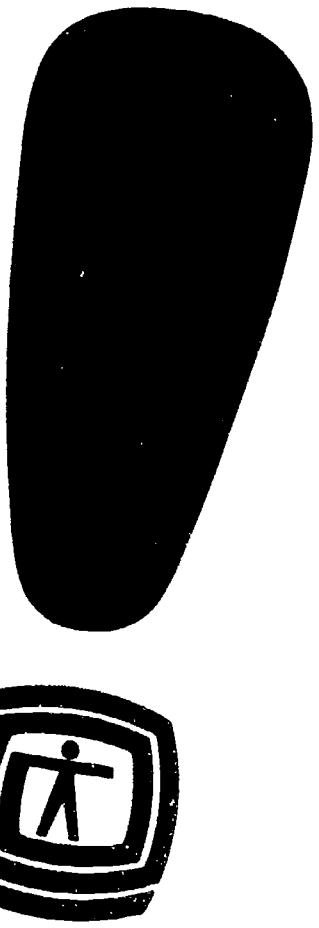
_____
_____
_____
_____
_____
_____
_____
_____

A[illegible] consider the experience of the students when selecting an activity. If it is one [illegible] pick up an activity near water offers too many possibilities for [illegible] A better first choice may be an upland field or forest

4

SECTION

we can help



Now that you have used public lands and community resources to make student learning more real and worthwhile, we would like to offer our continued support. The U.S. Fish and Wildlife Service is already cooperating with State Departments of Education and Natural Resources, other federal agencies, and colleges to help teachers use community and public land resources.

• REGIONAL OFFICES

The Service has published other aids to environmental education. You may write to:

U.S. Fish and Wildlife Service:

Region I P.O. Box 3737
Portland, OR 97208

Region II P.O. Box 1306
Albuquerque, NM 87103

Region III Federal Building
Ft. Snelling
Twin Cities, MN 55111

Region IV 17 Executive Pk. Dr. NE
Atlanta, GA 30329

Region V John W. McCormack Post
Office and Courthouse
Boston, MA 02109

Region VI P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Alaska Area Office
813 D Street
Anchorage, AK 99501

• MORE ENVIRONMENTAL EDUCATION RESOURCES

These will help you with your community environmental education program:

- college credit EE methods course
- EE use of public lands for resource managers
- coordination methods for building a community EE program
- slide-tape program showing how an elementary teacher can use a wildlife refuge
- outdoor recreation facilities
- EE poster
- educational site selection

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 1

Synopsis

PLANTS AND PLACES
A counting technique is used to compare the density of plants growing on places with differing amounts of soil moisture. By pooling their data, students are able to infer some relationships between soil moisture and plant density.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its la ds a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Why do certain plants grow only in some places? One might think it is because that is where the seeds are. It is more than just seeds, because seeds tend to get scattered all over and many never produce plants. Instead, the environmental factors that exist in a place favor the growth of plants which do best under that set of conditions. Some of these factors are moisture,

Plants and places

A. **Purpose**: This activity will acquaint students with—

1. The identification and meaning of environmental factors.
2. The effects of soil moisture on plant density.
3. A technique for determining soil moisture.
4. A technique for determining plant density.

B. **Objectives**: During this activity students will—

1. Identify and map areas of differing soil moisture.
2. Sample plant density on two areas of differing soil moisture.
3. Interpret the collected information and make some inferences about the effects of soil moisture on plant density.

C. **Activity requirements**: Each student, or team of students, will need—

Copies of the data sheet, pencils and perhaps clip boards.

The class will need—

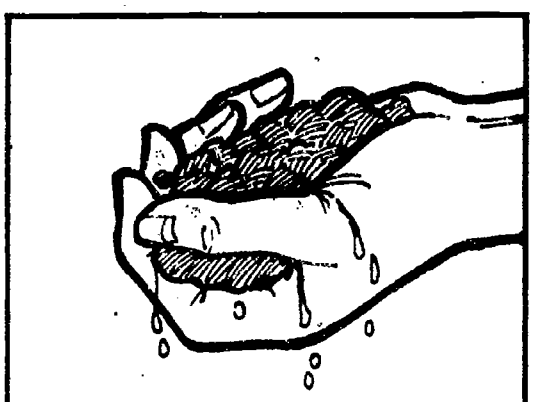
1. Large sheets of paper for mapping and stakes for marking collecting areas.
2. Large sheets of paper for pooling information from the individual data sheets.

Introduction

Being able to determine differences in environmental factors in an area helps explain the diversity and density of plant life. One environmental factor, soil moisture, has been selected for this activity because it is easy to determine and can be related to dramatic differences in plant density.

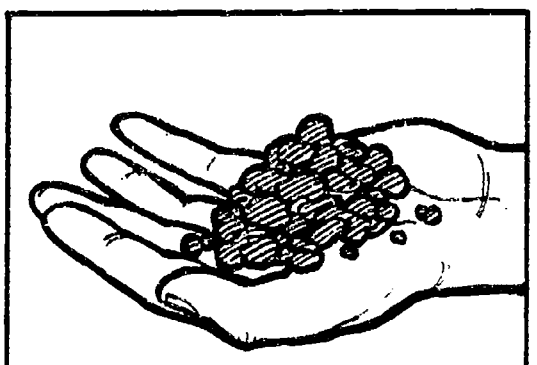
To begin, students may need some practice in identifying and describing how an environmental factor differs from place to place. A walk around the school grounds or surrounding area will identify places where there are differences in soil moisture. Use the following guide to evaluate the soil moisture conditions at each site.

Amount of Moisture in Soil

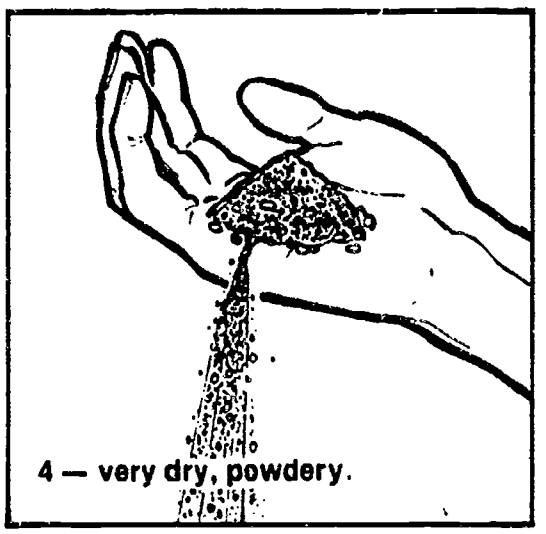


1 — very moist, water runs between fingers when squeezed.

2 — moist, clumps together when squeezed.



3 — dry, crumbly.



4 — very dry, powdery.

Data Sheet

Outdoor Classroom Guide Number 1

Plants and Places

Team _____

SIDE ONE

AREA 1
DRY, SANDY SOIL

plot a	plot b	piot c

AREA 2
WET, HUMUS SOIL

plot a	plot b	plot c

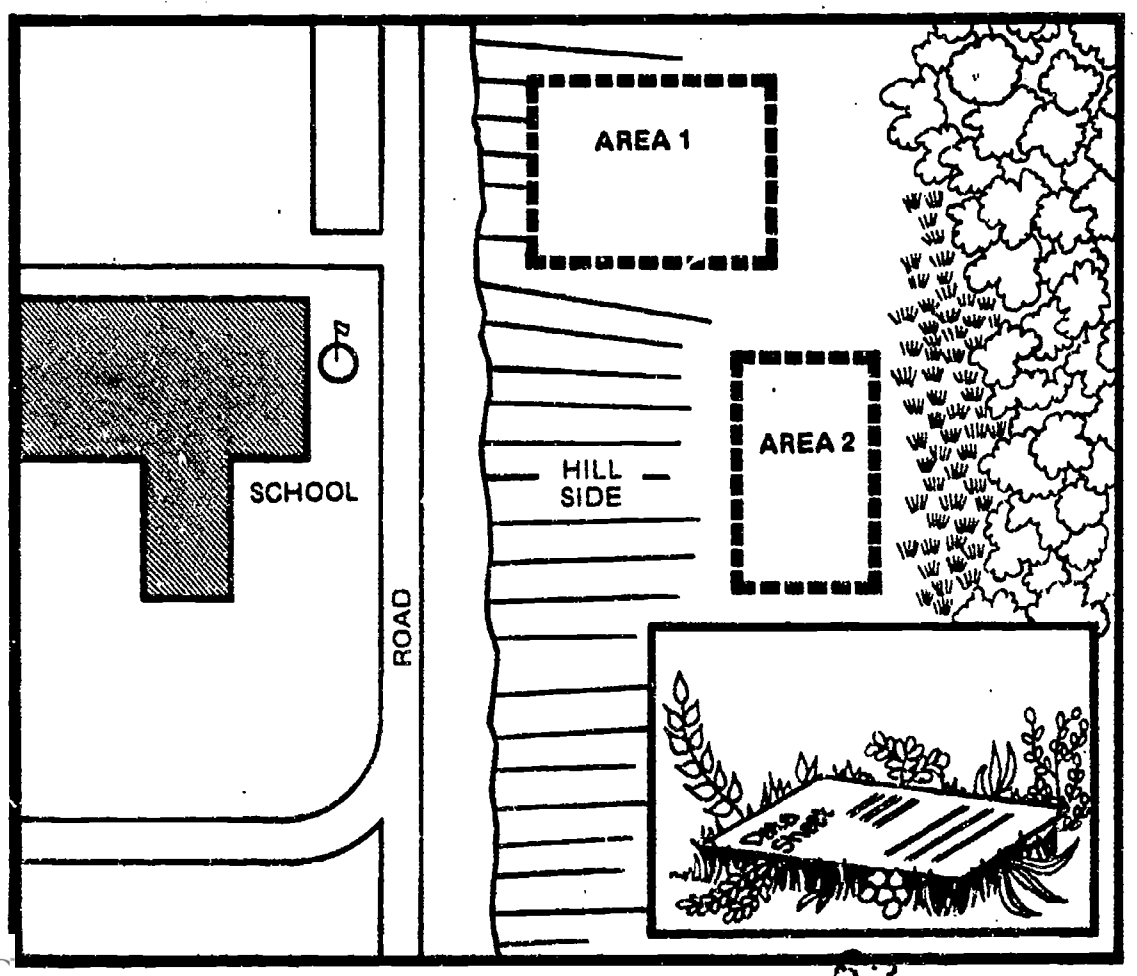
sunlight, temperature, and soil type. It is easy to compare these factors when contrasting two very different places, such as desert and a tropical rain forest. However, dramatic differences may also exist from place to place within a relatively small area such as a schoolyard or city park.

Environmental factors may change over a period of time, causing changes in the kinds and numbers of plants that grow in a particular area. This gradual change is called succession. It follows this sequence: sun-loving annuals are crowded out by perennial herbs and grasses, which in turn are shaded out by woody shrubs and trees. At each stage, new kinds of plants appear which, in turn, support different kinds of animal life.

During this slow process of change, the soil is being enriched by sedimentation and decaying plant remains. Soil moisture changes also; as shrubs and tress take over the wet areas, the soil becomes less moist and in dry areas, the soil becomes more moist. Thus the interaction of environmental factors and plants is a two-way process, each influencing the other.

It may be necessary to dig beneath the surface to get an accurate sample of the soil. As sites are identified, record them on a large map for future reference. It may also be necessary to mark the site with a stake and number. Try to identify several sites for each of the moisture types above.

While this is going on, some students may recognize that the amount of light, soil surface temperature and soil composition also vary from place to place. This awareness should be encouraged; these environmental factors could be investigated later on.
Once several sites are recorded on the map, areas of extreme soil moisture conditions will be apparent. From area to area the range might be from very moist to very dry or, perhaps, from dry to very dry. On the map, enclose areas with similar soil moistures. Look for large areas rather than the exceptional site of limited size. These areas become the plant sampling sites for the next part of the investigation. See the sample map.



The ideal situation is to find two large areas, one with sandy, dry soil and the other with moist soil conditions. Only two areas are needed for this investigation.

Plant Sampling Activity Description

Teams of two students work best for this activity.

In each area, each team will randomly select three sample plots, (a, b and c on the data sheet). To select the plots in each area, students can simply shut their eyes and drop their data sheets to the ground. The area under the sheet becomes one of the sample plots. At each plot in each area, students are asked to make a count of the number of plants in each sample and write this measurement in the appropriate box on their data sheet.

Students will count the total number of plants of any kind on an area of ground aproximately as big as the data sheets they have in their hands. They can hold their data sheet in one place over the plants and count those which are under it.

It is not necessary that "data-sheet-size" counting areas be perfectly exact, nor is it critical if a student wrongly identifies a complete plant. The results of this study are based on a statistical average of all students' measurements.

Some plants may be dead. Count them too because they were also produced from this soil at another time of year.

Some student may finish early. It is to

their benefit that they are then free to pay attention to other things around them. This investigation is designed to allow students to see and experience more than is usual; hopefully more than plant samples.

Collecting Data — Using Student Data Sheets

Make multiple copies of the printed data sheet. Each student will need a copy and a pencil. Students should write only a number in each square of the data sheet.

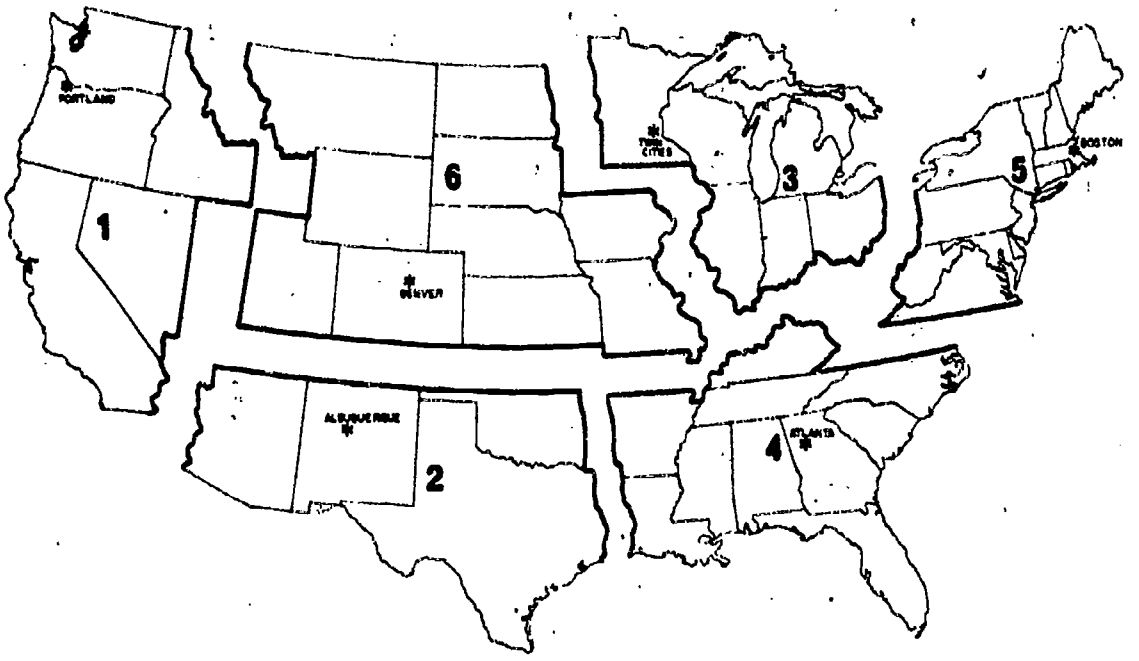
Individual student counts of plants from each plot may range from zero to several hundred. A more likely range is 3 to 25. Results will differ between students and plots.

"Does dry, sandy soil or wet, humus soil support more plants?" Individual data sheets may show a difference between area 1 and area 2, or between individual plots. It is interesting for students to speculate on conclusions from their separate data; especially in that many of their measurements will conflict in the differences they show.

Statistically, the information on one data sheet is not a valid sample of the plants being counted. It is not a large enough sample. But if several students or an entire class sampled the plants, the information can be pooled into a large, valid sampling. Use a blank data sheet and write in the total from all individual data sheets for each box. If this is done on an overhead transparency or enlarged wall chart of the data sheet, all participants can see the results at once. Now is there any indication of an answer to the question above? Are there more plants in the wet or the dry area? Is there any pattern between wet and dry soil and the size of the plants?

for information

Many Service land areas provide shelter, toilet facilities and limited equipment for your use. For trip reservations and further information, contact your local **U.S. Fish and Wildlife Service** office or the following regional Service offices:



Jenny Publishing Co. Inc.
57 Queen Ave. So.
Minneapolis, Minnesota 55405

Region I:	P.O. Box 3737 Portland, OR 97208
Region II	P.O. Box 1306 Albuquerque, NM 87103
Region III	Federal Building Ft. Snelling Twin Cities, MN 55111
Region IV	17 Executive Pk. Dr. NE Atlanta, GA 30329
Region V	John W. McCormack Post Office and Courthouse Boston, MA 02109
Region VI	P.O. Box 25486 Denver Federal Center Denver, CO 80225

Alaska Area Office
813 D Street
Anchorage, AK 99501

This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

after the investigation

1. As a follow-up to this activity, other environmental factors can be investigated. Variation in light intensity, surface temperature, soil compaction, and their effects on plant density can be compared using the techniques in this activity.

2. It may also be informative to study the effects of varying soil moisture on a much broader scale. Differences in the amount of rainfall over an entire state or continent can be identified and compared to differences in vegetation types. Compare the amount of rainfall with the locations of natural plant communities such as prairie vs. hardwood forest, and domestic plants such as small grains vs. corn.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 2

Synopsis

WATER FLOW AND IMPOUNDMENT
Students will apply skills of measuring and mapping to construct a model of the land's surface. They will apply these skills in the construction of a mini-dam.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

Wildlife is decreasing because there is less and less place for it in man's managed habitats — farms, towns, industries, parks. One of the things land management people are trying to do to reverse this trend is replace some of the drained wetlands, which previously provided habitat for waterfowl, with man-made wetlands which are maintained. This is accomplished mainly

Water flow and impoundment

A. **Purpose**: This activity will acquaint students with—

1. The construction of simple surveying instruments.
2. How to survey a piece of land.
3. How to draw a topographic map.
4. How to build a three-dimensional model of a topographic map.
5. How to construct a mini-dam.

B. **Objectives**: During this activity students will—

1. Understand the tools and the task through building the tools themselves.
2. Work together to accomplish a class surveying project.
3. Evaluate their surveying data in order to choose a site for building a mini-dam.

C. **Activity requirements**: You will need—

1. Supplies to construct one surveying instrument for each team of 3 or 4 students (see illustrations on Data Sheet, Side 2).
2. Enough 8 to 10-foot poles to supply each team with one.
3. Three 2-foot lath stakes per team.
4. Compasses for each team.
5. A plumb line for each team.
6. Rope for each team.
7. Large sheets of paper for mapping.
8. Cardboard for making a three-dimensional model of the map.

Before You Begin

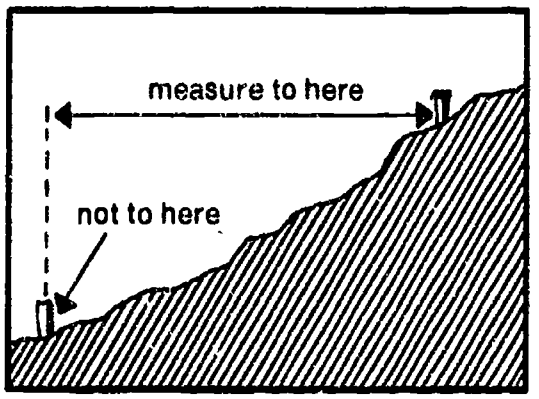
The class can choose one of the sighting devices appearing on the Data Sheet, Side 2, or each team can choose its own. Using the illustration as a guide, each team can build the device it will use in the surveying activity.

Each team will also need to build one range-pole. Using an 8 to 10-foot length of 1 x 1 inch clear pine or a bamboo pole, mark the pole in alternating 1-foot intervals with red paint, red cloth or plastic tape.

Next, the class can learn to use the equipment by measuring furniture and stairways inside the school. They can also go outdoors to measure variations in the topography of the school grounds. Practice measuring both distance as well as elevation.

Distance measurements are always made on the level. Example:

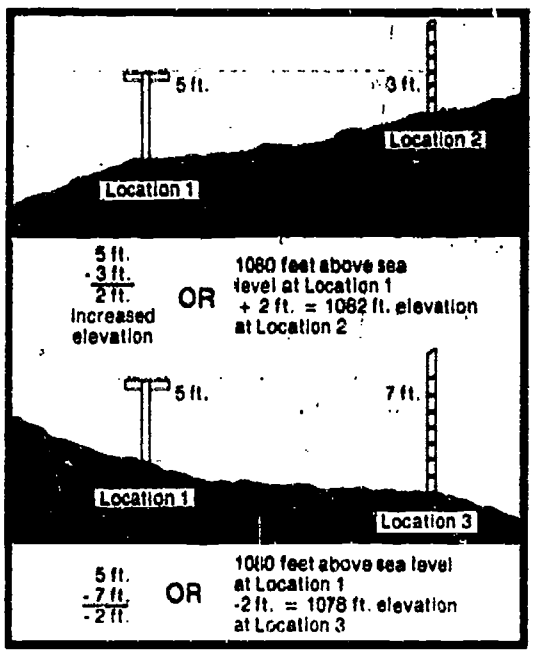
distance between two locations



A plumb line can be extended to obtain a vertical above any location to make measuring more accurate or a range pole can be balanced on end to estimate a vertical.

Distance measurement requires at least two students per team — three are best.

Elevation is measured with the level and range pole and some known elevation to start with. **Example:**



Activity Procedure

An outdoor area must be selected for this activity. The area should be of sufficient size to accommodate the class working in teams of 3 or 4, at 10 to 20-foot intervals. It can be a very small valley, or a large gulley. A gulley may be available on school property or close enough to make it unnecessary to arrange a field trip.

The following problem is proposed for students to solve: Given the small valley or gulley, where is the best place to build a dam?

Data Sheet

Outdoor Classroom Guide Number 2

Water Flow and Impoundment

Team No. _____

Names _____

_____

_____

SIDE ONE

Baseline compass direction _____

Distance between baseline stakes _____

Direction of compass line across valley or gulley _____ Toward _____

Elevation at stake No. 1 _____

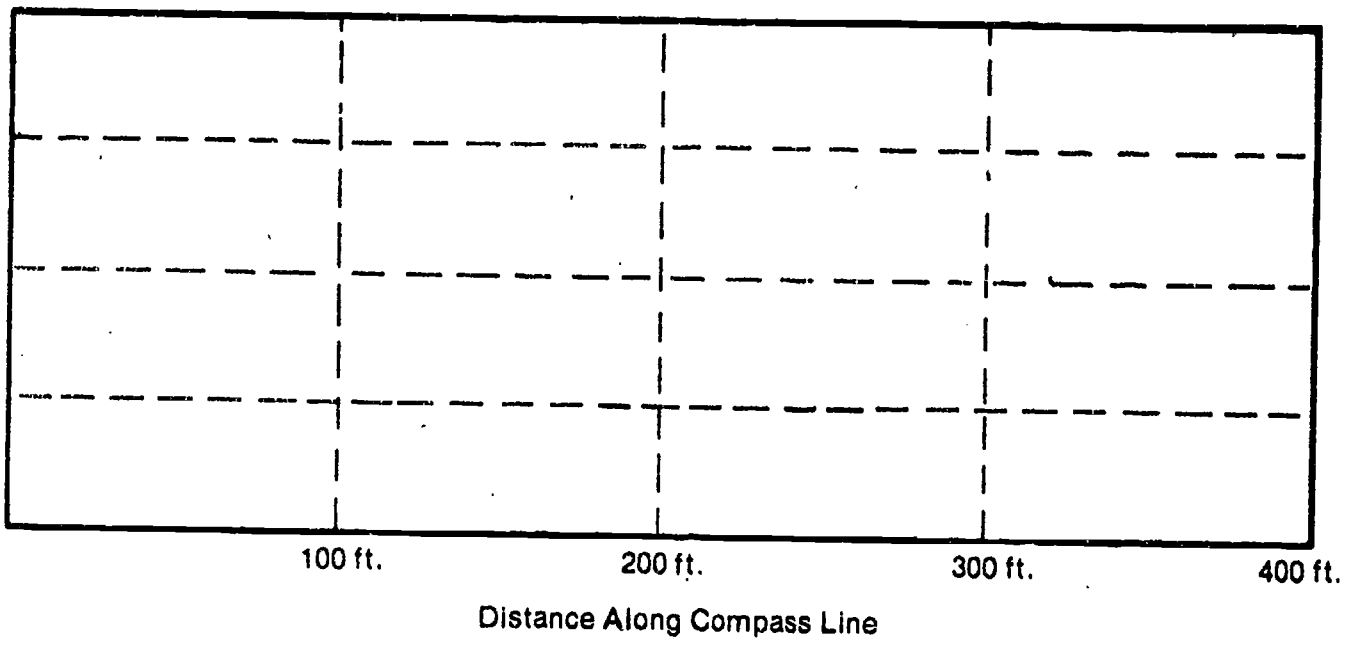
Two-foot elevation intervals along the compass line
(in order of measurement)

	Elevation	**Distance from Baseline**
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____
11.	_____	_____
12.	_____	_____
13.	_____	_____
14.	_____	_____
15.	_____	_____

SIDE TWO

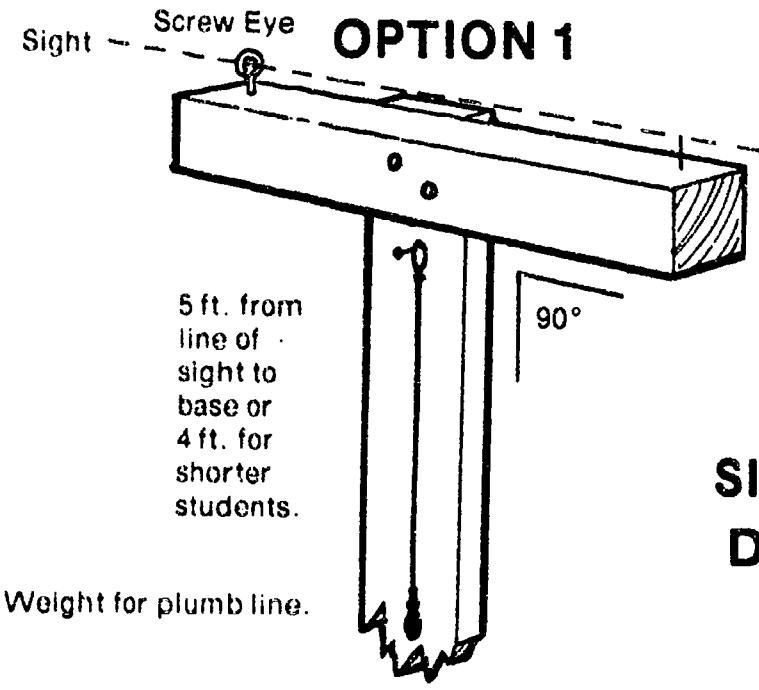
Represent the interval locations along your compass line on this chart.

ELEVATION



SIGHTING DEVICES

OPTION 1



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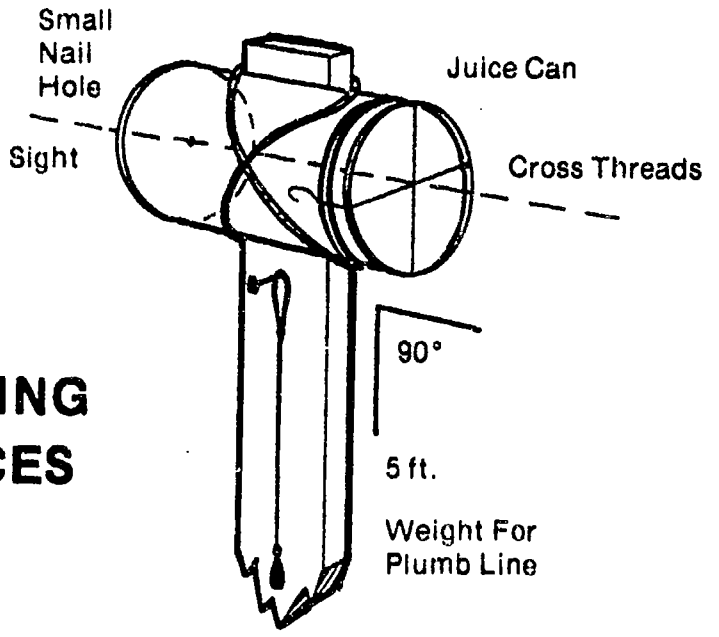
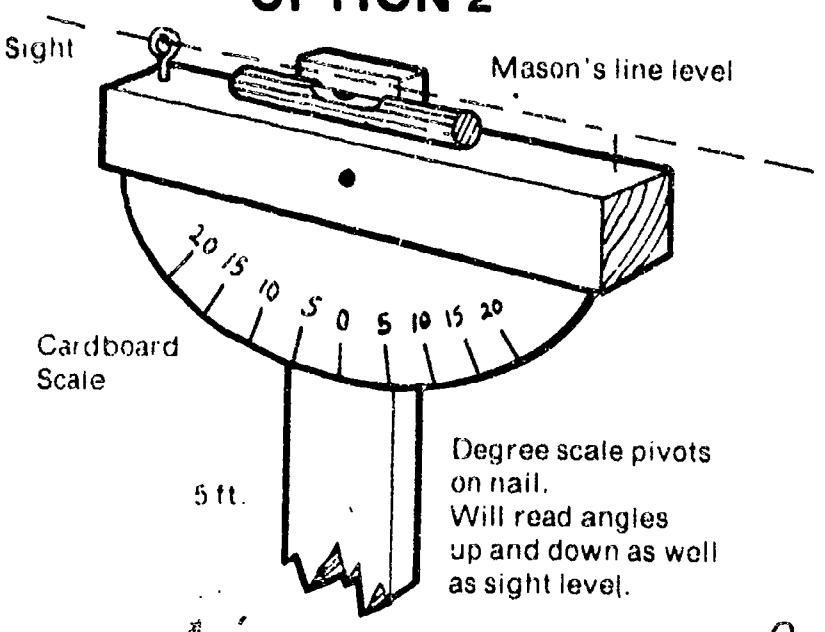
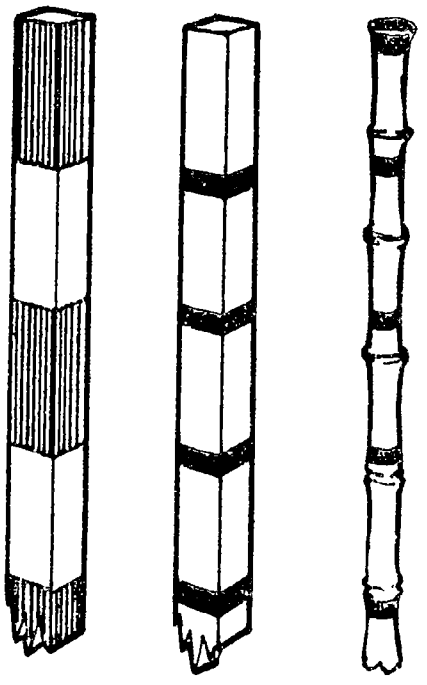


OPTION 2



RANGE POLES



Marked in one foot intervals.

8-10 ft. Tall

through the building of ponds, although some water areas are established by blasting holes in dry marshes, or by damming small waterways.

Silting is one of the factors that contributes to the rapid death of ponds by encouraging growth of choking vegetation. It is therefore of considerable importance in pond management that everything possible be done to prevent siltation. One of the first rules is not to build the pond in a stream. Although it may at first seem a logical place to impound water, a pond built in a stream has many disadvantages. It is likely to be subjected to unusually heavy overflows during floods because of the large drainage area involved. The dam and spillway are subjected to heavy pressures and the pond itself to unusual sedimentation.

Among the unexpected things about a pond is that the runoff from a rather small watershed is sufficient to keep it filled, especially where the soil is heavy and the climate humid. It need not necessarily be fed by springs or flowing wells. The rainfall running from crop fields, pastures and woodlots can be depended upon to maintain a pond. The runoff need only be sufficient to replenish the water lost by evaporation and seepage. The latter depends upon annual evaporation which varies from three feet in the humid East, to six or more feet in the arid Southwest.

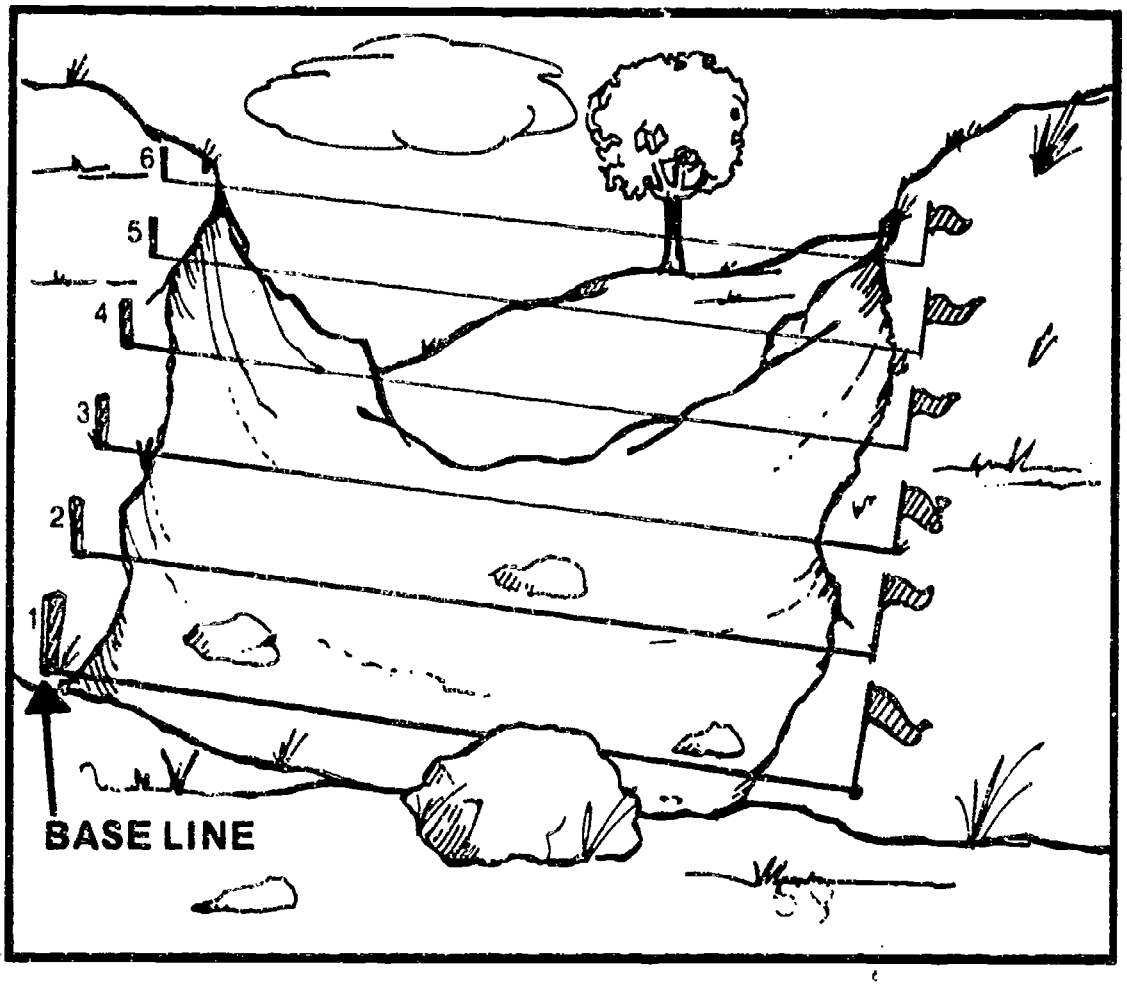
Land management people need to understand the interrelationship of the several factors of land topography, soil type, vegetation cover, and amount of precipitation and evaporation in a location being considered for water impoundment. The activity following emphasizes topography.

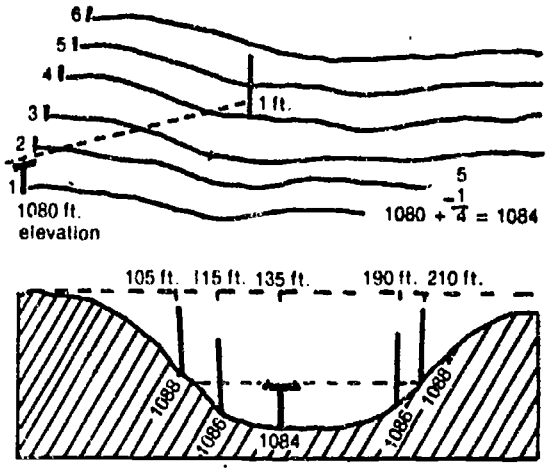
First, a base line must be set up which will be long enough to allow all the teams to work along it at no less than 10-foot intervals. This can be done by sighting a compass line roughly parallel to the valley or gulley length. Set stakes along it at 10 to 20-foot intervals, assigning each stake a number corresponding to one of the team numbers. The first stake at the top of the base line will be marked Stake #1, and will be the point of reference. Its elevation should be arbitrarily named (perhaps 100 feet), and marked on the stake. Each team should record that information on the Data Sheet, Side 1.

The teams, each with compass, level, range pole, and measuring rope are assigned to a numbered stake on the base line.

Each Team sights a line perpendicular to the base line and across the valley to be mapped. This will result in as many parallel lines as there are teams. If there are only a few teams, more lines will need to be surveyed later to completely map the area. A stake or flag can be placed at a distance point in line with the compass sighting to insure that all measurements will be in line.

Returning to stake No. 1, each team is to find a location on their compass line which is a 2-foot multiple of the elevation at stake No. 1. (See diagram below.) Having established this elevation, the team will find all further 2-foot elevation intervals along their compass line and measure the distance of each from the base line.





Measurements of distance can only be made to the limit of the rope, the range pole, or the student's reach. Thus, each total measure must be broken into units of level distance. The sighting device must likewise be moved to newly measured locations when the limit of the range pole is reached.

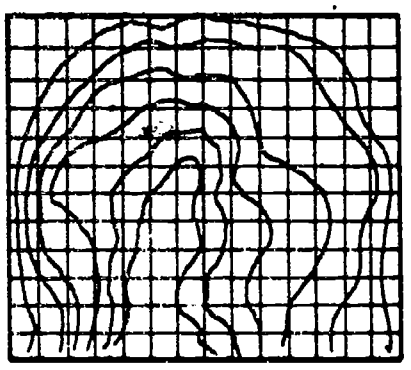
Ultimately the teams will have measured all 2-foot increments of elevation on a series of parallel lines running across the valley.

Record all measurements of distance and elevation on the Data Sheet. Each team should also complete the chart on Side 2 of the Data Sheet.

Using the Data

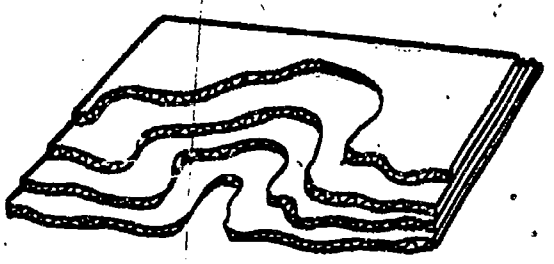
Back in the classroom, if the parallel lines are represented to scale on a large piece of paper, and points of like elevation are connected with curving lines, a contour map of the elevation of the valley will result.

Draw in the location of any landmarks.



After a scale map of about 1 inch representing 10 feet has been drawn on large paper, draw a smaller scale map of about ½ or ¼ inches representing 10 feet. Lay each contour line over a separate sheet of cardboard and cut away that portion of "land" which is below the elevation which that contour represents.

Glue one sheet of cardboard over another to represent



the respective increases in 2-foot increments of elevation. Add landmarks as desired.

Such questions as these will aid the class in deciding where a dam might be built in the gulley:

- What would be the result if your dam spanned the lower end of the gulley?
- What would be the disadvantages of building the dam there?
- What are the possible effects on a dam of placing it where the water runoff is fastest and heaviest?
- Where else could it be placed that would make it possible to catch enough water without danger of washing out? Is this necessary in this gulley?

The students should decide where to build the dam, construct it on the model, and calculate how large the water surface would be if the dam were actually to be constructed in the gulley. In order to make this calculation, a grid can be imposed over the model, using the same scale that you have used for the model. Draw the grid on transparent paper so it can be laid over the model.

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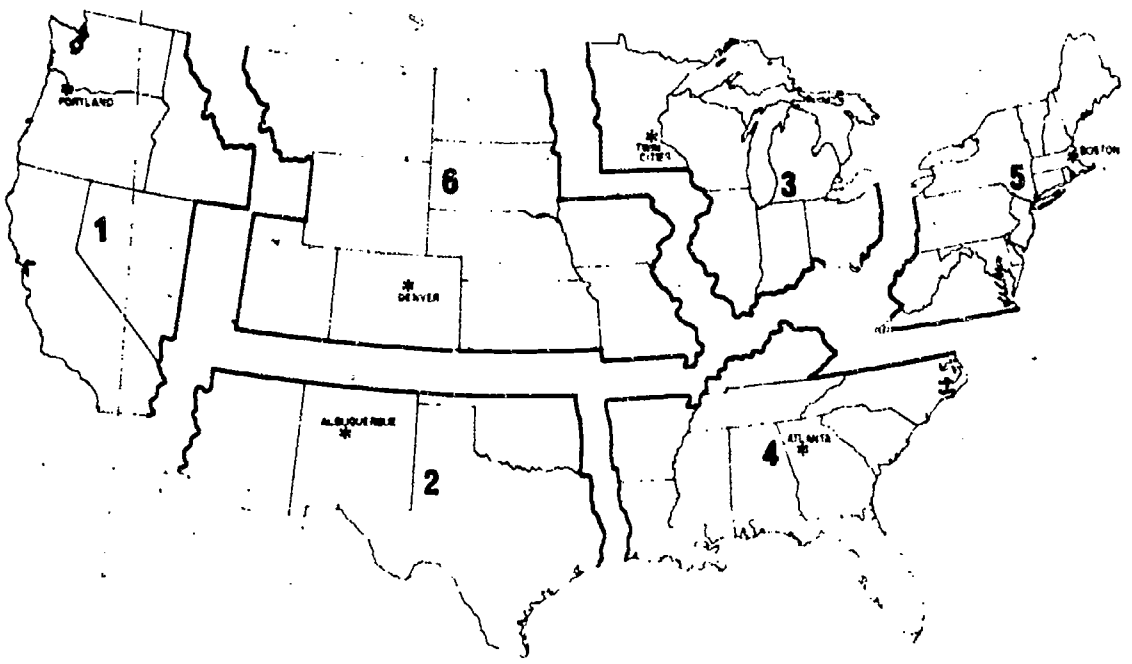
after the investigation

Here is an additional activity that will give students a chance to make an application of their surveying probe results. Ideally, it should be done during the spring thaw. In some parts of the country, where there is no spring thaw, a rainy day may be the only option.

Take the class outdoors to build a mini-dam. If the gulley they surveyed and mapped is close at hand, they might use it for their dam building project. If not, a school yard watershed area, or a construction site would work well. They will need to have accumulated some building materials before the day they begin to build — lumber scraps, loose dirt, boxes, bricks, stones, etc. They should be encouraged to refresh their surveying and mapping data, and to apply what they learned

After the dam is built, it can be visited often to check the results. Perhaps a week or 10 days later, the class can take the dam apart, and return the [illegible]in to the way they found it.



for information

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This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 3

Synopsis

A POPULATION OF POCKET GOPHERS

During this activity, students will map the number and distribution of pocket gopher mounds and come to some conclusions about their relationship to soil moisture and to vegetation type.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

It is possible for a female meadow vole to produce three to four litters of young a year. The babies are on their own within four weeks, each of the five to nine males start their own family when they are only two months old. Although not all wildlife species are so productive, each does produce enough young to maintain a healthy and stable population.

A population of pocket gophers

A. **Purpose**: This activity will acquaint students with—

1. The mound-building habits of pocket gophers.
2. Some environmental factors which influence pocket gopher distribution.
3. Some effects pocket gophers have on their environment.

B. **Objectives**: During this activity students will—

1. Map pocket gopher mounds.
2. Compare areas where pocket gopher mounds are numerous with areas where they are absent or inactive.
3. Discuss what might be some reasons for the difference.

C. **Activity requirements**: Each team will need—

1. Data sheet.
2. Plastic bag.
3. Cardboard box for map table
4. Rule with tab.
5. Pin or small nail
6. Tape
7. Two pieces 8-½ x 11-inch paper.
8. 50 feet of rope knotted at one-foot intervals.

[illegible]mall garden trowel.

Introduction

Pocket gophers are rodents that live underground. They indicate their presence by mounds of earth that they throw up on the surface above their system of tunnels. They prefer moist but well-drained, sandy loam soils. In farming areas they are most likely to invade hay-crop fields or pastures, roadsides, and railroad right-of-ways.

In its tunnels, about a foot beneath the surface, a pocket gopher feeds on tubers and roots. It occasionally leaves its burrow to feed on surface vegetation. Food items are cut into small sections and stuffed into its external cheek pouches, and transported to storage chambers in the tunnel.

Pocket gophers probably live solitary lives except for the period of mating and while the young are with the mother. As soon as the young animals are weaned they start their individual tunnel systems.

The tunnel system usually consists of a main tunnel with short laterals. At the ends of these lateral tunnels are the mounds of dirt, pushed up from below. Each gopher then constructs a cluster of mounds. Active clusters can be readily identified because one or more mounds will have been dug recently enough to be darker and moister than the others. Each cluster is to be counted in this study and the cluster will represent one animal.

Activity Procedure

For this activity it will be necessary to locate a meadow or field where there is a substantial, active, pocket gopher population, but which has areas where there are no mounds.

Each team can be assigned to choose one 100-foot circular area where there is at least one cluster of active pocket gopher mounds, and another area of equal size where there are no mounds.

In collecting data from active mounds, each team should place a stake or pole near the center of pocket gopher mounds. Circumscribe an area around the stake using a 50-foot cord tied to the stake as the radius.

Each team can count and record the number of pocket gopher mounds and the characteristics of the area using the Data Sheet, Side 1, as a guide.

To determine soil moisture, teams should cut away the top 2 inches of soil in a small area within their circles, using a small garden trowel. Each member of the team might dig a handful below that level, and feel it in order to arrive at a team judgement.

A map of the distribution of pocket gopher mounds can be drawn for each location. The map will aid graphically in the interpretation of the collected information.

The following mapping technique can be used:

Replace the center stake with an overturned cardboard box. The box will serve as a table upon which the map will be prepared. Tape two crossed pieces of 8½ x 11-inch paper together and place them on the center of the box. Fasten (glue) a cardboard or stiff tape tab on the back of a ruler as

Data Sheet

Outdoor Classroom Guide Number 3

A Population of Pocket Gophers

Team: _____

Members: _____

_____

Location of Study: _____

SIDE ONE

WITHIN A CIRCLE OF 100-FOOT DIAMETER:

Number of mound clusters: _____

VEGETATION

Kind of Ground Cover	Present	Absent	Most Common
Grasses			
Broad Leaf Ground Plants			
Shrubs and Bushes			
Trees			

SOIL TYPE

Sandy	Very coarse, grainy and loose. Made up of large particles.	
Clay	Tends to be clumpy and hard. Very tiny particles.	
Organic	Loose, but not grainy. Dark colored. Contains decaying plants & animal materials.	
Loam	Looser than clay, finer than sand, lighter colored than organic, made up of sand, silt and clay.	

SOIL MOISTURE

Dry	Falls apart.	
Slightly Moist	Appears moist but does not clump when squeezed.	
Moist	Clumps when squeezed.	
Wet	Water is obvious.	

SIDE TWO

Outdoor Classroom Guide Number 3

A Population of Pocket Gophers

Team: _____

Members: _____

_____

Location of Study: _____

WITHIN A CIRCLE OF 100-FOOT DIAMETER:

Number of mound clusters:

_____

VEGETATION

Kind of Ground Cover	Present	Absent	Most Common
Grasses			
Broad Leaf Ground Plants			
Shrubs and Bushes			
Trees			

SOIL TYPE

Sandy	Very coarse, grainy and loose. Made up of large particles.	
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SOIL MOISTURE

Dry	Falls apart.	
Slightly Moist	Appears moist but does not clump when squeezed.	
Moist	Clumps when squeezed.	
Wet	Water is obvious.	

Winter places heavy stress on individual animals due to weather, competition for food, and lack of sheltering cover. However, the surplus of young that are born each spring and summer make up for losses from winter hardships, illness, weakness, broken bones and all other possible misfortunes.

Every area of land can support only a certain number of each kind of animal — this is called its carrying capacity. For nearly every species, a surplus of individuals results in a deterioration of living conditions that affects the well-being of the whole population. Nature usually ensures that each population of animals has the capability to overproduce. The factors limiting actual numbers are determined by the land's carrying capacity.

Besides influencing the survival of surplus animals, carrying capacity affects production. Each species has an established social structure. Territorial competition in the spring for nesting sites and feeding territories limits the number of adults producing young. Man affects this production by changing the habitat and making more or fewer nesting sites or feeding territories available.

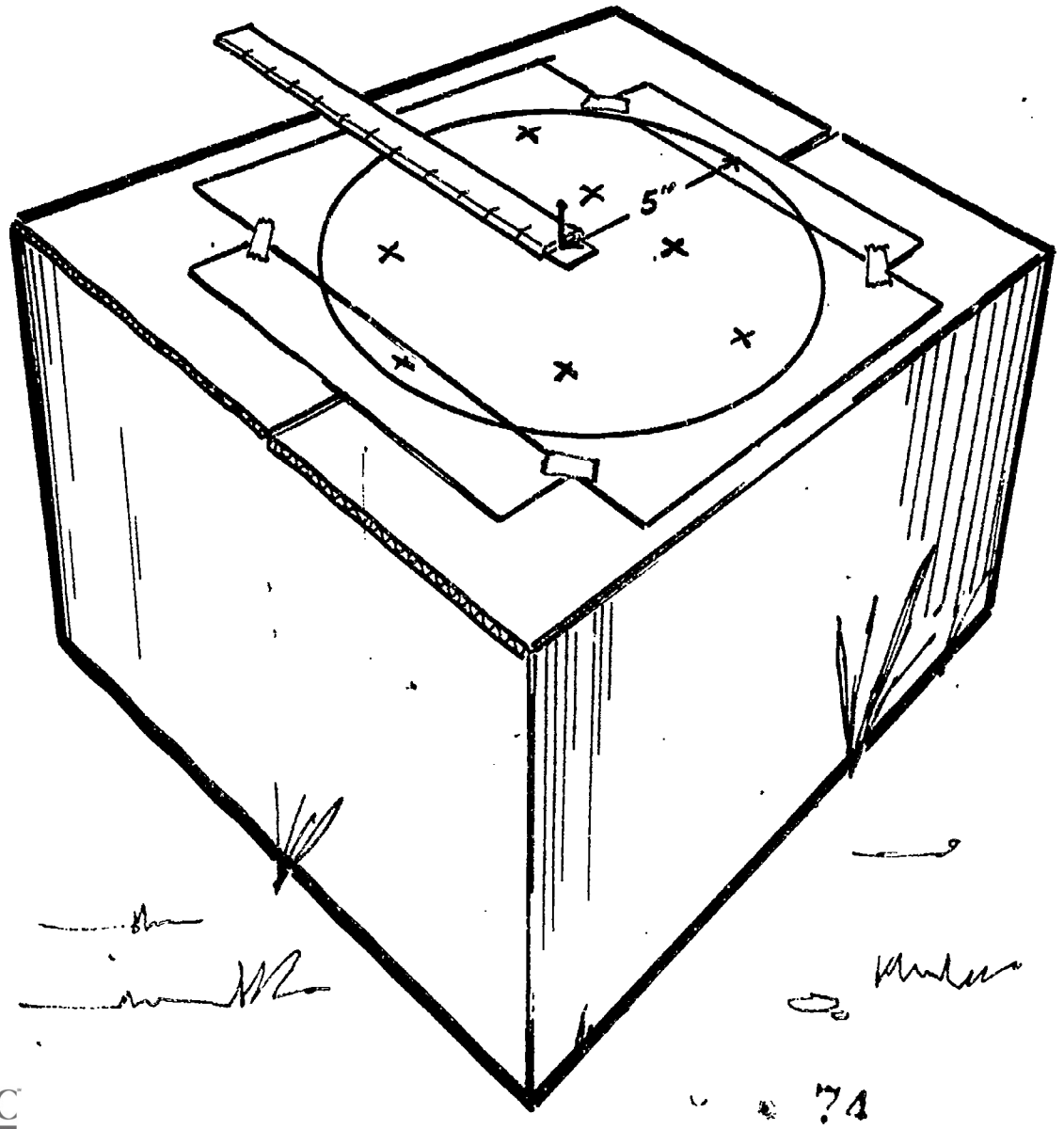
Through the discovery of population factors, including stress and the number of individuals within a population, a student can better understand his own environment and the "balance of nature." This balance includes man as well as the meadow vole. This discovery leads to questions of man's surplus population, our own stress factors and the carrying capacity of the land for man and his activities.

---

shown, and pin this sighting device to the center of the paper. Put the pin in at the zero end of the measuring edge of the rule. Sight along the ruler edge at a cluster of pocket gopher mounds. Another team member will measure the distance in feet from the box to the cluster of mounds. For each 10-foot distance, count out 1 inch along the ruler and place a mark to represent the cluster on the paper at the edge of the ruler.

Do this for each cluster within the 100-foot circle being investigated. Define the circle on the map at the 5-inch mark on the ruler.

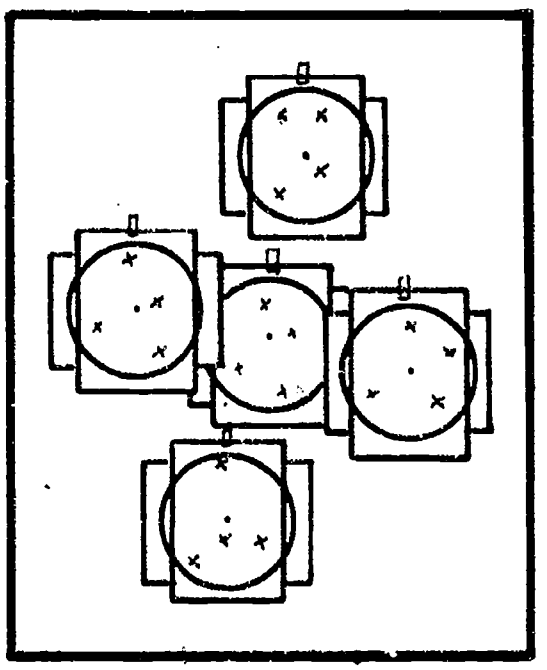
Attach the finished map to the Data Sheet.



After mapping the mounds, teams can move to areas where there are no mounds and use the Data Sheet, Side 2, to record their observations. Repeat the soil moisture procedure.

Using the Data

Back in the classroom, all the teams' maps can be arranged roughly in the same relationship team areas had to each other in the field. This will help the students to visualize the mound distribution while they are discussing their data.



Using data both from areas of gopher activity and areas where there is none, class discussion can deal with such questions as these:

1. Do pocket gophers usually choose a south-facing slope over a north facing slope? Why?

2. What seems to be the relationship between mound-building and soil type? Soil moisture? Food supply? Various combinations of these?

3. Does there seem to be a pattern to mound-building? Or does there seem to be no pattern at all?

4. Is there evidence of non-sociability among the pocket gophers in this area? What is the evidence?

5. What are some possible reasons that pocket gophers might have abandoned former mounds? Is there evidence that food supply was exhausted? What is the evidence?

6. Can you determine what effects these pocket gophers have had on this meadow environment? Good effects? Bad effects?

after the investigation

If the meadow is conveniently located and if the students are still interested, they could continue to watch gopher activity over a longer period of time. Many of their conclusions could be verified in this way. They could get a better idea of the relationship between mound-building and vegetation if they were to determine which mounds are abandoned. If the marking stakes used in the original activity could be left in place, teams could later identify the areas of their original observations, and could watch what happens to mound-building and vegetation there. They could use their original records and compare them with the conditions in their circles at the time mounds are abandoned. Have the kinds and amounts of ground cover changed? A great deal? What might this mean? Has there been comparable change in the second (moundless) area they originally observed? What does this indicate?

Other interesting places where pocket gopher activity could be observed are a hillside with north and south-facing slopes, or a road cut with north and south faces. Are there any mounds on the north-facing slope? If so, are there many more on the south-facing slope? Can you give an explanation for this

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for information

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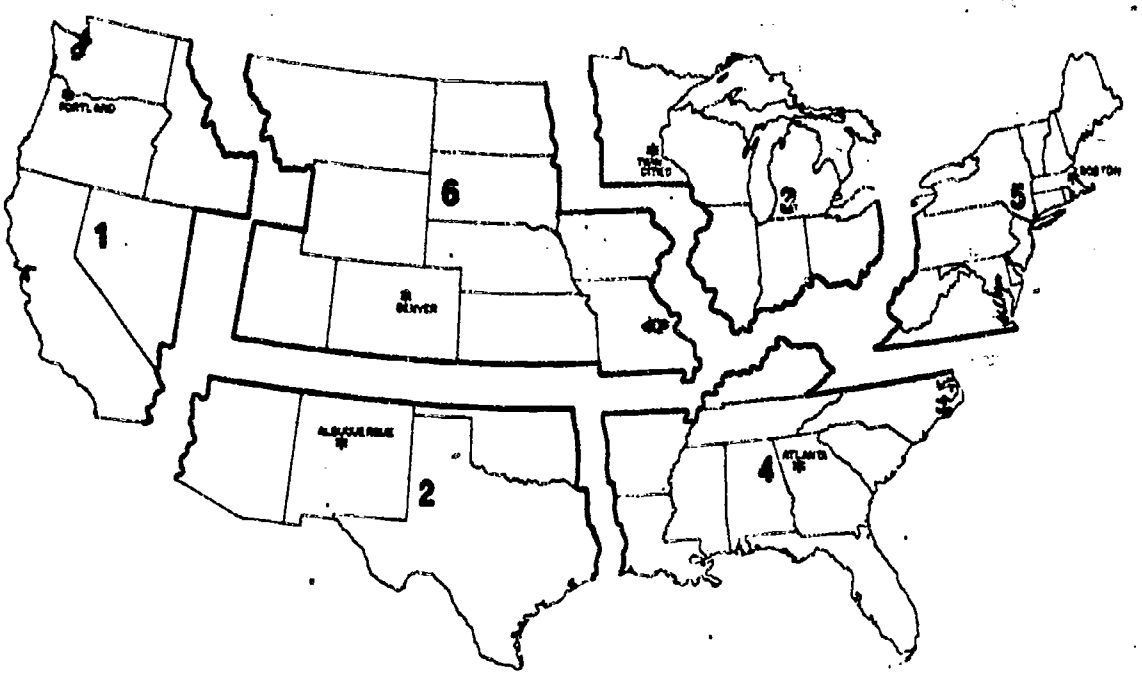

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 4

Synopsis

INSECTS AND PLANTS
In this activity students gain some understanding of the link between plant diversity and insect diversity by comparing the variety of plants and insects found in a semi-natural "weedy" area with those found in a lawn. They collect and display samples of each.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Did you ever wonder why there are so many different kinds of the same thing? There are numerous kinds of flys, beetles, worms, algae, bacteria, trees, snakes, frogs, fishes, birds and mammals.

It may seem that animals of the same kind, such as sparrows, all behave about the same way. This is not true.

Insects and plants

A. **Purpose**: This activity will acquaint students with—

1. The variety of plants and insects that exists in semi-natural "weedy" area.
2. The variety of plants and insects that exists on a lawn.
3. A way to collect, display, and compare samples of plants and insects.
4. The construction of an insect net.

B. **Objectives**: During this activity students will—

1. Compare an area where plants and insects are diverse with an area where they are not.
2. Make inferences about what causes this diversity.
3. Make a display of plants and insects to illustrate the concept of diversity.

C. **Activity requirements**: Each student, or pair of students, will need—

1. Materials to make an insect net: broom handle or equivalent, panty hose, coat hanger, pliers, needle and thread, extra wire.
2. Killing jars: baby food jars with caps, cotton soaked in fingernail polish remover or alcohol.
3. Grocery bag to contain plants.

The class will need—

1. Large pieces of white paper for displaying insects and plants.
2. White glue.
3. Felt-tipped markers.

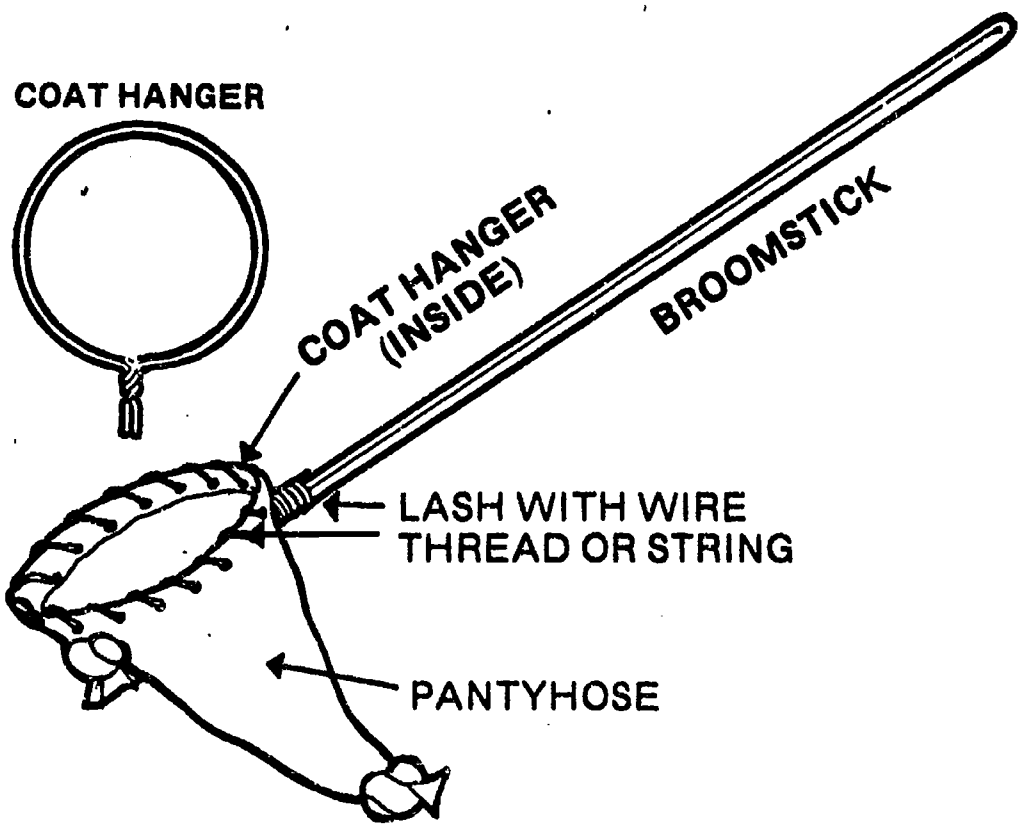
ten Series on Insects.

Introduction

On a local scale the concept of diversity can be studied and understood by students. This activity suggests a way to compare an unmanaged, weedy roadside with its plant and insect life and a managed and manicured lawn with its lack of plant and insect diversity.

Before You Begin

Each student can make a net, or if students will be working in teams of two they might make one net for each pair. (See illustration.) Follow this procedure:



- Remove the elastic waistband from the pantyhose;
- bend the coat hanger into a circle of at least 10 inches in diameter, and twist the ends around each other securely;
- fold the upper edge of the hose over the circle at least 1 inch and whip stitch with needle and thread;
- knot one leg tightly at the very top and cut it off below the knot;
- knot the other leg at the knee or below;
- lash the twisted ends of the coat hanger to the broom handle (or stick) with an extra length of wire.

Data Sheet

Outdoor Classroom Guide Number 4

Insects and Plants

Date _____ Team _____

Names _____

_____

_____

Collecting Area _____

SIDE ONE

		Ant Types	Beetle Types	Grass-hopper and Cricket Types	Fly Types	Bee Types	Dragon-fly Types	Butter-fly and Moth Types	Other Critters Spiders Worms
PLANTS									

When one observes different species of sparrows, it is discovered that each species behaves differently than the others. It may differ in when and what it sings; what, when and how it eats; when and how it nests; how it flys and walks; etc.

Because of the diversity of plant and animal life in the environment, each species of sparrow has been able to "put together" a unique composite of behaviors or niche. Since the niche of each species of sparrow is unique, sparrows of different species are not competing directly with each other. This allows several different kinds of sparrows to live in the same place.

And so it is with most animal life — a diverse environment with diverse plant life allows for a diverse animal life. Diversity then, creates a complex fabric of interrelationships among the environment, plants and animals. This fabric is both flexible and durable. Even in the face of disaster caused by floods or fires or hurricanes, some of the fabric remains to begin again.

Many things can affect the natural diversity of the environment. Modern agriculture has turned the diverse native prairie into a domestic prairie of corn and wheat. What effects has this had on prairie animal life? This activity may help answer this question.

Planning the Activity

Locate two areas to compare with one another; one managed by people and one unmanaged, weedy, and large enough to allow the class to work in teams of two with plenty of space for each team. An undisturbed roadside or railroad right-of-way are good possibilities. The managed area might be a grassy area of the school grounds.

In order that comparisons between the two areas be accurate, the class should decide how many sweeps with their net each team will make in each of the two areas (4 or 5 sweeps is suggested). Decide, too, how much time will be spent looking on the ground in each area for crawling insects (5 minutes is suggested). Finally, decide how many different plants to collect at each area (5-10 is suggested).

Activity Description

When the class arrives at the weedy area, assign each team to a generous space. First teams should collect one example of each of 5 or 10 plants, pick the plants at ground level, place them in a bag, and mark the bag with their names. Then they should make the agreed upon number of sweeps with their nets, being careful to sweep at a different level and a different place each time. Next examine the ground for crawling insects, and collect them for the length of time agreed upon. Transfer all insects to killing jars, and mark the jars with team names and location. Leave the insects in the jars for at least an hour.

The procedure can be repeated when the class moves to the school lawn. Here, all sweeps will have to be made at grasstop level. Spend the same amount of time collecting crawling insects. Again, transfer to killing jars and mark the jars. In collecting plants, it may be impossible to locate 5 to 10 different kinds. Perhaps students will have to collect 5 to 10 grass plants.

Using the Data

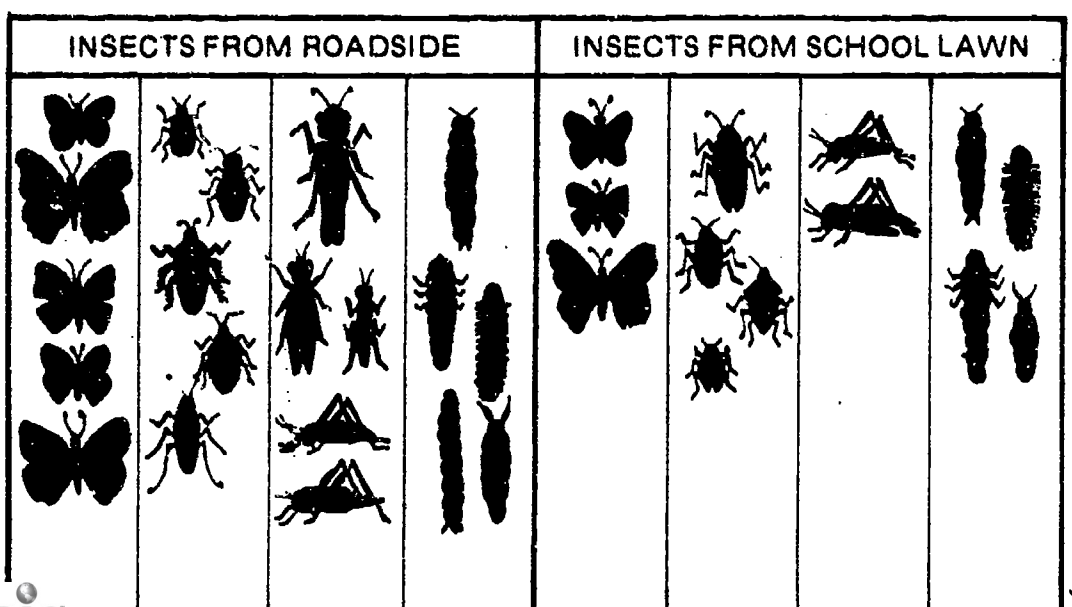
Back in the classroom, make two large displays; one of unmanaged area plants and insects, and one of managed area plants and insects. Cover two tables (one for each area) with white paper, and draw columns on the paper as illustrated on the Data Sheet. It will not be necessary to know the varieties of insects by name. Divide the entire class collection from each area on the basis of look-alikes, e.g. ants, beetle-types, butterfly and moth-types, etc. Line them up in the columnar areas. On the other half of the table, arrange the plants collected from the same area.

This process could be followed first by individual teams and then a group display could be made using all of the information from the entire class.

after the investigation

Students might be interested in knowing what the names of their insects are. If so, they could use a field guide to insects to identify and label them.

They might make a more permanent display of their collection which could be designed in such a way that it would be artistic, while still illustrating the concept of diversity. Plants and insects could be glued to heavy paper in an approximation of their natural appearance, like this:



With this visualization of diversity in front of them, students can begin to ask themselves some questions:

- Which area shows more insect diversity; plant diversity?
- What could attract insects to an area? Is it variety? Plant height and size? Plant color? Might it be food supply? Shelter? Temperature? A combination of reasons?
- If this great diversity exists when people leave an area alone to grow and develop naturally, what do you think the plant and insect life was like here 150 years ago?
- What effect on insect variety does a cultivated flower garden have? A field of corn?

for information

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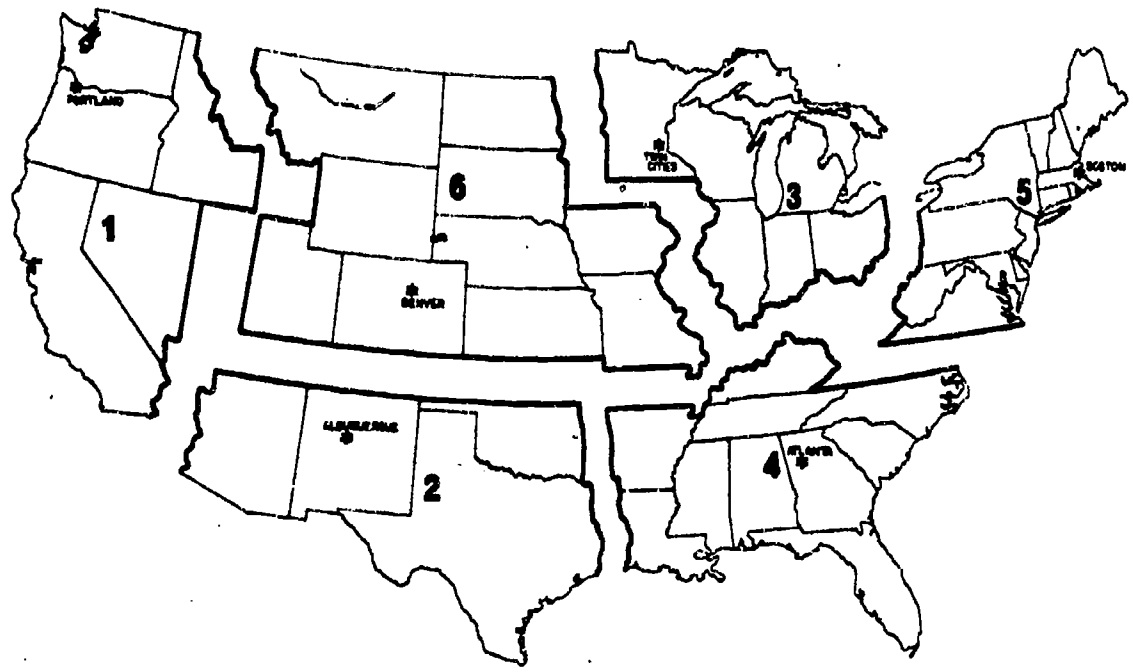

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 5

Synopsis

SNOW TEMPERATURES
Snow temperatures are measured by students and compared to air temperatures and depth of snow to find patterns of temperature variation.

Students use this information to determine the relationship between snow and the survival of animals.

Prepared by:
U.S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

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Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Snow performs a very important role in protecting plants and animals from freezing. Because snow is a poor conductor of heat it has the capacity to insulate the soil underneath it. This means that soil temperature will be higher under a cover of snow than it would be if there were no snow. Temperatures under the snow at the soil surface have been measured to be

Snow temperatures

A. **Purpose**: This activity will acquaint students with—

1. Ways to measure the temperature of snow.
2. Variables which influence snow temperature such as:

a. temperature of the air
b. depth of the snow
c. depth within the snow at which temperature is measured
d. whether snow is sheltered or exposed.

3. Ways to identify the presence of small animals.

B. **Objectives**: During this activity students will—

1. Discover the insulating characteristics of snow, and what that means in terms of soil temperature.
2. Discuss the affect on snow temperature of different variables and combinations of variables after using graphs to make comparisons.
3. Investigate the relationship between the survival of small animals and snow depth and temperature.

C. **Activity requirements**:

1. Thermometers—accurate to 1 deg. F. or ½ deg. C. (40-160 deg. F. metal probe, dial-type thermometer available from refrigeration supply companies is most durable and reliable for this investigation. A cost from $2.50 to $5.00 each may require the use of less expensive and less accurate thermometers.) Tie on a long, colored to prevent loss in snow
2. One-half inch diameter candle and matches for each team of two students.
3. Rulers or measuring stick marked in inches or centimeters.
4. Copies of data sheets (one for each team) and pencils (pens will not work at temperatures below freezing).

Before You Begin

Practice using thermometers to get a "feel" for measuring temperatures. Spend 15 to 20 minutes with students taking temperatures in many different places — in air, under snow and soil, in grass, in the sun and shade, in holes in trees, under brush, under conifer trees, and inside clothing. Encourage an exchange of information while students are measuring.

What is the temperature today? Students will realize the answer to this question depends upon where the measurement is taken.

Students may get varying measurements when using thermometers in the same place. This usually is due to improper handling of the thermometer. In cold weather, warmth from a hand holding the thermometer can raise the measurement several degrees above the true temperature. It is best to set the thermometer down and wait until the indicator stops moving before a reading is taken. Warmth from the sun can also give a false reading. Unless "in the sun" temperatures are specifically sought, always measure with the thermometer in a shadow. A wet thermometer will be cooled by evaporation (or warmed by freezing) and give a false reading. Students may want to test out these assertions and see if they or other conditions will result in large or small errors in measurement. One thermometer should always be used dry, shaded, and unheld as a comparison.

Activity Procedure

Selection of an appropriate study site is important. It must be large enough to accommodate teams of students working along a line with 10 to 20-foot intervals between teams. It should include sheltered areas (woods or brush) and exposed areas (field), and when possible, a hillside with both north and south faces. It may be possible to find such an area on the school grounds or within walking distance.

Next, a series of stations should be selected and numbered in sequence. Teams can be assigned to stations by numbering the data sheets to correspond with the station numbers, and assigning each team to a station. Students should follow Side One of the Data Sheet and record temperatures from different snow depths as indicated.

On Side Two of the Data Sheet, each team can make a record of every evidence of small animal activity that they find at their station. They can look for tracks, tunnels, scats, bits of fur caught on twigs or grasses, carcasses or parts of carcasses.

If there is time, an intriguing contest which is related to the investigation can make a day in the snow much more fun.

Snow is a good insulator. (Students

Data Sheet SIDE ONE

Outdoor Classroom Guide Number 5

Snow Temperatures

Names _____

_____

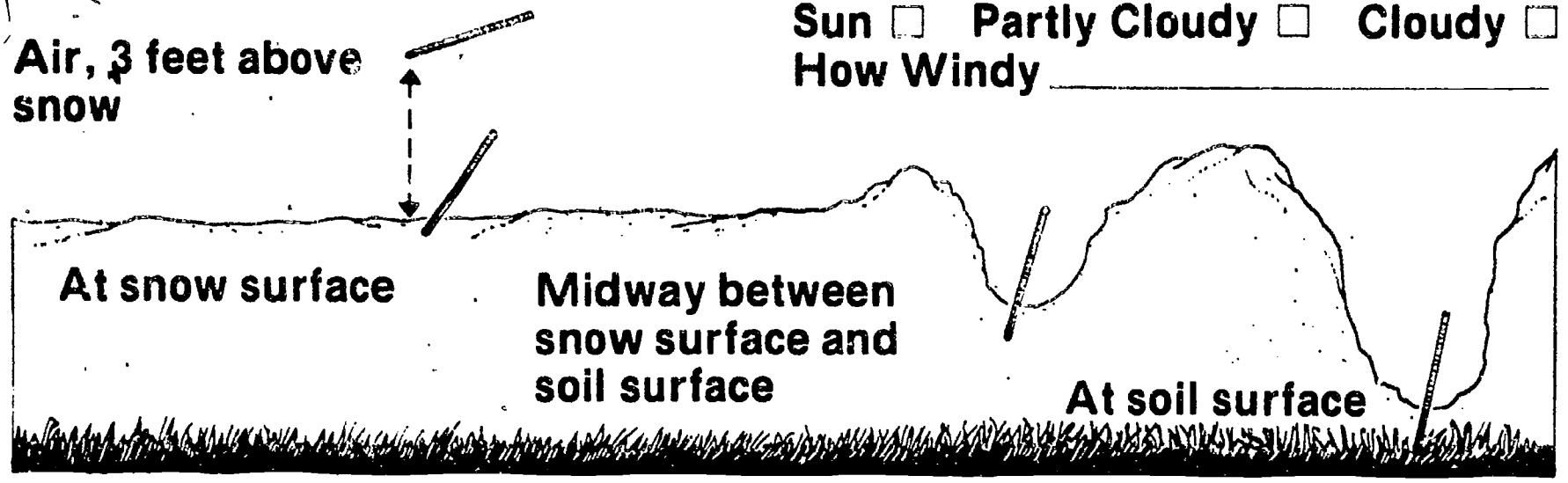
_____

Station Number _____ Date _____

Sun ☐ Partly Cloudy ☐ Cloudy ☐

How Windy _____

TEMPERATURE READINGS:



Depth of snow _____

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Air 3 Feet Above Snow																				
Snow Surface																				
Midway to Soil Surface																				
Soil Surface																				
Depth of Snow																				

Station Numbers

SIDE TWO

Names_____

_____

_____

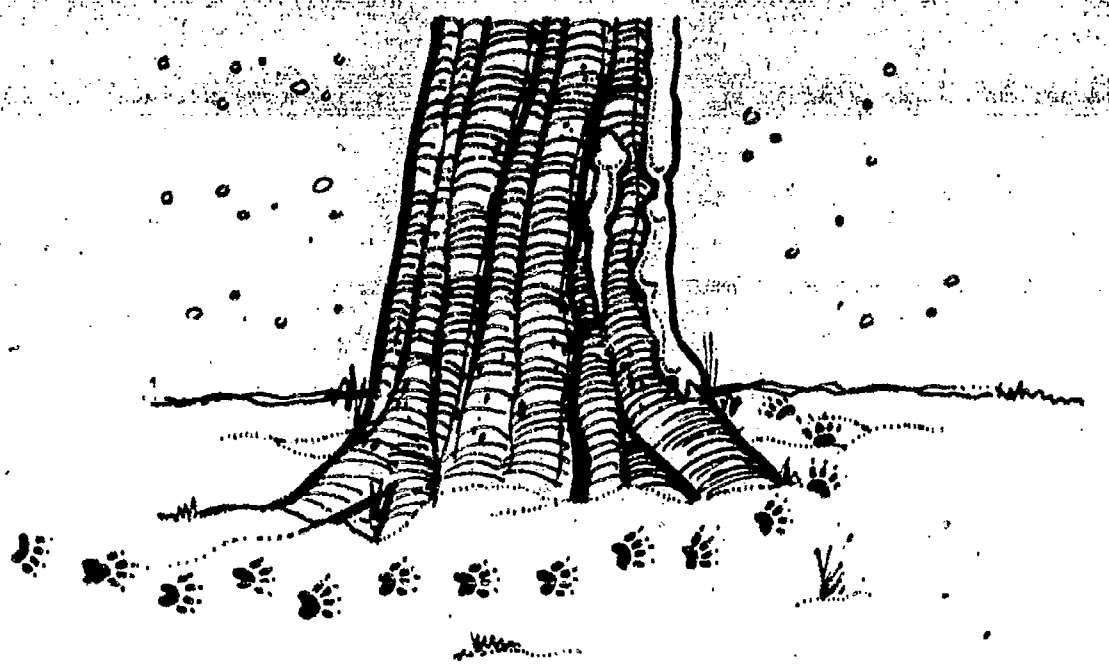
Station Number _____ Date _____

Record every evidence of small animal activity that you find at your station.

Illustrate some common signs:
tracks, nut shells, burrows, fur, feathers, etc.

15-32 degrees warmer than soil without the protection of snow. Snow also causes slower fluctuation in soil temperature.

The protection of snow has enabled small mammals to survive the winter in regions where, without its warming influence, this group of animals would perish. This, in turn, ensures the survival of larger, carnivorous animals such as arctic fox, ermine, weasel and sable which feed on the smaller animals in these regions.



may have made this assumption from the data collected.) The air in a small snow cave can be warmed many degrees if the cave is properly designed and heated. Many designs are possible.

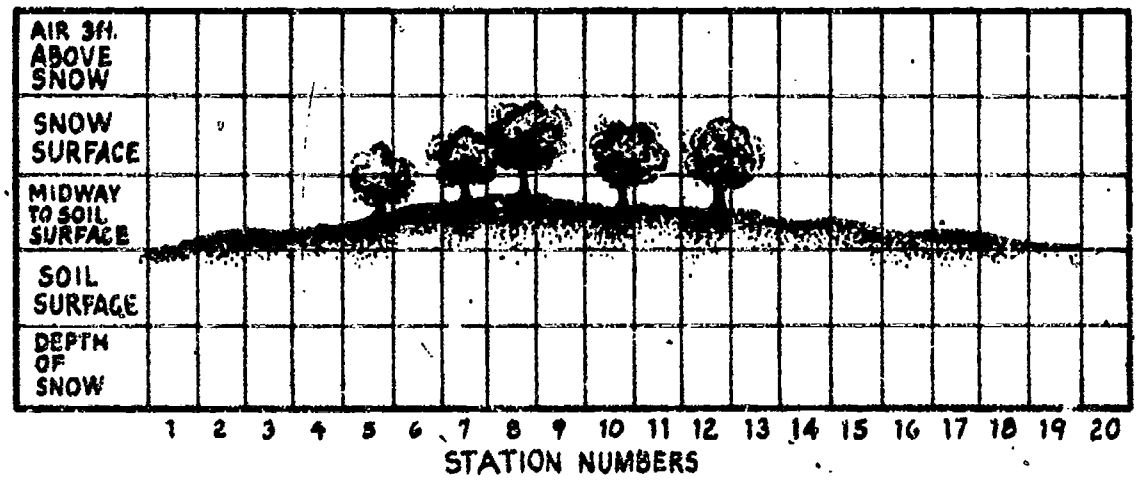
The contest is to see which team can design a snow cave that can be heated to the highest temperature. Two limitations on the design are that the heated part of the caves cannot be less than 1 cubic foot in size (1 foot by 1 foot by 1 foot) and only candles can be used for heating.

Thermometers should measure air temperature and should be shaded from the candle flame so as not to measure radiant heat.

Remember that this learning experience is all in fun and a little "cheating" here and there should not be considered detrimental to the objectives. Discuss and compare snow cave designs and try to conclude what design elements caused high or low resultant temperatures.

Using the Data

The chart that appears on the Data Sheet, Side One, can also be used to combine the information of all teams. Either each team can use one chart to collect other teams' information, or all teams can transfer their information to a large wall chart patterned after the data sheet. The wall chart could look like this:



When team data have been transferred to the chart, the range of temperature variation can be noted and an appropriate scale selected so that a line graph can be drawn for each temperature series.

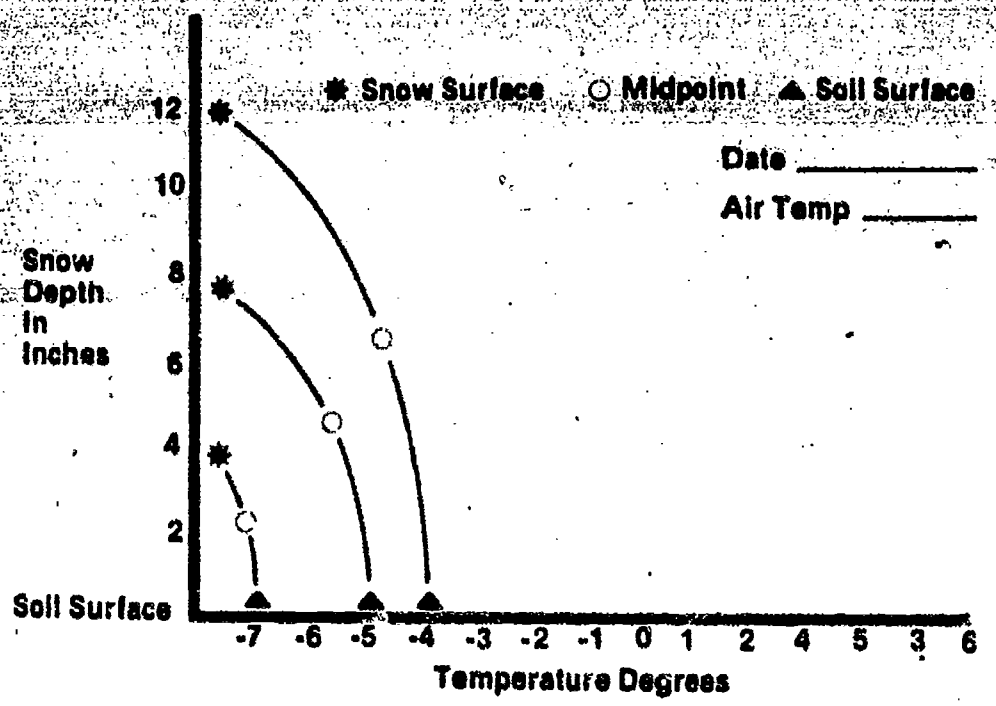
For example, each line on the graph could represent ½ degree if there is little variation in the measurements, or each line could represent 5 degrees if there is great variation in readings. Once a scale is selected, use it for all four temperature measurement series so that the four line graphs are readily comparable.

Take time to help students draw their own assumptions about the relationships between temperature and environmental factors, and between the presence of small animals and environmental factors. Discussion could include these questions:

- At which snow depth is the temperature variation along the series the greatest? What are some reasons for this fact?
- At which station is there the greatest variation between depths? Can you give reasons why this is true?
- What is the relationship between temperature and location of stations?
- At which stations did you find evidence of the greatest number of small animals? What is the relationship between the presence of small animals and snow depth? Snow temperature? Location of station?

Be cautious that assumptions are based only on collected data or the assumptions cannot be substantiated.

Specific assumptions can be tested if students are interested. For example, several students may want to verify or improve the measurements taken on north and south-facing slopes. Temperatures can be plotted against snow depth if depth measurements are taken with a ruler. The three temperatures taken at each station should be tied together with a line, as illustrated below. The slant of the lines should present an interesting pattern for students to interpret. Notice that if measurements are taken on an unusually warm day the lines will probably slant in the opposite way from those in the illustration; that is, the snow surface will be warmer than the soil surface.



for information

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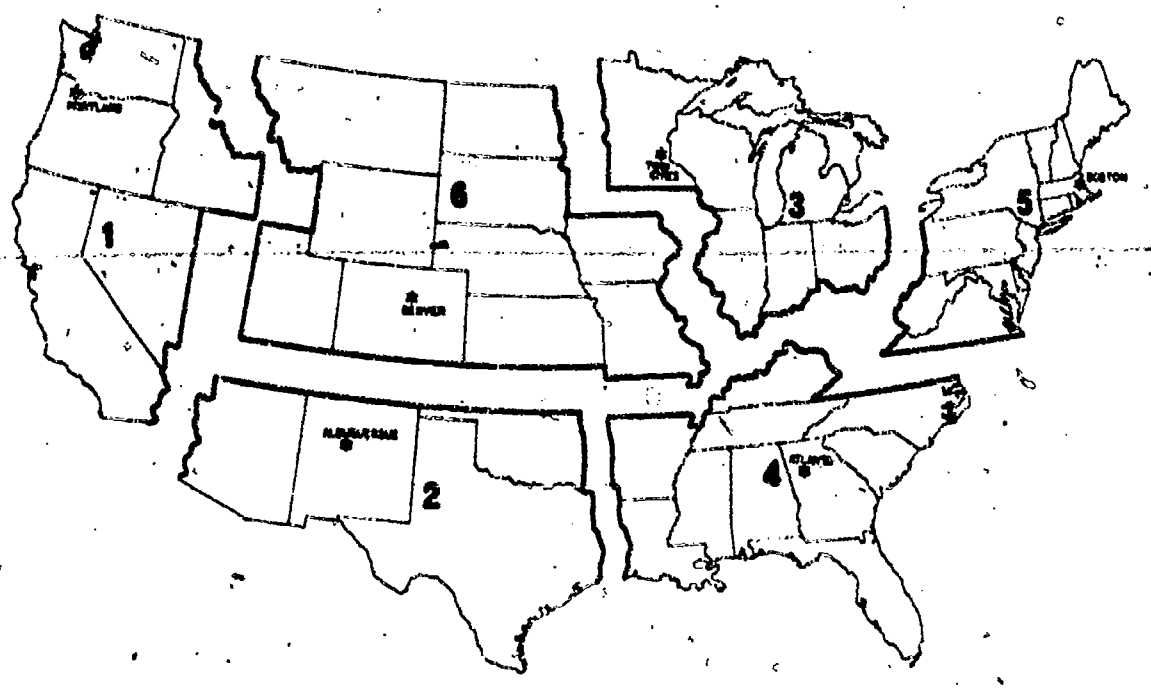

after the investigation

Snow Temperatures Through Time:

An interesting extension to this investigation is the construction of a graph which compares the fluctuation of snow and soil temperatures with the day by day fluctuation in air temperature.

This requires that students find a location near the school where daily temperatures of undisturbed snow can be taken for several sequential days or weeks.

Consideration should be given to the assumption that the temperature will fluctuate considerably in any one day. Perhaps students will want to measure daily fluctuations as well, or at least record daily maximum and minimum temperatures.

Charts might look like this:

	Day 1			Day 2		
Air temp.						
Snow surf.						
Midway						
Soil surf.						
Snow depth						
	7 AM	12 PM	3 PM	7 AM	12 PM	3 PM

	Day 1	2	3	4	5	6
Air temp.						
Snow surf.						
Midway						
Soil surf.						
Snow depth						

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 6

Synopsis

SNOW DEPTH AND SNOW MELT
With a tube designed to measure snow depth, students are able to gather information on the amount of snow-water which collects on the ground in different locations. A calculation of the amount of spring melt-water available in each of these areas can be made. Comparisons between the amount of water in different locations is possible and assumptions can be drawn.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

Water impoundment is one of the major management tools used to maintain an environment for waterfowl. This is particularly important in spring when birds are mating and when water plants and other populations are beginning to reproduce again.

An understanding of how melting snow will affect the amount of water in the

Snow depth and snow melt

A. **Purpose**: This activity will acquaint students with—

1. The construction of a snow tube as a measuring tool.
2. A way to measure snow depth.
3. A way to measure the water content of snow.

B. **Objectives**: During this activity students will—

1. Investigate relationships between snow characteristics and water content in snow.
2. Make comparisons between amounts of snow-water from one location to another.
3. Discover what kind of location collects the greatest amount of snow-water.

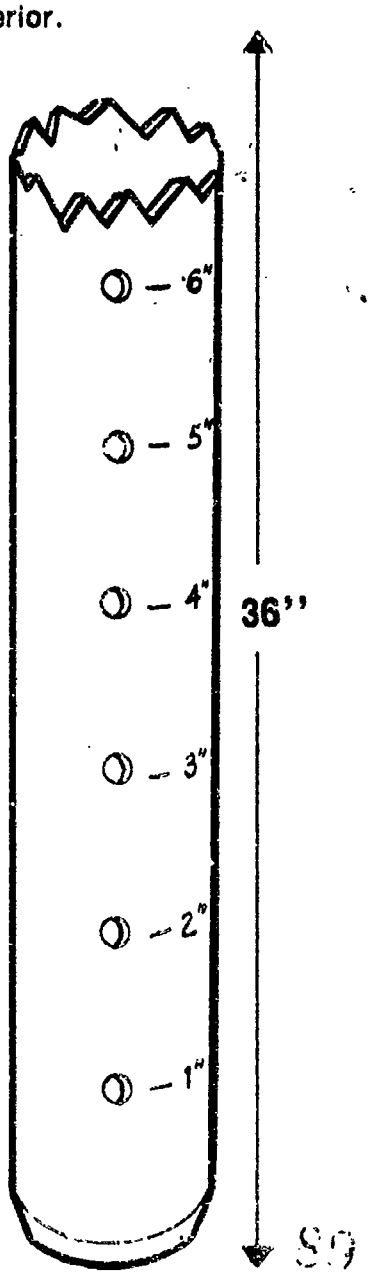
C. **Activity requirements**:

Obtain—

1. Enough 1-7/8 inch plastic drain pipe from a plumbing or hardware store to supply a 3-foot length to each team of student investigators.
2. Enough small plastic garbage bags to supply one bag for each measurement taken by each team.

Before You Begin

In this activity each team of students is given the task of constructing the tool it will use for measuring snow depth. Each team of 3 or 4 students will need a 3-foot length of plastic drain pipe. They should bevel the edge at the bottom end; mark off one-inch intervals starting from the bottom and drill 3/16-inch holes at each mark for viewing the interior.



Activity Procedur.

For this activity, it will be best to select 4 locations for snow sampling: open field, open forest, dense forest, and conifer forest. Such locations may be hard to locate within walking distance; it may be necessary to arrange a field trip. If such locations are not accessible at all, 4 different kinds of locations can be substituted, provided they are chosen in areas where heavy human activity has not taken place; such activity would make the measurements inaccurate.

Each team can take one measurement at each of the 4 locations. To measure snow depth the snow tube should be thrust vertically into the snow until it touches the ground. Then the snow should be dug away from the tube on one side so that a hand, card or shovel can be slid underneath to hold the snow inside. Lift the tube, read the snow depth, and record it on the Data Sheet. Transfer the snow to one of the garbage bags, close tightly, and mark the bag with its location and the team number.

Back in the classroom, the snow can be melted. Unless there is reason to hurry, the bags can be left standing until the snow is melted. The water from each bag can then be poured into a graduated cylinder which will measure the volume of water in milliliters. At this point, because of the difficulty of the math involved, it will probably be necessary for the teacher to convert the water volume measure in milliliters to its equivalent depth in inches. In this way, students can compare snow depth and depth of water content. One inch within a tube having

Data Sheet

Outdoor Classroom Guide Number 6

Snow Depth Snow Melt

Team No. _____ Date _____

Names _____

_____

_____

SIDE ONE

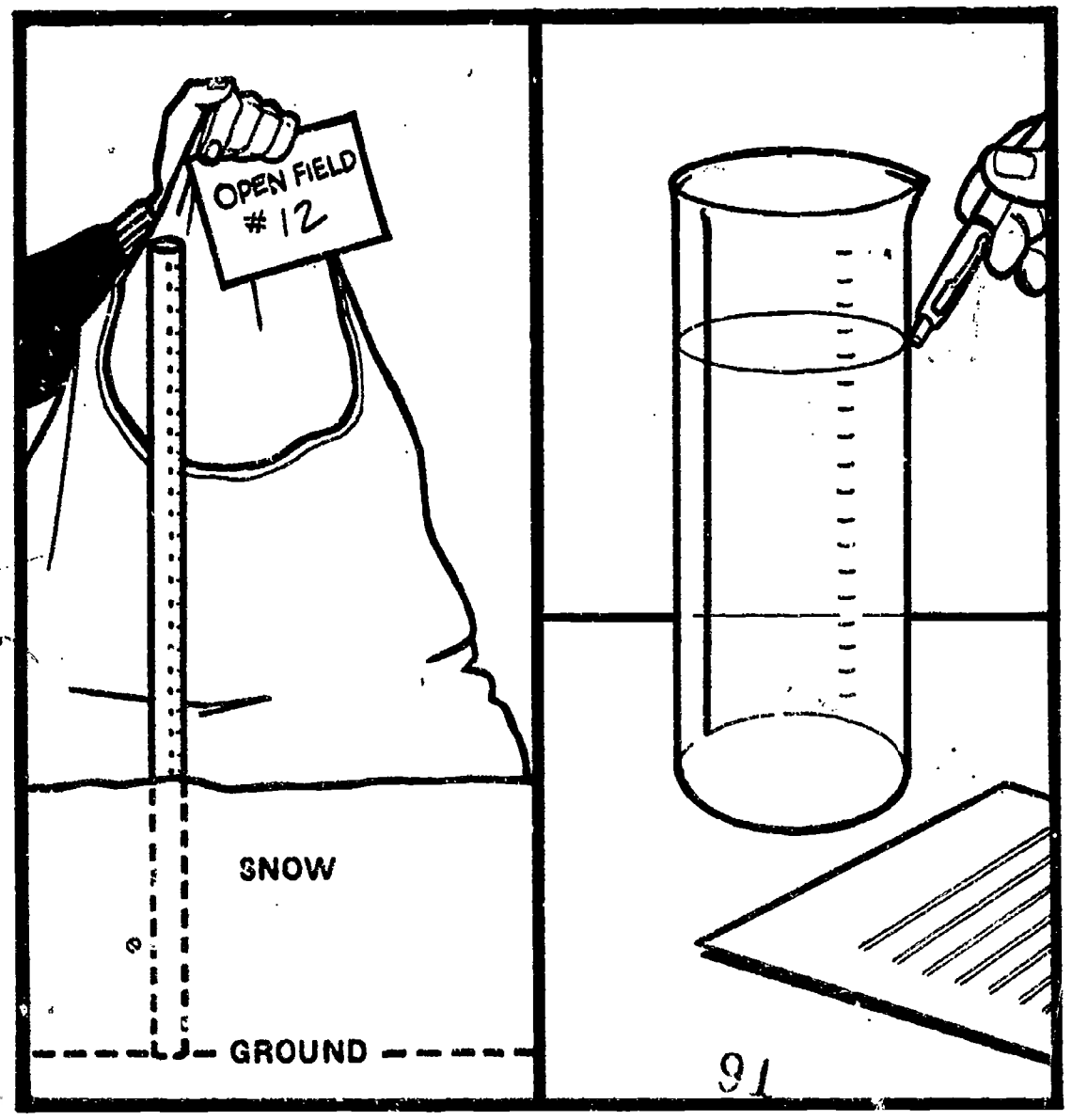
		Snow Depth In Inches	Water Content In Inches
Location 1	Dense Forest		
Location 2	Open Field		

		Snow Depth In Inches	Water Content In Inches
Location 3	Open Forest		
Location 4	Conifer Forest		

soil or in streams and ponds is important in understanding environmental management.

a 1.55-inch diameter would equal a volume of 1.89 cubic inches or 30.9 (31) milliliters $\pi R^2 H$. So the depth of melted snow-water would equal its volume in cubic inches divided by 1.89, or its volume in milliliters divided by 30.9. (One ounce = 1.8 cubic inches = 29.6 milliliters.) Each team can then record each water volume measure in inches on its data sheet.

There is a great advantage in the teams of students pooling or averaging their measurements. The statistical validity of the investigation is increased by smoothing out the variation in individual samples.



Using the Data

Assumptions and conclusions are most validly made by all the students based on the results of the pooled data. Such quesions as these might help in class discussion:

- How does snow depth compare from one location to another?
- Where is snow depth the least? Can you give some reasons for this?
- How might wind affect snow depth?
- What is the relationship between snow density and water content?
- At what location is snow most dense?
- What might cause snow to be denser at one location than the others?

Here is a way to use the data that will enable students to visualize the mass of the water content in snow. If the area covered by the base of the snow tube is 1.89 square inches or about 1/75 of a square foot, calculate how much water it would take to cover a square foot. Use the figures for average snow depth and average water content that were arrived at by pooling the class data. Find out the square footage of the schoolyard, and calculate how much water would be standing on the schoolyard if the water did not run off at the spring melt.

for information

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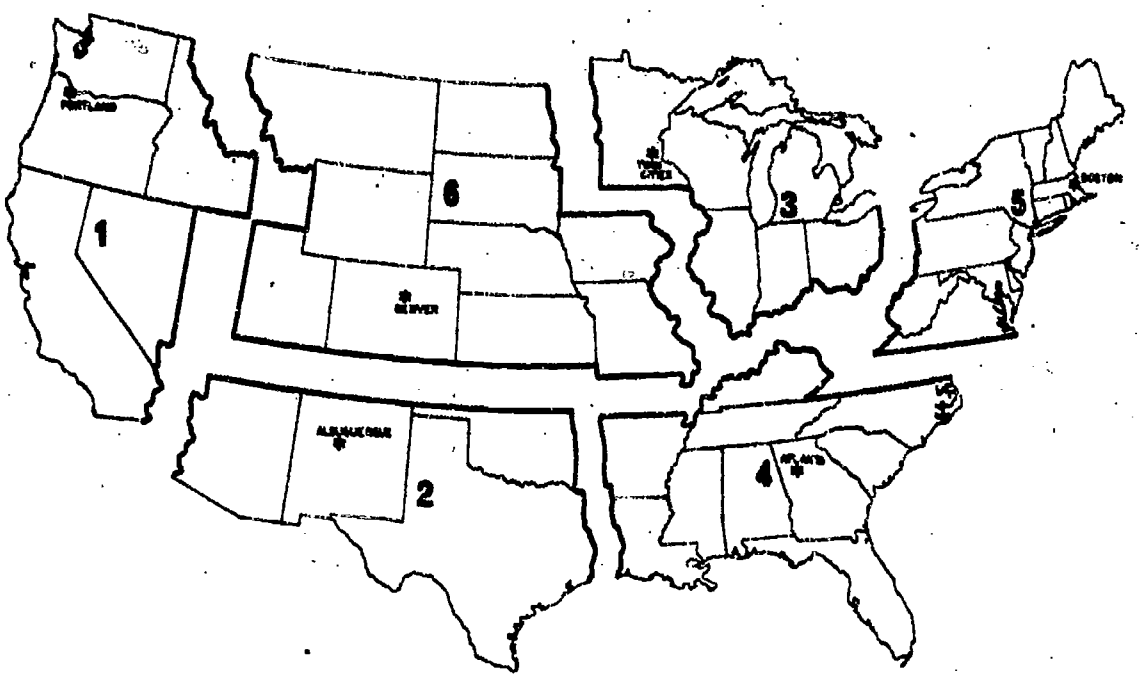

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after the investigation

Here is an idea that will help students understand the variations of snow depth and water content from location to location and from year to year, and what this means. Contact the local weather station and ask to have someone come to class to talk with the students. Such a person could talk about where the water goes in the spring thaw, what some of the conditions that influence rate of snow melt are, why flooding occurs some years and not others, and what means are available to control the run off in the spring. Such discussion will increase the value of the investigation for the students.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 7

Synopsis

SOCIAL HISTORY CEMETERY STUDY
Gathering information from a cemetery gives clues to the history of a community and reveals some of the environmental factors people lived with.

93

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

Cemeteries offer a remarkably varied group of possibilities for student involvement. Foreign language classes can use stone inscriptions as a starting point for translation and a study of the culture of immigrant groups; art students can use stones for making beautiful rubbings; natural science students can investigate vegetation and wildlife habitat as they are found

Social history cemetery study

A. **Purpose**: This activity will acquaint students with—

1. Local social and historical changes.
2. Some environmental factors which affected the lives of people in the past.
3. Some sources of information on local history.

B. **Objectives**: During this activity students will—

1. Collect information from grave markers.
2. Use the collected information to show historical and environmental patterns and events.
3. Discuss the implications of their information.

C. **Activity requirements**:

1. Data sheets and materials for recording information from grave markers.
2. Art materials for making rubbings.
3. Graph paper for interpreting information.

Introduction

Investigating local cemeteries can lead to knowledge and excitement for students. If their curiosity is whetted by their trips to cemetery sites, they can go on, as a class or as individuals, to substantiate some of their inferences with the help of local historical records.

Because burial of the dead is a unique human social function, cemeteries on refuge lands have been retained. They offer historical monuments or locations which are considered to have social and religious significance and value. Of course, this activity is appropriate for all cemetery sites whether on refuge lands or not.

It is possible to reconstruct some of this history of a region by collecting and processing information left on grave markers by former inhabitants. This must be a careful and respectful investigation, as any environmental investigation must be. In this case it is especially important because information is being collected from an environment which involves strong social attitudes as well as more physical factors such as place, time, and kinds of people.

Respect for cemeteries would, hopefully, emanate from respect of another man's way of life (and death) and not necessarily from current-day aversion to thinking about death. A little study will show that death was a familiar thing to the families who first homesteaded the land years ago.

Incidentally, respect for the way of life (and death) of living things other than humans has led to the creation of the social monuments — the National Wildlife Refuges.

Locating A Cemetery

There are usually several possible choices: cemeteries may be found on refuges, churchyards, historical sites, military sites and certainly within most towns and cities. Be sure to secure permission to visit the site. At the same time, request maps and other information such as acreage, number of interments, availability of death records, and the names of local people who are knowledgeable about the cemetery and local history.

Collecting Information

Each student or group of students needs a copy of the data sheet. Information from several grave markers can be recorded on each sheet. Note the illustration for help in identifying types of markers. If the composition of markers is to be recorded, the differences among granite, limestone and sandstone should be reviewed. A class of 30 students can easily collect information on 500-600 markers in two to three hours with time for some relaxation.

Divide the cemetery into sections and assign sections by number to teams of two people each. Each team should have many data sheets. Each data sheet should be labeled with respect to the section and the sequential number of the grave marker investigated in that section.

Photographs are good ways to accurately copy shapes and design of markers, however inscriptions do not photograph well unless lighting is just right.

At what time did inscriptions in foreign languages cease?

Was there a change in ornamentation or content of inscription over the years?

Data Sheet

Outdoor Classroom Guide Number 7

Social History
Cemetery Study

Names _____

_____

Date _____

SIDE ONE

NAME OF DECEASED	BIRTH			DEATH			AGE	MALE	FEMALE	FAMILY PLOT	VETERAN	CHILDBIRTH	RELIGIOUS	TYPE OF MARKER								NOTES
	DAY	MONTH	YEAR	DAY	MONTH	YEAR								GRANITE	LIMESTONE	SANDSTONE	WOOD	SLAB	BLOCK	POST		

In cemeteries; social studies classes will find a rich record of religious attitudes and their evolution, economic conditions, in- and out-migrations, national makeup of populations, medical history, and other social upheavals such as war, great epidemics, and great natural disasters such as fires. They offer students mute but stirring testimony that life was lived in a vastly different manner in generations gone by.

It is true that cemeteries everywhere have general simularities, but at the same time, each cemetery is unique in character. Consider Colonial cemeteries in the eastern United States with their precise slate stones listing partial genealogies in dignified columns, and compare them to Rocky Mountain cemeteries with their fading wooden crosses offering such information as, "In Memory of Hon. E. D. Holbrook. 2nd Territorial Delegate to Congress from Ida. Terr. Shot to death by Charles H. Douglas in Idaho City, June 18, 1870." They reflect with accuracy the spirit of people who lived in that place in that time. However, it is not necessary to examine cemeteries 2000 miles apart to be able to savor this distinctness; even two cemeteries in the same town will be different in character. Search for that uniqueness.

Note any characteristic practices such as both a headstone and a footstone at a single grave. Is such a practice repeated?

What nationalities do the names suggest?

Can family size be determined?

Can patterns of in- or out-migration from the region be determined?

Are there any unmarked graves? (Look for low mounds and different vegetation on grave locations.) What might explain many unmarked graves in certain locations of the cemetery?

A better and far more enjoyable way to preserve both design and inscriptions is to make a rubbing. This is done by covering the marker with a piece of soft paper and rubbing over the paper with a large wax crayon to bring out the differences between raised and cut surfaces. Rice paper works best but even school manila drawing paper works well. Newsprint is weak and breaks too readily over sharp contours. Rubbings, when done carefully, can result in attractive and striking decorations.

In some cemeteries permission to make rubbings is required.

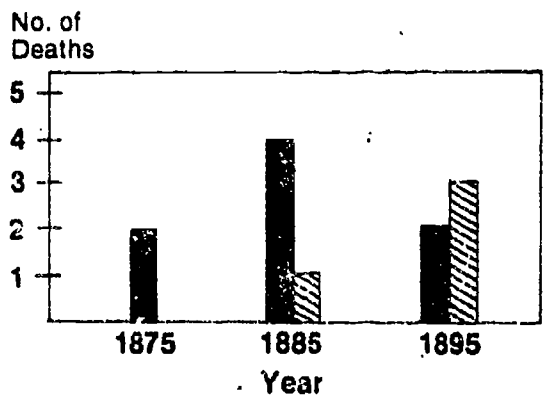
Processing the Collected Information

Reconstructing the information from the data sheets can be tedious unless everyone does a part. Each team can be assigned a particular category of information to collect and process from all the data sheets (best way), or each team can be responsible for transferring its data to master charts (more awkward).

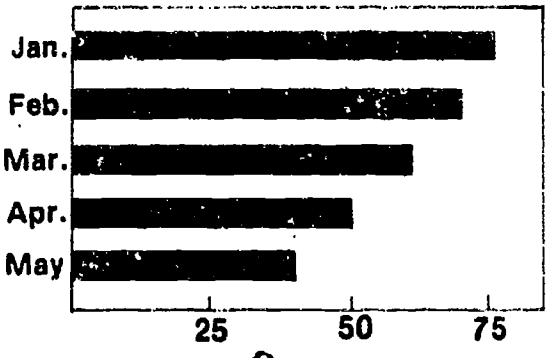
If the first way is chosen, all data sheets can be enclosed in one loose-leaf binder for convenience, each team using it in turn. Or several sets of all the data sheets can be duplicated, one for each team.

Categories of information and comparisons between categories which have proved interesting and revealing are given below. You will probably think of others.

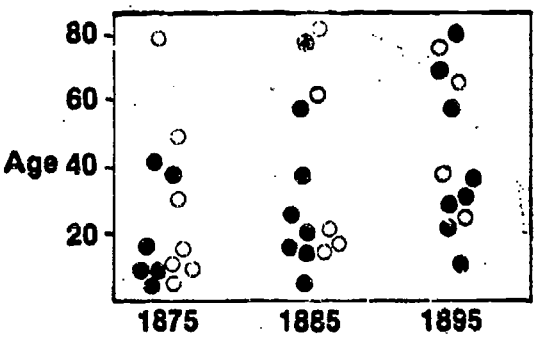
Graph the No. of Deaths by year.



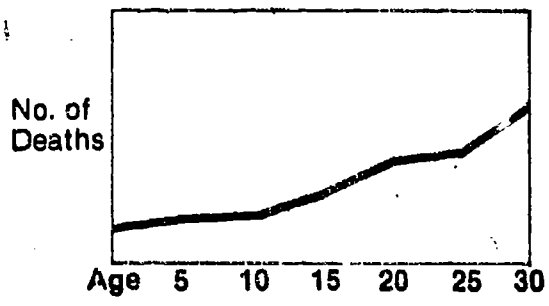
Graph the No. of Deaths by Month of the Year.



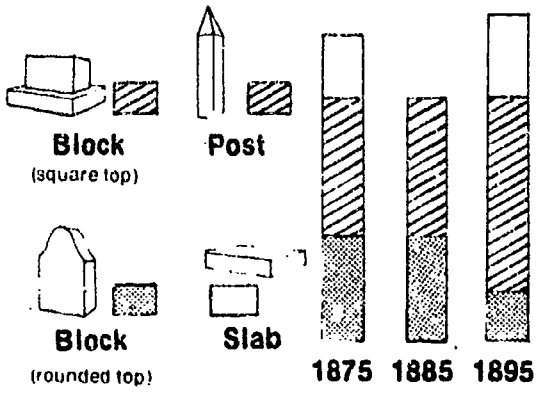
Graph the age at death by year. Indicate males by one color dot, female another.



Graph the number of female deaths against age at death.



Compare prevalence of stone type or style of marker by decade.



Encourage the students, as they tabulate their data, to make inferences about the cultural conditions of earlier times based on the data. For example:

—Questions about the self-image and status: How can we tell from this information what people think of themselves? What they think of their relatives? Is there any indication that one part of the cemetery might be more important than another? That one citizen might have had more prominence than others? In inscription? In stone material? In stone size?

—About family life: What does your data indicate about family size? Does family size decline over the decades? How can you decide this? Can you guess why from your data? Does the number of family plots decline? Do many family names reappear decade after decade? Does this begin to decline? When? Why? Is age at death listed on the stone? Is this practice more frequent the younger the deceased? Why might this be?

—About national origins of groups and their assimilation into the community: When do inscriptions in various foreign languages first appear? When do they completely cease? Do they cease suddenly or gradually? Can you guess why this might be? Is there evidence of increasing prominence? Increasing decline?

—About economic growth or decline of the community: Is there evidence that one national group was socially dominant? What is it? How can you tell? Was one family (or a few families) socially dominant? What is your evidence? Does there seem to be a period where the cemetery was abandoned or infrequently used? Why might this be? Is there continuity of most family names before and after this period? If not, what are possible reasons?

after the investigation

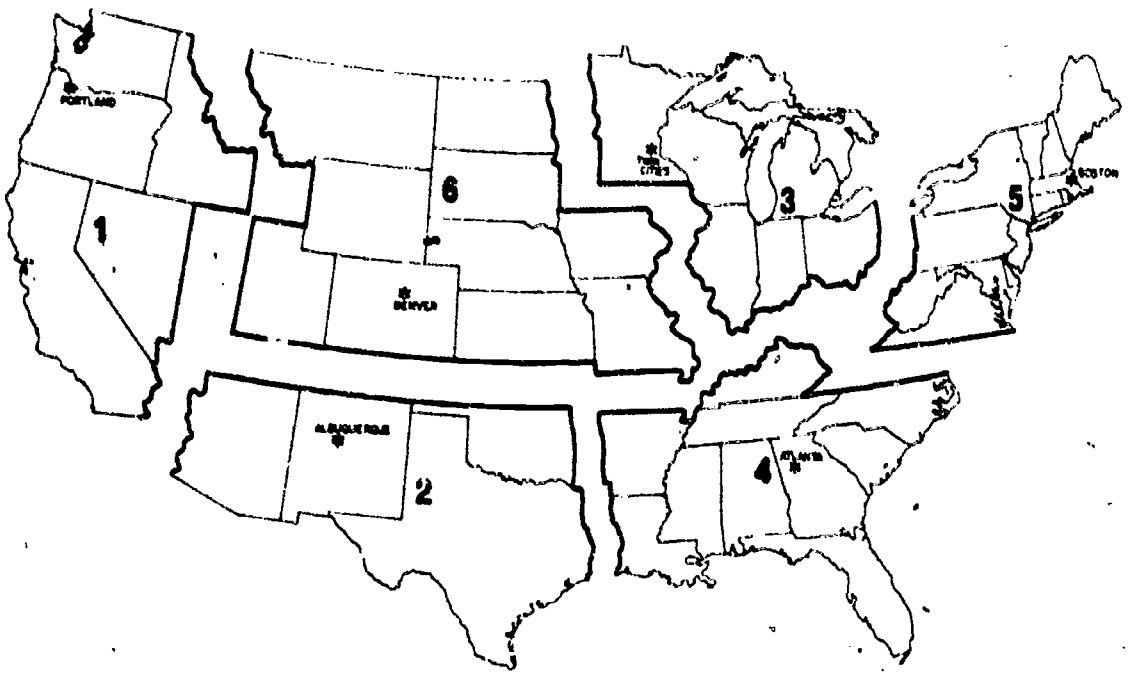
Locate the death records for the cemetery you investigated. These records are commonly kept at the county court house, in local churches or by morticians. It will be worth the effort in obtaining this information because it will lead to interesting social and historical insights. The following questions should apply to these records.

—About the state of medicine and health care: What does your data on age of death and cause of death indicate about medical care in former decades? What evidence is there that health care improved? Are there other possible reasons for changes in age and cause of death? What evidence is there of the toll of epidemics? Do epidemics appear to be seasonal? Why might this be?

—About local and national events: Is there evidence of any of the major national epidemics, e.g. the influenza epidemic in the early 1900's. Is there evidence of local historical events? Fires? Indian wars or battles? Floods? Is there evidence of the Civil War? World War I? World War II? The Korean War? The War in Viet Nam? Is there any evidence of the Great Depression of the 30's?

for information

Many Service land areas provide shelter, toilet facilities and limited equipment for your use. For trip reservations and further information, contact your local **U.S. Fish and Wildlife Service** office or the following regional Service offices:



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This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

Jenny Publishing Co. Inc.
57 Queen Ave. So.
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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 8

Synopsis

OLD PONDS AND YOUNG PONDS (SUCCESSION)
Two ponds of different ages are identified and samples of small organisms are collected and counted from each pond. Comparisons are made between the ponds and the organisms that live in them.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Characteristics of the environment determine where plants and animals live. Some of these environmental characteristics are temperature, sunlight, soil type and amount of moisture. Because these environmental characteristics vary from one place to another, so do the kinds and numbers of plants and animals.

In any particular place, such as a pond, thousands of plants and animals exist as a complex interrelating system. The environmental characteristics of the pond influence which plants and animals live there, and the plants and animals affect each other and the environmental characteristics. Plants affect the temperature of the water by intercepting sunlight, the waste products of animals affect the composition of soil and water. Thus the environment affects the plants and animals and the plants and animals affect the

Old ponds and young ponds (succession)

A. **Purpose:** This activity will acquaint students with —

1. Some plants and animals that live in a pond environment.
2. Succession as a naturally occurring change in nature.
3. The relationship between a changing environment and kinds and numbers of organisms.
4. Some sampling and data interpretation techniques.

B. **Objectives:** During this activity the students will —

1. Determine some of the characteristics of an "old" pond and a "young" pond.
2. Collect plants and animals from ponds of different ages.
3. Determine some relationships between ponds of different ages and the organisms that live in them.
4. Consider how some of man's activities affect the natural aging of ponds.

C. **Activity requirements:**

1. Two ponds or marsh areas at different stages of succession. (See Side Two of the data sheet.)

2. Description	Quantity
Sampling containers with caps or small plastic bags	9 per team
Hand lens, 10X or 15X [Microscopes and lights, dissecting and/or zoom scopes — if available these can be used to continue examination in your classroom.]	1 per team
Low dishes for observing collecting material	2-4 per team
Medicine droppers [Microscope slides, cover glasses, culture dishes.]	2-4 per team
3. Data sheets reproduced from master copy	1-2 per team
4. An elementary field guide such as Pond Life	
5. Materials for making charts and displaying information.	

Introduction

If we could use a time machine to go back in history and watch a pond, we would see over the years a changing parade of different groups of plants and animals. Each successive group could be seen taking over and then gradually being replaced by the next, until the pond is no longer a pond but perhaps a wet meadow or low place in the forest floor.

Succession is not a series of big jumps; rather it is a progression of small steps, one moving gradually into the next. A single step may take a year, a decade, or pehaps a century. The onward progress is inevitable — a natural orderly sequence. The rate of change depends on several factors such as water quality, sedimentation, depth and size of pond, and bottom type. Therefore, it is possible for two ponds

Data Sheet

Outdoor Classroom Guide Number 8

Old Ponds and Young Ponds (Succession)

Names _____

_____

Location _____ Date _____

SIDE ONE

Sampling Procedure

Use small capped containers or small plastic bags of equal size for samples of water. Fill the containers ¾ full. Take samples from 2 ponds of different ages.

Pond No. 1

Sample A Clear water near the surface of the pond.

Sample B Water and some bottom materials a short distance from shore

Sample C Some plant material and water from among the plants

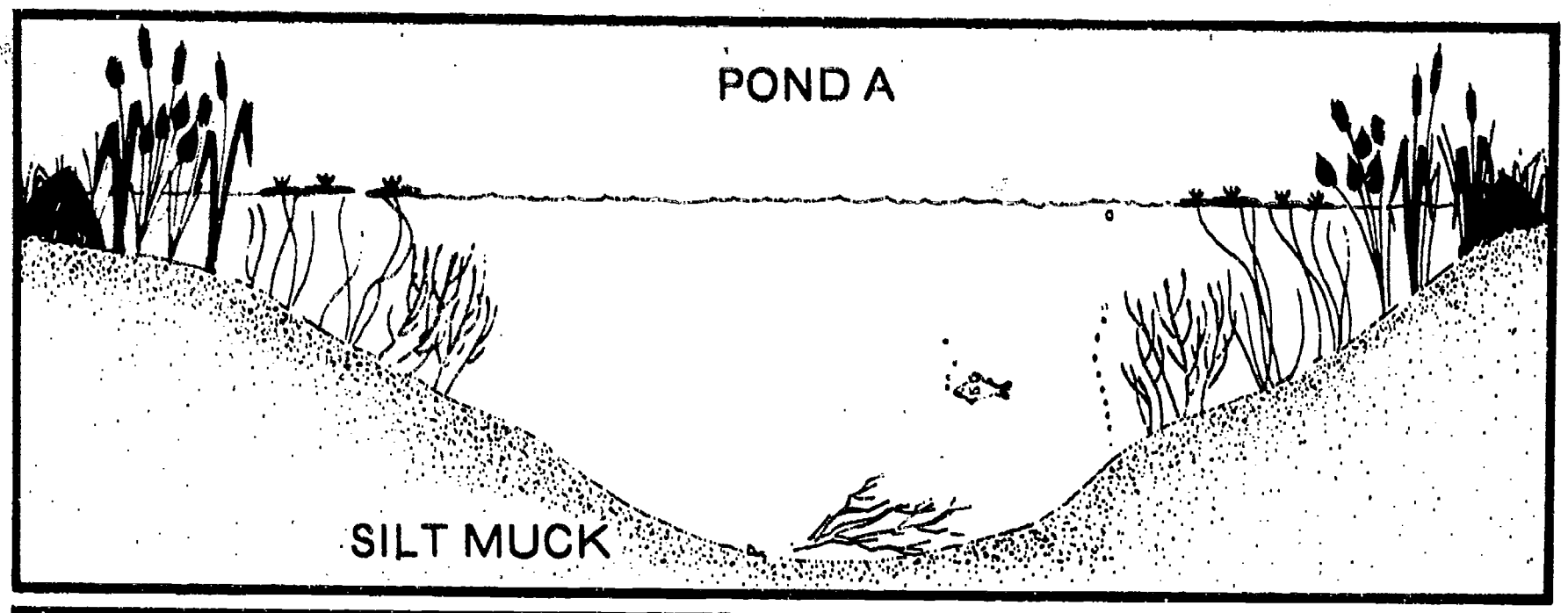
Pond No. 2 Same procedure

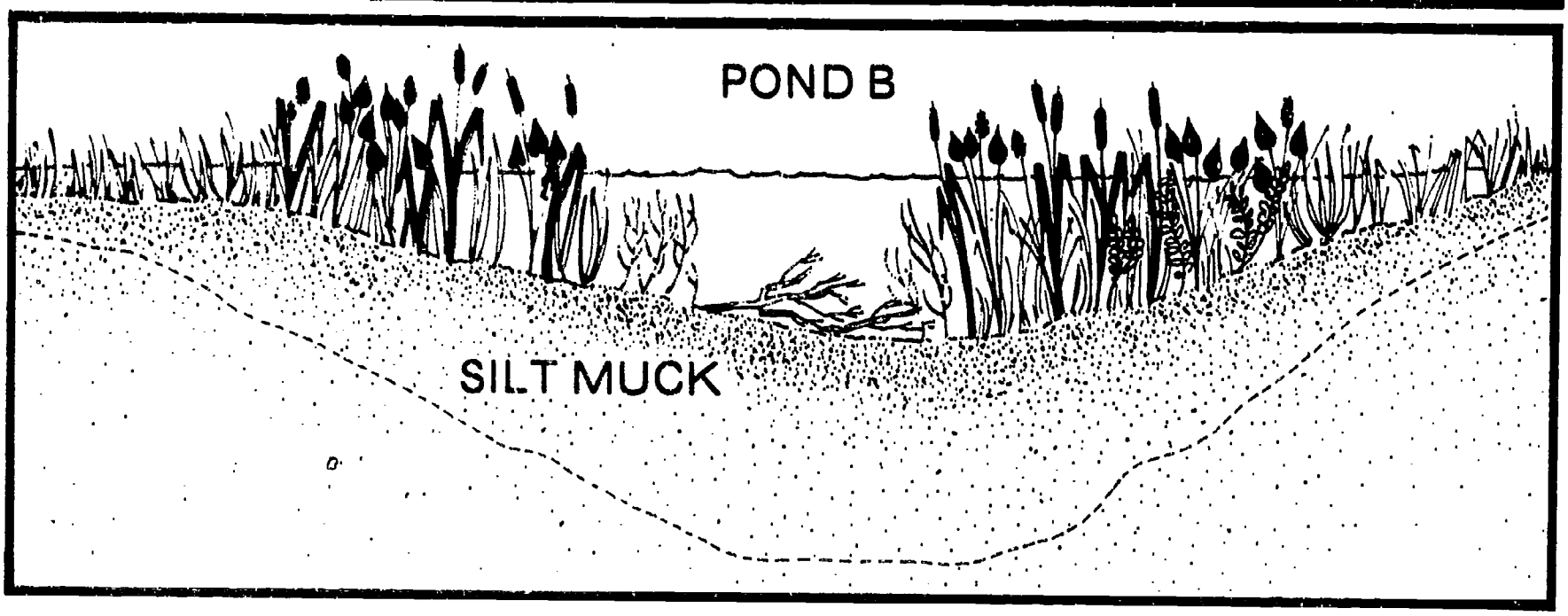
Several most-numerous organisms in the samples from each pond. Identify or draw a picture and give the total number of this organism found in the combined samples from each pond.

Number of Organisms of Each Kind

Pond No. 1									
Pond No. 2									

SIDE TWO





Which pond would you call a "young" pond?

How is it different from the other pond?

List some characteristics of a pond that will help you decide whether it's "young" or "old".

1. _____

2. _____

3. _____

4. _____ 101

5. _____

environment. This creates a kind of "balance" where the existence of any one factor is modified by the presence of all the other factors.

Thousands of factors get into "balance" by co-existing with each other for a long period of time — several years or perhaps several thousands of years. This "balance" is not a steady, unvarying thing, but ever changing.

If one factor in this "balance" is changed or removed, there is generally an unpredictable change among the thousands of other factors which were originally in balance with the one factor.

The change is unpredictable because it is almost impossible to measure all the thousands of ways that the changed factor affected the others.

Sometimes this "imbalance" will be hardly perceptible. Sometimes the "imbalance" will result in extremely different behavior of the other factors. This new behavior may last only a short time until a new "balance" results, or the extremely different new behavior may become the new balance. Always, however, whether one factor or many are changed, or whether the results are hardly perceptible or great, there will be a new "balance" which is different from the original.

One kind of "balance" change is called succession. Succession is a naturally occurring phenomenon which usually happens very slowly. However, because of the many large changes due to the presence of man's technology within the natural setting, succession has been proceeding much more rapidly in recent years.

Man is now able to decide yes or no about some of the "natural balance" changes which his technology causes. Before succession proceeds so rapidly that he cannot keep pace with it, it would be well for man to be better educated about what succession really is.

This investigation of pond succession will acquaint students with a natural phenomenon that may become man's primary concern within a very short time.

---

of the same age to be very different. One could still be in the "pond stage" of succession, and the other more like a wet meadow. The illustrations on Side Two of the data sheet show examples of two different ponds at different stages in succession. To help differentiate between the two ponds, pond A is referred to as a "young" pond (an early successional stage) and pond B as an "old" pond (a late successional stage).

Activity Procedure

During this activity students first learn how to identify "young" and "old" ponds. Then they collect samples from each type of pond to determine if there are differences in numbers and kinds of organisms. Through observation and discussion the populations and kinds of organisms are determined and compared to each pond.

Begin by helping students interpret the illustrations and answer the questions on Side Two of the data sheet. After the discussion, students should be able to identify ponds at early and late stages of succession. Next, locate a "young" and "old" pond for sampling. If there is none nearby, a trip to a park, nature center or wildlife refuge will be necessary.

Sampling and Organizing

Spend up to one hour making observations and taking samples from the ponds. Each team of two or three students should take three samples from each of the two ponds according to the sampling procedure on the data sheet. Make sure the sampling containers are properly closed before transporting them.

Identification of organisms by name is not important, but in order to pool data later, students should be able to recognize shape, size and behavior of organisms.

Be sure to check the school library for identification guides. A Golden Guide, **Pond Life** by Western Publishing, Racine, Wisconsin, is an excellent guide for this part of the activity.

Make a count of the kinds of organisms in each pond and fill in the data sheet with drawings and numbers of kinds. Large numbers can be estimated.

Once students get a feel for the kind of information which needs to be gathered, they might want to return to the ponds to refine their collecting technique.

Pooling Data and Interpreting Results

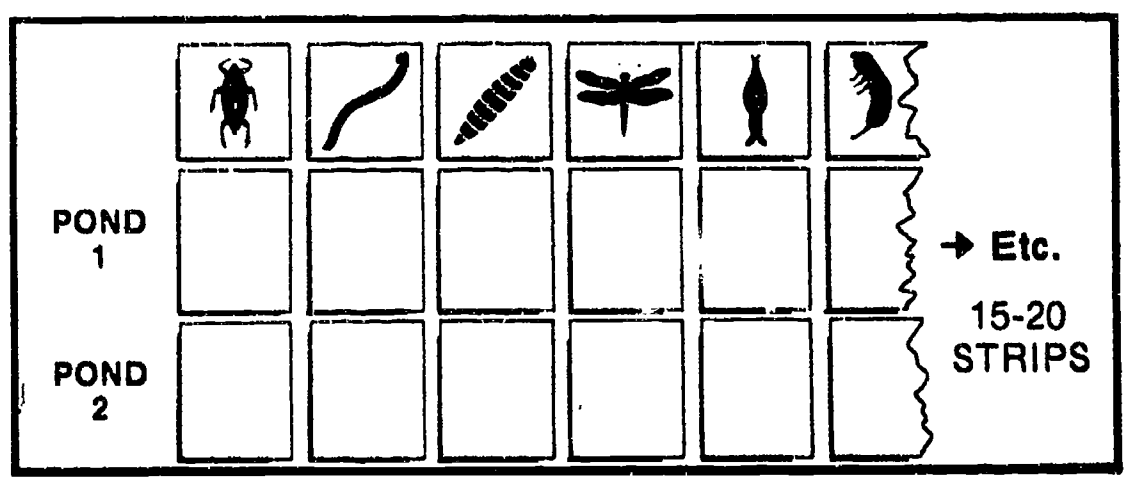
The counts of organisms recorded on individual data sheets will allow students to compare the kinds and numbers of organisms in the two ponds. However, the small sample that each student collected is not a reliable representation of the pond's populations. Records may vary considerably from student to student.

An important part of this investigation is the pooling of data from individual samples.

After some students have completed counting organisms in their samples, they can start transferring the data to a large wall chart. Allow up to an hour for sorting and counting organisms.

Making a Composite Chart

A large wall chart is used to display the results of the pond sampling. The chart should look something like this:



Data for each organism are collected on a separate strip of paper. The strip has an illustration, sample, or other identification for the organism at the top. Correct names for organisms are not important. Equal spaces are provided for totaling the counts of the organisms in each pond.

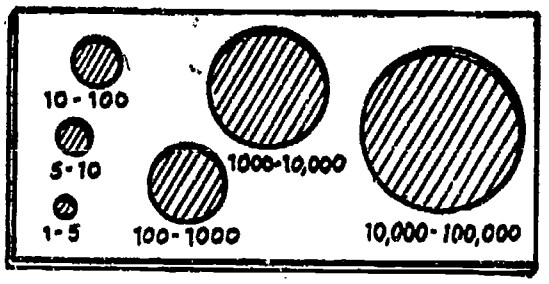
Separate strips of paper are used for each organism so that, after the combining of data, the strips may be interchanged in search for a pattern of population difference in the two different ponds. Determine if different organisms or differing numbers of the same organisms live in the two ponds.

It may also be possible to recognize that different organisms will have different patterns of occurrence in the two ponds. This can be read vertically on the chart.

Students may be able to show that one organism's pattern of occurrence can be compared to another. For example, a floating plant may occur in great numbers while a small fly larva occurs in small numbers in pond No. 1, and the reverse is the case for pond No. 2.

It is possible to arrange the strips of paper so that a pattern develops which includes most or all the organisms. Strips of high numbers for pond No. 1 could be put to the left of the chart and all strips with high numbers for pond No. 2 put to the right. Students may suggest several schemes, some of which yield patterns and some of which do not.

A method of making the total counts of organisms easier to compare is to use a dot of color to represent each population number or population size. A card



with holes in it can serve as a template for making different sized dots with a magic marker.
Use a dot size to number ratio which best matches the results of your count.

Some Questions to Consider

1. Can the difference in the successional stage of the ponds be demonstrated by the pattern of organisms in the chart?
2. Can students make any generalized assumptions about the characteristics of young ponds or old ponds?
3. Is succession occurring in these ponds?
4. Do informal observations of the ponds tend to agree with the data or patterns in the chart?

after the investigation.

Find a pond or marsh area in your locality that is being influenced by activities such as construction work, farming, or lawn care of nearby residents. Determine if these activities are affecting the succession of the pond or marsh.

1. List activities that could slow down succession and those that could speed up succession.
2. Which activities do you think could be good for the pond and which could be bad for the pond?
3. Do you think ponds and marsh areas should be protected from some activities? Which ones?

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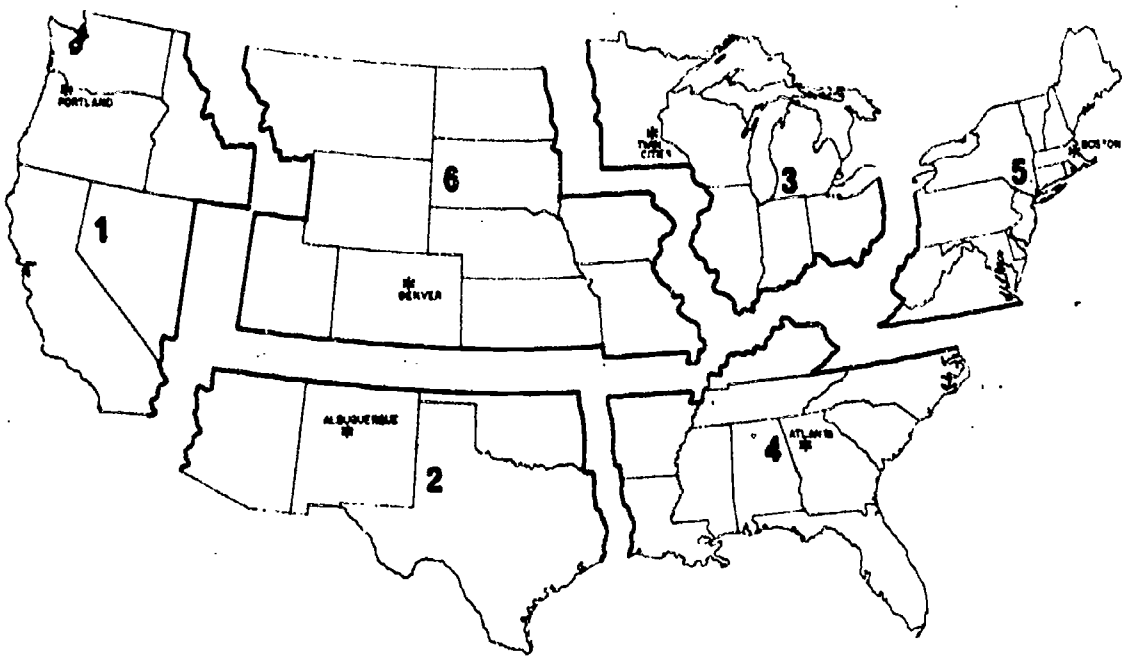

for information

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Alaska Area Office
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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 9

Synopsis

DEER FOOD SURVEY
Woody twigs are collected to determine which ones are most frequently browsed by deer. The total quantity of these food plants are estimated and related to the number of deer which can be supported in the area.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

It is possible for a female meadow vole to produce three to four litters of young a year. The babies are on their own within four weeks; each of the five to nine males and females potentially may start their own family when they are only two months old. Although not all wildlife species are so productive, each does produce enough young to maintain a healthy and stable population.

Deer food survey

A. **Purpose:** This activity will acquaint students with —

1. The food habits of white-tailed deer.
2. The relationship of available food and numbers of deer.
3. A food sampling technique used in deer management.

B. **Objectives:** During this activity the students will —

1. Collect samples of browse plants available to deer in winter.
2. Determine the kinds of plants eaten by deer and the total amounts available for food.
3. Predict the number of deer that can live on the area based on their calculations of available food.

C. **Activity requirements:**

1. Four 20-inch sticks per team.
2. One hedge clipper per team.
3. Ten medium-sized plastic bags per team.
4. Identification guide for trees and shrubs.
5. Scale, postage-type, for measuring ounces.
6. One data sheet per team.

Introduction

In the northern United States, winter is often a time of hardship for the white-tailed deer. Deer are herbivores, therefore winter means a change in diet from the green, succulent foliage of summer to the woody tips of trees and shrubs in winter. This woody food, called browse, is usually the deer's primary winter subsistence diet, although nuts and some green vegetation are also eaten if not buried too deeply under the snow.

The major interaction is between environment (weather conditions and the amount and types of available food), and deer (population numbers and state of health). Knowing the factors and how they influence this interaction is essential to maintaining a healthy population of deer in balance with what the environment can support. But not all of the factors are known and how they work is even a greater mystery. Wildlife managers do not know all the answers; they are always learning, always changing their practices to be consistent with additional knowledge.

Factors influencing interaction between deer and the winter environment are numerous and complex. These factors include climate; weather; plant succession, variability and abundance; deer abundance, their state of health, mobility and food habits; and on and on. In this activity, just a few of the factors influencing this interaction will be investigated. It should be realized from the beginning that our technique, measurements, calculations and conclusions are tentative and subject to immense error. However, this should not discourage the use of this activity, for here is an opportunity for new experiences and better understanding of wildlife and the land.

In this activity, the number of deer a given area can support (the carrying capacity) in winter can be estimated by sampling the available food plants.

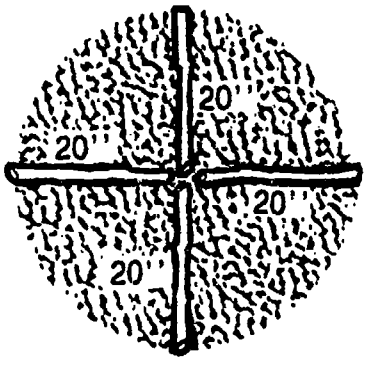
Planning

Contact the refuge manager for assistance in identifying sites for this activity. A trip to a refuge may not be necessary if suitable areas are available nearby.

Activity Procedure

This activity is most easily done in small teams of 2-4 students. Each team should have the necessary equipment for collecting samples and recording information. A map of the study area showing where each team will collect samples may be helpful.

Each team should sample ten different plots. To identify each sample plot, one of the sticks can be randomly tossed. Align the other three 20-inch sticks with the first one, forming a cross as illustrated below.



Data Sheet

Outdoor Classroom Guide Number 9

Deer Food Survey

Names _____

_____

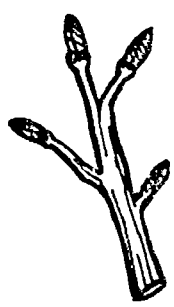
Location _____

Date _____

SIDE ONE

1 Type of plant (e.g. gray bark, red buds — 11 samples)	2 Number of Twigs (237)	3 Number Browsed (33)	4 Ratio (.14)
1.			
2.			
3.			
4.			
5.			

1. Describe or name the types of plant collected. Record the total number of samples for each type.
2. Count the number of twigs for each plant.
3. Determine how many twigs have been browsed by deer for each plant. See illustration.



Not browsed

shredded off

Browsed

clean cut, typical of rabbit

Clipped by rabbit

4. Determine what ratio of twigs for each plant was actually eaten by deer.

$$\text{Ratio} = \frac{\text{number of twigs eaten by deer}}{\text{total number of twigs}}$$

By comparing the ratios, select the two most frequently eaten plants:

SIDE TWO

Estimating Carrying Capacity:

Assume that the highly browsed plants are uniformly spread throughout the area. The 40-inch diameter of the study plot equals 1/5000 of an acre.

---

1. Twigs per acre $= \frac{\text{total number of twigs x 5000}}{\text{number of plots sampled}}$

To estimate the carrying capacity of the area, it is necessary to calculate the amount of food available to deer. This requires two major assumptions:

a. That the two plant foods are uniformly spread throughout the area

b. That about ½ of each twig is used as food by the deer.

Determine the average weight of a twig for each food plant by weighing several at once and calculating an average. Since about ½ of each twig is available for food, divide the average weight by 2.

---

2. Average weight per twig $= \frac{\text{weight of 10 twigs}}{2}$

---

3. Weight of available food per twig $= \frac{\text{average weight per twig}}{2}$

To determine the total twigs of each food plant available in the area, multiply twigs per acre (No. 1 above) by the acres of habitat in the area.

Now multiply the total number of twigs in the area by the weight of available food per twig (No. 3 above).

Total weight of available food* = total number of twigs x weight of available food per twig.

***Remember to determine this for both food plants. An average deer eats about seven pounds of food per day.**

Given the length of winter in your locality, how many deer could survive the winter based on your calculations of available food? Keep in mind that the calculations are subject to a wide range of errors and therefore represent only approximations of actual conditions.

Winter places heavy stress on individual animals due to weather, competition for food and lack of sheltering cover. However, the surplus of young that are born each spring and summer make up for losses from winter hardships, illness, weakness, broken bones and all other possible misfortunes.

Every area of land can support only a certain number of each kind of animal — this is called its carrying capacity. For nearly every species, a surplus of individuals results in a deterioration of living conditions that affects the well-being of the whole population. Nature usually ensures that each population of animals has the capability to overproduce. The factors limiting actual numbers are determined by the land's carrying capacity.

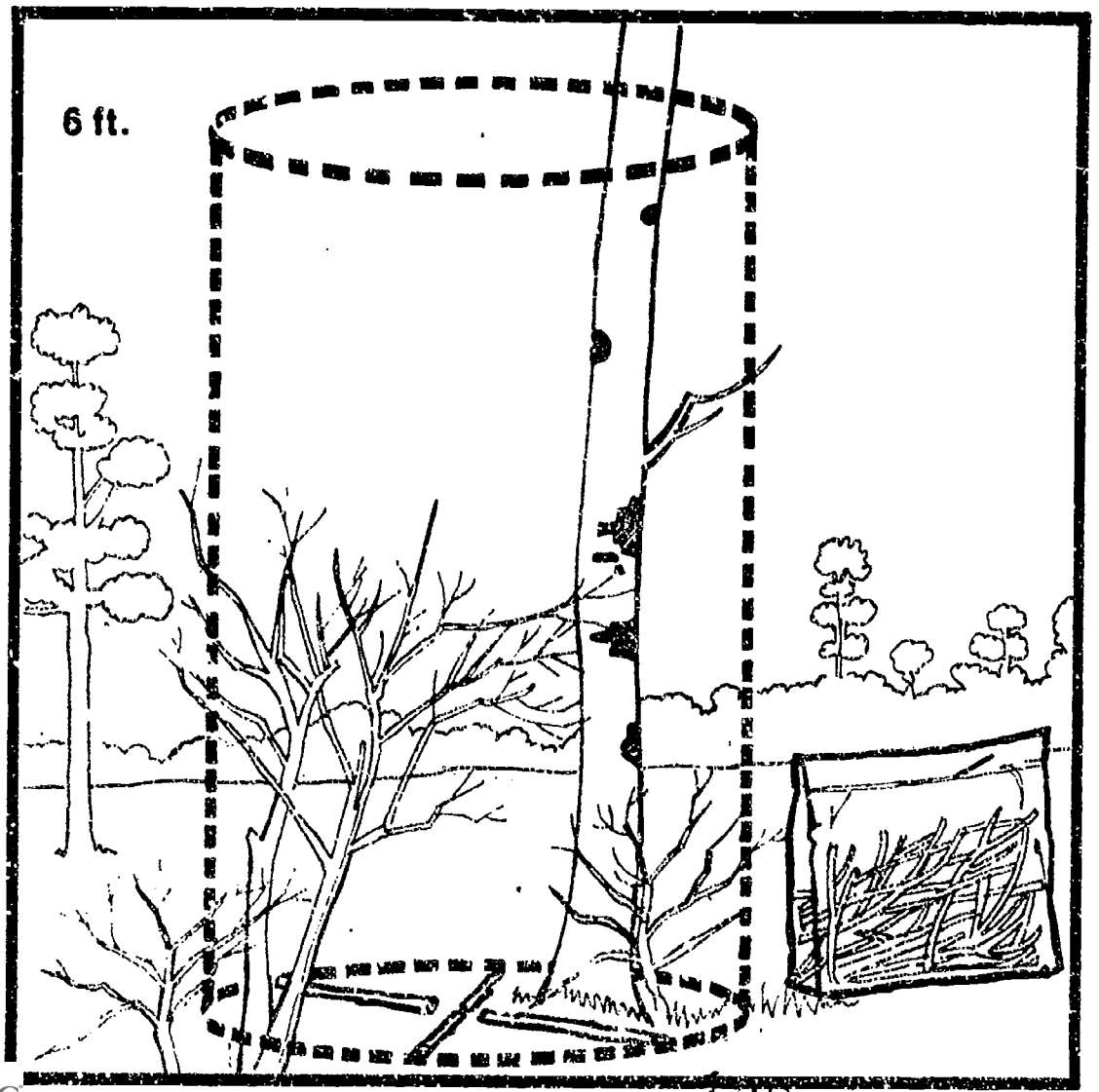
Besides influencing the survival of surplus animals, carrying capacity affects production. Each species has an established social structure. Territorial competition in the spring for nesting sites and feeding territories limits the number of adults producing young. Man affects this production by changing the habitat and making more or fewer nesting sites or feeding territories available.

Through the discovery of population factors, including stress and the number of individuals within a population, a student can better understand his own environment and the "balance of nature." This balance includes man as well as the meadow vole. This discovery leads to questions of man's surplus population, our own stress factors and the carrying capacity of the land for man and his activities.

This forms a circular study plot, 40 inches in diameter. It is important to sample food within the reach of deer, upward to a height of 6 feet. Thus, the sample plot becomes an imaginary cylinder 40 inches in diameter and about 6 feet high.

Clip about 6 inches off the tip of every branch in the plot, including those that enter the imaginary walls from the outside. Put all samples in plastic bags, keeping twigs from the same plant together in the same plastic bag. Do not hesitate to clip the branches since pruning will produce numerous new sprouts next year.

Each team should sample as many plots as time permits, using the same procedure for selection and sampling. Since the data will be pooled among all the teams, it is not necessary that each team sample several plots. Pooled samples from the plots are usually sufficient for most areas.



Pooling the Samples

Calculating which plants are eaten most:

Once the plant samples have been collected, move indoors for pooling samples and calculations. A large surface will be needed for organizing the twig samples into piles of similar plants.

Each team should take their samples out of the bags, making sure that similar plants are kept together in separate piles. Now sort through the samples from all of the teams, putting similar plants together.

Be sure to record how many samples were pooled to make each pile. This information will be needed later on. It is not necessary to know the names of the plants, but by careful observation each can be distinguished from the others. Use characteristics such as bark color and texture; bud shape, color and arrangement; and even the general growth form of the twigs. It may also be helpful to use an identification guide to trees and shrubs in your locality.

Once the twig samples have been pooled and separated into piles of similar plants, follow the directions on Side One of the Data Sheet.

Estimating Carrying Capacity

Calculating the carrying capacity is important to deer management because it is an estimate of the number of deer an area can support at a particular time. Now that the two most important browse plants have been identified, the total quantity of these food plants can be calculated for the study area. See Side Two of the Data Sheet.

after the investigation

A simplified way to view deer management is that the carrying capacity of the environment and the number of deer should be in balance.

Environment (food) _____ Number of deer

However, these two factors are never static. Plants communities change from small tree and shrub associations to mature stands of trees with little shrub understory. Deer populations fluctuate from levels of abundance when food is plentiful to near depletion in times of scarcity.

Major winter survival requirements are food, liquid water supply, escape cover, and cover for protection from wind and storms. Wildlife managers attempt to maintain a healthy population of deer consistent with what the environment can support (carrying capacity).

List and discuss some ways the following practices can help and harm the balance between the carrying capacity of the environment and the deer population.

	Help	Harm
1. Hunting		
2. Lumbering		
3. Burning		

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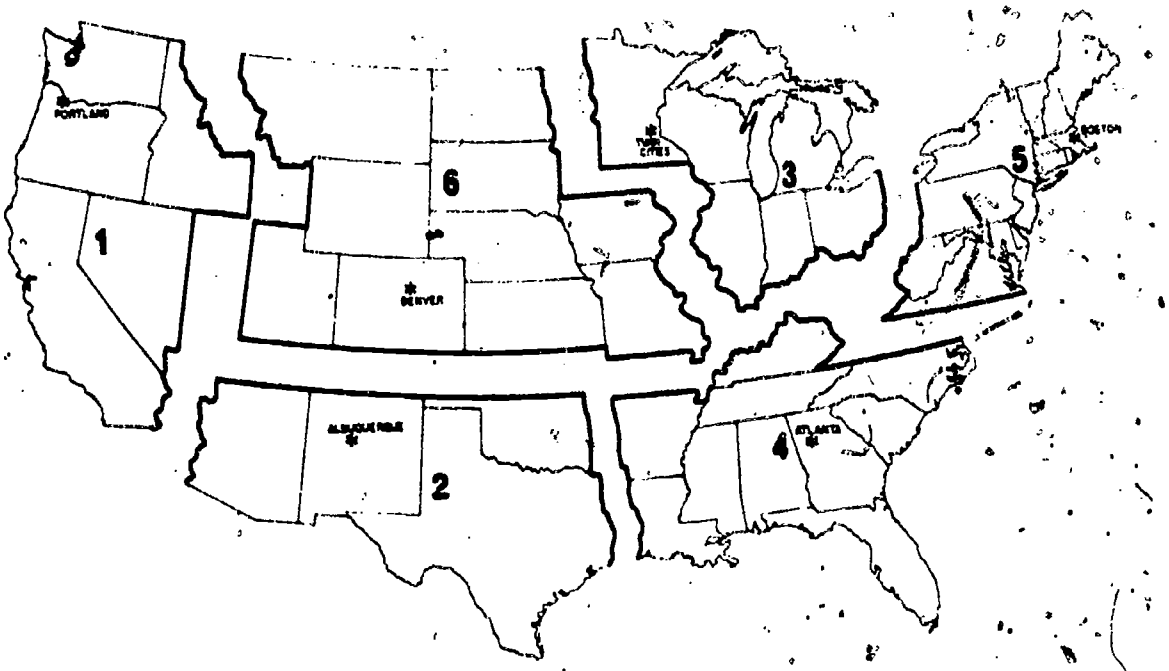

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 10

Synopsis

WATER QUALITY ANALYSIS
Periodic water quality measurements and freshwater organism samples are taken at specific places in a water system. Changes in water quality are compared with changes in organism population densities.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

Eutrophication:

Eutrophication is a natural process whereby bodies of water change from a clear, fairly infertile condition with few organisms to a condition of fertility with dense populations of many organisms clouding the water. When in a fertile condition, bodies of water collect sediment and fill until they turn

Water quality analysis

A. **Purpose:** This activity will acquaint students with —

1. Water sampling techniques.
2. Freshwater organism and sampling techniques.
3. Some effects of land use on water quality.
4. Some effects of changing water quality on fresh-water organisms.

B. **Objectives:** During this activity students will —

1. Determine sampling sites and schedules for periodic analysis of water quality.
2. Collect data on water quality.
3. Collect data on fresh-water organisms.
4. Look for patterns of change between water quality and organism density and diversity.

C. **Activity requirements:**

1. Map of refuge and surrounding area showing water areas.
2. Water sampling equipment:

   Field test kits for dissolved oxygen, nitrates, phosphates, pH, and sediment or turbidity.

   An accurate thermometer.

   Kits are available from the LaMotte Chemical Products Company, Chestertown, Maryland 21620, and from Hach Chemical Company, P.O. Box 907, Ames, Iowa.

3. Organism sampling equipment:

   Large funnels and filter paper.

   Centigram balance

   Liter measures

   Fine mesh sieves or flat pans for separating organisms from sediment

   Magnifiers or 15-30X binocular microscopes

   Forceps or probes

   Accurate thermometer

   Secchi disc (available from Wildlife Supply Company, 2200 S. Hamilton St., Saginaw, MI 48602)

Introduction

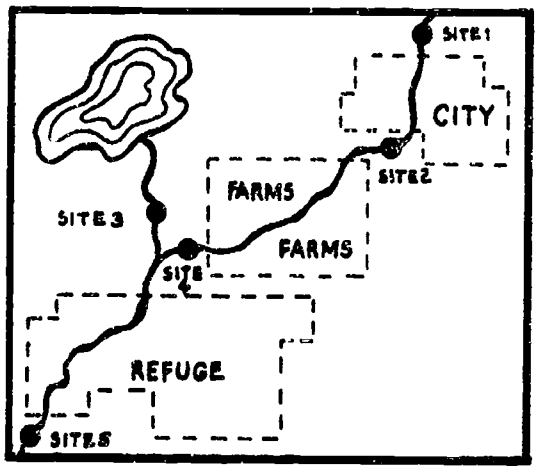
Water is essential to the environmental management programs of fish hatcheries and most wildlife refuges. The amounts of sediment, minerals and nutrients all influence water quality characteristics. For instance, if the water source for a refuge contains great amounts of sediment or nutrients which can cause rapid plant growth, the living conditions within the water will be affected. Thus, environmental management program planning must take into account present water conditions and also how conditions might change in the future.

Thus, investigation will provide data which is useful for making decisions for managing waterfowl habitat. It is suggested that this study should be initiated as a long-term study allowing for data comparisons from year to year.

Planning the Study

Contact the refuge manager for a map of the refuge and surrounding area. The map should be extensive enough to show a major part of the watershed in which the study area is located. A highway map may also be necessary to locate environmental factors which influence water quality such as farms and communities. The maps are needed to help identify where water testing sites should be located for your study.

Where water testing sites are to be located depends upon the kind of information you want to collect. An example for this activity is illustrated below.



Data Sheet

Outdoor Classroom Guide Number 10

Water Quality Analysis

Names _____

_____

_____

Date _____

SIDE ONE

WATER ANALYSIS TEST STATION NO. ____

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Water Present ✓												
Ice Present ✓												
Water Temperature C°												
Dissolved Oxygen												
Nitrate												
Phosphate												
pH												
Turbidity												

SIDE TWO

Name _____

_____

Date _____

POPULATION AND DIVERSITY SAMPLING

STATION NO. _____

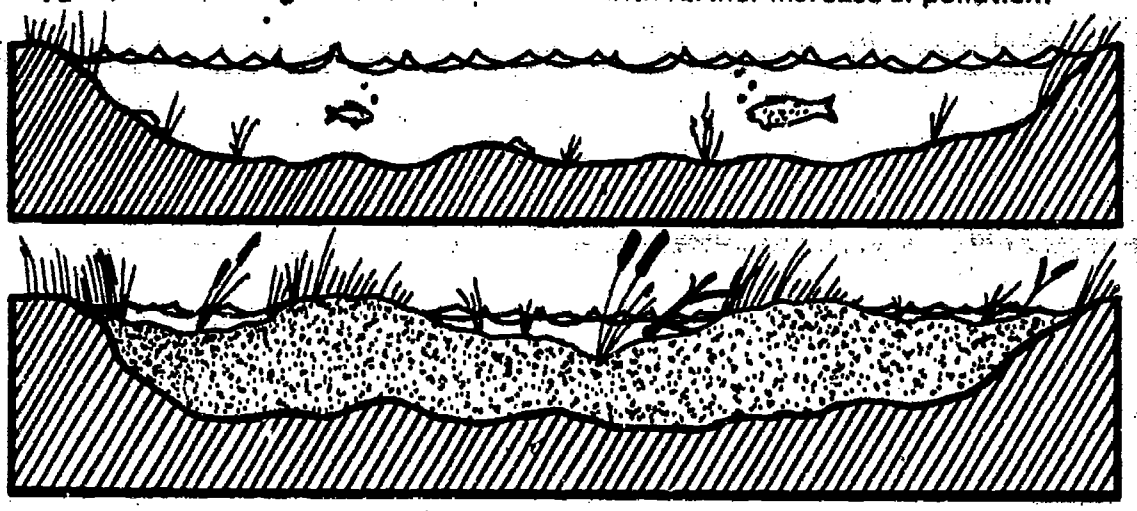
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature: Surface													
	Middepth												
	Bottom												
Depth of Visibility													
	Suspended Material												
	Grams/ Liter												
Diversity in Water													
	No. of Species												
	No. of Liters												
Diversity in Sediment													
	No. of Species												
	No. of Liters												

from lakes into marshes, and from marshes into meadows.

Several kinds of materials add to the sediment in water. The soil, rock, or dust can be washed or blown into the water. Minerals can be precipitated out of water solution. Plants and animals which live in water die and fall to the bottom. Waste from other organisms, especially human waste, may collect or be deposited in water.

Pollution:

Pollution adds excess materials to water and increases the rate or degree of eutrophication. The greatest danger of pollution is that increased growth of organisms in enriched water may completely use up the available supply of oxygen, thus causing the death of almost all organisms. This leads to anaerobic decay of the dead organisms with further increase of pollution.



The major concern is to identify the possible sources of pollution affecting the water flowing into the refuge, so testing sites are located before and after each town and where farm run-off can be analyzed. Ten sites are then established on a refuge lake and marsh for sampling organism populations. Comparisons can then be made between water conditions and organism populations.

Determine the questions that you find interesting and need information about and then identify where the test sites should be located.

The following list may provide the basis for discussion in identifying some questions for investigation. Chcose factors appropriate for your area.

1) agricultural run off
2) power plant discharge
3) housing development
4) solid waste dumping site
5) highway construction
6) recreational use
7) other

Collecting Data

Periodic analyses should be made at all or at selected test sites. These analyses are compared to organism population samples taken at marsh and lake sampling stations. Any fluctuation in the diversity or the population size of organisms will be checked against any change in the water composition.

Water Analyses to Conduct at Each Site

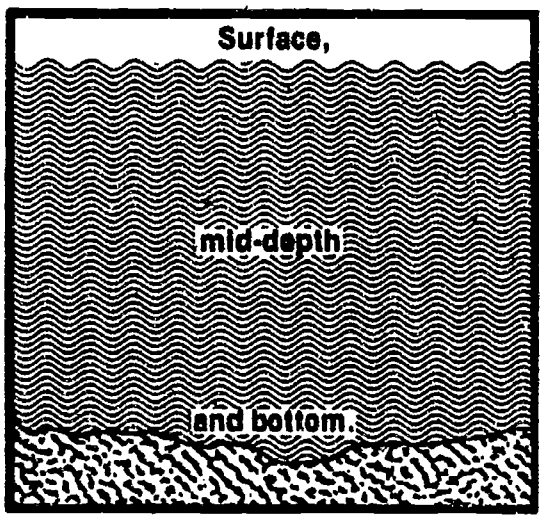
Do water analysis tests in accordance with the directions on each of the kits.

Population Samples to be Made at Each Marsh and Lake Station

You should consider taking population samples in places other than the study watershed area. This information can then be used as a control against data collected from refuge sites.

Measurements

A. Temperature.



B. Depth of visibility.

The Secchi disc is lowered until it no longer can be seen through the water. The length of cord from the disc to the water surface is recorded. A homemade disc can be made from a large can cover 20 centimeters in diameter painted with alternate white and black quadrants.

If stain and sediment in the water do not fluctuate greatly, the depth of visibility is a reasonable indicator of the number of plankton organisms present. Sediment, stain, and organisms diminish light penetration into the water.

C. Weight of suspended material in water

Unless the water is severely stirred by waves or flood, most suspended material filtered from water will be living organisms. Algae, protozoans, bacteria, rotifers and crustaceans will be most common.

Weigh a dry filter paper. Filter water in multiples of one liter until there is some noticeable collection of material. (Several minutes are required to filter one liter. Other work can be performed during this time or water samples can be transported to a lab for vacuum filtration.) Dry the filter paper with the collected material. Weigh, subtract the weight of the paper and record the weight of suspended material in terms of grams per liter.

D. Sampling aquatic organisms

1. Filter one liter multiples of water and wash the collected material into a shallow dish with a small amount of water. Observe under magnification. Record the number of different species, or the diversity, of organisms--both plant and animal. It is helpful to be able to identify the various organisms but not essential. However, the most useful study will require a listing of organisms observed. Record diversity of organisms and the number of liters sampled. Record population size for each species if desired.

Useful identification references:

A Golden Guide: **Pond Life.** New York, New York, Western Publishing.

A Guide to the Study of Freshwater Biology by James A. Needham and Paul R. Needham. San Francisco, Holden-Day, 1967.

Useful sampling technique references:

Freshwater Ecology, Englewood Cliffs, New Jersey, Prentice Hall, 1972.

Field Biology and Ecology by Allen H. Benton and William E. Werner, Jr., Minneapolis, Minnesota, Burgess Publishing Company, 1967.

2. Collect one liter samples of bottom sediment. Wash away sediment and count the diversity of organisms--plant and animal. Record the number of organisms and the number of liters sampled. Record the population size of each species if desired.

after the investigation

After periodic samplings and analyses of the water have been made, look for any changes in diversity, in population size or in mineral and sediment content of the water. Do any of the changes relate to each other in times of occurrence?

Please send a copy of your data and your conclusions to your refuge manager so that he may use it to help determine management practices for the refuge.

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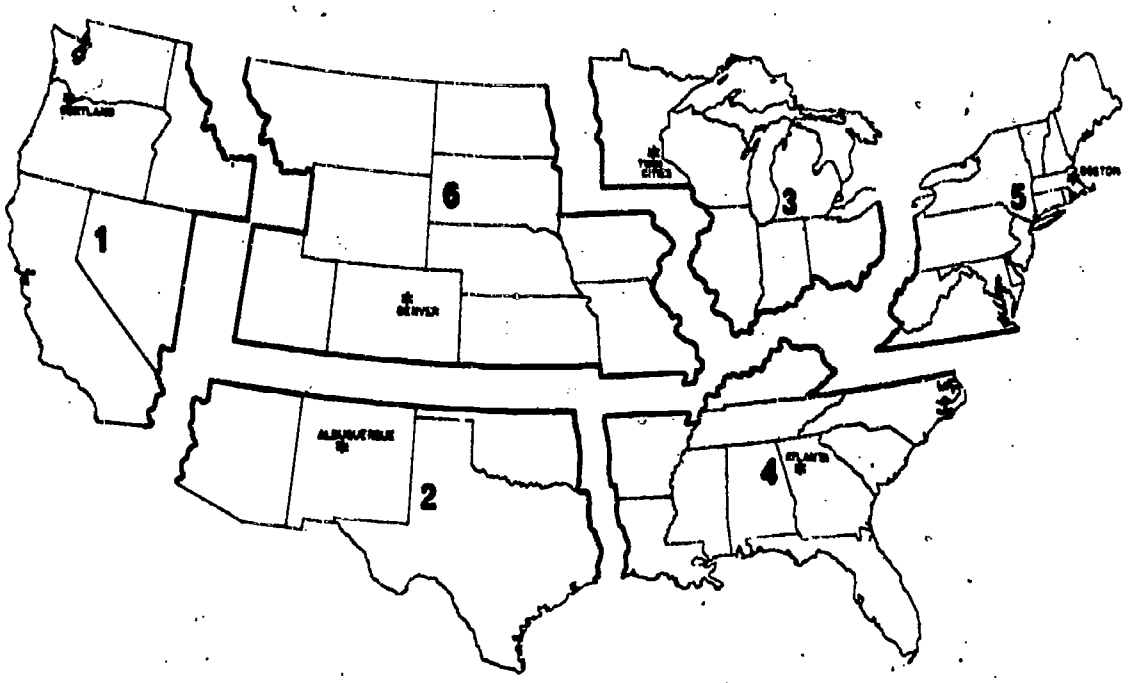

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 11

Synopsis

PUBLIC USE OF PUBLIC LAND
A questionnaire and survey procedure is used by students to determine people's intent and behavior during use of public lands.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

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Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

An important goal of the National Wildlife Refuge System is "to promote harmony between man and his environment." One way to reach this goal is to allow the public to learn and experience on refuge lands.

Our visitors come to a refuge for many reasons — to learn about the environment, to photograph animals or

Public use of public land

A. **Purpose:** This activity will acquaint students with —

1. The uses of refuges.
2. The recreational interests of the public.
3. A technique for surveying public use.

B. **Objectives:** During this activity the student will —

1. Collect information using an interview survey technique.
2. Graph the information to show patterns of responses.
3. Describe their interpretations of the data.
4. Make some recommendations based on their interpretations.

C. **Activity requirements:**

1. Survey forms, clipboard and pencils.
2. Map of the refuge.

Introduction

National Wildlife Refuges exist to be used by people as well as wildlife. The official use that may be made of refuge lands is mainly in the areas of scientific research, education and wildlife-oriented recreation.

Major recreational uses of many refuges are often known to some t. However, specific information on the variety and frequency of uses and future trends is usually not available.

Student teams can survey public use of public land by asking questions of people as they enter or leave the refuge.

Teams of three students are stationed at all entrances during a selected period of time. Information is collected from all people and vehicles entering or leaving the refuge by using copies of the enclosed survey sheet.

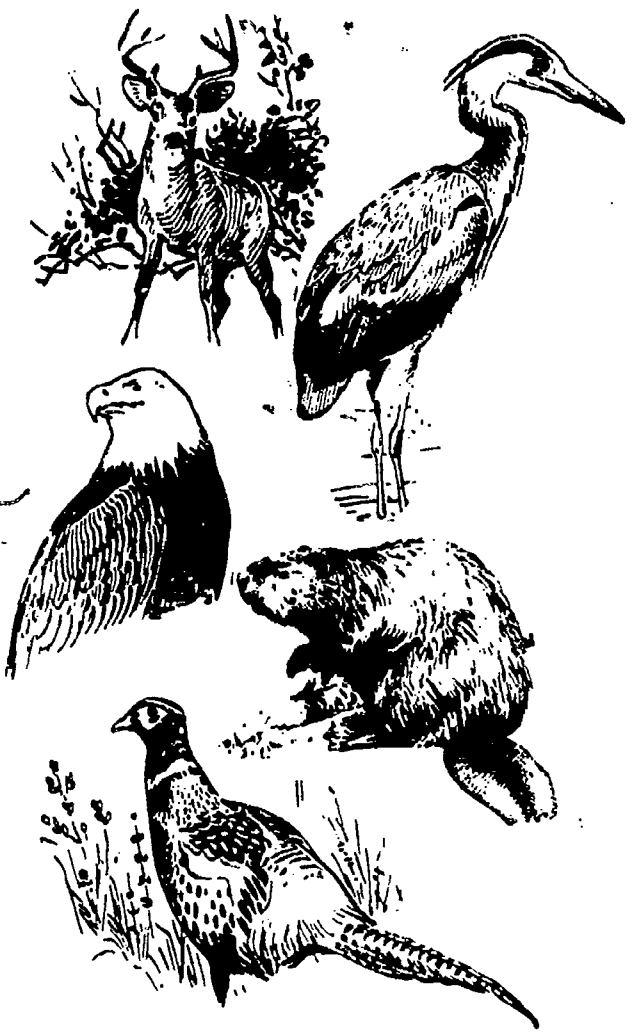
One student asks questions of the people, a second records their answers and a third records information about the vehicle, weather conditions, etc.

Selecting a Study

It is known that public use of public lands increases over weekends. This use is probably of a different kind from weekday use. One of the best studies will compare the differences in public use between weekend and weekday during the same time of year. This will require one or more (preferably many) surveys to be conducted on Saturdays or Sundays and one or more (preferably many) surveys during the week.

Another study can show the difference in public use with a change of season. This study requires one or more (preferably many) surveys conducted at each of two or more different times of the year. These surveys must all be conducted on either a weekday or a weekend.

Other studies can be selected to suit your needs or interests.



Locations for Surveys

Identify refuge entrances on the map. Teams should be located at each entrance. Teams should start and end their surveying at the same previously arranged time. Teams must be equipped with survey sheets, pencils, and a friendly smile. Not all people will respond cooperatively, but students should view the survey as an enjoyable, interesting experience to get the best results.

Data Sheet

Outdoor Classroom Guide Number 11

Public Use of Public Land

Team No. _____

Surveyors _____

_____

Date _____

SIDE ONE

SURVEY
PUBLIC USE OF PUBLIC LAND

Have you answered another survey today? Yes _____ No _____

(If no,)

Would you answer a few questions about why you came to this refuge?

What kinds of activities have you engaged in or for what particular reason did you come to the refuge?

- ☐ Nature trail
- ☐ Picnicking
- ☐ Observing wildlife
- ☐ Walking, hiking
- ☐ Sightseeing from car
- ☐ Photography
- ☐ Birding
- ☐ Berry picking
- ☐ Horseback riding
- ☐ Boating and canoeing
- ☐ Fishing
- ☐ Hunting
- ☐ Snowskiing
- ☐ Snowshoeing
- ☐ Trapping
- ☐ Educational
- ☐ Scientific research
- ☐ Local resident
- ☐ County maintenance
- ☐ Business with refuge
- ☐ Telephone, power, etc.
- ☐ Other

SIDE TWO

How many hours will you stay for your visit? _____

How many miles did you travel to get here? _____

Are you here as a member of a club or organization? Yes_____ No _____

What is its name? _____

Are you here in connection with a school? Yes_____ No _____

Would you like some other kind of experience? Yes_____ No _____

Will you return soon? Yes_____ No _____

For what kind of experience will you return? _____

_____

Response:
Cooperative_____ Reluctant_____ Uncooperative _____
Vehicle:
Auto_____ Truck _____ Camper_____ Trailer _____
Machinery_____ Boat _____
Number of people: Adults_____ Children _____
Vehicle license (what state) _____

_____

Weather conditions: Temperature _____
Wind _____
Cloud cover _____
Precipitation _____

plant life, to go canoeing, to walk a wildlife trail or just to visit a "quiet place." As man's knowledge of the environment becomes greater and quiet places for solitude become more scarce, demand for use of wildlands will increase.

Most lands within the refuge system are set aside by anAct of Congress that establishes the primary objective of each refuge. Although there are different kinds of refuges, including some for buffalo, elk or bighorn sheep, three-fourths of all these lands are established as resting, feeding and nesting areas for migratory waterfowl.

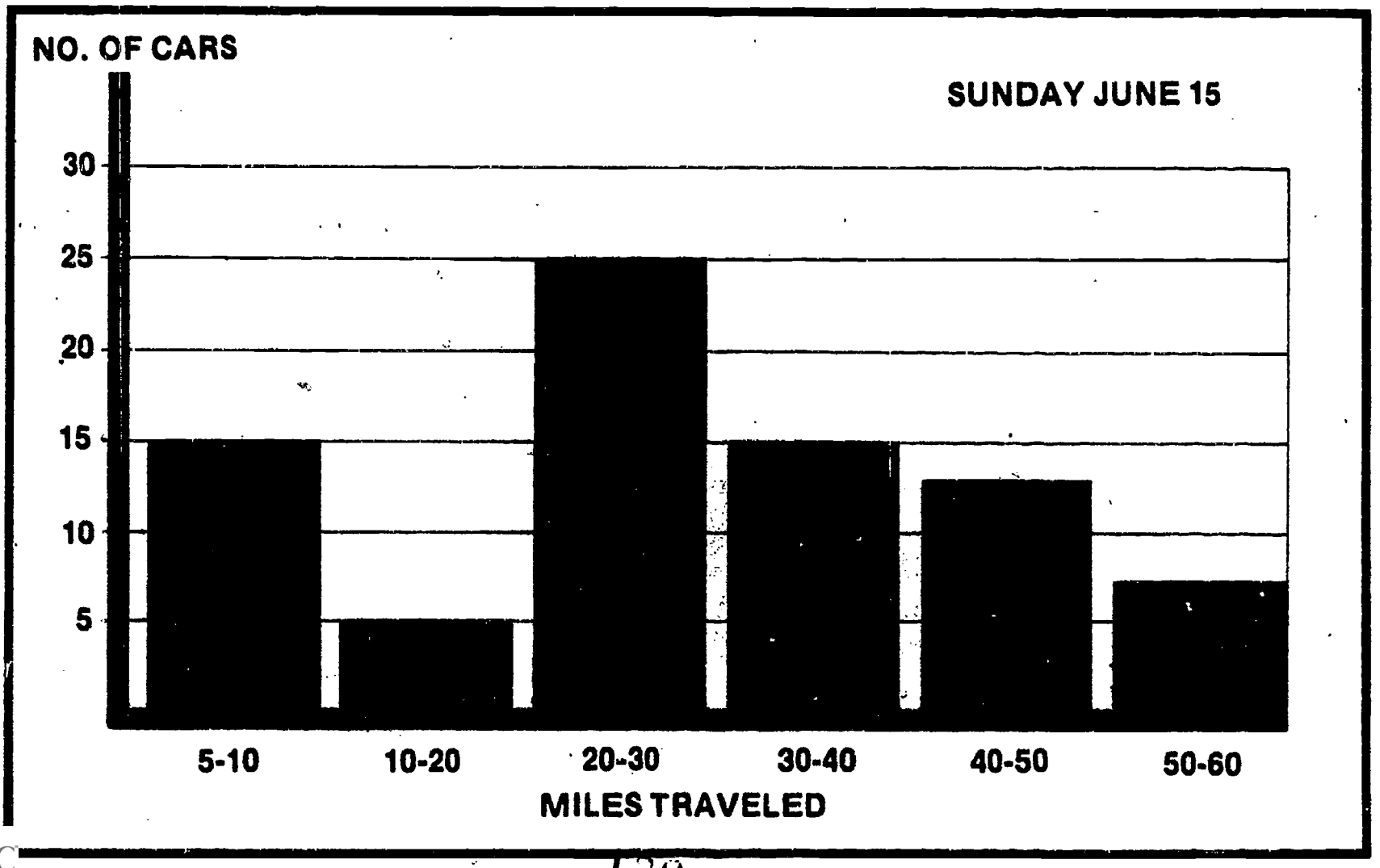
Although conserving wildlife and the environment are our main commitments, providing for public enjoyment and appreciation of wildlife has become increasingly more important. By surveying the public use, public attitudes, and awareness of local communities concerning a refuge and its programs, a student may develop an appreciation of land use problems. Local community and even national pressures may change or influence land use policy. The problems of administering lands in public trust for present and future generations can be studied. The values of wildlands and quiet places to a community can be discovered.

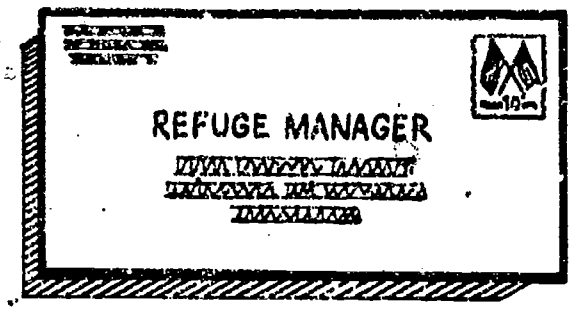
Analyzing the information

Data can be extracted from the survey sheets and put into graphic form for easiest analysis. For example, the number of miles that people drive to reach the refuge can be described by concentric circles around the refuge located on a state map; or the data can be represented by a bar graph as in the example below.

Many comparisons can be made with the information: number of people visiting the refuge on weekends compared to weekdays; number of hunters compared to birdwatchers; number of camper vehicles compared to hunting and fishing or non-hunting and fishing activities; number of visitors compared to weather conditions.

Students should search for significant relationships or patterns which occur in the data.





after the investigation

1. Inform refuge personnel of the results of your investigation. Send a copy of the data and a summary of your analysis to the refuge manager. This information will help them plan better services for public use of public lands.

2. It may be interesting for students to look at their leisure time activities now and what they might be in the future. Have students list their favorite activities and the average time they devote to each in a month.

After discussing the lists, have students predict their future activities by preparing similar lists for 15, 30 and 45 years from now. Because thinking into the future is not easy, some students may become frustrated with this. However, this should be a fun activity where wild guessing is usually the rule and not the exception.

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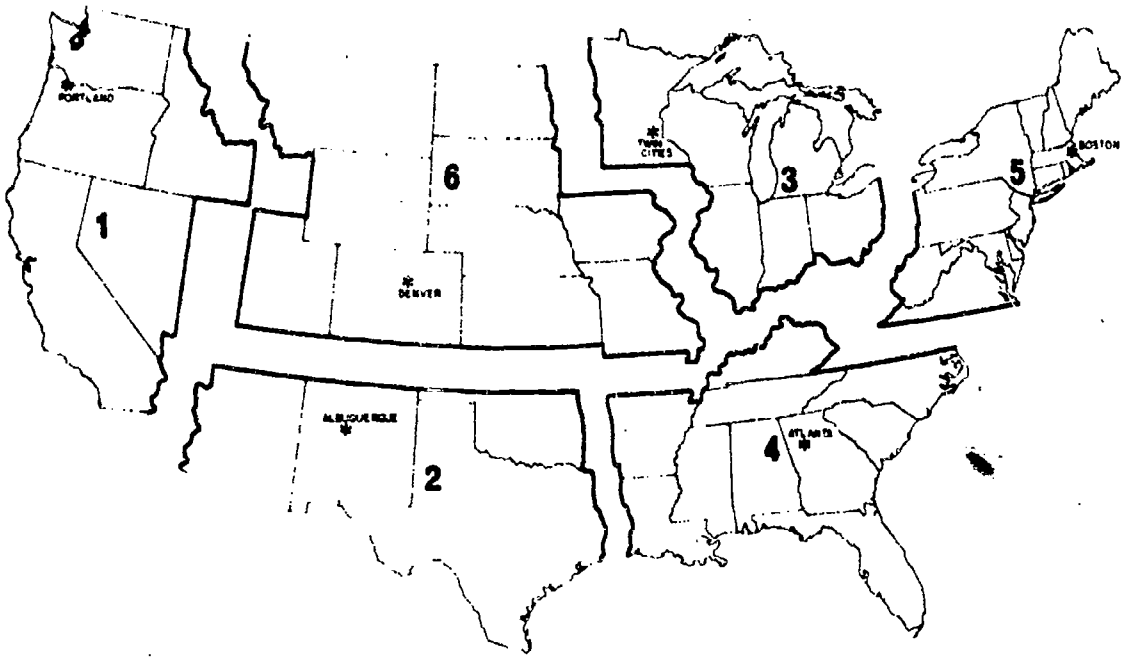

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 12

Synopsis

WILDLIFE/WILDLANDS PHOTOGRAPHY
This probe is appropriate for elementary or secondary students. It emphasizes the use of simple photographic techniques for investigating the out-of-doors. Several short and long term projects are described.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

One way to take a close look at a natural area such as a wildlife refuge is through the lens (or viewfinder) of a camera. The camera may be thought of as another kind of eye, although many times our own eye sees differently from the camera's eye. This is one of the reasons that our photographs often surprise us. The camera sees only what it is pointed at, and is not influenced by sounds, feelings or thoughts.

Wildlife/wildlands photography

A. **Purpose:** This activity will acquaint students with —

1. The value of refuges for nature photography.
2. The variety of opportunities for using photography to investigate the environment.
3. Some simple photographic techniques.
4. Photography as a means of communication.

B. **Objectives:** During this activity students may select among the following activity options —

1. Making a pin-hole camera.
2. Developing black and white film.
3. Making prints from negatives.
4. Activity options involving short-term projects.
5. Activity options involving long-term projects.
6. Using prints and/or slides in preparing a presentation.

C. **Activity requirements** (depending on activity options):

1. Construction materials for making a pin-hole camera.
2. Chemicals and other material for film and picture development.
3. Any available camera.
4. Special equipment (optional):
   - close-up and telephoto lens
   - focal frame
   - remote shutter tripping device
   - construction materials for a blind
5. Resources and equipment for preparing a photographic presentation.

Introduction

The activities described in this probe do not require a lot of experience and materials. They have been written to help students become familiar with basic photographic techniques and skills. Inexpensive and reasonable techniques have been emphasized.

You and your students will be able to choose from among several activity options. Some of the activity options are excellent starting points for students with more photographic experience. A brief technique sheet has been provided to assist you in darkroom techniques and the manufacture of a pinhole camera. Have fun!

The enclosed slip sheet gives step-by-step directions for techniques which you may find useful in complementing the activity options.

Some One-Trip Activities:

A. Photograph What You Like Best

Often when students are part of a class their activities are structured in a particular direction.

In this activity students should be allowed to explore freely and photograph whatever most attracts them. The possibilities are limitless and could include both natural and man-made subjects on the refuge.

Once the subject has been captured on film, the student should **describe** what he photographed using another medium such as:

1. Poetry--It may be necessary to acquaint students with various forms of poetic verse such as free verse or haiku.

2. A short paper--Describe the subject and its relationship to the surrounding environment.

3. Art--A drawing may help emphasize that which is particularly interesting to the student.

B. Getting to Know an Animal

Before going to the refuge the student should select an animal that is interesting to him and found in the area. Through reading and other sources the student should become familiar with the natural history of his animal. Once this is known, the life of the animal can be documented using photos.

Go to the area where the animal lives, its habitat. Begin by taking some general pictures of the area from a distance at your eye level. This will provide information on the gross characteristics of the place such as plant types and topography. Now take some pictures at the animal's eye level. Photograph tracks, droppings, evidence of feeding, resting spots, nesting areas and other signs of activity. It may be useful to consider close-up photography skills. These photos, in addition to the natural history information, will tell you

Technique Sheet

Outdoor Classroom Guide Number 12

Wildlife/Wildlands Photography

1. MAKING A PIN-HOLE CAMERA

Materials

a. 4- to 6-inch square box (½ gallon milk carton bottom)

b. Flat black paint

c. Heavy aluminum foil

d. Masking tape and black friction tape

e. Sheet film (from photo store)

f. Needle or pin

Procedure

Make sure your box has a tight-fitting cover, or make one out of construction paper. Decide on one side for the front; if it is longer than wide, use one of the shorter sides or ends. Cut a ½-inch diameter hole in the middle of the front. Next, paint the entire inside and outside of the box black to prevent transmission and reflection of light.

Cut a circle of aluminum foil 1½ inches in diameter and glue or tape it over the hole on the inside. Paint it black also (inside only). In the center of the foil, prick a small hole with a needle or pin.

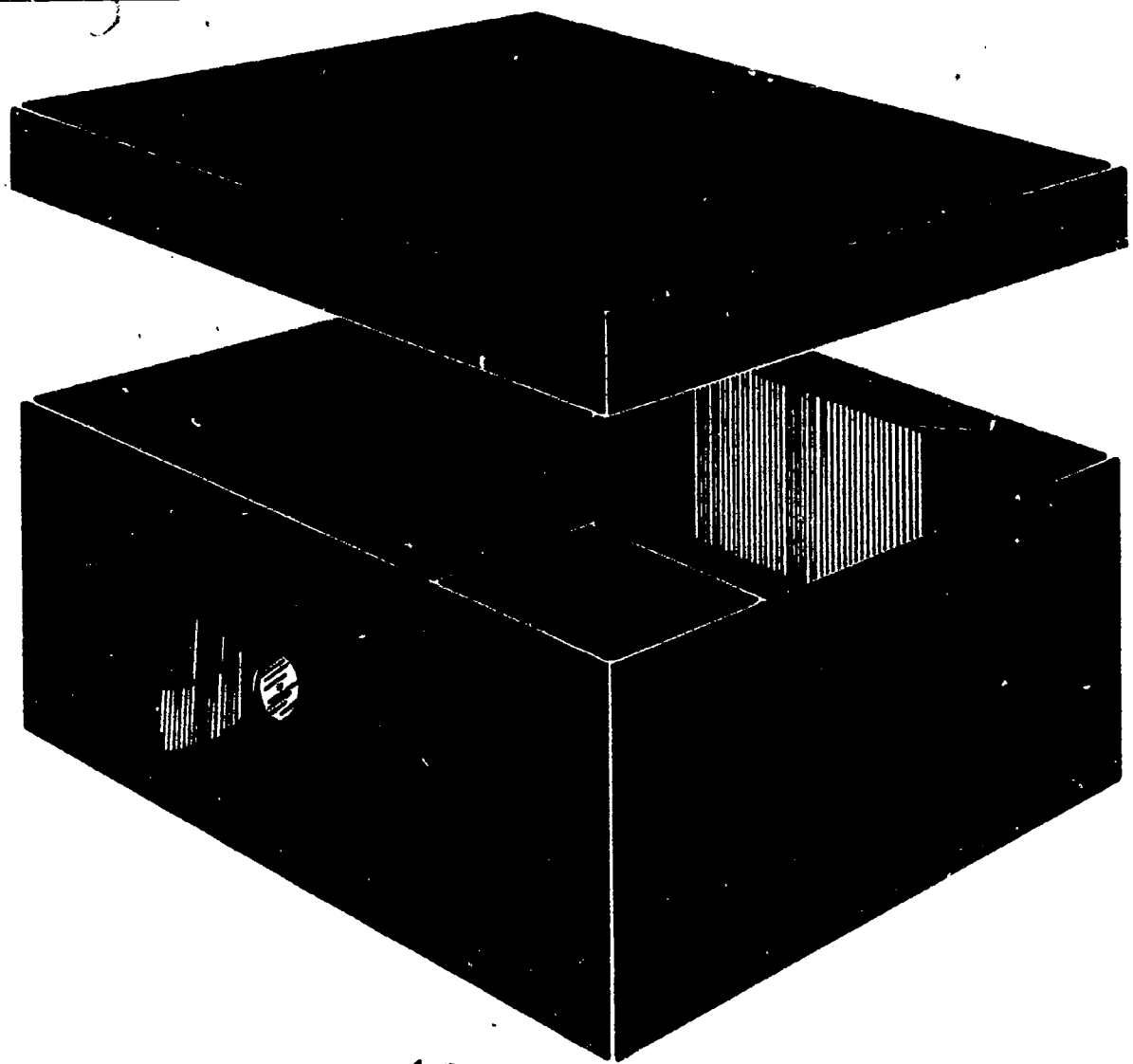
Opposite the hole fasten an H-shaped piece of masking tape, sticky side out, which will hold the film.

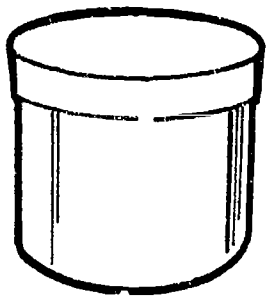
Place a piece of black friction tape over your pin-hole until you are ready to take a picture.

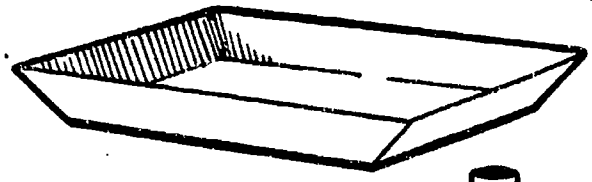
Load a piece of film (emulsion side toward the pin-hole) IN A COMPLETELY DARKENED ROOM SUCH AS A CLOSET. Tape the film to the inside back of the camera.

When you decide on a subject set your camera down and aim it, and then remove the friction tape. Leave the camera undisturbed for several minutes. You may have to experiment, varying the time from five to thirty minutes.

You can now take pictures galore!







2. DEVELOPING BLACK AND WHITE FILM

Materials

a. Completely dark room

b. "Daylight" developing tank

c. Spring-type clothes pins

d. Plastic funnel

e. Sink or pan full of water

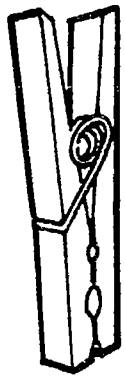
f. Developing tray

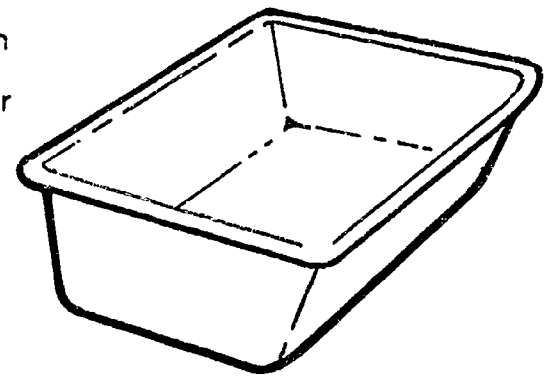
g. The following chemicals (available at a photo store)

(1) Film developer

(2) Stop bath

(3) Acid fixer





Procedure

a. Load film into developing tank in complete darkness.

b. Replace lid and turn on light.

c. Place tank into one shallow tray and pour film developer into hole in lid until the chemical begins to overflow.

d. Start timing process according to instructions on can of developer and turn reel once every ½ minute.

e. After proper time for development, tilt unopened tank and pour developer back into its jar.

f. Pour stop bath chemical into unopened tank, turning reel once or twice.

g. Pour stop bath back into its jar.

h. Pour acid fixer into unopened tank, turning reel every ½ minute for five minutes.

i. Put tank under a cold water faucet for ½ hour.

k. After the film is washed, turn off water and add a few drops of "Photo-flo"

l. Hang film up to dry using clothes pins. Put one on the end to keep film straight.

You now have **negatives** ready to be printed.

---

3. MAKING BLACK AND WHITE CONTACT PRINTS

Materials

a. Four trays

b. Clear glass 100 watt white bulb

c. Red bulb (optional) for light

d. Photographic contact print paper

e Printing chemicals

(1) Paper developer

(2) Stop bath

(3) Acid fixer

(2) and (3) are the same chemicals used in activity 2.

Procedure

a. Fill trays, each with one of the three chemicals.

b. Select a negative and remove one piece of photographic paper. (Do **not** expose photographic paper to light.)

c. Place between a piece of cardboard and clear plastic in this order: cardboard, paper (shiny side up), negative (shiny side up), clear plastic. Clip tightly together with a clothes pin.

d. Expose this to the white light, at 5 to 10 feet, for **5 to 20 seconds**.

e. Quickly pull out the **paper** and place **face down** in print developer.

f. When the image is completely developed, the edges of the paper will be black. When this happens, quickly transfer paper (face down) to stop bath for 20 seconds.

g. Place in fixer for ten minutes.

h. Take fourth tray and place under running water. Put print in for at least one hour.

i. Place print between paper towels and hang up to dry.

You now have
a printed photograph.

The photograph becomes a permanent record of whether there was too much or too little light, the interplay of shadow and light, composition and focus. A good photograph often involves a great deal of looking around. We may wait for the sun to be just the right height or a cloud to pass, or for a day when we can best capture the mood of fog, snow, rain or sleet. We look for patterns and wonder how we can capture them. We think about composition and what we are trying to do. We try early morning and late afternoon light, and are willing to investigate an area in more and somewhat different detail than we are normally accustomed. Photography seems to involve a lot of standing around and looking.

Perhaps if we call this "creative daydreaming" we can see that this process — the decisions involved in making a picture — is truly educational.

To tell a story about the way a wildlife refuge works, to explore the interrelationships of plants and animals, to capture and communicate your feelings about the refuge or a subject on that refuge can be as involving, challenging and as much fun as any other kind of study of the interrelationships of the refuge and its wildlife. It is a search and exploration of the way things are.

The involvement and results can lead to new understandings and provide us with another way of looking at and thinking about refuges. It may also help us better understand the manner in which we are related and clarify the way we want to be related to the environment.

---

something about the life of the animal. Explore several ways of arranging the photos and telling the story.

C. Looking at Natural Communities

Communities usually consist of several different kinds of living things which influence each other in various ways. For instance, in a marsh community muskrats and cattails influence each other, as do shrubs and trees in a forest community.

How do communities differ? What changes are discovered when comparing a marsh community and an upland forest community? The student can record some of these differences and changes using photography. Use photos to record evidence of community characteristics such as:

1. **Amount of moisture**
2. **Amount of light**
3. **Density of plant cover**
4. **Plant species**
5. **Animal species**
6. **Plant/animal interactions**

To record changes within and between communities, the following techniques could be used:

1. **Photograph at different levels**
2. **Photograph at points along a line**
3. **Photograph at various directions around a particular point**

D. Studying Careers

The management of natural resources involves several careers. The student interested in exploring these careers will find photography a useful tool. Have the student select a career and then contact a person who could provide on-site guidance.

It is important that the student is prepared to communicate effectively. Questions and other interview considerations should be planned before the visit. See **Careers**, Outdoor Classroom Guide No. 13, for details on planning a career interview.

Working conditions and task responsibilities are two important career characteristics which can be photographed. Perhaps it would be possible for the student to spend some time on-the-job as an assistant. Interview information along with actual on-the-job photos will provide a fun and meaningful introduction to any career.

Some Ideas for Long-Term Projects

These projects require several visits to the same area over a period of weeks or months;students should therefore select study sites near their homes or school.

All things change over time--the life of a particular animal, a community, a job and hopefully, our understanding of the environment. Each of the shorter term projects could be improved by extending them over several visits.

Select one of the short-term activities but plan several visits over a period of weeks. It will be helpful to extend the project over two seasons, or at least from the beginning to the latter part of one season. Make use of photography to help record long-term changes. Some of the following questions may help the student get started:

How does a particular place change from season to season?

How does the life of a particular animal change from season to season?

Which characteristics of a community change from season to season or over a much longer period of time?

How do working conditions and job responsibilities change from season to season? Do these changes affect your ideas about the job as a possible career?

Special photographic techniques and equipment may be used for long-term projects. Although these projects require some training and more advanced equipment, a few students may find them more appropriate for their interests and experience. A few ideas are :

1. **Using special close-up and telephoto lenses to record the micro-habitat, structure and behavior of certain plants and animals.**
2. **Using remote releases and photoflash equipment to photograph wildlife at night.**
3. **Using a blind to photograph the behavior of animals.**

The local camera shop can provide useful references such as booklets produced by the Eastman Kodak Company.

Follow-up Activities

A. Sharing the Results with Others

After completing one or more of the activities, students should be encouraged to share their projects with

others. Perhaps other classes would like to learn about nature photography and some of the things the students have discovered.

If prints were made, a collage or exhibit of photos with captions can be arranged to effectively relate an experience or story.

A presentation using 35mm slides is another way to communicate with small or large groups. Each picture should make a point, draw attention or make a conclusion; arrange them so they tell the story smoothly.

Some of the following questions may help students select an activity and also organize their thoughts for preparing a presentation.

1. Which kinds of photographs would you rather take? Rank them from most liked to least liked, and why?

a. People

b. Wildlife

c. Man-made objects

d. Landscapes

e. Cities

2. Do you prefer to shoot black and white or color pictures, and why?

3. Do your photos give you the same feelings and impressions as when you were right there, taking the picture? Tell how you felt when you took that photograph. Tell how you felt when you saw the same photograph.

4. Fill in the open-ended sentences of your choice:

I think man takes photographs to...

I think photographs are better than words because...

I think photographs are as good as paintings because...

I cannot take good pictures because...

I do not think photography is much fun because...

5. In what ways would your life be different without photography?

B. Picture Taking in Your Neighborhood

From the skills and techniques learned through nature photography, students could develop a project about their neighborhood, school or community. Here are some ideas;

1. The way man uses his habitat

- Shelter

- Recreation

- Travel lanes

- Escape routes

- The way he uses it differently from other animals

- His use of the environment

- His abuse of the environment.

2. A record of one day in the life of

- The student

- The teacher

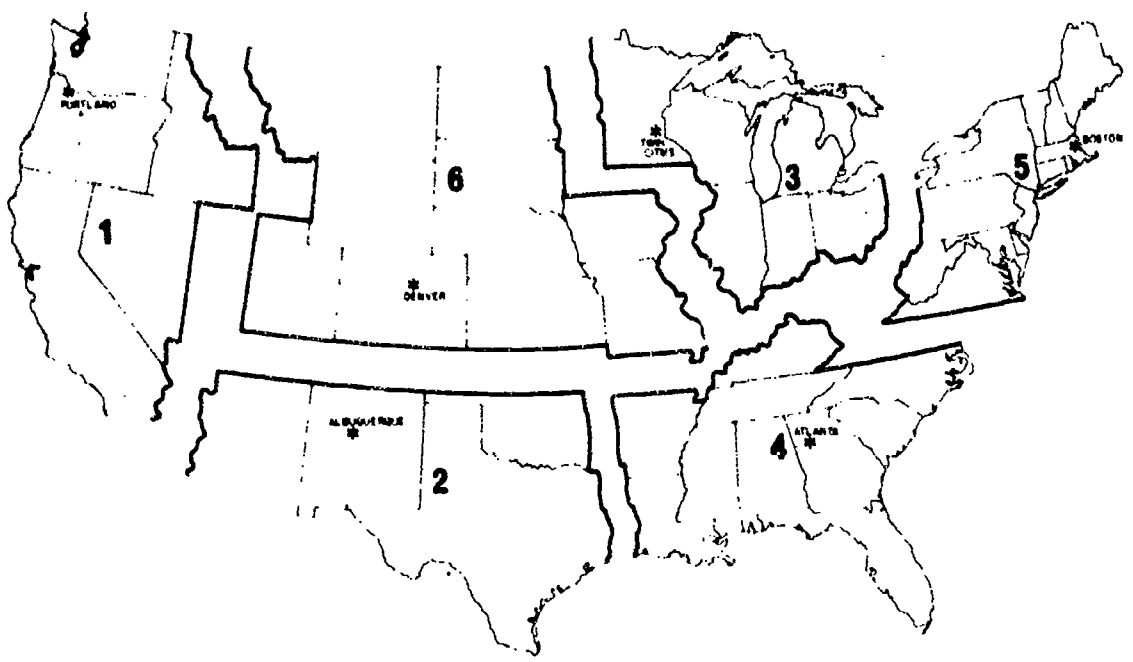
- A community resident

- The janitor

- The principal.

for information

Many Service land areas provide shelter, toilet facilities and limited equipment for your use. For trip reservations and further information, contact your local **U.S. Fish and Wildlife Service** office or the following regional Service offices:



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Region IV	17 Executive Pk. Dr. NE Atlanta, GA 30329
Region V	John W. McCormack Post Office and Courthouse Boston, MA 02109
Region VI	P.O. Box 25486 Denver Federal Center Denver, CO 80225
Alaska Area Office	813 D Street Anchorage, AK 99501

This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 13

Synopsis

CAREERS
Students plan, conduct and report results of an interview with a refuge employee. Information gathered includes job possibilities and career training in the natural resource management field.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

Refuges play an important role in fish and wildlife management. They combine proper land management techniques with the disciplines of modern science and technology to ensure wildlife populations for the future.

The range of occupations included in the refuge cluster of jobs is surpris-

Careers

A. **Purpose:** This activity will acquaint students with—
   1. Most of the resource career opportunities on refuge lands.
   2. Interview planning and development.
   3. People involved in resource careers.
   4. A general process for exploring career opportunities.

B. **Objectives:** During this activity students will—
   1. Plan and develop an interview questionnaire.
   2. Conduct an interview with an employee.
   3. Report the results of the interview.

C. **Activity requirements:**
   Bureau employee time for participating in the interviews.

General Job Descriptions

Although a refuge's main objective concerns fish and wildlife management, its operations can be thought of as a small business. Purchases, bills and program activities all must eventually result in a product that serves the general public. This product comes in the form of education, recreation and a diverse natural community.

Refuge positions reflect the many services it maintains and produces. There are positions for men and women; some require college education and others require skills acquired from working experience with machinery. All have one goal—the management and improvement of our natural resources.

Although a brief description of refuge careers is included here, it is necessary to visit a refuge and talk to the employees to really discover what they do and their attitude about a particular job.

A. **Refuge Manager**
A refuge manager plans and supervises a yearly work program on the refuge. These duties include maintenance and improvement of wildlife habitat, censusing and regulation of wildlife populations, determination of economic and public land use, public relations, financial decisions and enforcement of laws.

B. **Soil Conservationist**
A soil conservationist determines proper techniques for land management for the benefit of wildlife, prepares and supervises land management plans, and is sometimes responsible for supervising the work program and maintenance of physical facilities such as fences, buildings, roads, dikes, and protection of the area against fire and trespassing.

C. **Clerk**
The refuge clerk has responsibilities beyond the expected routine office

Data Sheet

Outdoor Classroom Guide Number 13

Careers

Names _____

_____

_____

Date _____

SIDE ONE

Site _____ Job Title _____

1. Career Description: _____

_____

_____

2. Related Fields: _____

_____

_____

3. Working Conditions: _____

_____

4. Abilities and Training: _____

_____

_____

5. Satisfactions: _____

_____

_____

6. Attitudes: _____

_____

_____

_____

_____

_____

ingly wide. Refuge employees serve as technical advisors and must be able to determine what action is necessary to protect, modify, manage and improve our country's land, water, vegetation and wildlife resources.

These refuge employees offer unique interview possibilities to the interested student. Gaining first-hand information about job descriptions, satisfactions and its place in station operations gives the student knowledge of job possibilities and increased understanding of the refuge's role in natural resource management.

matters. She or he must maintain correspondence, handle inquires for information from the public, and keep accurate bookkeeping records involving equipment inventories, purchases, and payroll. At times the clerk is the only official refuge person in the office and must handle visitors' inquiries as well as provide assistance to tours and student groups.

D. **Wildlife Biologist**
The wildlife biologist will form plans for organizing and carrying out field biology studies to make recommendations for new management programs and to determine effects of management practices on fish and wildlife populations. Other duties include assistance in control of disease, predation, and other activities as directed.

E. **Public Use Specialist**
The public use specialist plans and directs all refuge recreational activities, provides guidance and assistance for environmental education programs, and is actively involved in refuge public relations such as tours, speaking engagements and communications media (newspaper articles, radio and television programs). This position requires creative and original thinking, writing and speaking abilities, and often artistic talents.

F. **Maintenance**
A maintenance person must be able to perform a variety of trade and craft skills. The work is primarily outdoors accomplishing tasks related to fences, roads, building repairs, boat docks and recreational equipment. Welding, plumbing, masonry, carpentry, electrical and record keeping skills are needed for a well-rounded maintenance program.

G. **Engineering Equipment Operator**
The operator performs a variety of duties in operation of heavy equipment. The skills include operation and care for equipment such as bulldozers, draglines, road graders, backhoe, truck-mounted cranes, front-end loaders, etc. The work projects may call for road and dike construction and repair, excavating ditches and ponds, stockpiling materials, trench digging, timber clearing, island building and other similar work.

Federal Fish Hatcheries
Federal hatcheries are also Bureau property and students may find it interesting to explore this career field.

Fish Hatchery Manager
A hatchery manager plans and supervises the fish rearing and distribution programs in addition to the station maintenance program at the hatchery. Rearing fish species on a production scale requires the practical application of fishery biology and the ability to diagnose and treat most of the common diseases of fish. Other duties include making financial decisions and public relations.

Planning Your Interview

The work descriptions of refuge employees may help you decide who you want to interview. A visit can be made as a group or as an individual who then can report to his class.

Suggestions for a worthwhile visit:

1. Decide who you want to interview, and make an appointment by writing or calling the refuge. Explain why you would like an interview and ask for a definite time and day.
2. Be on time for your visit. Take notes and ask questions that interest you—this is your chance to get first-hand information.
3. If you plan to take pictures or use a tape recorder, ask for permission. Know how to use your equipment—let it be a useful tool and not a nuisance.
4. Summarize your impressions and relate them to your host. He or she will appreciate a sincere thank you.
5. As soon after your visit as possible, organize and collect your data so it can be useful in a report to your class or organization.

Suggested Questions
A successful career interview should cover the following six dimensions involved with any job. Often the employee will volunteer information, making it unnecessary to ask questions in each area. In any event, do not hesitate to ask what you want to know.

1. Career description:
   What kind of work is involved in your job?
   How long have you worked at this job?

2. Related fields:
   How does this job fit into the purpose and objectives of the refuge?
   How does this job relate to similar ones in other natural resource agencies?
3. Working conditions:
   Where do you work—indoors vs. outdoors?
   With what other employees do you work?
   What should a new employee expect for a starting salary, advancement possibilities and fringe benefits?
4. Abilities and training:
   What preparation, background and training is needed?
   What personal abilities are needed?
5. Satisfactions:
   What would you do during a typical day?
   What do you enjoy the most; the least?
6. Attitude:
   What advice do you have for a young person who is interested in this work?

after the investigation

Prepare a report for your organization or class.

Taking your information and data collection into consideration, notice that there are satisfactions as well as disagreeable duties which must be considered in refuge work as in all careers. How do they all add up to you?

If you want additional information, contact your school counselor for information sources such as the Government Printing Office bulletins, State Department of Natural Resources, Regional Offices of the U. S. Fish and Wildlife Service, Manpower Employment Services, University Extension Services and course instructions at vocational-technical schools.

For personal involvement, other Outdoor Classroom guides are available from the refuge manager.

Developed with the assistance of:

Donald Johansen, Coordinator Careers Project Co-sponsored by Minnesota Environmental Sciences Foundation, Inc. and Robbinsdale Area Schools, Inc. District #281

Jenny Publishing Co. Inc.
57 Queen Ave. So.
Minneapolis, Minnesota 55405

for information

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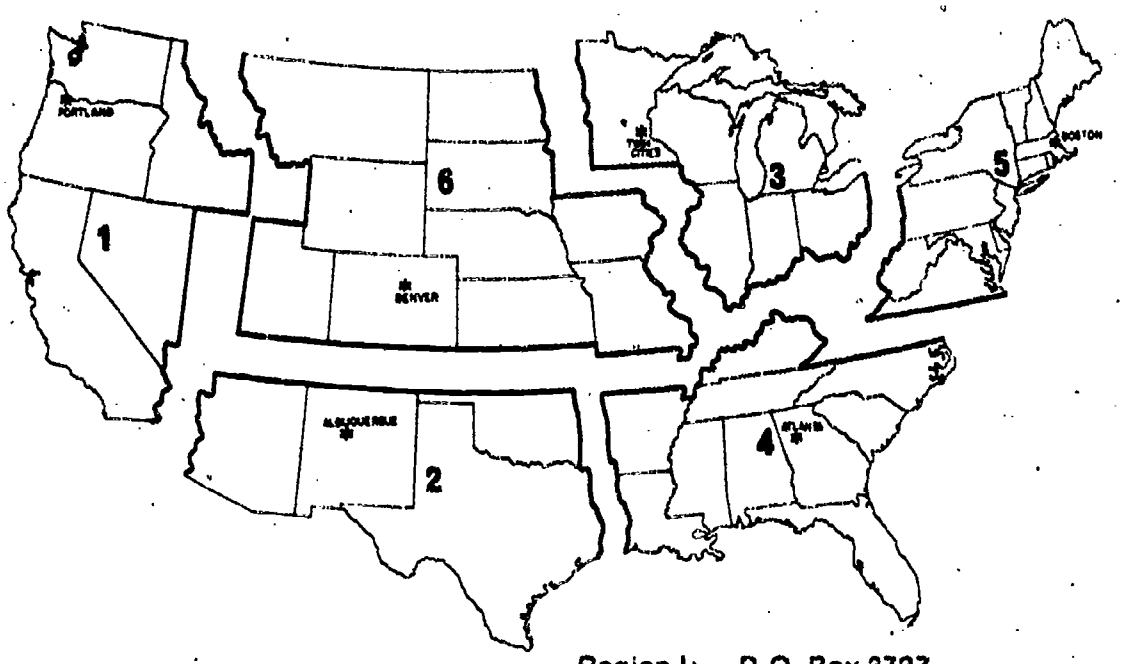

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Region VI P.O. Box 25486
Denver Federal Center
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Alaska Area Office
813 D Street
Anchorage, AK 99501

This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 14

Synopsis

FOREIGN LANGUAGE
Students use language related to objects in a natural environment to learn foreign word definitions and sentence structure.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

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Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

Why use a natural setting to teach foreign languages? The languages of most cultures are rich in words reflecting man's interest in describing nature. What better place to learn and use these words than in the natural setting.

In this setting students can find real examples of the words for vocabulary

foreign language

A. **Purpose:** This activity will acquaint students with—
   1. The natural setting as a useful place for foreign language study.
   2. The natural setting as a stimulus for using their knowledge in a foreign language.

B. **Objectives:** During this activity students will—
   1. Translate a list of words common to a natural setting.
   2. Use the translated list as a basis for labeling a map, writing poetry, or composing short descriptive sentences.

C. **Activity requirements:**
   1. Gridded area for mapping.
   2. Map of area showing trails, roads, etc.

In this activity guide, students will translate a list of words and then use them in individual activities. The suggested vocabulary list consists of words commonly associated with natural areas. This list should be changed to fit the conditions of your local area. After translating and learning the list, students will use it as a word pool for individual activities involving mapping, writing poetry and descriptive composition.

Materials

Students will need writing paper and pencils

Translating the Vocabulary List

The suggested vocabulary list on the Student Data Sheet is the basis for the individual activities described later This list was compiled by a group of foreign language teachers representing German, French, Spanish and Russian. It should not be considered rigid and you are encouraged to modify it according to your program needs and the unique characteristics of your locality. If you choose not to use the suggested words, perhaps you and your students could work together in constructing a new one.

It is strongly suggested that students translate and practice the list before beginning the individual activities. You may want to translate the words in the classroom before taking the trip. However, students will find it interesting to practice them once they are at the natural area by trying to find examples of the words.

Directions for Individual Activities

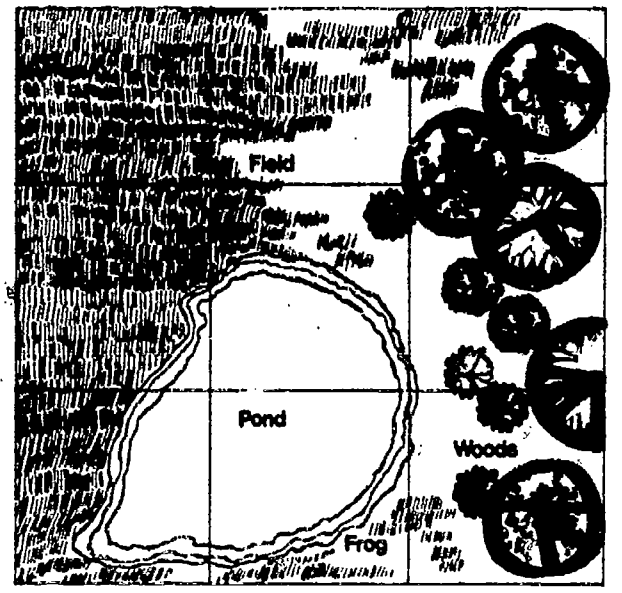
The following activities are designed to make use of the vocabulary list. They are suggested as ideas only and you and your students are encouraged to modify or substitute others for them.

Labeling a Map

An area of land has been selected and marked to form a grid pattern of the same proportion as the grid on the sample map and on the student data sheet (side 2). The "gridded" area of land contains a variety of habitats and surface features to make exploring and mapping an interesting experience. Students can translate land features to the data sheet and then use words from their list for labeling the features.

The land surface you use may not necessarily look like the sample map because of differences in local features.

Your local land manager will direct you to the location prepared for this activity.



Sample Map

Writing Poetry

Some students may wish to find a quiet place and express their feelings through poetry. To help them get started, use several examples of simple poems with outdoor themes such as ***The Poppy Field.*** Some could be highly structured such as Haiku poetry and others unstructured. Students could then be asked to write their own poem either focusing on the whole setting

Data Sheet

Outdoor Classroom Guide Number 14

Foreign Language

Names _____

_____

_____

Date _____

SIDE ONE

(e.g.) Translation

mushroom _____

moss _____

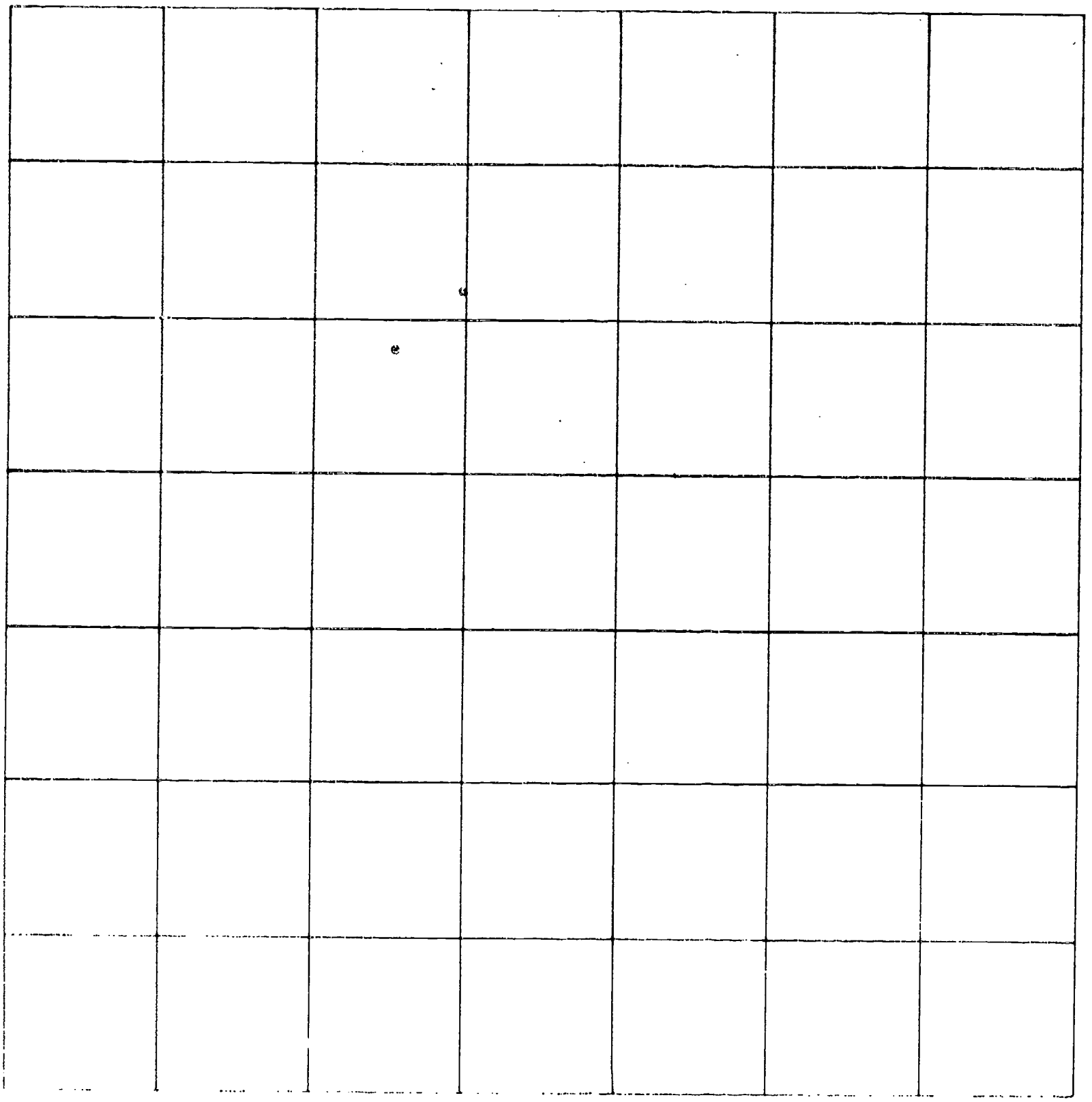
fox _____

Vocabulary List

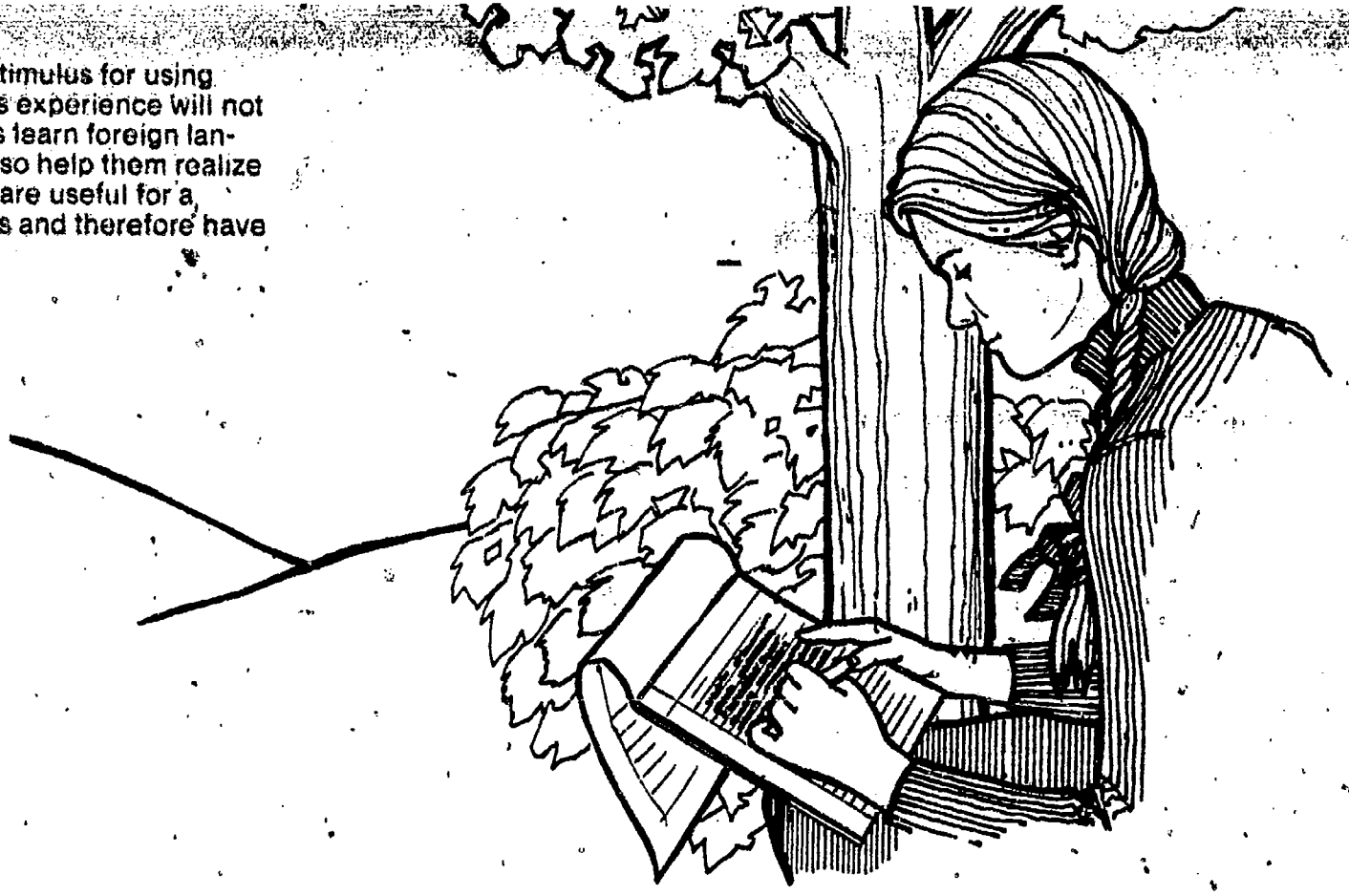
mushroom _____	wildflower _____	nest _____
moss _____	grass _____	weed _____
fox _____	raccoon _____	muskrat _____
beaver _____	squirrel _____	rabbit _____
skunk _____	deer _____	chipmunk _____
fish _____	spider _____	snake _____
bird _____	frog _____	grasshopper _____
brush _____	duck _____	willow _____
birch _____	bush _____	tree _____
log _____	fir _____	branch _____
cone _____	twig _____	seasons _____
marsh _____	water _____	stream _____
soil _____	pond _____	forest _____
sun _____	meadow _____	wind _____
fresh _____	sky _____	beautiful _____
spring _____	peaceful _____	clear _____
north _____	moist _____	rocky _____
south _____	summer _____	fall _____
east _____	west _____	

SIDE TWO

Grid for the Mapping Activity: (1" - 25')



building and the stimulus for using them. Perhaps this experience will not only help students learn foreign languages, but will also help them realize that natural areas are useful for a variety of activities and therefore have value to all of us.



around them or one central object or feature. They should attempt to use as many of the words on the list as they can.

Das Mohnfeld

Und auf der stillen Wiese stand
Rings Mohn bei Mohn und unbewegt
Und war bis an den femsten Rand
Der rote Teppich hingelegt.

The Poppy Field

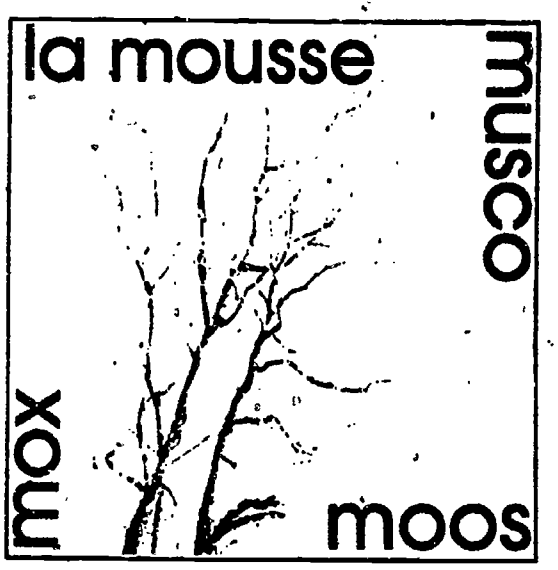
And in the quiet meadow stood
Motionless poppies all around,
That stretched away to meet the wood
And decked with carpet red the ground.

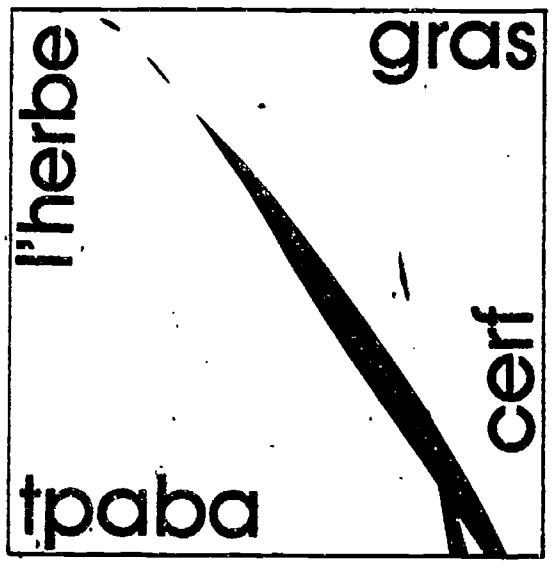
Poem and Translation from
German Poetry For Beginners
ed. A. Watson, Bain
St. Martin's Press 1967

Descriptive Composition

Some students may want to describe some features of the landscape or some things they find by composing short paragraphs or sentences. Some examples are given below. By working in small groups, students can quiz each other on the meanings of their compositions.

Les Champignons poussent près du marais.
(The mushrooms are growing near the swamp.)
Des chouettes se sont applelees tout la nuit.
(Owls called (hooted) all night long.)
Les troncos des arbres sont tordus par le vent.
(The tree trunks are twisted by the wind.)





after the investigation

Upon completion of the activity, a more detailed study of the results should be carried out in the classroom with particular emphasis on grammatical structure, as well as further development of the vocabulary. Classroom conversation in the language, based on what was seen in the natural area, may be practiced.

Prepare sentences and paragraphs for supplementary reading which is related to the class experience. This should help to reinforce both the sense of involvement and the word identities which were part of the activity.

Examples:

John got wet when he reached for the frog.

We were hidden in the bushes. The west wind had blown the clouds away.

Susie sat on the moss and fed her sandwich to the chipmunk.

Das Lied der Vogel

Wir Vögel haben's wahrlich gut,
Wir fliegen, hüpfen, springen;
Wir singen frisch und wohlgemut,
Dass Wald and Feld erklingen.

The Song of the Birds

We birds have really got it good,
We fly, we hop, we jump;
We sing fresh and cheerfully,
So that the woods and fields resound.

Hoffman von Fallersleben

Translated by:
Katharine Fournier, German Teacher
North High School
No. St. Paul, Minnesota

for information

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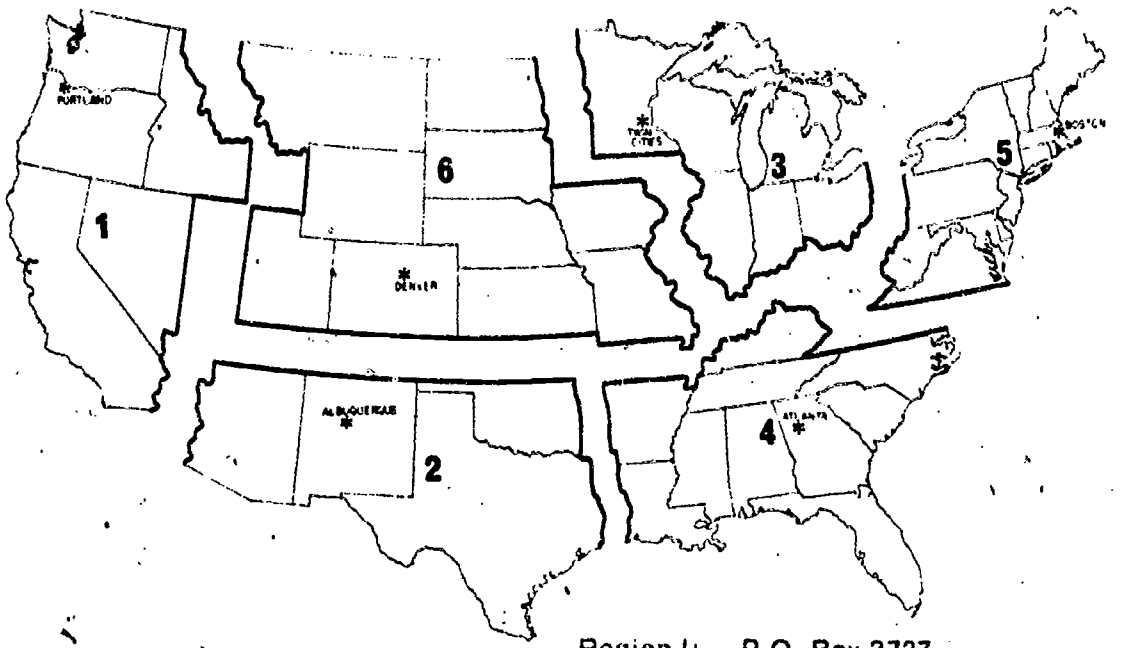

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Alaska Area Office
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This Outdoor Classroom guide is one of a series; others are available from your local or regional Service representative.

Developed with the assistance of:
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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 15

Synopsis

WATERFOWL NEST STRUCTURES
During this early spring activity, students investigate waterfowl nests to determine the number of young birds produced in several man-made nest structures. Using their data and information from other sources, population changes from one breeding season to the next are calculated.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

Population Studies
It is possible for a female meadow vole to produce three to four litters of young a year. The babies are on their own within four weeks; each of the five to nine males and females potentially may start their own family when they are only two months old. Although not all wildlife species are so

Waterfowl nest structures

A. **Purpose:** This activity will acquaint students with—
   1. The life cycle of waterfowl
   2. Some environmental factors which influence that life cycle
   3. Annual population change
   4. The use of nest structures in waterfowl management.

B. **Objectives:** During this activity students will—
   1. Estimate the total production of several nest structures
   2. Estimate how many of these birds will breed in the following spring by using data from other sources to determine survival to flight stage and survival to first breeding season
   3. List some environmental factors that influence population levels during specific stages of the life cycle.

C. **Activity requirements:**
   1. Active nest structures for waterfowl
   2. Map showing water/land boundaries and the locations of several nest structures
   3. Equipment needed for access to nest structures.

Introduction
The production of young is the link between generations and thus life is really a cycle that has been programmed to perpetuate itself. The health of this life cycle depends to a great extent on the health of the environment. Groups of similar organisms (populations) are constantly interacting with each other and their environment to meet their needs. To begin to understand these relationships between populations of organisms and the environment, it is important to start with a problem that is manageable.

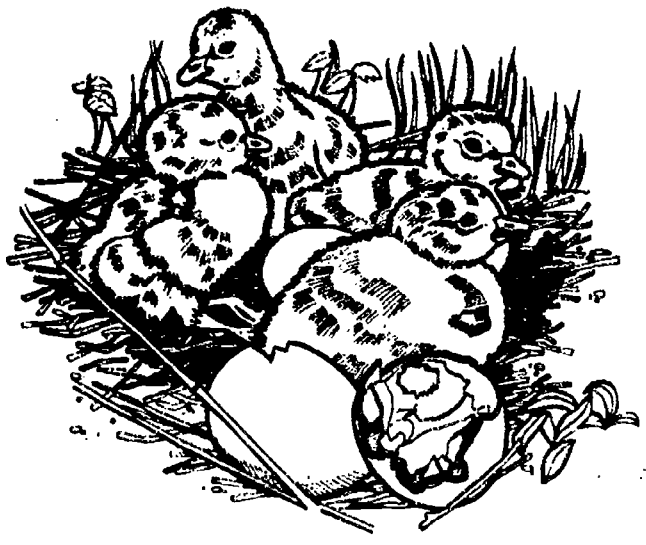
You will be investigating a very small population—ducklings or goslings produced from a single nest. However, your data, when combined with that of others, will not only help answer some important questions but should also be useful to the local waterfowl manager.

Pre-trip Planning
You will need to consider some of the following tasks while planning the activity.

I. Contact your local Service officer.
   A. Determine the best time in the spring to do this activity. Late spring is usually best since most nests will have hatched and thus incubation disturbance will be minimized.
   B. Get a map showing the land/water boundaries and the locations of several nest structures.
   C. Make arranagements for equipment, such as boats or ladders, needed to gain access to the nesting structures.

II. Read and discuss this activity guide.
   A. Make sure you understand the questions on the Student Data Sheet.
   B. Practice the techniques that you will be using in the field.
   C. Form small teams (2-4 students) and choose the nest structure that each will investigate.

A New Generation Begins
Breeding pairs arrive on the nesting grounds in early spring. After courting and selecting a nest site, the hen begins egg-laying. Typically, an egg is laid each day until a clutch of 10-15 eggs is produced. Then the hen begins to incubate the eggs, keeping the temperature near 100° F for about 26 days.
Since the hen does not start incubating until all of the eggs have been laid, they will hatch at about the same time. The young usually stay in the nest for several hours after hatching. During this time they dry off and become imprinted to the hen. Now the hen must get her brood to water for food and protection. This task may be quite easy or very difficult, depending on the location of the nest. Within 10 weeks the brood will grow, develop and accomplish flight.



Data Sheet

Waterfowl Nest Structures

SIDE ONE

• Part A

1. Team Number _____
2. Names _____
3. Place _____
4. Date _____

• Part B—Nest Structure Description

1. Type and number of structure _____
2. _____ Yes _____ No—Used this spring by waterfowl
   If yes, probable species _____
3. General condition of structure _____
4. Misc. _____

• Part C—Production of Young

1. Check one of the following:
   a. _____ Eggs have hatched.
   b. _____ Eggs are being incubated.
   c. _____ Eggs are still being produced or have been abandoned.
2. Total number of eggs _____
3. Estimated number of young that left the nest _____
4. Misc. (unhatched eggs, dead ducklings, etc.) _____
5. Total production _____ (total number of young that left all of the nests being studied).

SIDE TWO

First Spring | **Summer** | **Fall/Winter** | **Second Spring**

(Question 1)
____ breeding pairs

Approximately 52% of the ____ adult breeding pairs will die before the second spring, leaving ⟶

(Question 2)
Approximately
____ breeding pairs

(Question 3)
produce an average of
____ young

(Question 4)
Approximately 50% of the ____ young will die before reaching flight stage, leaving ____ young

Approximately 67% of the ____ young will die before spring, leaving a potential of ⟶

(Question 5)
Approximately
____ breeding pairs

(Question 6)
Total = ____ breeding pairs

Part D

List some environmental factors which influence survival for each numbered part in the life equation (an example is given for each).

(1) Number of nest sites	(2 & 5) Disease	(3) Weather Conditions	(4) Predations

• Part E

1. **How do your results compare with those from the Massachusetts study?**

2. **If they differ, what are some possible reasons for the differences?**

3. **Based on this investigation, predict if the population is increasing, decreasing or staying about the same? What are the limitations of your study in being able to make the prediction above?**

4. **To maintain a population at the same level from year to year, what must be true about: the number of breeding pairs? the number of young produced? the environmental factors influencing survival?**

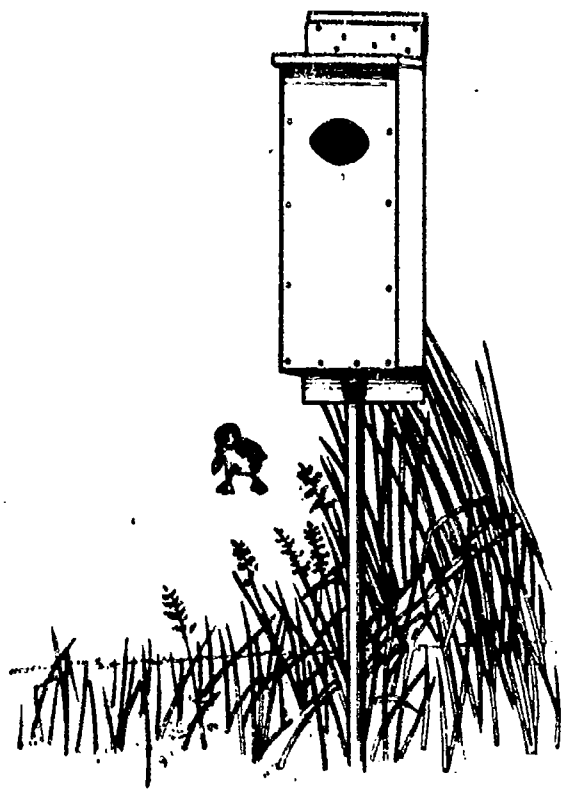
productive, each does produce enough young to maintain a healthy and stable population.

Winter places heavy stress on individual animals due to weather, competition for food, and lack of sheltering cover. However, the surplus of young that are born each spring and summer make up for losses from winter hardships, illness, weakness, broken bones and all other possible misfortunes.

Every area of land can support only a certain number of each kind of animal—this is called its carrying capacity. For nearly every species, a surplus of individuals results in a deterioration of living conditions that affects the well-being of the whole population. Nature usually ensures that each population of animals has the capability to overproduce. The factors limiting actual numbers are determined by the land's carrying capacity.

Besides influencing the survival of surplus animals, carrying capacity affects production. Each species has an established social structure. Territorial competition in the spring for nesting sites and feeding territories limits the number of adults producing young. Man affects this production by changing the habitat; making more or fewer nesting sites or feeding territories available.

Through the discovery of population factors, including stress and the number of individuals within a population, a student can better understand his own environment and the "balance of nature." This balance includes man as well as the meadow vole. This discovery leads to questions of man's surplus population, our own stress factors and the carrying capacity of the land for man and his activities.



Not all of the young that hatch this spring will survive to flight stage. And of the young that survive to flight stage and migrate in late fall, only a fraction of them will survive to breed in the following spring. Those that survive and breed are the vital link from one generation to the next—they start the next life cycle. Productivity and survival are two very important factors to investigate. Waterfowl biologists are concerned with these factors and the ways the environment affects them. Here are three key questions and some corresponding factors that will be considered in this activity:

1. How many ducklings or goslings hatched successfully?
   —Production.
2. Of those that hatch, how many survive to reach the flight stage?
   —Loss between hatching and flight.
3. How many survive to the first breeding season?
   —Loss in first fall and winter.

You and your friends can begin to help answer these questions by collecting some data on your nest structures and by using some additional information which has been collected by waterfowl biologists.

Collecting Your Data

- Refer to Parts A and B on the Student Data Sheet.

This information is important because it describes what happened for each nest structure and can be referred to in future years. Use the illustrations in this activity guide for B-1 and ask for help if you need it. (If your nest structure has not been used this spring, go to another one or join another team).

- Refer to Part C—Production of Young.

egg membrane

If your nest structure has been used by a hen this spring, you will probably find one of these three possibilities:

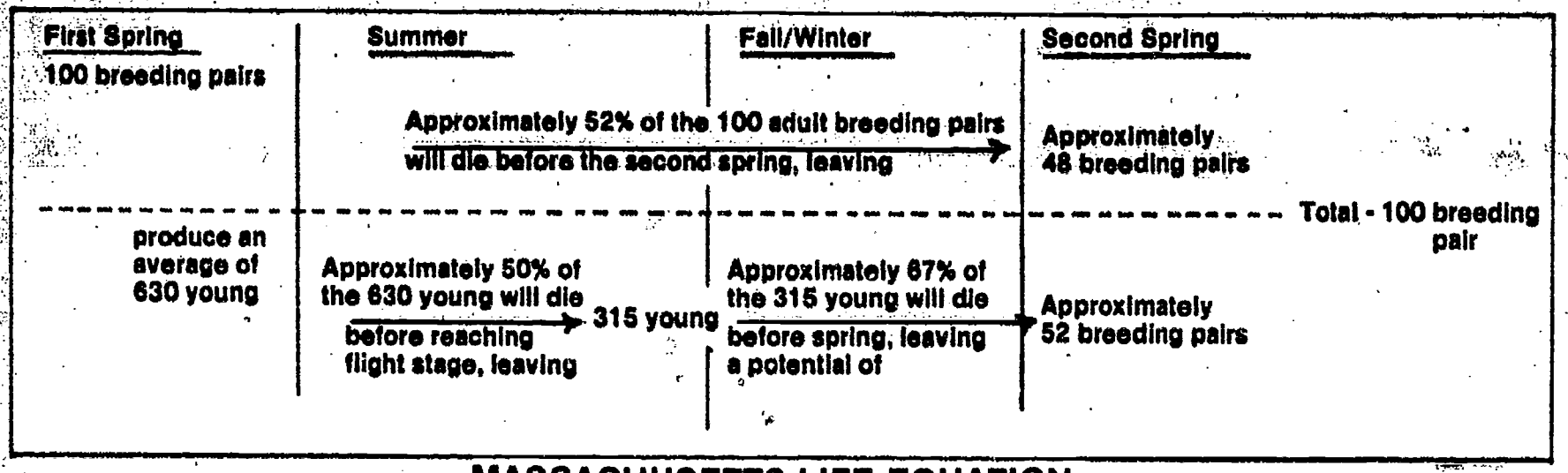
1. The eggs have hatched.
2. The eggs are still being incubated (should be warm to the touch).
3. The eggs are still being produced by the hen (a late nest or a second attempt) or the eggs have been abandoned (this is difficult to determine from only one observation).

If the eggs have hatched, you can estimate the number of ducklings or goslings produced by counting the intact egg membranes (see the illustration).

If the eggs are still being incubated, assume that about 85% of them will successfully hatch and record that estimate. ***(Your local Service officer may have a more accurate hatching percentage for your locality.)***

After you finish question 4, get together with the other teams and determine the total productivity for all the nest structures investigated.

This leads to the other two questions mentioned earlier: (1) Of those that hatch, how many survive to reach the flight stage? and (2) How many survive to the first breeding season? To answer these questions we have to make use of some information collected by other investigators. Based on a long-term study of wood ducks in Massachusetts, two waterfowl biologists proposed a "Life Equation" giving expected production and losses from one spring to the next. Read this life equation carefully and ask for help if you don't understand it.



MASSACHUSETTS LIFE EQUATION

Before you continue, answer these questions:

1. Of the 100 breeding pairs in the FIRST SPRING, how many survived to the NEXT SPRING? ____
2. Of the total number of ducklings produced in the FIRST SPRING, how many breeding pairs could they form in the NEXT SPRING? _____
3. Do the number of breeding pairs increase, decrease, or stay about the same from one spring to the next? _____

(Answers: (1) about 48 pairs; (2) about 52 pairs; (3) stay about the same.)

- Refer to Part D on the Data Sheet.

If local information is not available, use the mortality percentages from the Massachusetts Life Equation as a guide for answering the questions.

You and your friends have already determined total production (question 3). Question 1 of Part D can be completed by simply recording one breeding pair for each successful nest in your study. Now answer questions 2, 4, 5 and 6.

- Refer to Part E on the Data Sheet.

Draw conclusions from the data you have collected. Use the questions as a guide.

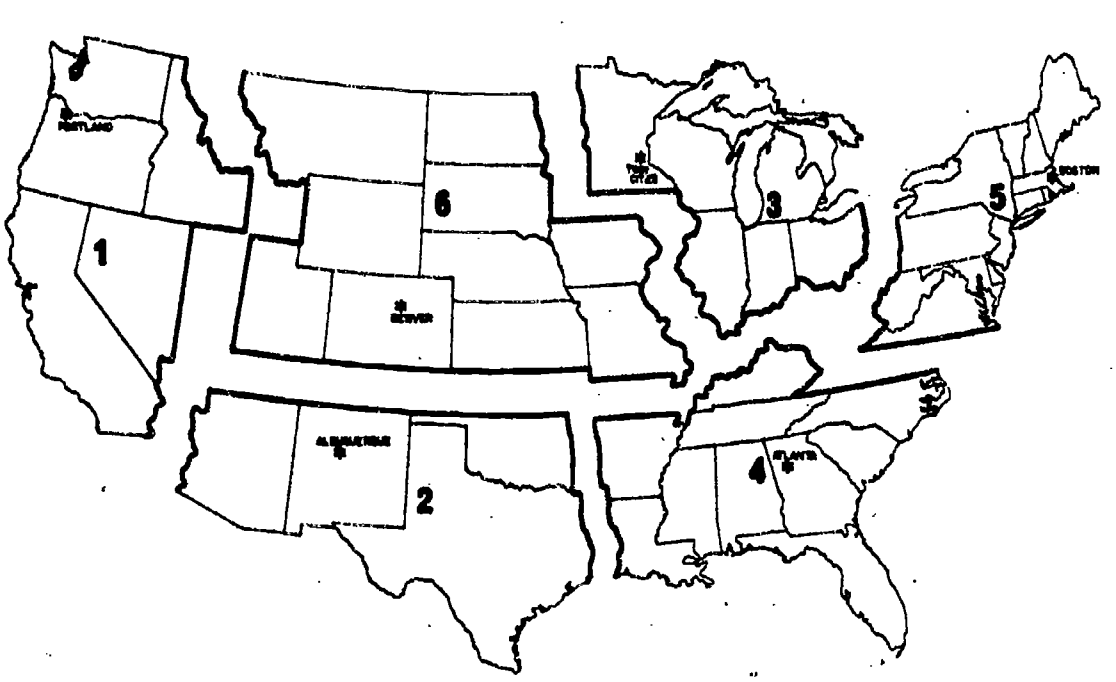
after the investigation

Could you construct a "Life Equation" for humans? (Ask your local life-insurance agent for help.)

Would the human life equation differ from the wood duck life equation? How? Compare the environmental influences affecting Man with those affecting other organisms.

How could you improve your local environment for waterfowl? For other wildlife species?

Here is a suggestion: Erect some nest structures in a suitable place and [illegible]r their use. Ask for information [illegible]our local service officer.



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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 16

Synopsis

FIRE ECOLOGY
Direct experience with fire and its effect on natural environments enables students to determine how fire can be used as a management tool.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

Prairie fires were feared by almost every pioneer. Each autumn and spring, fires set by lightning and man would leave a path of ash, grass stubs, and scattered livestock.

For years many agencies and individuals felt that fire had only disastrous effects on the land and especially on wildlife populations. With increased

fire ecology

A. **Purpose:** This activity will acquaint students with—

1. Some safe procedures for starting and controlling fire.
2. Factors which influence fire such as:
   a. amount of fuel
   b. type of fuel
   c. moisture content
   d. relative humidity
   e. wind
   f. other climatic conditions.
3. Some effects of fire on vegetation.
4. The use of fire as a management tool.

B. **Objectives:** During this activity students will—

1. Discuss how to control a prescribed fire.
2. Discuss some characteristics of fire spread and temperature in different locations: open marsh, grassland, hardwood forest, coniferous forest and mixed forest condition.
3. Investigate the effects of fire on diversity and growth patterns of vegetation by comparing a burn plot and a control plot.

C. **Activity Requirements:**

1. Study plots: burn plots with known fire histories and control plots.
2. Materials for mapping the study plots: maps of the area to be studied and aerial photographs if available.

Introduction

Many factors affect the vegetation and associated animals that inhabit a given area. Plants provide the required energy source for animals to survive. The type of plant cover found in a given location is directly related to the soils, climatic conditions, and natural and man-influenced forces that affect change.

One of the most powerful natural or man-caused effects on vegetation patterns is that of fire. It has been estimated that at one time, prairies occupied more than a billion acres of the North American continent. Extensive grasslands and prairie habitats provided desirable conditions for millions of buffalo, antelope and other grazing animals. Fires were an important determinant in the maintenance of prairie habitat.

Many forested areas are also affected by fire, although significant and observable changes may not be visible for hundreds of years. Ecologists tell us that the redwoods of California would not be as abundant today had it not been for fire.

Likewise, fires that burn over wetland areas influence plant communities and animal associations. Control of willow growth in wetland areas is essential if certain species of waterfowl are desired. A technique utilized on many refuges is burning marsh areas to control extensive willow growth.

Uncontrolled fire can be very dangerous to human life and property. However, under controlled and thoroughly managed conditions, fire is a valuable tool for the land manager.

Planning the Activity

When planning this activity, contact the refuge manager for information and assistance. Be certain to ask about the availability of suitable study plots for discussing a burn and for fire effect comparisons.

Students should work in teams of three to five. Each team should be thoroughly familiar with the objectives and data collection techniques in this activity.

Activity Procedure

This lesson is designed to allow the student to investigate and learn about the use of fire as a management tool. In the first part of the activity a few basic concepts relative to fire behavior will be examined. Due to the safety hazards of involving students in conducting a burn, the major factors of starting and controlling a fire will be discussed. After discussing and observing a burned area, students will investigate the effects of fire on vegetation by comparing a burned area with a control area. Vegetative sampling can be conducted in the summer and winter if the ground has less than 6 inches of snow cover.

Discussion of a Controlled Burn

Three key ingredients are necessary in order to have a fire. They are *heat, air* and *fuel.* By controlling the supply of one or more of these three elements, a fire can be controlled. Air is probably the most abundant ingredient, with fuel being next, and a source of heat being last.

Data Sheet

Outdoor Classroom Guide Number 16

Fire Ecology

Names _____

_____

Date _____

Place _____

SIDE ONE

Mapping the Plots

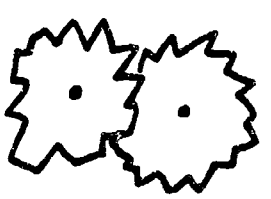
A. Control plot (unburned)

1. Location: _____
2. Dimensions: _____
3. Land-use history: _____

   _____
4. Average depth of litter: _____
5. Evidence of wildlife use: _____
6. Sketch the plot—use vegetation symbols and show mapping lanes:

grasses

nonwoody herbaceous plants



woody shrubs and trees

SIDE TWO

B. Burn plot

1. Location: _____
2. Dimensions: _____
3. Land-use history: _____

_____

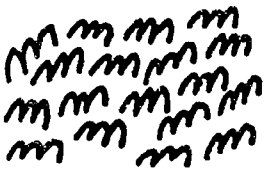
Average depth of litter: _____

5. Evidence of wildlife use: _____

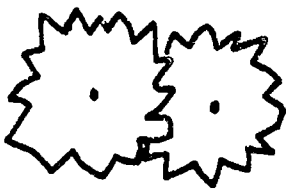
_____

6. Sketch the plot—use vegetation symbols and show mapping lanes:

grasses



nonwoody herbaceous plants



woody shrubs and trees

research in fire behavior, control techniques, and general ecological studies being published, it is now recognized that fire is a valuable management tool.

One main advantage of fire over other management tools, such as mechanical removal or spraying of undesirable vegetation, is that fire is natural and does not have unexpected secondary effects on the environment. It is also less expensive.

By studying fire as a land management tool, students learn that fire can maintain a healthy stand of native grass, modify species composition, control undesirable species and maintain early successional stages of vegetation that increase the land's wildlife values.

Some ecologists are suggesting that fires in certain "wilderness" areas should be allowed to burn uncontrolled. Others say that fire should always be controlled and not used as a management tool. Before final conclusions are reached, it will be necessary to gather additional facts and experience.

It is much easier to start a fire with dry grass than with small twigs--with a hotter kindling temperature, a fire can be started with greater ease The drier the plant material to be burned, the easier it is to get a fire started. In some regions of our country, fires occur more frequently in spring and fall, and in other regions in the summer months when air temperature is high and humidity and fuel moisture is low.

Ask the manager to explain the controlled burning program on the refuge. Discuss their management objectives and how the effects of fire are assessed. Some important factors are listed below. It will be helpful to refer to the following during the discussion.

1. relative humidity
2. wind velocity
3. weather conditions
4. ground temperature during the fire—surface and sub-surface
5. air temperature
6. relative fuel moisture
7. fuel type and amount (e.g. grass, cattails, small twigs, forest understory, etc.)
8. description of fire, rate of burning, etc.
9. effect on wildlife

Encourage students to discuss their questions and ideas. Following are some common questions:

1. Could a fast-moving fire have about the same effect on an area as a slow-moving, cool fire? Why?
2. After a fire has burned an area, describe some possible effects on insects and other animal life. Would burrowing animals be harmed?
3. Could you tell by looking at the burned area whether the vegetative material is dead?
4. Describe what you think an area would look like one month from the day of the fire.

Comparing Burned and Unburned Plots

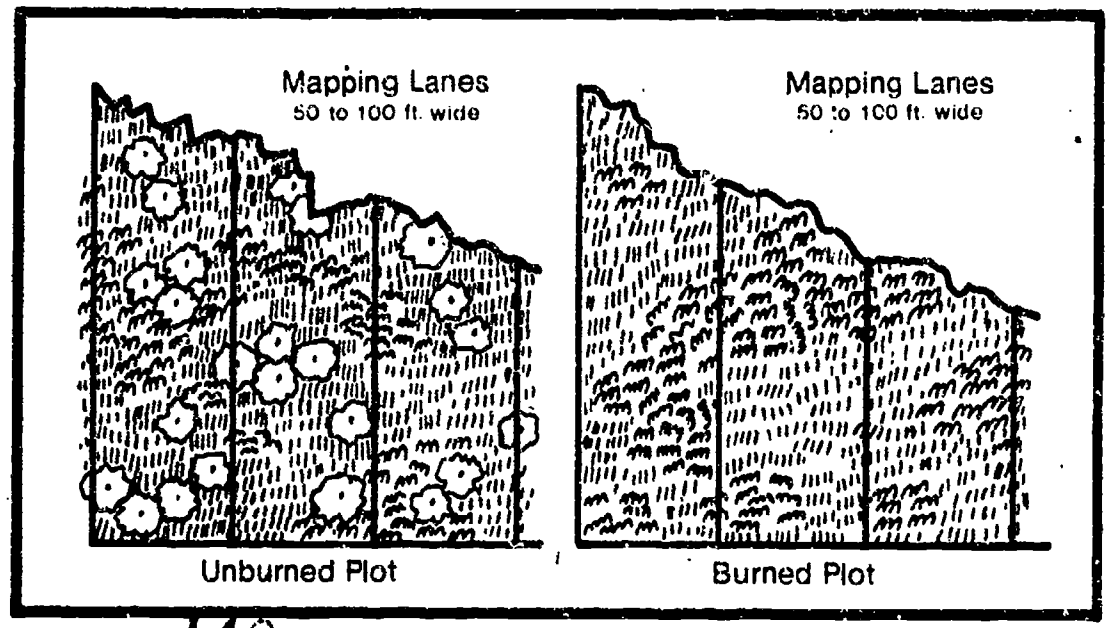
If there are burn plots with known burn histories available, some comparisons can be made with unburned areas (control plots). Using a mapping technique, students can contrast vegetation diversity and patterns, amount of litter and wildlife use found in each area. If regularly burned plots are available, a record of the long-term effects of fire on plant succession can be mapped.

The study plots should be divided into mapping lanes 50-100 feet wide. Each team should record the diversity of vegetation types and growth patterns by using symbols similar to those illustrated on the Student Data Sheet The average litter depth for each lane should also be recorded by taking several measurements. Use the Data Sheet for recording this information.

Using the Data

Once each lane has been mapped, a composite map should be assembled for the entire plot. The composite maps showing the vegetation diversity and growth pattern records for the plots will be useful for future comparisons. Copies should be given to the refuge manager.

Based on the maps of the two plots, contrast any differences in plant species composition, density and growth patterns. Contrast wildlife use of the two areas. Are there differences in the availability of wildlife food and cover?



after the investigation

Annually or at other time intervals, remap the vegetation and describe wildlife associations by the same method.

If possible over a long period of time, adjacent plots may be burned at intervals of one, five or ten years to provide a series of artificial succession stages from which future classes might benefit. Perhaps students may be interested in assisting refuge personnel in establishing a series of study plots.

for information

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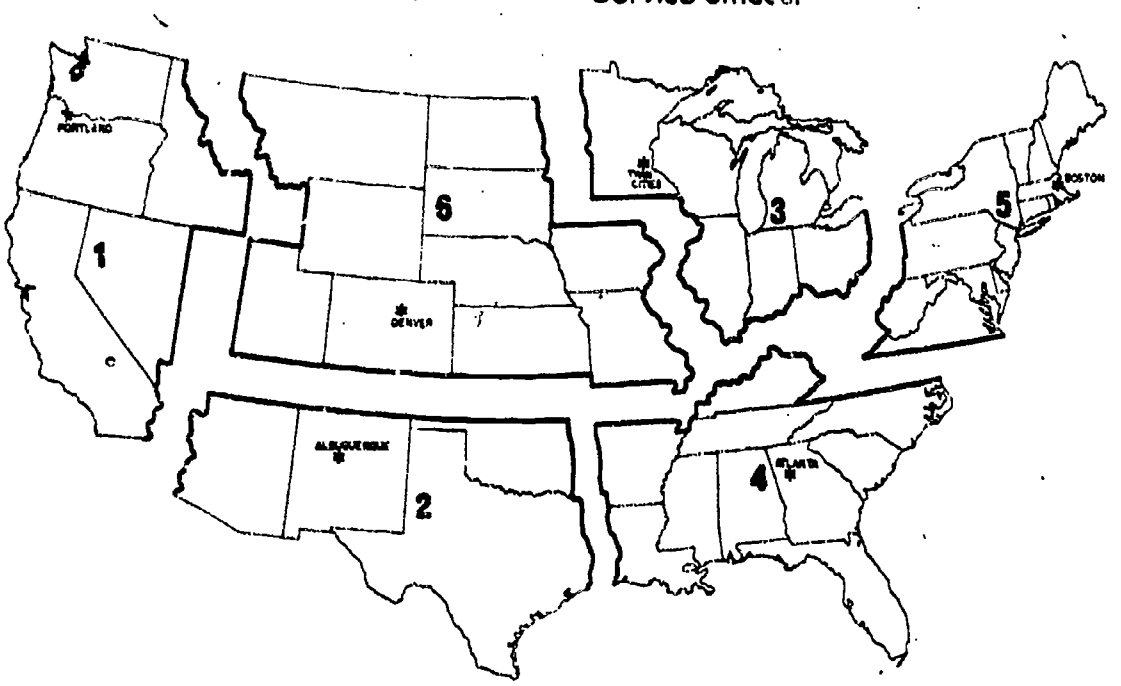

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 17

Synopsis

MUSKRATS
During this investigation students map a portion of marsh showing the locations of dense cattail stands, open areas and muskrat houses. Using these maps and additional data, some interesting marsh relationships are uncovered.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

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Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

It is possible for a female meadow vole to produce three to four litters of young a year. The babies are on their own within four weeks; each of the five to nine males and females potentially may start their own family when they are only two months old. Although not all wildlife species are so productive, each does produce enough young to maintain a healthy and stable

muskrats

A. **Purpose:** This activity will acquaint students with—

1. The life history of the muskrat.
2. Some environmental factors which influence muskrat productivity and survival.
3. Some influences muskrats have on the environment.
4. Some of the relationships between man's activities and muskrat survival.

B. **Objectives:** During this activity students will—

1. Map the locations of muskrat houses, cattail stands and open areas in a designated part of the marsh.
2. Make comparisons between:
   a. density of muskrat houses
   b. density of cattail stands
   c. amount of open area
3. Offer some explanations for the results of the comparisons.
4. Open a muskrat house to determine some food sources for the muskrat and to describe the composition and interior of the house.

C. **Activity requirements:**

1. An area of marsh marked to form a grid system for mapping.
2. The tools needed to open a muskrat house.

Introduction

It is winter in the marsh. The marsh wrens, swamp sparrows, redwinged blackbirds, ducks and geese have been gone for several weeks. Some of the prominent features of the winter marsh are dense cattails, open areas now frozen over and the large mound-like muskrat houses.

Conspicuous plants in most marshes are the cattails. Clouds of their tiny wind-borne seeds scatter everywhere as one trudges among them. Sometimes called flags; cattails propagate by underground stems or rhizomes. In fact if growth is not controlled, cattails may cover the entire marsh thereby eliminating all open water areas and hastening the change of the marsh to a grassy meadow community.

Among the cattails and open areas are large, frozen mounds. These hollow mounds or lodges are built by a common marsh inhabitant, the muskrat. This small, furry vegetarian is able to survive the winter months by fashioning underwater passageways under the ice from the lodge to collect food. Depending on geographic location, muskrats breed several times during the year, producing four to eight young per litter. Thus muskrats have a high potential for rapid population growth.

Cattails, open areas and muskrat houses form an interesting pattern. Some relationships of this pattern will be investigated by mapping these prominent features of the marsh.

Pre-trip Planning

Some planning is necessary before arriving at the study site.

1. Contact the refuge manager and make arrangements for this activity. He will be able to help you with the planning and possibly provide assistance and some equipment.
2. Make sure that the students understand the process of laying out the mapping lines, mapping the physical features and recording the data.
3. Since this is a winter-time activity requiring up to three hours, make sure students are clothed properly.

Establishing the Mapping Lanes

Choose an area of the marsh that contains dense cattail stands, open areas and several muskrat houses. Minimize the danger by selecting a shallow area with a safe ice cover. As you plan your study sites, refer to the illustration below.

Students should begin by placing markers at regular intervals along one side to form a base line. The distance between markers depends on the area that a small team can easily map, perhaps 50-foot or 100-foot intervals would be appropriate. While the students are laying out the base-line markers, each should practice pacing and determine his length of stride. For example, if it takes 20 paces for a 50 foot distance, the length of a stride is $\frac{50 \text{ feet}}{20 \text{ paces}} = 2.5$ feet.

Once the base line has been established, a corresponding row of markers must be placed out in the marsh. Students can establish this row by pacing a given distance into the marsh and tying markers to cattail clumps. Compasses would be handy here to keep the mapping lanes straight and uniform. These two rows of markers will establish mapping lanes for the area.

Data Sheet SIDE ONE

Outdoor Classroom Guide Number 17

Muskrats

Names _____

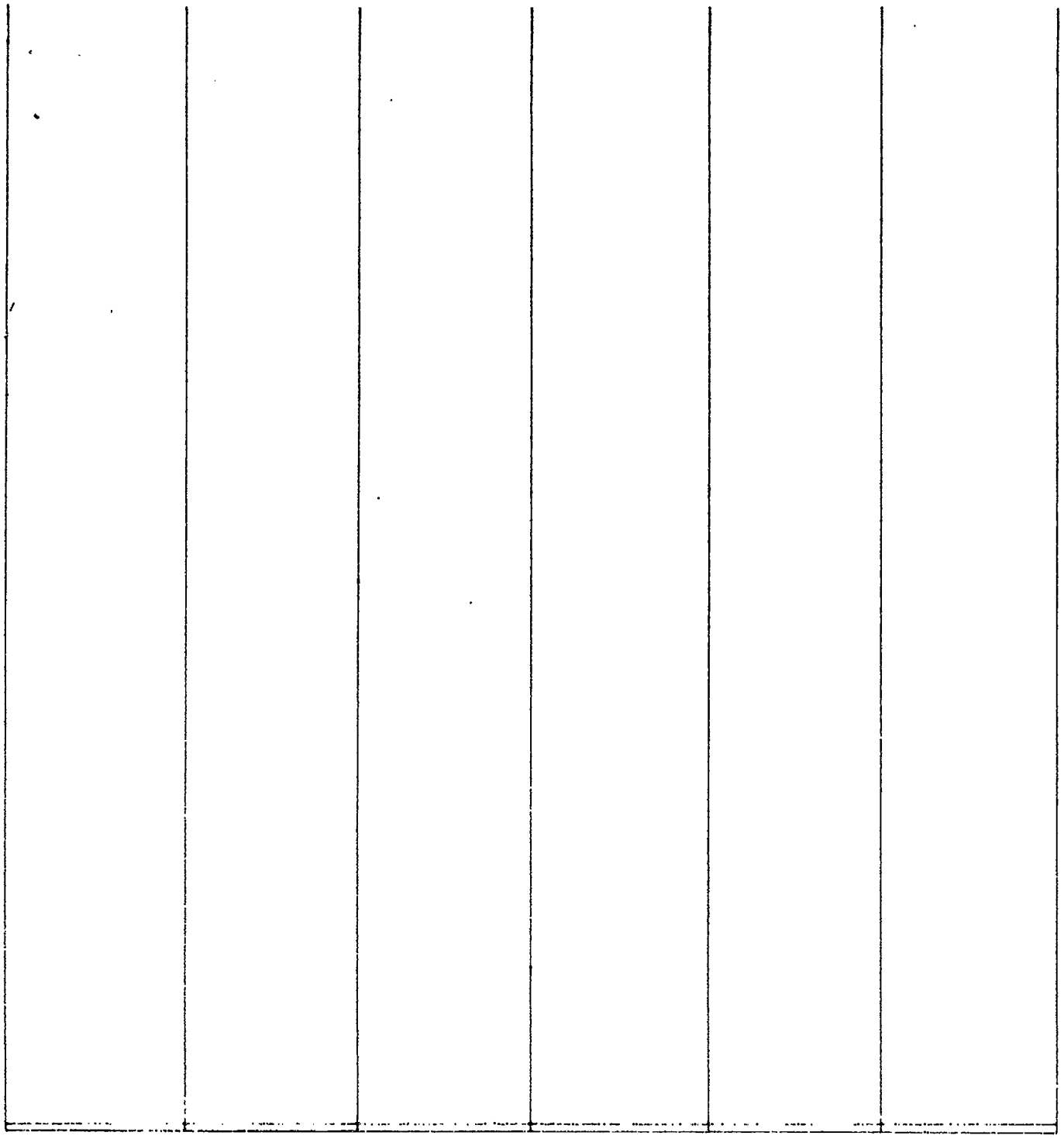
_____

Date _____

Part A

1. Mapping Lane number _____
2. Label the mapping grid, giving distances between markers _____

   and lengths of mapping lanes _____
3. Sketch the physical features on these mapping lanes:



SIDE TWO

Part B Association chart

Which two features are closely associated with each other?

Give some reasons for your answer for number 1 above. What are the houses made of? What do you think muskrats eat?

Part C Opening a Muskrat House (optional)

Sketch a cross-section of a muskrat house.

What is it made of?

Are there food plants inside?

Are there any signs that it is being used?

population.

Winter places heavy stress on individual animals due to weather, competition for food, and lack of sheltering cover. However, the surplus of young that are born each spring and summer make up for losses from winter hardships, illness, weakness, broken bones and all other possible misfortunes.

Every area of land can support only a certain number of each kind of animal —this is called its carrying capacity. For nearly every species, a surplus of individuals results in a deterioration of living conditions that affects the well-being of the whole population. Nature usually ensures that each population of animals has the capability to overproduce. The factors limiting actual numbers are determined by the land's carrying capacity.

Besides influencing the survival of surplus animals, carrying capacity affects production. Each species has an established social structure. Territorial competition in the spring for nesting sites and feeding territories limits the number of adults producing young. Man affects this production by changing the habitat and making more or fewer nesting sites or feeding territories available.

Through the discovery of population factors, including stress and the number of individuals within a population, a student can better understand his own environment and the "balance of nature." This balance includes man as well as the meadow vole. This discovery leads to questions of man's surplus population, our own stress factors and the carrying capacity of the land for man and his activities.

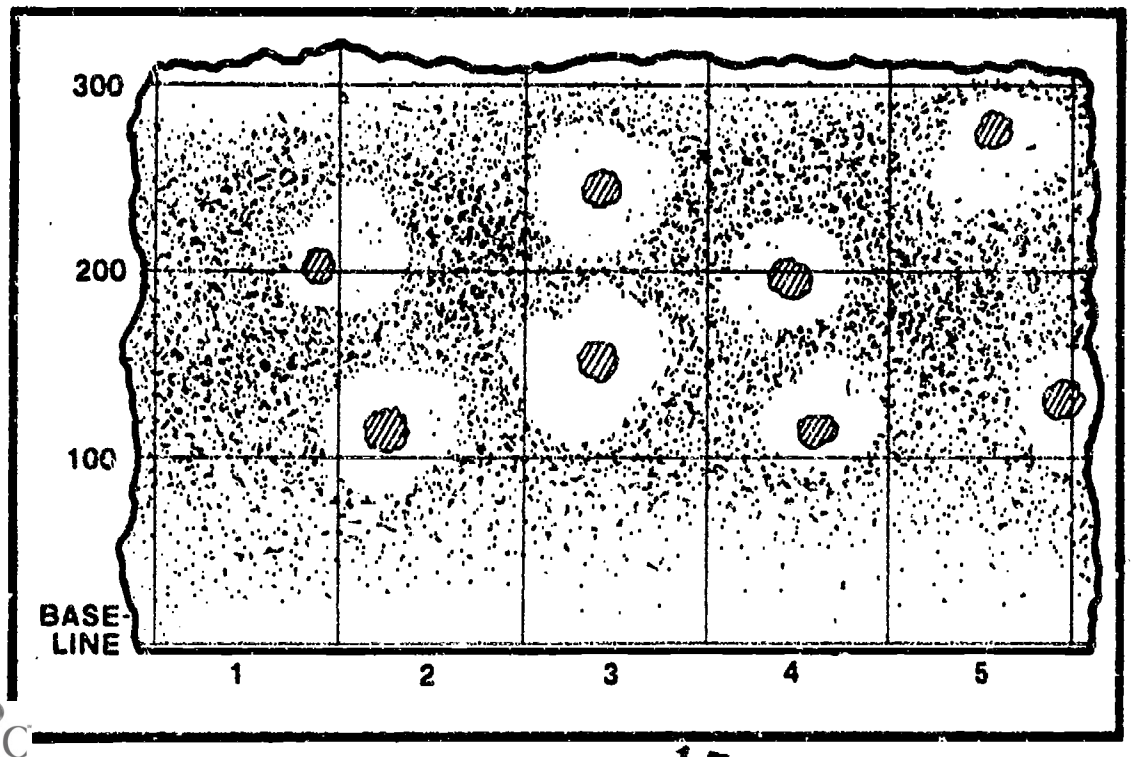
Mapping

Students should form small mapping teams (2-4 students), and each team should be assigned one or more mapping lanes. One student should be the recorder and sketch the features as they are encountered. The other students provide distances from the base line and other pertinent dimensions of each feature. Remember, the three most important features are the locations and dimensions of cattail stands, muskrat houses and open areas. As an example, lane two in the illustration shows the location of a muskrat house about 100 feet from the base line. The house is surrounded by cattails except for a 10 to 15-foot open area immediately around the house. Students should also be encouraged to note other observations such as animal tracks, sightings, etc. All of this information should be recorded in Part A on the Student Data Sheet.

After finishing the mapping activity, each team should answer the questions in Part B on the Data Sheet.

Part B

The association chart below is a useful technique for identifying relationships between variables. In this investigation, the variables are the three physical features which you mapped—dense cattails, open areas and muskrat houses.



Fill in the chart by starting at letter A (dense cattails) and proceed horizontally across the chart. If two variables are closely associated with each other, put a + in the box; if they are not, put a - in the box. As an example, for A (skip the first box because it's the same variable), dense cattails are not associated with open areas; therefore a— is placed in that box. Fill in the other boxes and then answer the questions.

	ASSOCIATION CHART		
	Dense Cattails	Open Areas	Muskrat Houses
A. Dense Cattails	X	—	
B. Open Areas		X	
C. Muskrat Houses			X

Part C—Opening a Muskrat House (Optional)

This part of the activity is optional, depending on the abundance of houses in your locality. The refuge manager can help make this decision. If a house is opened properly and all the materials are replaced, this will not be harmful to the inhabitants. Students can gain some additional information from this activity and should answer the questions in Part C on the Data Sheet.

after the investigation

1. Each team should contribute its information to form a composite map covering the entire study area. Once the composite map is completed, the whole class should do part B on the Data Sheet again. Differences in interpretation among the teams should be discussed.

2. Consider the following description of an interrelationship between cattails, muskrats and ducks.

Cattails, muskrats and ducks do not seem to have much in common. However, they are involved in a very real interrelationship, one which is essential to each. Muskrats use cattails for building materials and for food; at the same time they help propagate the cattails. New plants get started when the muskrats' food gathering activities disperse tuber fragments throughout the marsh. Young ducks and geese depend on cattail cover for protection and for the associated food source of insect life. Adult mallards, teal and other waterfowl prefer open water with cattail and other vegetation clumps and a pondweed diet. Thus a balance must exist between open water and cattail; the muskrat is the natural control. To upset this system jeopardizes the integrity of the marsh and, ultimately, all its plant and animal species.

What could happen if the muskrat population is too low? Too high?

3. If each muskrat house contains an average of five muskrats, how many live in the area mapped in your study? Is the population high, low, or in between? Contact the refuge manager and find out how the muskrat population is managed. If trapping is used, some of the students may want to accompany one of the local trappers while he is tending his lines or perhaps he would visit with the entire class. The manager could help you organize this activity.

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for information

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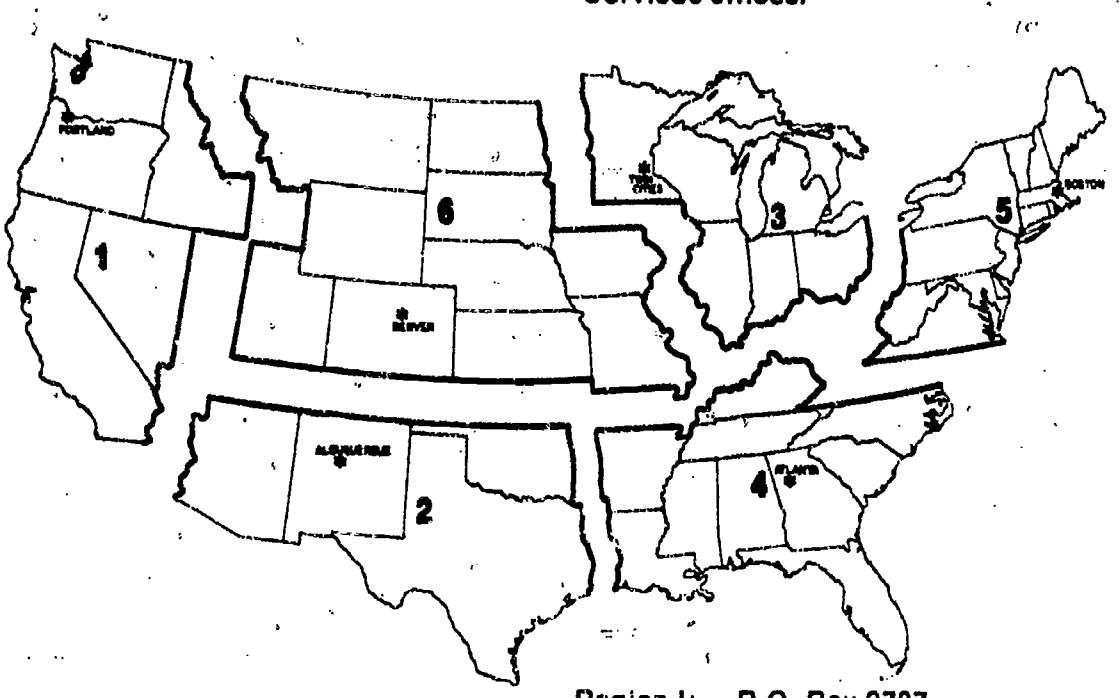

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 18

Synopsis

WETLANDS AND WILDLIFE
Students survey wetland areas on Service property by using mapping and inventory techniques. Water control and land use practices are evaluated in relation to their effects on wildlife. This experience is then applied to wetland areas in the students' community.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

A watershed is an area of land from which water flows through a common outlet. The entire earth is a watershed, as is the Mississippi River Valley and its tributaries. The upstream water source flows to a lower area or valley called a floodplain, and then finally to the ocean.

Man's activities often alter this

Wetlands and wildlife

A. **Purpose:** This activity will acquaint students with--

1. The use of maps.
2. Wetlands and their importance for wildlife.
3. The relationships between water management practices and wildlife survival.

B. **Objectives:** During this activity students will—

1. Use and construct a map to illustrate:
   a. wetland drainage areas
   b. wetland cover characteristics for wildlife
2. Identify and map the water management areas and control structures.
3. Assess the management practices in relation to their value for wildlife needs.
4. Survey and assess local community wetland areas for wildlife potential.

C. **Activity requirements:**

1. Map of Service property showing wetland areas
2. Mapping materials.
3. Information and activity assistance from the refuge manager on:
   a. water control structures and wetland management practices
   b. assessing wetland cover characteristics for certain local wildlife species

Introduction

The lives of numerous wildlife species are intricately linked to wetland areas--marshes, sloughs, ponds, swamps, coastal estuaries, river and creek bottoms. These water-plant communities provide wildlife with their essential life support requirements—cover for protection and food and home sites for breeding.

Local land use and water control practices determine the health and quality of wetland wildlife communities. How do land use and water control practices influence wetlands in your community?

In the first part of this activity, Service properties serve as a model for wetland management practices that benefit wildlife. Students use mapping and a cover inventory system to become familiar with these practices.

Although Service properties and local communities are managed for different purposes some Service management practices can be applied in order to support and benefit wildlife in the community. Thus in the second part of this activity, students apply the information and techniques from the first activity section to assess the wetland wildlife areas in their own community. Perhaps this can lead to active student involvement in improving local wetland wildlife conditions.

Pre-trip Planning

The first part of this activity involving a trip to a Service-managed wetland area is the basis for student assessment of wetland wildlife areas in their own community. This will involve mapping techniques, evaluating wetland habitat characteristics for wildlife, and gaining an understanding of the effects of wetland management practices on wildlife habitat.

Contact the refuge manager for maps and other information several days before taking the trip. Students should be familiar with the maps of the wetland areas and the wildlife species to be studied in these areas. At this time it would also be helpful for students to identify community wetland areas they plan to investigate. This will bring up questions which can be explored through Service personnel during the trip.

Activity Procedure

In order to help the students relate their experiences from Service property to the community, wetland wildlife species that are common to both areas should be emphasized. Some basic understanding of the natural history and requirements of these species before beginning the field activity will be helpful.

Part One—Service Property Survey

Several types of wetland areas and water control practices may be available. The refuge manager should provide maps of the entire area to be used by students as an orientation reference. A survey could be accomplished on foot or via a bus tour, depending on the size of the area. It may be helpful to the students to have a refuge employee accompany them during the activity, but not necessary.

SIDE TWO

Part Two

After evaluation of several wetland wildlife areas in your community, consider these questions:

1. **Which wetland areas offer good to excellent cover for wildlife and which do not?**

2. **List water control and land use practices that seem to be beneficial to wildlife and those that seem to be harmful.**

3. **Do the results of the investigations show that your community values wildlife as an important part of the environment?**

4. **Predict whether the abundance of wildlife in the community will increase, decrease or stay about the same in the future.**

5. **Should future community development consider affects on wildlife or consider alternate sites for construction? Discuss long-term versus short-term benefits.**

Data Sheet

Outdoor Classroom Guide Number 18

Wetlands and Wildlife

Names _____

_____

_____

Date _____

Place _____

SIDE ONE

Part One

A. List the species of wildlife that are to be emphasized.

B. On your map identify and label:

1. Water inlet and outlet and direction of flow.

What is the source of the water?

Into what water system does it drain?

2. Water control structures and areas such as dikes, ditches, spillways, dams, impoundments, etc.

Describe the use of these structures for wetland wildlife management of the species listed above.

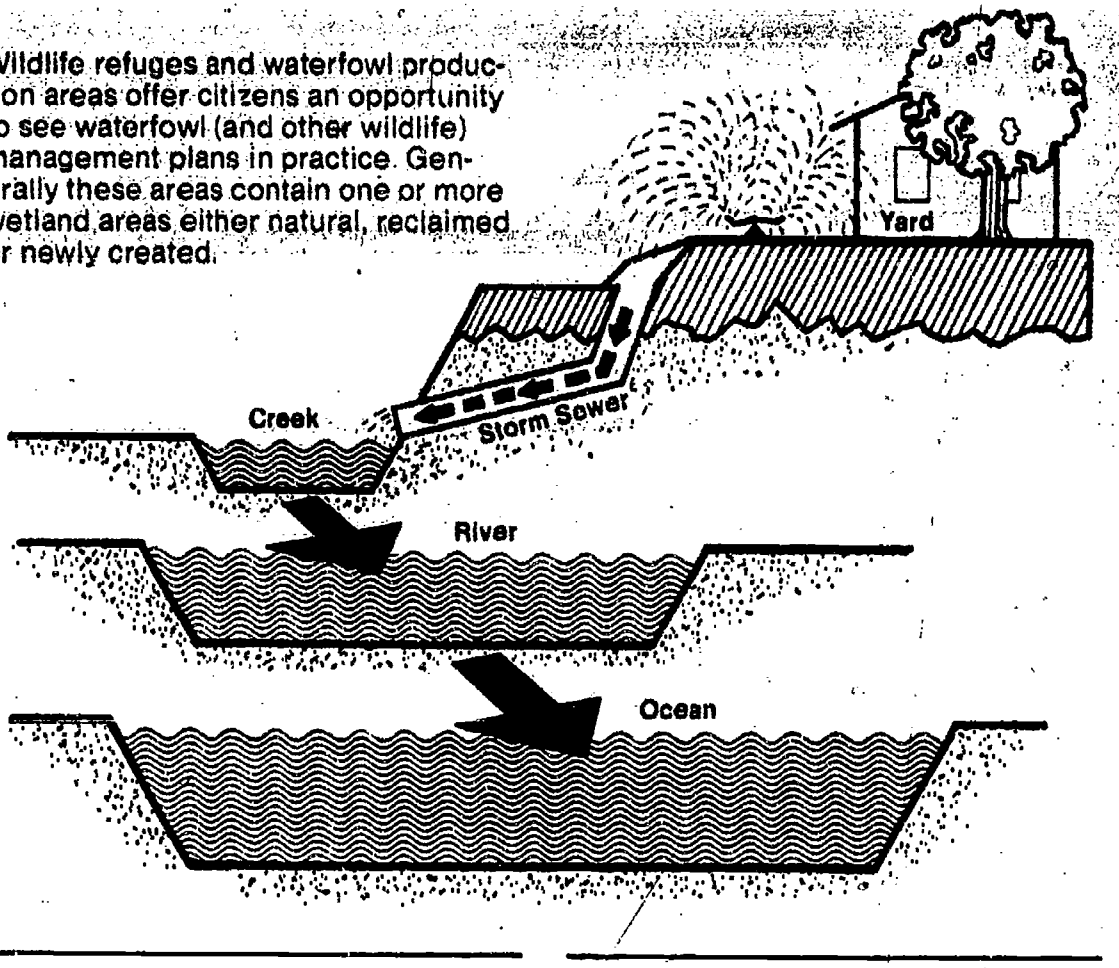
3. Good cover areas for the wildlife species listed above.

For each wildlife species briefly describe what would constitute poor cover, good cover and excellent cover. Consider food, protection and breeding sites in your descriptions.

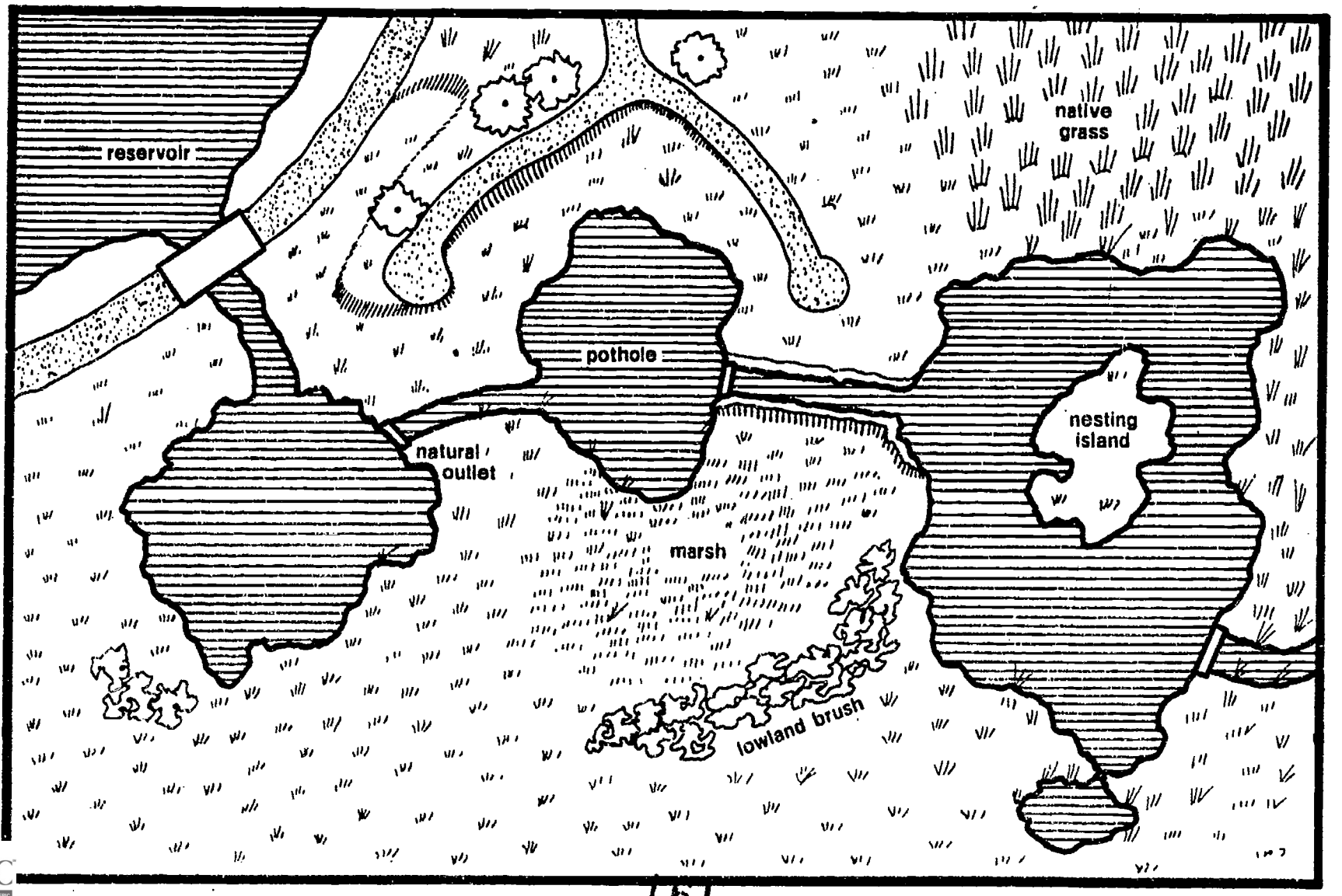
natural water flow. Any alteration in upstream waters eventually affects all life forms along the lower water course. Often when these changes are for man's benefit, such as dams for water storage or channels for agricultural lands, fish and wildlife are on the losing side through loss and destruction of their habitat.

All life depends on water for its existence. Through wetland studies a student will learn how man must consider wildlife when planning water-flow manipulations. He may then understand that any resulting change of natural conditions affects man as well as wildlife.

Wildlife refuges and waterfowl production areas offer citizens an opportunity to see waterfowl (and other wildlife) management plans in practice. Generally these areas contain one or more wetland areas either natural, reclaimed or newly created.



Using the Student Data Sheet as a guide, each student should: (1) label and identify water inlets, outlets and directions of flow; (2) label and identify water control structures and areas, and (3) label and identify good cover areas for the wildlife species being emphasized. See the illustration of a sample map.



Students will be able to establish the basis of a cover inventory system to be used in Part Two by study information and references provided by the Service.

Part Two—Local Community
From Part One students should: (1) be familiar with some common local wildlife species; (2) be able to map a wetland area; (3) be able to identify some water control structures and practices, and (4) be able to use their wildlife cover descriptions to inventory other areas. These become the basis for evaluating wetland-wildlife conditions in the local community.

Perhaps individual students or small study teams could be responsible for certain wetland areas in the community. They should follow the same procedures used in Part One. Once several areas have been evaluated, students should present and discuss the results of their investigations. The questions on part two of the data sheet should be considered.

after the investigation

Talk to local citizens who own wetlands or land adjacent to wetlands about projects that would benefit wildlife on their land.

Present the results of your investigation to local government officials and ask for assistance in improving some wetland areas for wildlife.

Find information about federal or state programs and grants that assist a private landowner with land management practices that benefit wildlife.

for information

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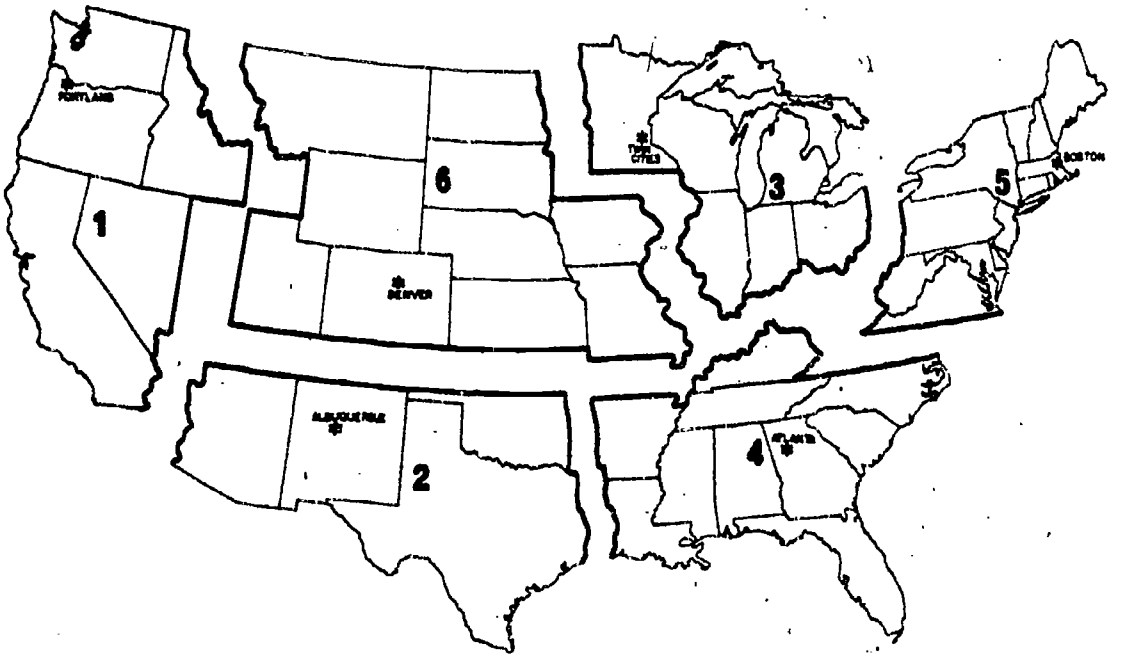

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 19

Synopsis

FISH POPULATIONS
This early summer activity involves the investigation of some characteristics of fish populations. Students become acquainted with fish hatchery programs and are assisted by Federal fisheries personnel.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

Every pond has a specific carrying capacity that determines the maximum pounds of fish the pond can support. The more fertile the pond, the more fish it will yield.

This pond may contain several species, including small fish that feed mainly on algae and insects (bluegill) and large predatory fishes (bass). If the

fish populations

A. **Purpose:** This activity will acquaint students with—

1. Some differences between individuals and populations.
2. Some important characteristics of population dynamics such as age class frequencies, relationships between weight and length, and relationships between frequency and length.
3. The importance of population information to hatcheries and the management of natural populations through hatchery programs.

B. **Objectives:** During this activity students will—

1. Measure, weigh and age two sample populations of fish:
   a. a uniform age class population at a hatchery
   b. a multi-age class population from a natural body of water
2. Construct graphs to show the relationships between
   a. numbers and age classes
   b numbers and length
   c. weight and length
3. Use the data to make some inferences about fish population dynamics and the role of hatcheries in fish population management.

C **Activity requirements:**

1. Equipment for capturing sample populations of fish.
2. Equipment for weighing, measuring and aging fish.
3 Materials for constructing the graphs.

Introduction

Man, a terrestrial animal, is at home on land but not in water. Oceans, lakes, rivers and streams may seem somewhat mysterious to us compared with forests, fields and meadows. By using rather simple means we can get around on the water surface quite easily, but to go below the surface for more than a few minutes requires complex equipment. However, there are several ways to investigate what's going on in aquatic environments. The plants and animals that make up the communities in these environments are important to us and often closely linked with those on land. In this activity students will be investigating some of the characteristics of fish populations.

This activity is written to begin at the fish hatchery where fisheries management personnel will be available for assistance. Students will investigate a hatchery-reared population of fish and become acquainted with fish rearing programs. Following this, the same investigation techniques are applied to a more natural population of fish made up of diverse sizes and ages.

Planning

Begin planning this activity by contacting the Federal fish hatchery you plan to visit. Ask for assistance in organizing the following:

1. This activity should be scheduled when a suitable population of fish is available for study at the hatchery.
2. Locate a place where a natural population of fish can be investigated. For convenience this should be on or near the hatchery.

3. Form teams of 3 or 4 students. Students should be familiar with the data collecting techniques and how to record their data on the Student Data Sheet.
4. The equipment needed for this activity is listed below. The amounts will depend on the number of study teams.
   a. measuring boards (marked in inches)
   b. traps or seines for capturing fish
   c. scales (postal-type)
   d. plastic pails
   e. clipboards
   f. graphing materials
   g. dissecting scissors and forceps, formaldehyde, plastic bags, bag fasteners (to carry fish back to the classroom for aging and dissection)
5. If students are to handle seines, they are likely to get wet and should be aware of this. Life jackets may be needed for younger students.

This activity is designed to give students actual practice with some of the techniques used to gain an understanding of population characteristics.

An understanding of a population cannot be inferred from an understanding of one individual. The life of an individual organism has a definite beginning (birth) and a definite end (death); a population has no definite beginning and usually no definite end. Instead, it is a reproducing group of individuals of the same species whose numbers may fluctuate from time to time.

Data Sheet SIDE ONE

Outdoor Classroom Guide Number 19

Fish Populations

Names _____

Date _____

Place _____

A Hatchery-reared population:

Description of body of water: _____

_____

Study species: _____

Other species caught and returned. _____

_____

Fish	Length	Weight	Age	(collect scales from each fish)
1				
2				
3				
4				
5				
6				
etc.				

B Natural Population:

Description of body of water: _____

_____

Study species: _____

Other species caught and returned: _____

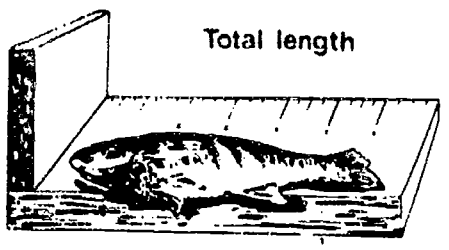
_____

Fish	Length	Weight	Age	(collect scales from each fish)
1				
2				
3				
4				
5				
6				
etc.				

SIDE TWO

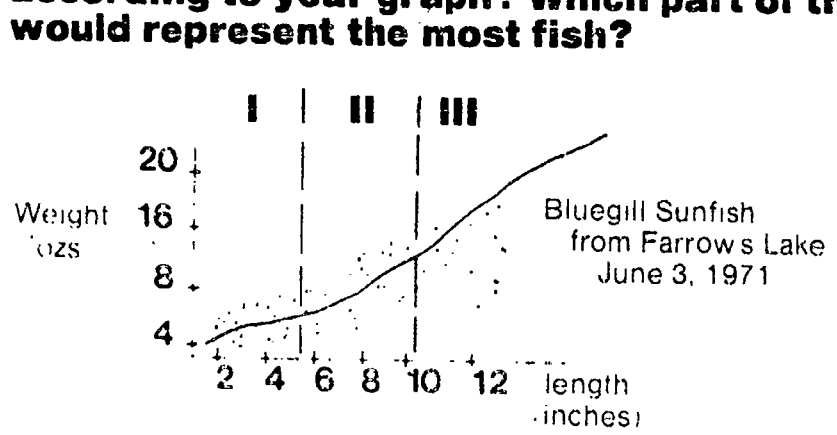
C Using the data:

Based on your graphs and keeping in mind the inadequacies of the data, answer the following questions:

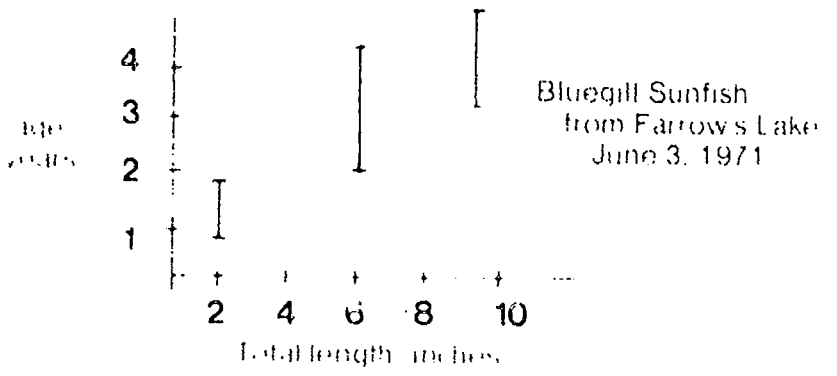


Name some environmental factors which would account for the steady decline in numbers as fish become larger? What might an irregular distribution of numbers indicate about spawning success from year to year?

What is the relationship between weight and length according to your graph? Which part of the graph below would represent the most fish?



What are some environmental factors that could account for two different aged fish (of the same species) being the same size? Discuss the meaning of the graph below:

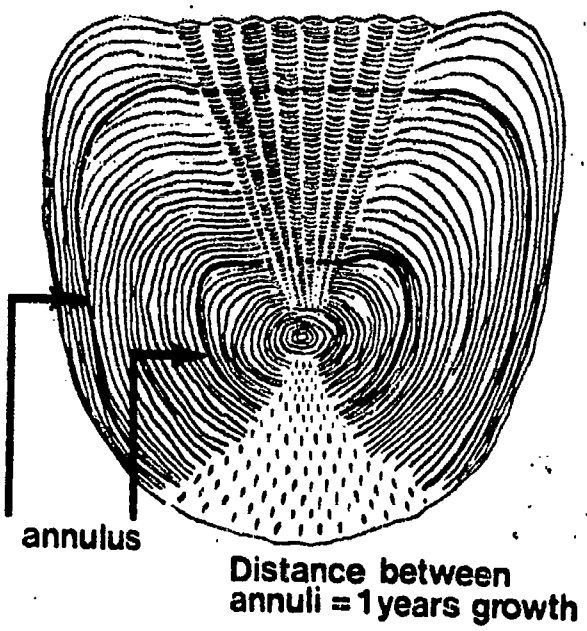


population is out of balance and there is an overpopulation of either bluegill or bass, the pond will *still* contain the *same* poundage of fish. This maximum poundage is determined by the carrying capacity.

Fisheries management attempts to keep the different fish populations of a body of water in balance. If too many of a species are competing for the same amount of food, then less of the food energy is converted into growth, being mostly used for maintaining basic metabolism. In this way you may have a large population, but each individual is stunted in growth.

Therefore, information about the age and growth of fish can be useful in managing fisheries. Growth rates reveal the general condition of fish populations. Fish age can be determined by seasonal changes in growth rates that leave annual marks on scales, spines and ear bones. A stunted fish of a known age indicates an unstable population.

Through study of the processes that control the kinds of fish that dominate a pond, their age and growth relationships and their productivity, a student can learn how population dynamics affects the balance and health of a population.



In this study, students apply investigative techniques to two different fish populations: (1) a managed population in a rearing pond, and (2) another population found in more natural conditions. It is suggested that students first investigate the hatchery-reared population of fish and then the population in more natural conditions.

It is doubtful that brood stock (adult fish used for production) would be utilized for this activity because of the danger of harming the fish. However, young fish, called fingerlings, are available in large numbers at certain times. By beginning with this population, students will gain practice in handling fish properly and collecting their data. Also, a uniformly aged hatchery population will contrast sharply with a multi-aged natural population, providing some interesting questions for discussion. However, if a managed population is not available, this activity can be done with just the natural population.

Since it is important to minimize the possibility of harming the fish, the data must be collected quickly with proper handling techniques. Any surface that the fish will come in contact with should be kept wet. Each team member should be responsible for one of the tasks with one student acting as a recorder.

Capture at least 50 fish of the same species and place them in plastic pails of fresh water. In the process of obtaining the study species, it may be interesting to count the number and frequency of different species found in the net. Perhaps some could be preserved and brought back to the classroom for identification and further study.

Collecting the Data

Each team should randomly select as many fish as they have time for. The lengths and weights are to be recorded on the data sheet for each team. In order to determine the ages of the fish, scales will have to be collected and brought back to the classroom. On the Student Data Sheet record for each fish:

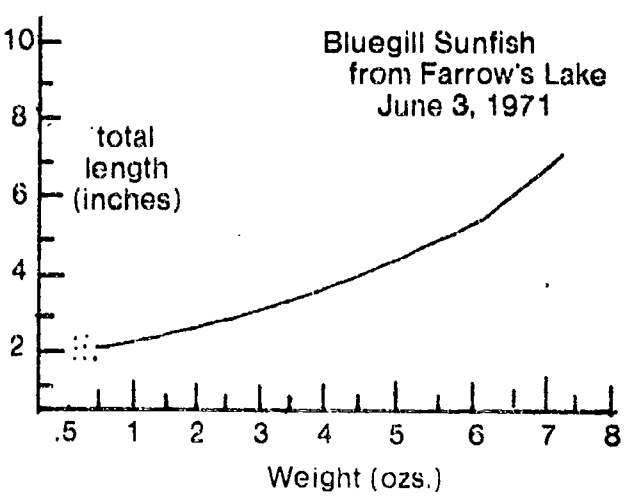
- *Total Length*
  Lay the fish on the wet measuring board and record the total length.
- *Weight*
  Put the fish on the wet scale platform. If very small fish are to be weighed such as sunfish fingerlings (approximately 200 per pound), several can be weighed in a plastic bag and then an average weight per fish can be calculated.
- *Aging*
  The hatchery employee will show the students how to remove two or three scales from each fish without harming it. The scales should be placed in an envelope and then labeled as to the size range of the fish and collecting team.

Using the Data

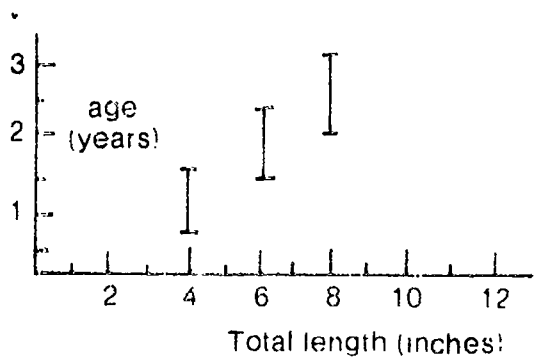
Combine the fish scales from similar sizes of fish. Rinse the scales in detergent water, dry them, and then glue them with white glue directly to a microscope slide. Use one microscope slide for each size range. Ages can then be determined for each size range (see the illustration). Ask for information and assistance from the hatchery employee.

Graphing the combined team data will help show some relationships among the measured characteristics of the population. Bar graphs and/or line graphs will be most useful for the following:

Graph one: Weights of fish (x axis) / lengths of fish (y axis).

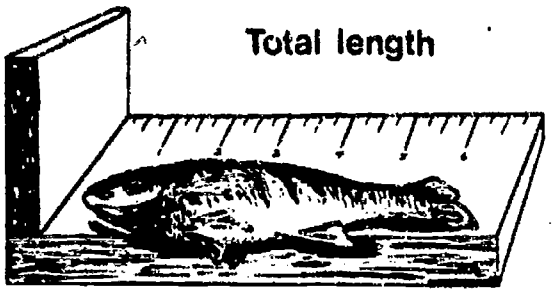


Graph two: Lengths of fish (x axis) / age distribution of fish (y axis)

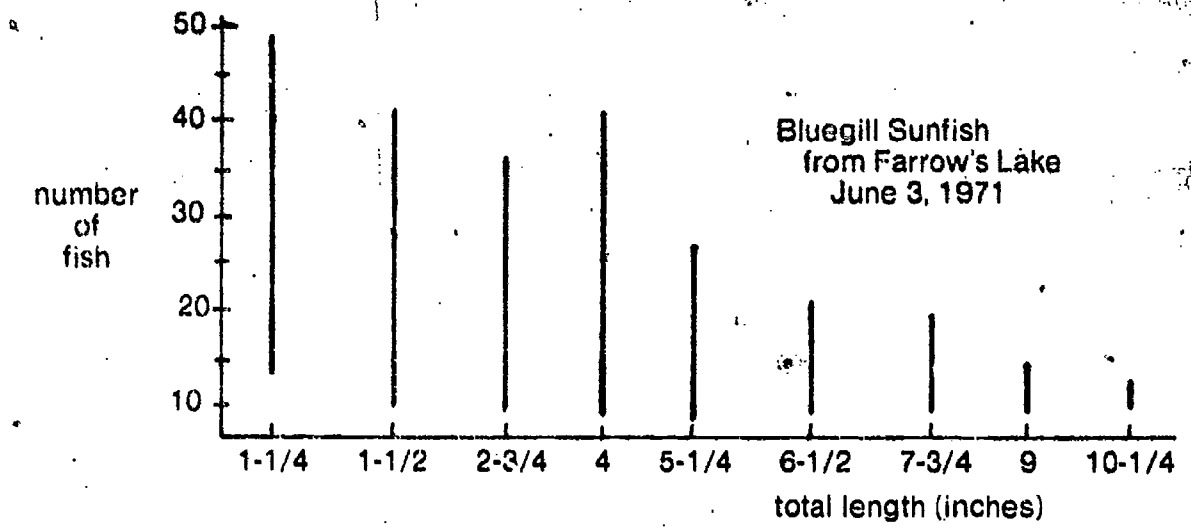


Bluegill Sunfish
from Farrow's Lake
June 3, 1971

Graph three: Lengths of fish (x axis) / number of fish in each length range (y axis). It will be helpful to group similar lengths into length ranges such as 0 - 1-1/4 in., 1-1/2 in. - 2-3/4 in., etc.



measuring board



After students have constructed the graphs, they should answer the questions on the back of the Student Data Sheet. Other ways of graphing or representing the data should be encouraged.

after the investigation

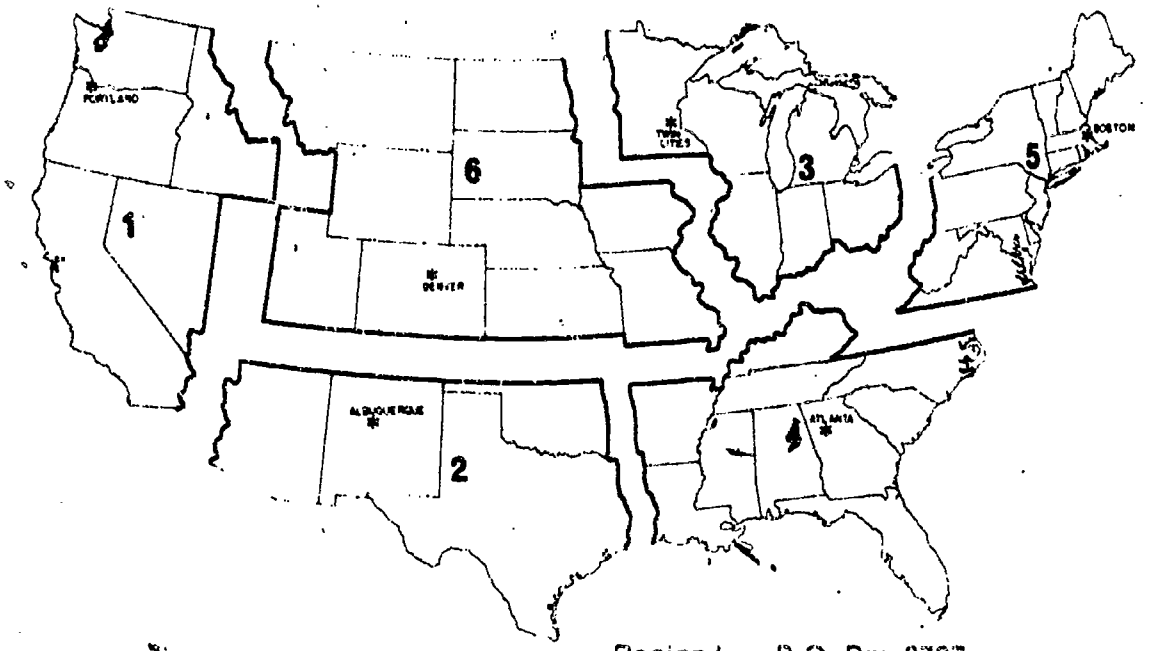
A healthy population of fish in natural waters is usually an aggregation of varied sizes and age classes. However, it is not uncommon, in small lakes or farm ponds, to find an abundance of uniformly sized fish such as sunfish or bass. Name some environmental factors that could cause this condition. What management techniques would you use to correct this condition?

How are fish a valuable resource in your community? Stream improvement, farm pond management and controlling water pollution are management practices for improving the fish resource.

If you are interested in getting involved in a fish management project, ask the hatchery employee for help in selecting and planning an appropriate one for your community.

Can the population dynamics that affect the balance and health of a fish population be applied to man?

Many Service land areas provide designated activity sites, shelter, toilet facilities and limited equipment for your use. For trip reservations and further information, contact your local **U.S. Fish and Wildlife Service** office or the following regional Services offices:



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Region V	John W. McCormack Post Office and Courthouse Boston, MA 02109
Region VI	P.O. Box 25486 Denver Federal Center Denver, CO 80225
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Jenny Publishing Co. Inc.
57 Queen Ave So
Minneapolis, Minnesota 55405

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 20

Synopsis

PUBLIC SURVEY
Students learn a survey technique. They gather information and opinions about leisure time activity and the use of public land from individuals within a community. Through analysis of the returned information, they gain an understanding of the role of National Wildlife Refuges and the kinds of public use these refuges are able to provide within the limits of their prescribed function.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

An important goal of the National Wildlife Refuge System is "To promote harmony between man and his environment." One way to reach this goal is to allow the public to learn and experience on refuge lands.

Our visitors come to a refuge for many reasons—to learn about the environment, to photograph animals or plant

public survey

A. **Purpose:**

1. To determine in what way public attitudes toward public land affects the use of those lands by:
   a. determining public attitudes toward public property
   b. determining public use of a refuge
2. To determine community leisure-time activity needs.
3. To discuss with refuge managers the appropriate ways of meeting wildlife-oriented recreational needs in the community.
4. To increase public awareness of a nearby refuge.

B. **Objectives:** Sudents will—

1. Develop and administer to a portion of the community a checklist of leisure-time options perceived as needed by the community.
2. Gather attitudinal data from the several communities located nearest the refuge as it concerns:
   a. gathering data on present level of community use
   b. awareness of the existence of the refuge
   c. awareness of its purpose
   d. awareness of its public programs
3. Match needs with attitudes and formulate conclusions and recommendations which will strengthen and enhance public use of public lands.

C. **Activity requirements:**

1. Construction of the following survey instruments:
   a. leisure-time needs inventory
   b. present public land use form
   c. attitude-awareness form
2. Description of present refuge programs and use data.
3. Formulation of a systematic method for administering various surveys.
4. Presentation to refuge manager.

Public use programs have evolved over a considerable period of time and are designed to be compatible with the purpose of the refuge—to manage land for wildlife habitat. As times change and as the public's preferences for leisure activities change, managers of public properties must give thought to altering their programs so they will help meet public needs. They must do this in such a way that the established purpose of the refuge is not jeopardized.

To seek out prevailing public needs and attitudes toward leisure time and to discover whether or not, in the public mind, public lands can or should provide the means of satisfying some of these needs, questions must be asked of those most likely to be potential users. This means going into nearby communities and polling a representative sample of its people

In order to learn the process of polling for information gathering, students with the help of teachers can develop questionnaires. The questionnaires can be administered, analyzed and charted. The information can be presented in summary form to a refuge manager for discussion about helping to meet public needs.

Such a study, properly conducted, will engage students in many aspects of communication and will also alert the public to wildlife oriented leisure-time activities offered by refuges.

Organizing

Teachers and students should study maps of their area to determine which communities can be surveyed feasibly. A coordinated intercommunity project may mean that no class would have to collect data outside its own town. The refuge manager may help students select other cooperating communities, contact interested groups and bring together representatives who would attempt to coordinate their studies by sharing survey items. However, a multicommunity involvement is not a requisite for undertaking this project. Regardless of how a data pool is formed, the same method for community survey should be observed by all investigators.

Constructing the Questionnaires

Students must first discuss their reasons for undertaking this study. Such a discussion would touch on national and local leisure-time needs as well as personal needs. Increasing population pressures on limited space and the varying compatibilities of leisure activities can be examined.

Any use date already available from the Service and state agencies would provide background information for these discussions. Present use will also provide a basis for developing a checklist of items representing the

Data Sheet

Outdoor Classroom Guide Number 20

Public Survey

SIDE ONE

INFORMATION SHEET:

SAMPLE QUESTIONS FOR EACH PART OF THE SURVEY

PART I: Community Leisure-Time Needs Checklist

Activity	**Number of Responses**
Snowmobiling	_____
Playgrounds	_____
Hiking	_____
Relaxation	_____

PART II: Community Leisure-Time Use (type and frequency) On The Refuge

	Use time/year		
Activity	**Seldom (1-2 times)**	**Moderate (3-4)**	**Frequent (5)**
Hunting	_____	_____	_____
Hiking	_____	_____	_____
Picnicking	_____	_____	_____

PART III: Community Attitudes Toward Refuge

Example 1:
People use the refuge for many different purposes. Please rate the following uses according to what you feel should be the most important with "1" equaling most important, "4" least.

_____ **Photography, hiking, cross-country skiing**
_____ **Hunting and fishing**
_____ **Snowmobiling, water skiing**
_____ **Camping**

Example 2:
Who should determine how the refuge is used? Check one.

_____ **The federal government**
_____ **The local manager**
_____ **The local people**
_____ **Those who use it most frequently**

SIDE TWO

Example 3:
Refuges are managed to protect our fish and wildlife. What effect do you think the following uses have on fish and wildlife?

	Little Effect	Somewhat Harmful	Quite Harmful
Camping			
Hunting			
Snowmobiling			
Hiking			

STUDENT NOTES:

INTRODUCTORY NOTES--

Who am I

Name of school

Purpose of survey

Time it will take

LIST OF PEOPLE TO BE SURVEYED--

life, to go canoeing, to walk a wildlife trail or just to visit a "quiet place." As man's knowledge of the environment becomes greater and quiet places for solitude become more scarce, demand for use of wildlands will increase.

Most lands within the refuge system are set aside by an Act of Congress that establishes the primary objective of each refuge. Although there are different kinds of refuges, including some for buffalo, elk or bighorn sheep, three-fourths of all these lands are established as resting, feeding and nesting areas for migratory waterfowl.

Although conserving wildlife and the environment are our main commitments, providing for public enjoyment and appreciation of wildlife has become increasingly more important. By surveying the public use, public attitudes, and awareness of local communities concerning a refuge and its programs, a student may develop an appreciation of land use problems. Local community and even national pressures may change or influence land use policy. The problems of administering lands in public trust for present and future generations can be studied. The values of wildlands and quiet places to a community can be discovered.

real range of activities in which people are typically involved on the refuge property.

The survey can be divided into three parts, each of which can have its own questionnaire. **Part I** of the survey should assess community leisure-time needs. A checklist can be formulated and some practice in survey methods can be gained by polling fellow students. Once completed it will form the basic checklist to survey community leisure-time needs. Another checklist should include all possible leisure activities, not just those typical of refuges. For example, swimming pools, ball diamonds and playground equipment are not refuge facilities, but they are often those provided by a community for its residents. In order to establish total community needs, a wide range of items should be included.

Part II of the questionnaire should reveal the respondents' awareness of the refuge. It is probable that many people will be unaware of the existence of the refuge. Obviously no unaware respondent can answer all questions of this questionnaire; this should be recorded.

For those who do use the refuge, students can obtain amount of use as well as kind of use. An example of a simplified means of getting both kinds of data in one question is included on the student information sheet. The activity items can be selected from Part I of the survey and from refuge data. The activities given are just a sample, but they will give students some ideas for designing this part of their survey.

Part III of the survey will reveal attitudes. Attitudes are usually expressed as opinions, so students will want to elicit opinions about refuge resources. Opinions are usually not absolute—they tend to fall someplace between positive or negative. Therefore, the construction of items for a questionnaire should provide respondents with a range of choices. To clarify their task, specify the choice range.

Some examples of items specifying choice range are found in Part III of the student information sheet. This will be the most difficult part of the questionnaire to construct because there are so many important questions to ask. Perhaps the refuge manager can be given a list of tentative items from which he could select the 10 most important. The same list could be scanned by frequent users (people identified by the manager) and they could select 10. The class could also choose 10. When there is some agreement among raters (manager, users, students, etc.) these questions could be included in the questionnaire.

A "good" questionnaire is neither lengthy nor difficult to complete. Once the identity of basic items is established, try it out on several groups to get an idea of time, ambiguity of items and interest. Perhaps other teachers would be a good test group for a trial run.

Activity Procedure
Once the questionnaire has been formulated and trial tested, students will be ready to administer it to a sample of the community. The question is then, "Who should be questioned and how should the survey be conducted?"

Sampling Criteria
It is usually impossible to interview all members of a community. Knowing this, establish some ground rules for selection. Ask yourself how much time can be devoted to the study? What arrangements can be made to execute it? How many should each student administer? Answers to these questions will give you an estimate of your sample size.

Next, you'll want to vary the composition of the sample by obtaining responses from several age ranges, e.g. 15-25 years, 26-35 years, etc. You must also remember that all people are potential users so you will want to sample a cross section of society. Establish age ranges and social categories through discussion.

Making the Survey
Develop a brief introduction as a guideline for students to use when they approach people. It should include the following:

1. Student identity.
2. Purpose of the study.
3. How long it should take to complete.
4. What will be done with the data.

Many students may never have had an opportunity to engage in public survey activities. This is not a difficult task and actually can be a great deal of fun. (It can also be a good public relations device for the school when its representatives are engaged in a project which concerns the public's needs.) Common sense suggests that cooperation from the public proceeds from a polite and courteous manner. Students should be equipped to

answer questions such as "Why are you doing this?" "Is this what the schools think you should do?" "Who's paying for this?" etc.

If your past experience suggests that surveys best be taken during out-of-school time, negotiate for evenings and Saturdays with your students.

Divide the work among class members so that each student or team deals with a manageable number of interviews. They can help you decide what is manageable.

For reliable return of questionnaires, a student should wait while the respondent completes it or return at a specified time to pick it up.

Analyzing the Data
All questionnaires should be collected and reviewed by the students who can, with help, decide on how to deal with the information. Generally, the best procedures for analysis include the following steps:

1. Tabulating raw data.
2. Obtaining averages, percentages or correlations where possible.
3. Describing the results obtained in number 2 above.
4. Making inferences about the results; inferences must reflect the real data.

Following is an example of applying the above guidelines for analysis:

EXAMPLE

Who should determine how the refuge is used?

Rank order (N-62)	Number	Percent
Local people	7	11
Local manager	22	35
Federal government	27	44
Frequent users	6	10
Total	62	100%

This tabular presentation gives raw data and percentages as well as the rank order. In describing the meaning of this question it could be stated that "almost one-half of the people feel that the government should determine refuge use." An inference would be that "many people, given a choice, would want government officials to prescribe how they may use public property."

Each section or question on the survey should be treated in a manner similar to the above example. Out of such treatment will arise information which is both comprehensible and accurate. It will allow one survey response to be compared with another and, in turn, will provide students with guidelines for making a summary recommendation to the manager.

after the investigation

Managing resources is a balance between managed use and preservation. In the case of National Wildlife Refuges, is the purpose or intent of refuges in support of the perceived leisure-time needs of the community? If not, what agency, council or organization can support these needs? Do the students feel that the refuge can fulfill a real public need for leisure-time activity? Is there any evidence that they are so doing? If so, what is it? Is the information from this survey sufficient to adequately support the conclusions?

for information

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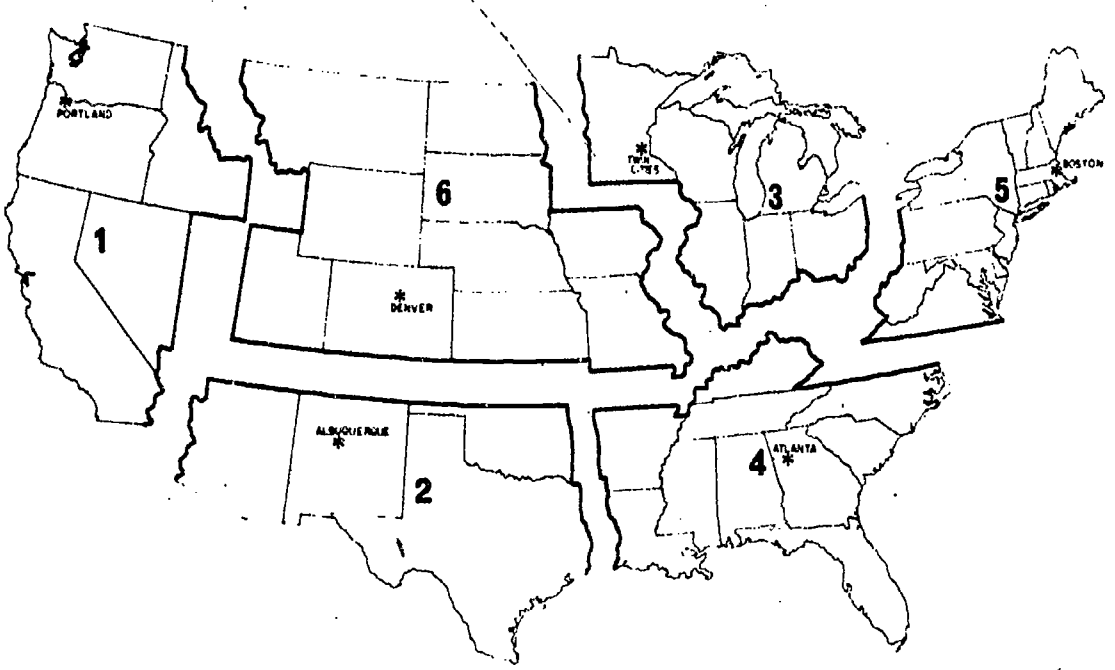

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Jenny Publishing Co. Inc.
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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 21

Synopsis

FISH HATCHERIES
By observing hatchery ponds and investigating food sources, a student can learn about food chain relationships and fisheries management.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

Over 90 National Fish Hatcheries are operated throughout the country to keep Federal lands stocked with fish. Their goal is to raise not only more, but healthier fish through research and selective breeding.

Hatcheries in the northern and western states and in the mountainous regions of the South raise trout or salmon.

fish hatcheries

Activity Description

A. **Purpose:** This activity will acquaint students with—

1. The life cycles of common game fish.
2. Food chain management for rearing fish in natural ponds.

B. **Objectives:** During this activity students will—

1. Determine the major food source for a population of fry in a natural pond by using a plankton seine and by analyzing stomach contents.
2. Calculate the approximate weight of plankton needed to produce the fry population being investigated.
3. Make some inferences about the productivity of natural waters under varying conditions after being given some of the environmental factors which influence plankton growth.

C. **Activity requirements:**

1. A population of fry being reared in a pond
2. Information and assistance from hatchery personnel
3. Each team will need the following equipment.
   a. dissecting scissors
   b. net or trap for capturing fish
   c. formaldehyde (5% solution)
   d. scale (postal type)
   e. hand lens (15x)
   f. plankton seine or fine mesh dip net
   g. plastic bags
   h. specimen dish or pan
   i. eyedropper

REFERENCE BOOKS

Pond Life, Golden Nature Guides, Golden Press, New York, 1966

How to Know Series, Wm. C. Brown Company Publishers, 135 South Locust Street, Dubuque, Iowa 52003, 1958.

Introduction

This activity is designed for pond fish or a warm water rearing program. Largemouth bass and bluegill sunfish are two common warmwater species reared for stocking. It is important to know some aspects of the life cycles of these two game fish.

Bass and bluegills are nest builders, which means that the male of these species uses his tail to fan out a depression in the pond bottom in shallow water. The nest building urge is triggered by water temperature. Bass begin to construct nests when the pond water warms up to 60-65° F. Bluegills wait until the water temperature reaches 78°F, which means they do not spawn until early summer. Bass spawn only once a year in the spring, but bluegills may spawn several times during one summer.

After he has made his nest, the male bass or bluegill encourages the female to deposit her eggs in it, he fertilizes them as they are laid. The eggs stick to roots and other material in the bottom of the nest. They hatch into tiny fry that remain in the nest for a short period until their yolk sacs are absorbed. The yolk sac is a built-in food supply and when it is used up the hungry young fish swim up off the nest in search of food.

"Swim-up" fry remain in the vicinity of the nest for a few days. The male bass guards his young for a short time, but soon reverts to his predatory instincts and given the chance, will devour them! To avoid cannibalism losses by adults, the hatchery personnel gently scoop up schools of bass fry with a fine seine and transfer them to food-rich rearing ponds where they grow into fingerlings large enough to be shipped by tank truck to stocking sites. Bluegills, on the other hand, do not eat their young, so fry can be reared to fingerling size in the same pond with their parents.

Planning

This activity depends on the availability of fry reared in a warmwater pond. Therefore, it is important to contact the hatchery manager early in the spring to schedule the trip. Hatchery personnel may be able to provide some of the required equipment and assistance during the activity.

It is not important that students know all about the hatchery before they begin since a general orientation will be part of the activities. However, students should be familiar with the equipment and the techniques used.

Activity Procedure

Successful warmwater fish production is dependent upon an adequate food supply at all times. This not only assures rapid growth but also reduces cannibalism among fish such as largemouth bass.

The basic requirement for any fish hatchery is a dependable supply of

Data Sheet

SIDE ONE

Outdoor Classroom Guide Number 21

Fish Hatcheries

Names _____

_____

Date _____

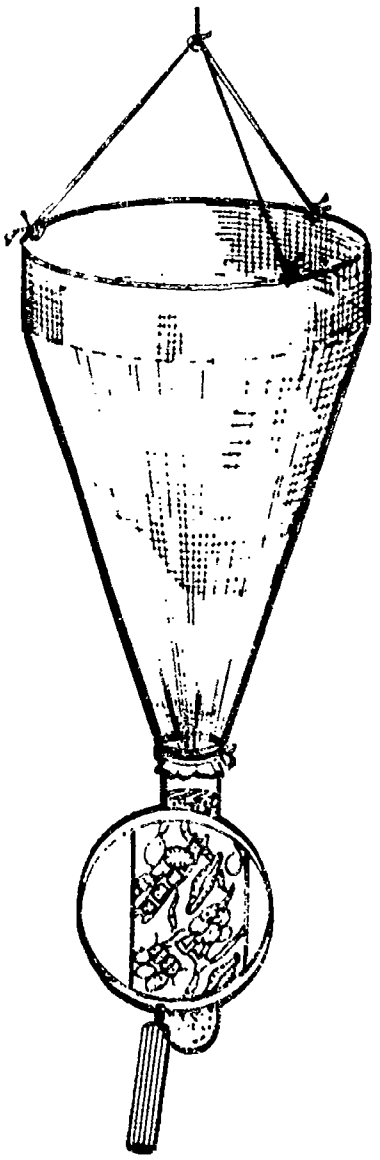
Place _____

General Information

1. **Pond size:** _____ **acres**
2. **Pond volume:** _____ **gallons**
3. **Study species:** _____
4. **Number of fish stocked:** _____
5. **Weight of fish stocked:** _____
6. **Total weight of the fish in the pond:** _____
7. **Total gain in weight since fish were placed in pond as fry:** _____

_____

8. **Sketch some of the common food organisms.** _____

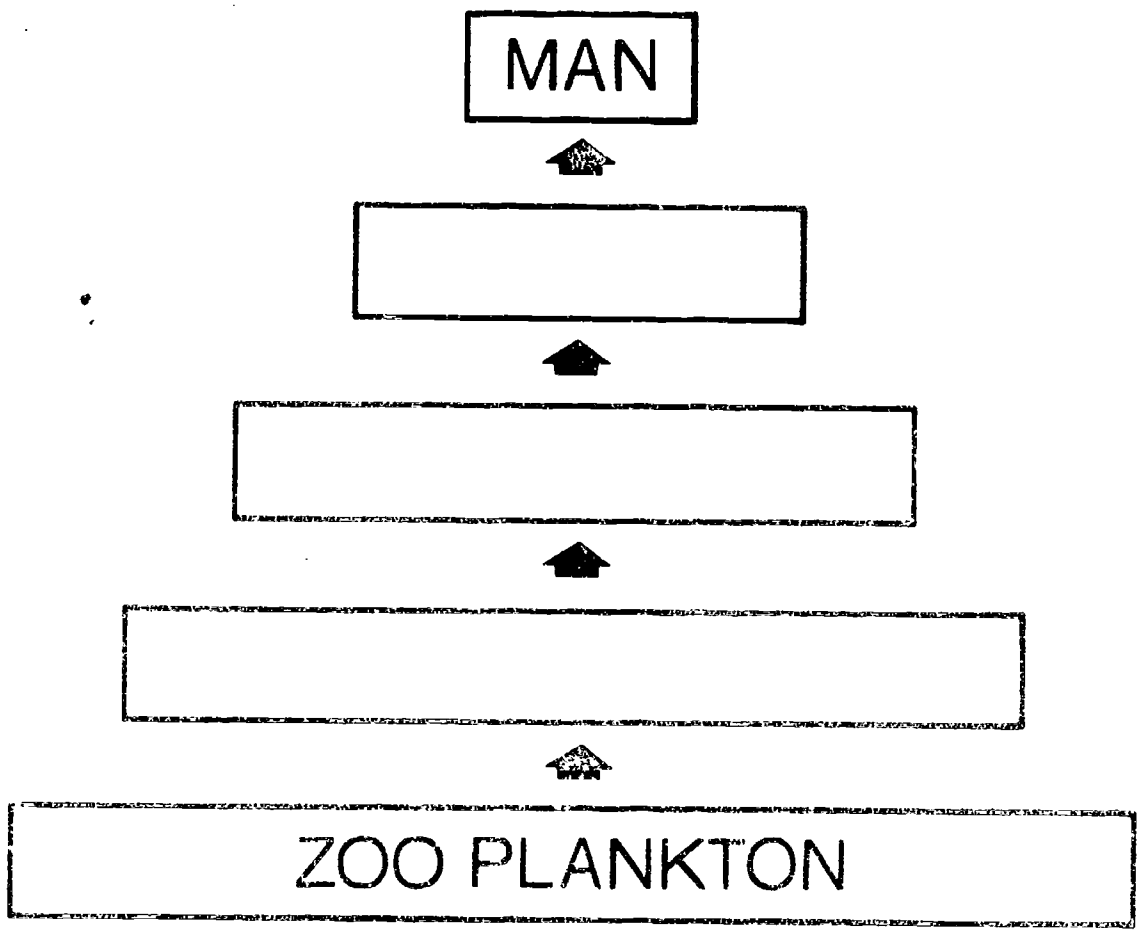


SIDE TWO

9. $\frac{10}{} \times \frac{\text{4.5 lbs. zooplankton}}{\text{1.0 lb.}} = \_\_\_$ lbs. of zooplankton

How many pounds of zooplankton will it take to support this population to the fingerling stage? (Find out how much the fingerlings will weigh when they are taken out of the rearing pond.) Why do you think plankton are identified as the basis for aquatic food relationships? Does your data support this statement?

10.



Others in the central and southern states are pondfish hatcheries. These produce largemouth bass, bluegill, and channel catfish and, to a lesser extent, other warmwater fish like smallmouth bass, redear sunfish, northern pike, and walleye.

A natural rearing pond supports a complex food chain of plants and animals. Plant nutrients dissolved in the water provide food for small aquatic plants called algae, which are then eaten by small microscopic animals called zooplankton. The zooplankton are eaten by insect larvae. Small fish feed on plankton and insect larvae, and in turn the smaller fish serve as a food source for larger predatory fish.

For certain species of warmwater fish, a hatchery can propagate food organisms found in many natural ponds. Natural rearing ponds are used to raise warmwater fish for stocking.

When a hatchery raises fish in man-made ponds or raceways, an artificial diet often supplements or replaces the natural diet fish would find in the wild. This artificial diet is carefully planned to promote normal growth and freedom from disease.

---

suitable water. Ponds for spawning and rearing pondfish are of various sizes, but preferably less than one acre. The depth of water in each pond is from two to five feet.

Thousands of fry are placed in a single rearing pond until they have reached one to two inches in size. This will take about three weeks, depending upon water temperature and other conditions of the pond.

How does a small rearing pond support the growth of vast numbers of fry? The following activities will help students answer this question. Each team of students should follow the activity procedure given below and record their observations on the Student Data Sheet.

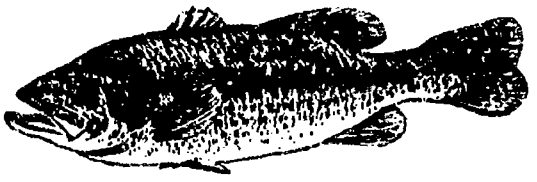
- A hatchery representative will provide the information for questions 1-5 on the Data Sheet.

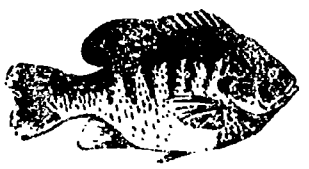
- Determine the total weight of the fish in the pond by weighing several fish together and calculating an average weight per fish (Question 6). Calculate the total gain in weight since the fish were first placed in the pond (Question 7).

- Food supply. In order to determine the food supply for the fish, each team should remove the stomachs from at least three freshly preserved fish. (A scissors will be needed for dissection and a 5% solution of formaldehyde for killing and preserving the fish.)

1. The stomach contents should be placed in water in a dish or shallow white pan for observation with a 15X hand lens or microscope.

2. Each team should also use a plankton seine or fine mesh dip net to collect food organisms present in the water.





Compare the stomach contents of the fish with the organisms collected in the water. Are they similar? Sketch some of the organisms found in the water and in the stomachs on the data sheet. Perhaps hatchery personnel will help identify them.

- These tiny aquatic organisms are called zooplankton. How many of them does it take to support the fish in this pond? Fisheries biologists have determined that it takes about 4-1/2 pounds of zooplankton to produce one pound of fish flesh. Using 4-1/2 pounds as a conversion factor, calculate the weight of zooplankton it took to produce the total pounds of fish flesh recorded for question 7 on the data sheet (Question 9).

This huge population of zooplankton is propagated by fertilizing the rearing ponds just as a farmer fertilizes his fields. Alfalfa hay is often used to encourage the growth of bacteria which are eaten by protozoa. The protozoa are food for the zooplankton. Data from a hatchery in Hebron, Ohio is given below.

Data from a Hatchery in Hebron, Ohio

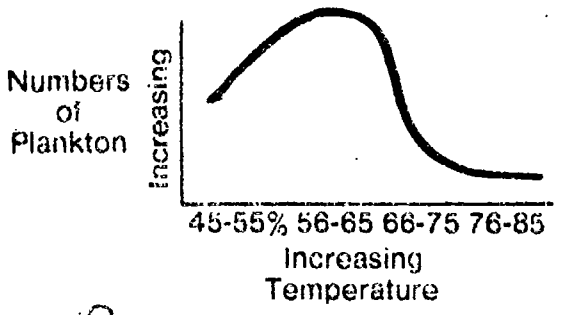
Pond size	1.0 acres
Pond volume	1,270,900 gallons
Fertilizer applied	1,320 lbs. alfalfa hay
	75 lbs. alfalfa meal
Fish crop removed:	
numbers	76,400
weight	191 lbs
Weight of fish stocked	70 ounces

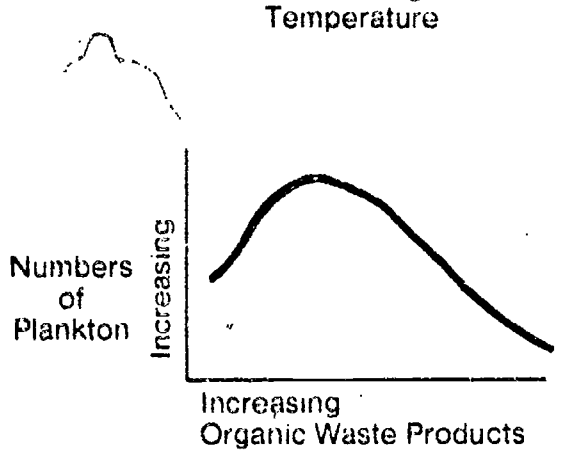
With all this food present, the number of zooplankton increases into the billions, providing a food supply for the young fish. When they have reached one to two inches in size, fish change their food habits to include larger animals such as insects, and in the case of bass and northerns, may even begin to eat each other! As fingerlings they are now large enough to be shipped by tank truck to stocking sites.

- Based on your observations and other related information, fill in the intermediate levels in the food chain diagram for number 10 on the data sheet. Discuss the possible choices for each level with the members of your team.

after the investigation

1. The tremendous density of plankton found in rearing ponds is usually not typical of natural lakes, ponds, rivers or streams. Yet plankton also forms the basis of food relationships and thus the productivity of these bodies of water. Plankton population growth is influenced by many environmental factors. The relationships between some of these factors and plankton growth are illustrated below.





Based on these relationships, how could chemical pollutants and thermal pollution affect the productivity of aquatic communities?

2. Stimulating the growth of aquatic organisms can be easily done in the classroom by fertilizing pond water with hay or dried grasses. Students can sample this "hay infusion" at various times to observe and record the presence and abundance of organisms. Fish such as guppies can be reared in an aquarium where organisms are cultured in this way.

3. Find out from the hatchery manager how you can improve the fishery resource in your community.

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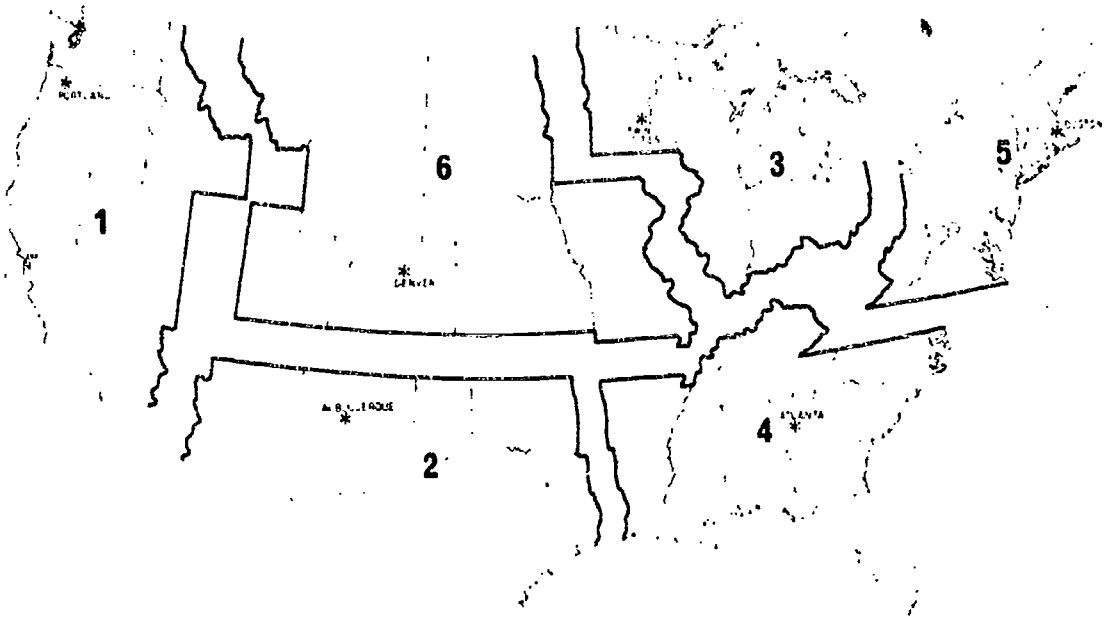

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 22

Synopsis

FARMING AND WILDLIFE
In this winter activity students compare two farm sites which differ in land use practices for wildlife. Physical and natural features are mapped and wildlife use of food and cover areas identified and analyzed.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U. S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Beside this, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guideline for public land management if citizens see value in these practices.

background

Wildlife is a product of the soil. Soil is the base for the pyramid of life; poor soil makes poor animals. The quantity and quality of any animal population indicates the quality of the land, and is therefore also an indicator of the quality of the entire environment.

Since croplands are chosen for their production capabilities, they can also

farming and wildlife

A **Purpose:** This activity will acquaint students with—

1 The relationships between various farming practices and the availability of winter cover and food for wildlife

2 The concept of habitat

3 The natural history of several wildlife species

B **Objectives:** During this activity students will —

1. Assess two different farm sites for wildlife by mapping winter cover and food types

2 Assess the same sites for abundance and diversity of wildlife by mapping winter signs

3 Compare the land use practices on these two sites as they relate to the quality of winter cover and food for wildlife

C **Activity Requirements:**

1 Access to farm sites which differ in land use practices

2 Equipment
a natural history field guides
b mapping materials

Introduction

Habitat, the place where organisms live, must provide the essential life requirements—food, water and cover. It is estimated that about 85 per cent of wildlife habitat is under private ownership, primarily as farmland. On cultivated land the need for food and cover for wildlife is often acute. This has been intensified by gradually increasing human pressure on the land—there are fewer weeds, less waste and less idle land.

Many wildlife biologists believe that wildlife decline in agricultural areas is a result of modern farming practices combined with drastic changes in agricultural land use. Winter places heavy stress on individual animals due to weather, competition for food, and lack of sheltering cover. More efficient fall harvest practices mean less waste is left in the fields for wildlife food through the winter. Declining pasture land, ditching, draining, plowing, and burning vegetation from fence lines and road sides have all resulted in less cover and reduced food sources for wildlife.

However, to the casual observer these land use changes may not be recognized and declining wildlife numbers may be attributed to any number of causes other than the quality of the habitat. In this investigation students compare different agricultural areas by using mapping procedures. Specific areas being used by wildlife are identified and the relative abundance of each species is estimated.

Planning

Contact the refuge manager for information on farming practices in your area and assistance in identifying the farm sites for the activity. This activity may require more than one trip to each site.

ACTIVITY PROCEDURE

Selecting the Activity Sites

In order to assess the results of farming practices on wildlife, two farmed areas showing different land use practices should be chosen. It may not be appropriate to compare a farmed area on a refuge with a privately owned farm since refuges raise crops specifically for wildlife. However, the refuge farm program should serve as a model of land use practices that are beneficial to wildlife. Refuge personnel can provide information about these practices and possibly give assistance in locating two farms for the activity. A list of some land use practices that differ in their benefit to wildlife is given below.

Some common land use practices on farm lands

Beneficial to Wildlife	Not Beneficial to Wildlife
1 Crop residues left in fields.	1 Crop residues gleaned or plowed under
2 Weedy areas	2 Weeds are mowed or sprayed
3 Shelter belts, windbreaks, groves, sloughs, wetlands, road sides and fence lines left as natural areas	3 These areas are drained, plowed or used as pasture

Mapping the Sites

Master maps of both farm sites should include the following:

1 Identify all major physical and natural features such as the locations of buildings, roads, fences, ditches, crop lands, pastures, groves, water areas, etc.

Data Sheet

Outdoor Classroom Guide Number 22

Farming: Land Use and Wildlife

Names _____

_____

Date _____

SIDE ONE

Farm site one _____

Field notes

1. Field conditions: (plowed, not plowed, etc.)

2. Cover plants: (identification of specific plants)

3. Food plants: (identification of specific plants)

4. Miscellaneous notes: (evidence of predation, death due to weather, etc.)

5. Weather conditions

SIDE TWO

Farm site two _____

Field notes

1. Field conditions: (plowed, not plowed, etc.)

2. Cover plants: (identification of specific plants)

3. Food plants: (identification of specific plants)

4. Miscellaneous notes: (evidence of predation, death due to weather, etc.)

5. Weather conditions

grow an excellent "crop" of wildlife by providing food and homes. But man's pressure for the use of more land, and more intensive use of existing lands, is drastically decreasing the numbers of other animals that can live there.

Many National Wildlife Refuges are established on lands that were ecologically disturbed by man's activities. Through better land use practices, their areas have been restored to a more natural environment.

By learning about the land management techniques that benefit wildlife, a student can more readily understand the land's sensitivity to change factors, its ability to recover from these changes, and the ecological problems that result when a natural habitat is disturbed.

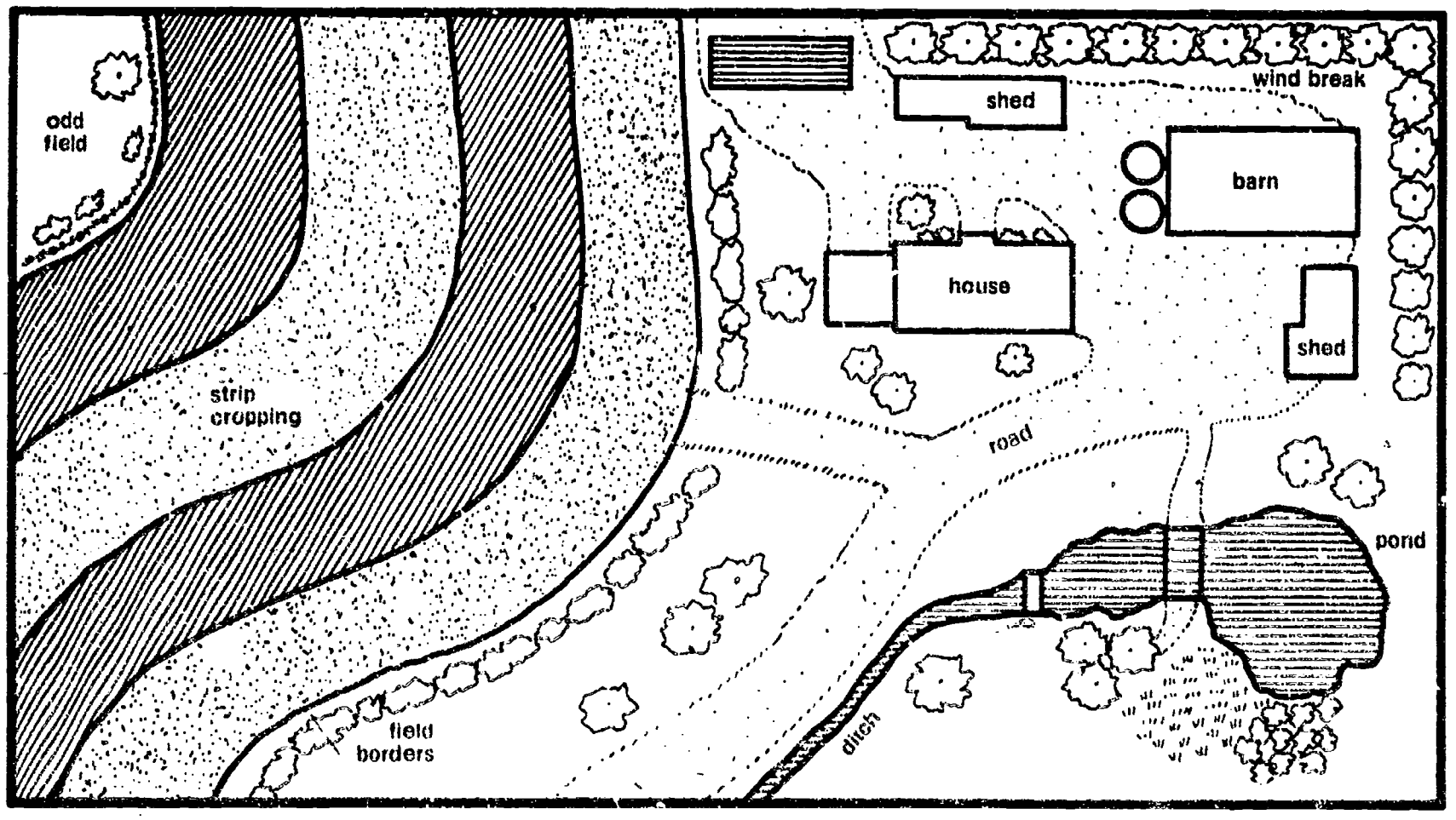
The private landowner will play an increasingly important role in determining the future of our Nation's wildlife resources by wisely managing land for man and wildlife, or by creating biologically sterile wastelands. Good agricultural practices plus reasonable consideration for wildlife are the most important part of a management plan for fish, birds and mammals.

2. Identify and label wildlife cover and food areas. Symbols could be used for these general vegetation types: grasses, nonwoody herbaceous plants, and woody shrubs and trees.

The Data Sheet can be used for rough sketches of the study sites and field notes.

Recording Wildlife Signs
Students will be recording tracks, droppings, sightings and other signs as evidence for the presence of wildlife. Local wildlife species of all types that are active during the winter should be considered. A fresh snowfall will offer the best conditions for mapping.

Individual teams of students could assess the sites for the presence of one or two species. Students should become familiar with the natural history of the common species to be mapped.
Evidence of wildlife should be recorded directly on the master map or on acetate sheets. A different symbol could be used for each wildlife species or group, for example a ▫ for songbirds, + for pheasants, **0** for deer, etc. A separate symbol should be used for different individuals of the same kind. For example, if two pheasants are using an area, two + + should be recorded on the map. If each team records their symbols on acetate sheets, they can be combined and used as overlays on the master map. see the illustration.



Field Notes
While students are identifying and mapping wildlife signs, general field conditions and miscellaneous points of interest should be recorded. Students could identify specific cover and food plants by using field guides or collecting samples to be identified later in the classroom.

Data Analysis
If each team records their wildlife data on acetate sheets and the master maps are also transferred to acetate, then they can be combined in numerous ways on an overhead projector. The following questions should be discussed:

1. What areas do wildlife species use? Why?
2. What differences in wildlife abundance and diversity exist between farm site one and farm site two? Do these differences relate to land use practices?
3. Do certain groups of wildlife seem to frequent places with common characteristics? (For example, are bird species typically found where there has been grain spillage or where certain plant species exist?)

after the investigation

1. Some students may be interested in talking to farmers and other residents about wildlife in their area. It may be possible to piece together the history of wildlife changes through hunting stories, old photographs and newspaper articles. Wildlife changes could be related to land use practices, life styles and attitudes over a long period of time.
2. Private land owners could be interviewed; current attitudes and land use problems should be discussed. The attempt should be to arrive at the reasons for opposing view points.
3. Wildlife habitat improvement projects could be initiated by students. This would be particularly valuable if done cooperatively with local land owners. The refuge manager can provide information and assistance for getting started.

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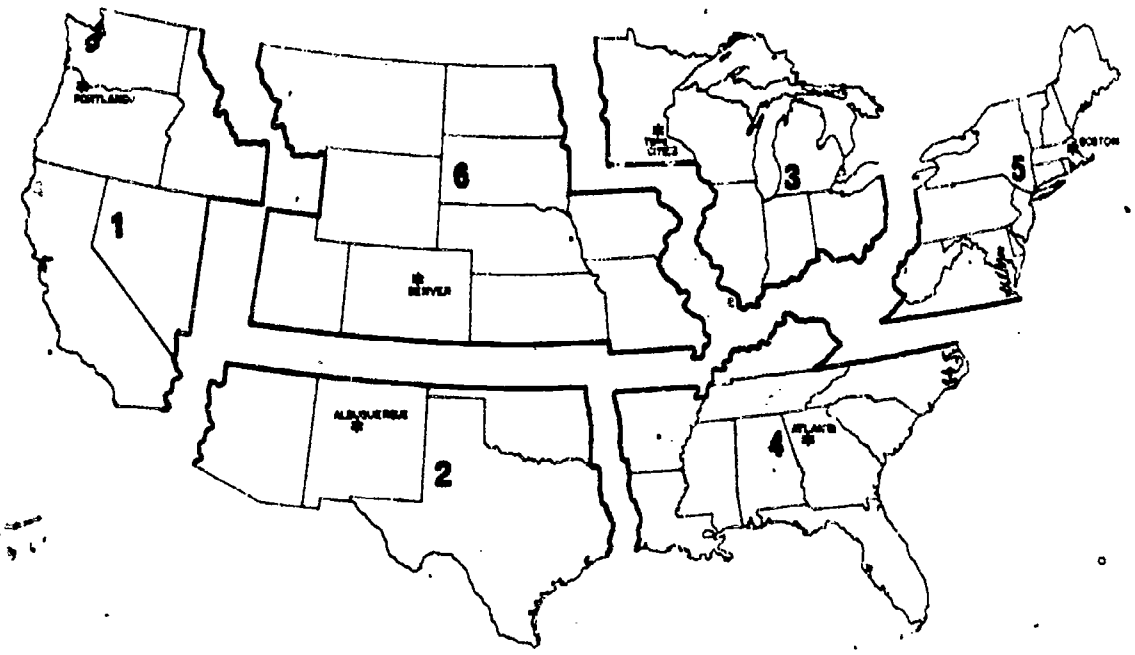

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Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 23

Synopsis

REDWINGED BLACKBIRD
In this activity students will be examining certain aspects of territorial behavior of redwinged blackbirds. They will map the territories of several males in a marsh area, observe territorial behavior, and theorize about possible relationships between territoriality and survival. One or more trips will be taken to the study site.

197

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

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background

It is possible for a female meadow vole to produce three to four litters of young a year. The babies are on their own within four weeks; each of the five to nine males and females potentially may start their own family when they are only two months old. Although not all wildlife species are so productive, each does produce enough

redwing blackbirds

A. **Purpose:** This activity will acquaint students with—

1. Some aspects of the life history of the redwinged blackbird.
2. Territoriality as a form of social behavior among animals.
3. Territoriality as it affects productivity of redwinged blackbirds.
4. Some of the relationships between man's activities and blackbird survival.

B. **Objectives:** During this activity students will—

1. Map the nesting territories of several blackbirds in a designated area.
2. Describe the behavior and communications used to establish and hold territory.
3. Offer some explanations for the spatial relationships of the territory boundaries
4. Suggest some influences that territory may have on productivity

C. **Activity requirements:**

1. An area of marsh marked to form a grid system for mapping
2. Binoculars should be available for observing behavior

Introduction

Investigations into the behavior of many species indicates that their social organization has survival value - survival for the individual as well as the species For example, a common behavior among birds is singing We usually think birds sing for the fun of it That may be true, but they also sing as a warning to other birds to stay away from their territory. The latter songs may not be appreciably different from other singing, but they will occur with greater frequency in the spring and then diminish in the summer after mating, egg production and the rearing of young. Thus, singing helps establish an area or territory where individuals of the same species breed and rear young.

Living as we do with many kinds of birds, we're accustomed to their singing and welcome it. Chances are we attach little importance to it as far as it relates to the birds survival. Yet, singing is a manifestation of territoriality which is a significant kind of social behavior observed when an animal acts to defend an area. The defense behavior ranges from physical attack of an intruder to chasing and feather ruffling, which is really a type of "psychological fighting." Individual defense of breeding territory may be crucial to the survival of the population because without territory, they usually will not mate

Pre-trip Planning

Contact the refuge manager and indicate your desire to do this activity While this activity need not be done exclusively on Service property, the manager is well informed, can provide assistance in creating and maintaining a study area and perhaps can even loan students some equipment The manager should definitely be consulted about the following.

1. Identification of a suitable study site on a refuge
2. Help in creating a grid system at the study site
3. The availability of a boat (if it is needed).
4. Constructing observation points if needed.
5. Estimates of peak territorial display dates and times.
6. The availability of binoculars.

Pre-trip Activity Sequence

Students will need practice with the techniques of observation and mapping. The following are suggested activities that will help them improve their skills.

1. By observing birds at feeding stations, students should be able to identify some common behaviors such as feeding and aggression. Students must be able to readily identify the redwinged blackbird and some of the common communication behaviors used to establish and hold the breeding territory. Refer to Figure one and two
2. On the study site, students should work in small teams with one acting as the recorder and the others as observers. Once the team has identified a territorial male, the communication behaviors of the redwinged blackbird will indicate its attachment to a general area or territory
3. Students may need to practice using binoculars
4. Students will also need practice in delineating and mapping an area on a grid system A football playing field will serve as a convenient grid system for the following suggestion

Data Sheet SIDE ONE

Outdoor Classroom Guide Number 23

Redwinged Blackbirds

Names _____

Date _____ Time _____

Place _____

PART A

Map of territorial area for each team (see numbers 4 and 5—procedure at the study area).

SIDE TWO

Figure Two

1. Perch

2. Singing

3. Flight

4. Fighting

PART B Behavior Checklist

Type of Behavior	Record Frequency for Each Observation	Total
1. **Perch:** Shoulder patch display		
2. **Singing:** song scolding		
3. **Flight:** hovering diving		
4 **Fighting:** chasing encounters		
5.		
6.		

PART C Discussion Questions

- Do any territories overlap?
- Are some territories considerably larger than others?
- Does territory size seem to relate in any way to the physical features of the marsh?
- Do you think your presence at the marsh had any effect on bird behavior?
- How might the size of territories relate to total egg production in the marsh you studied?
- Are there parts of the marsh which seem unoccupied? If so, can you suggest why this is the case?
- What kind of behavior was most frequently observed? Can you offer some reasons for your observations?
- Considering the habitat preferred, how might draining the marsh affect territory size? What effect would this have on egg production?

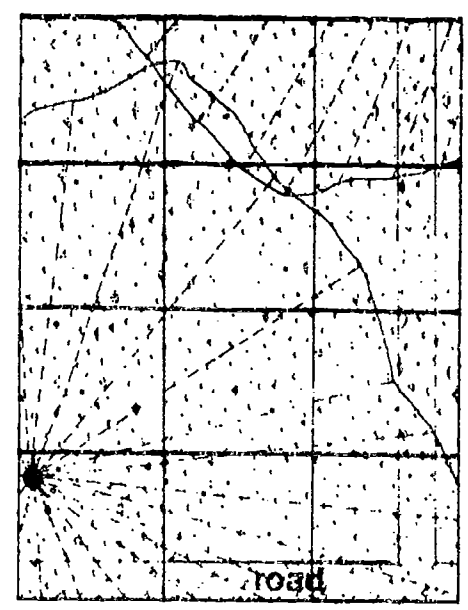


Figure Three—Portion of a Composite Map

young to maintain a healthy and stable population.

Winter places heavy stress on individual animals due to weather, competion for food, and lack of sheltering cover. However, the surplus of young that are born each spring and summer make up for losses from winter hardships, illness, weakness, broken bones and all other possible misfortunes.

Every area of land can support only a certain number of each kind of animal —this is called its carrying capacity. For nearly every species, a surplus of individuals results in a deterioration of living conditions that affects the well-being of the whole population. Nature usually ensures that each population of animals has the capability to overproduce. The factors limiting actual numbers are determined by the land's carrying capacity.

Besides influencing the survival of surplus animals, carrying capacity affects production. Each species has an established social structure. Territorial competition in the spring for nesting sites and feeding territories limits the number of adults producing young. Man affects this production by changing the habitat and making more or fewer nesting sites or feeding territories available.

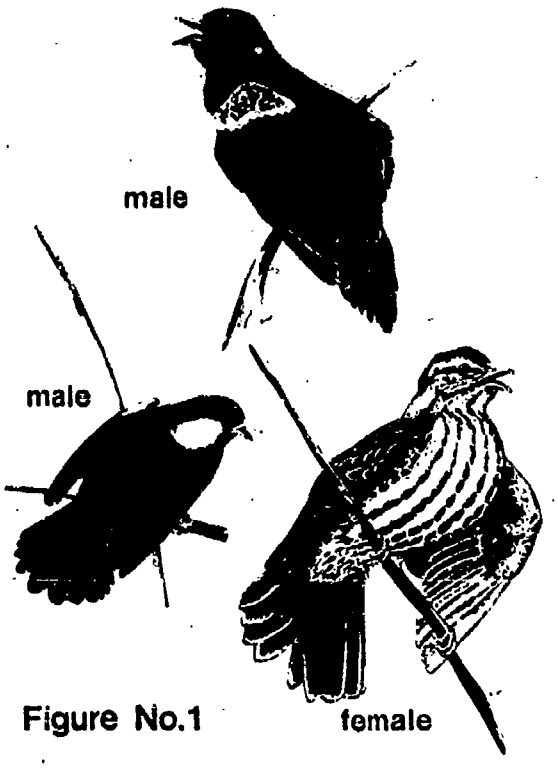
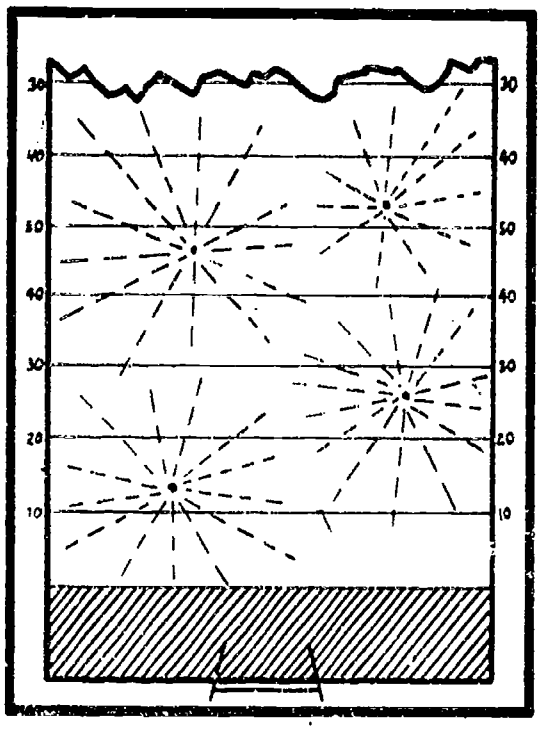


Figure No.1

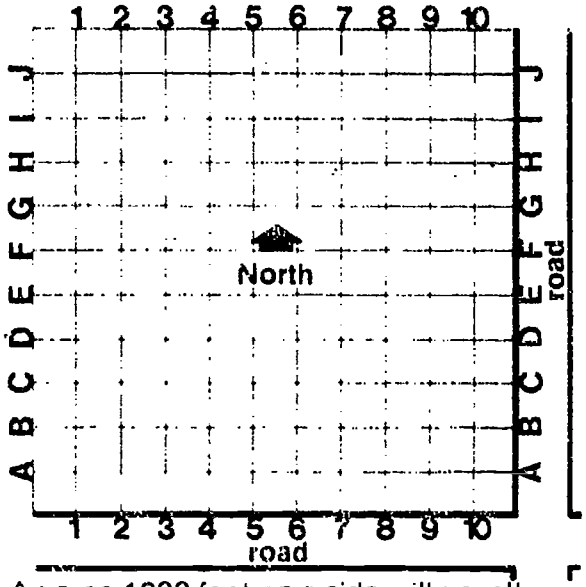
At various places on the field, students can simulate the movement of the redwings by running short distances from a central point and then returning. A set of movements, when mapped, will look something like the sketch below.



Teams observing single student "birds" should pool their data forming one big map to show the "territories" of all the students on the field.

Making a Grid

The marsh can be a confusing sea of cattails without the aid of a grid system as a reference for establishing positions and distances. As you read through this description of a grid system, refer to the following illustration.



An area 1000 feet on a side will usually encompass several territories. However, local conditions must be considered to determine this. The area should overlay a dense population of cattails or bullrushes, but not extend much into open water.

There are many ways to lay out a grid system. However, markers must be placed at least around the entire boundary of the area. The illustration shows two roads intersecting at the S. E. corner of the map. Note that the markers on the road edge correspond to the ones out in the marsh. Markers could also be placed inside the area showing the positions of grid line intersects. In this illustration, internal markers would be placed at 100-foot intervals forming a giant checkerboard This would help increase observation accuracy.

Points on the grid can be marked with stakes and colored strips of plastic for easy visability. Stakes can be placed through the ice in winter. If the marsh is wadeable, they can be placed after the ice melts early in the spring. The marker stakes must be tall enough to be seen easily over the vegetation after they have been driven several feet into the marsh soil.

If more than one trip is planned, students can help construct the grid system. They can easily lay out the grid using tape measures and stakes. If open water is encountered, boats or canoes would be useful; otherwise (assuming this is done in the spring), rubber waders will suffice. Observe the usual precaution of testing mud and water depth with a stake before stepping about.

Procedure at the Study Area

Plan to make at least two or more trips to complete the activities outlined below. Since most territorial behaviors occur between dawn and 10:00 a.m., get there early. An option here is to camp out overnight near the site, with permission, in order to begin observing at dawn. Also, some late afternoon (after 4:00 p.m.) territorial behavior has been observed

1. Plan to meet the refuge manager at the gridded study site. Obtain a brief status report on the birds Are there many or few at the study site? Are they just males or have some females returned?

2. Spend the time needed to familiarize the class with the area. Using binoculars, watch birds both perched and in flight. Do some preliminary tracking, cross-checking data from time to time. Is the technique simulated on the football field useful?

3. Preliminary observations should be concluded when teams choose to observe one particular bird. (More than one team can, and probably should, observe the same bird from several view points.)

4. Within the gridded area, map the general characteristics of the marsh habitat. Sketch open water, cattails, trees, shrubs, old posts and other features. These will be useful as reference points. Use Part A on the data sheet.

5. Begin mapping the territories. Since each bird is different, territorial behavior will vary so some may choose to remain perched longer than others, thus extending the observation time. Determine the major perching place of the bird being observed. At the peak of their mating periods, birds show increased antagonistic behavior and more frequently perch at the boundaries of their territories. Indicate the kind and frequency of these behaviors on the data sheet. Also, mark the location where specific behaviors occur.

   Often twenty perch points will define the territory. Mark these points using the grid, recording movement according to the coordinate system. Each team should plot the territory defined by their observations. A composite map showing all of the territories can be made later.

after the investigation

1. Begin preparation of a composite map. When complete it should show habitat and territories. In some instances only partial territories will show.

2. Number and estimate sizes of territories. Mark points where specific behaviors occur. Key this data into a behavior table, include in legend form on the map

3. A completed composite might resemble Figure 3 on the Data Sheet

4. Tabulate all the behavioral data gathered. Determine the frequency of certain kinds of behavior.

5. Discuss the questions in Part C on the data sheet.

6. At some point it may be worthwhile for interested students to acquaint themselves with the life history of redwinged blackbirds. Some students may wish to return to the marsh at regular intervals during the period in which eggs are hatched and the young are reared to verify the status of the territories observed during these initial studies. Redwings also nest in the uplands such as hayfields; this would also provide investigation opportunities.

Some rather interesting projects can be done to further gain more information about territoriality. For example, students can easily model blackbirds with styrofoam and paint. What might happen if such a decoy were affixed to a stake and placed in a territory? Try both a male and a female. If students enter a territory, how does the defender behave? The observable difference between males and females seems to be the red color on the wings of the male. Students could design and conduct a study which reveals the role of wing color and its relationship to territorial behavior.

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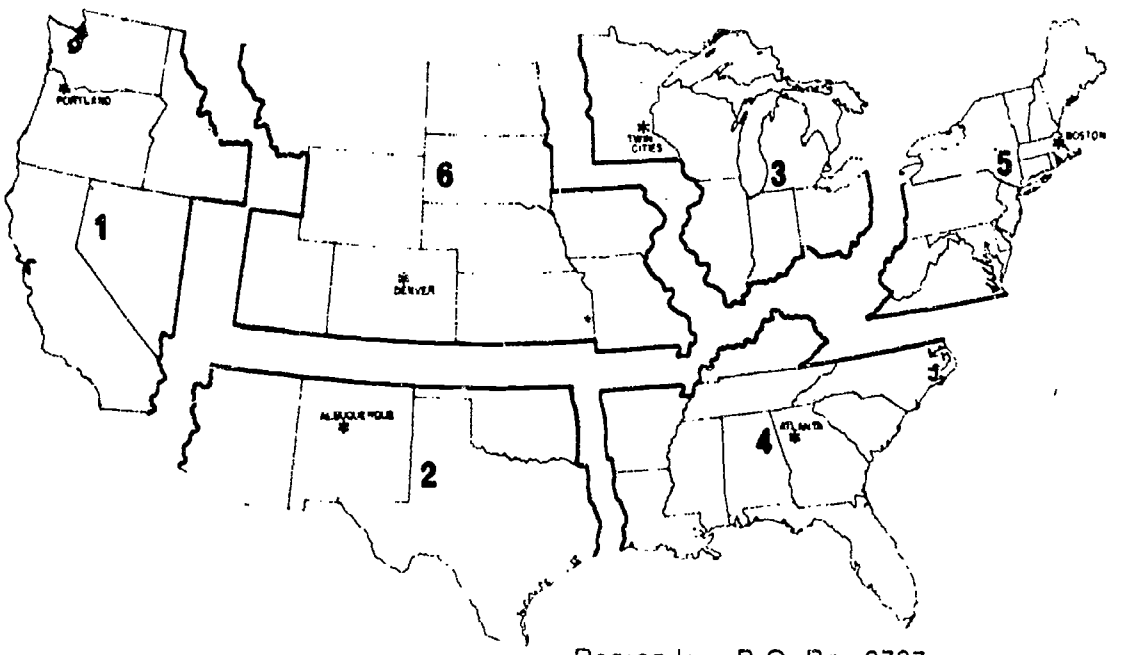

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Denver Federal Center
Denver CO 80225

Alaska Area Office
813 D Street
Anchorage AK 99501

This Outdoor Classroom guide is one of a series others are available from your local or regional Service representative

Outdoor Classroom

Environmental Education Guide

U.S. Fish and Wildlife Service

Guide Number 24

Synopsis

ENDANGERED SPECIES: MYSTERY BIRDS
Intended for junior-senior high school students and involves classroom activities which deal with differences within populations and between populations. The differences and some common life requirements are related to the survival of the populations.

Prepared by:
U. S. Fish and Wildlife Service
Minnesota Environmental Sciences Foundation, Inc.

environmental goals

Every citizen's decision, or lack of decision, in some way determines the use and the future of public lands.

The U.S. Fish and Wildlife Service is this Nation's only Federal land management agency solely responsible for fish and wildlife. It is the Service's belief that through education and direct experience, citizens can gain information, understanding and attitudes that will support wise use of public lands.

Maintaining environmental harmony is a crisis concern of the Service. Man must continue to live in the world in some reasonable "balance" with the land and with other life, otherwise he will not survive.

Service programs help people to learn about land and wildlife, involve themselves in interactions with the natural world, and enrich themselves through that strange aesthetic joy which can be experienced in the midst of a wild environment. Besides these, the Service attempts to make its lands a model of environmental management.

Quality and harmony will remain a part of the environment and remain the guidelines for public land management if citizens see value in these practices.

background

An ecologist has described animals and plants as actors in an evolutionary drama. As they spread over the earth, they become distributed among different habitats and environments or on different ecological stages. This drama is directed by interactions among the players: competition for energy and resources, climate, catastrophe, the relative stability of

Endangered species: mystery birds

A. **Purpose:** This activity will acquaint students with —

1. Some basic life requirements of organisms.
2. The differing tolerances, among species of wild animals, to adapt to changes in their environment.
3. The ways man influences the success of animals.

B. **Objectives:** During this activity students will —

1. List and discuss their own preferences to some environmental factors.
2. Compare and discuss two hypothetical human populations which are adapted to different room temperatures.
3. Predict and discuss the tolerance or adaptability of two different unknown species of birds to present-day environmental conditions.
4. Have the opportunity to explore their own values concerning endangered animals.

C. **Activity requirements:**

One data sheet for each student.

Introduction

In this investigation students compare variation within a population by examining some of their own tolerances and preferences. A consideration of variation between two different student populations is used to introduce participants to a general discussion of the life requirements of two mystery species, and the ways man may influence the survival success of animals.

Activities

1. Variation Within a Population: What Are Your Tolerances to Environmental Conditions?

Wildlife species possess different tolerances. Environmental conditions such as temperature, food, sunlight and water are often called life requirements.

The following activity dealing with some basic human survival requirements will help students identify their own individual tolerances. Although this activity will show variation within a human population, the information will be useful later on in dealing with variation between populations of different species.

Students should individually indicate their tolerances based on their choice of optimum level or preference for each life requirement continuum on the data sheet. The numbers, 1-7, do not indicate actual quantities but provide a way to record a tendency on the continuum. Students should check a number for each factor to indicate their preferences.

As a class, record student responses to the choices. One method for compiling the information is shown below.

Temperature: room temperature

low **high**

// //// //// //// /// / ///

No. of Students 10

Discuss diversity or similarity of choices for each life requirement. For example, using the room temperature responses above, some discussion questions might be: Are all of the responses the same? What are some possible reasons for variable responses? How do individuals at either end tolerate room temperatures that are usually adjusted to the center of the continuum? Are these means of adjustment available to other animal species? Keep the information for the next activity.

2. Variation Between Two Different Populations: A Hypothetical Problem

Divide the class into two hypothetical populations according to eye color. All students with blue eyes or variations of blue make up one population and all those with brown eyes or variations of brown make up the other.

Assume tolerance or adaptation of these two populations to temperature variations is narrow. The blue-eyed animal population requires a low indoor temperature and the brown-eyed animal population a high indoor temperature.

Some group discussion questions:

1. What consequences are there for setting the temperature high? Low?

2. Should one population be allowed to survive at the expense of the other?

3. Could both populations survive? What would you do to allow for the survival of both populations?

4. What competition pressures would exist between the two populations?

Tolerances and adaptation among wild plants and animals are comparable to

Data Sheet SIDE ONE

Outdoor Classroom Guide Number 24

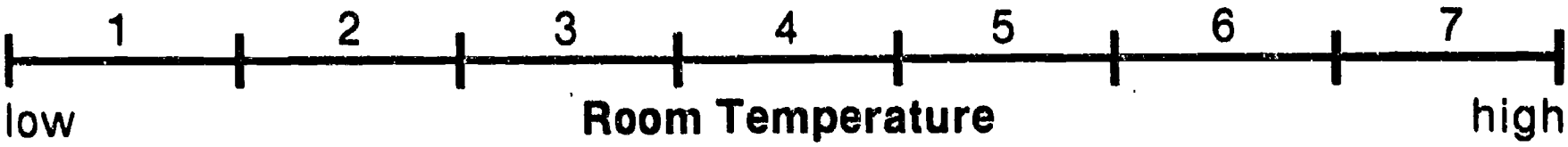
Endangered Species: Mystery Birds

Name_____ Date_____

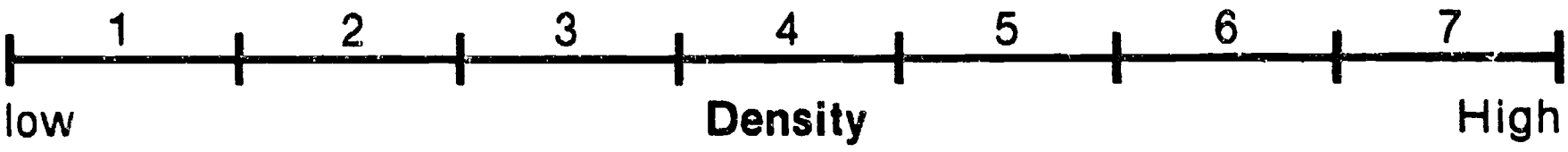
VARIATION WITHIN A POPULATION: WHAT ARE YOUR TOLERANCES?

Check a number for each life requirement continuum.

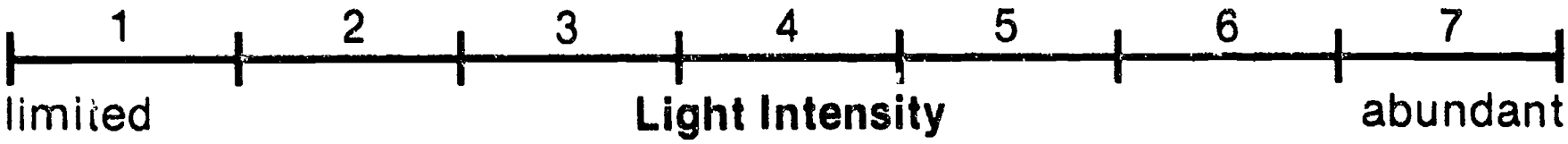
a. Temperature
For the following room temperature levels, indicate your preference.



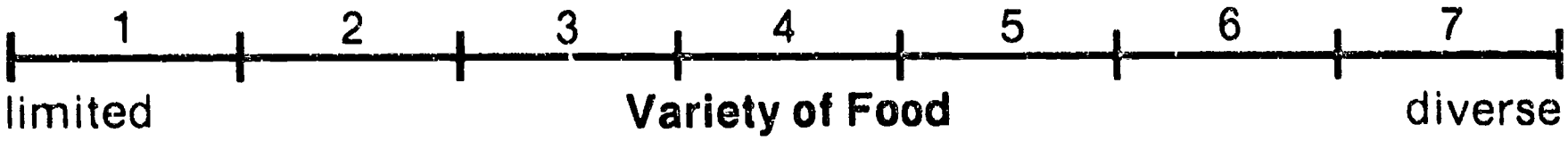
b. Density. (Number of People per Unit of Area)
For the following density levels of people, indicate your preference.



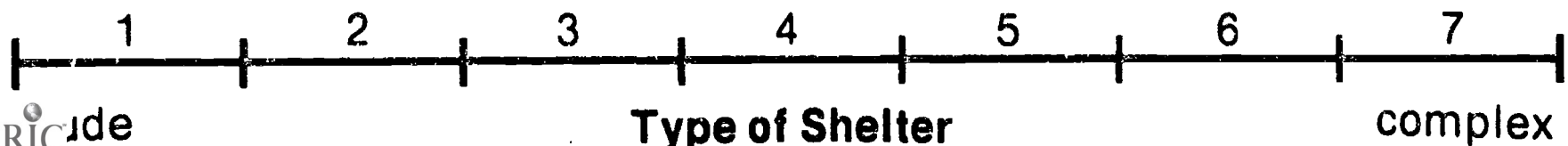
c. Light.
Indicate the amount or intensity of light vs. darkness you prefer.



d. Food.
Indicate whether you would prefer a lot of different kinds of food or only one or a few kinds of food.



e. Protection.
Indicate the type of shelter (degree of complexity) you prefer.



SIDE TWO

Mystery Birds: A Real Problem

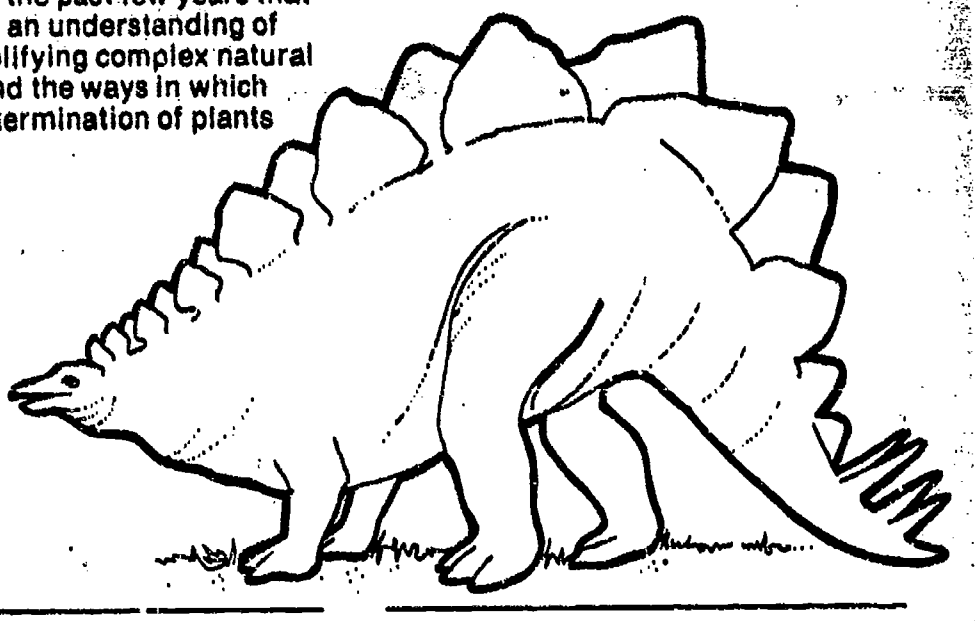
My prediction: The most abundant species is _____ because (list some reasons).

various environments and by all kinds of chance events.

Extinction of plants and animals has occurred many times in this theatre although the causes and their significance are not always well understood. For example, during the Permian period which occurred some 280,000,000 years ago, approximately half of the animal families on the Earth had disappeared. These extinctions did not occur all at once, of course; this period was approximately 50,000,000 years in length.

In the late Pleistocene (Ice Age) a similar major extinction occurred. Many local North American mammals became extinct. Man, using the Bering Land Bridge immigrating to this continent, is implicated in this extinction.

General concern about extinction directly caused by man, and threat of extinction by man, is relatively recent. It is only within the past few years that we have gained an understanding of our role in simplifying complex natural communities and the ways in which this leads to extermination of plants and animals.



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the hypothetical eye color/temperature problem in the sense that different organisms use survival elements in different ways. Some can adapt to many conditions, others cannot. However, this is not based on preference but on the adaptability of the species to evolutionary change.

3. Mystery Birds: A Real Problem

Two bird populations have been selected for this activity. The following chart gives some important information about their life histories.

After reading the life history descriptions, each student should record on the data sheet the species he thinks is most abundant and some reasons for his choice. Now tally the information from the entire class, give the number for each species along with some of the major reasons for the choices. Put this on the blackboard before discussing the following questions:

1. Which environment seems more stable to you? Which species would seem to demand a more stable environment? What reasons do you have for your answers?

2. Which species would seem less tolerant of human disturbance? What reasons do you have for your answer?

3. What do the feeding habits of the organisms tell you about the organism's behavior, physical appearance, its physiology, its habitat?

4. In what ways would human activities intrude on the behavior and life requirements of each organism? What are the reasons for your answers?

5. Rank order, from most important to least important, the environmental changes which would most affect each organism. (This list would be generated in class.)

After discussing these questions, determine if any students want to change their choices.

MYSTERY BIRDS

LIFE HISTORY CATEGORIES	SPECIES A	SPECIES B
1. Size	Large	Small
2. Range	No. America	No. America, Central America, and northern So. America
3. Time to reach adulthood	3-5 years	1 year
4. Lifespan of adult	20-40 years	2-3 years
5. Food	Fish and small mammals	Insects and seeds
6. Number of mates: pair	1 male: 1 female	1 male:2-3 females
7. Size of breeding territory	Large	Small
8. Nesting habitat	Large old trees or cliffs; large water areas	Wetlands, grasslands, grain fields or small grains
9. Average young produced/pair each year	1-2	3-4

Let's end the mystery.

Turn to the back page for the names of the mystery birds.

Although the endangered bald eagle is certainly a major concern, there are numerous species of plants and animals classified as endangered in the United States. The following questions may help individuals identify their personal understanding and values concerning this problem.

Many of the following discussion questions are intended to help students better identify their interests, concerns, attitudes and feelings about endangered species. Thus, these questions are deliberately open-ended with no precise right or wrong answers. These questions may or may not lead to extended discussion; when interest wanes, it is time to move on. Usually every student will want to respond sometime during the discussion. It is important that the questions do not become an interview.

Answers should be accepted in a non-judgemental atmosphere. Often additional clarifying questions related to terms, meaning, assumptions, implications, data collection techniques, alternatives, etc. are often very helpful in leading to further understanding.

It is important that students are not forced to answer these questions but are allowed to deal with them according to their interests.

1. Which would you rather see? (Rank order from first to last choice.)
a. eagle
b. deer
c. moose
d. wolf
e. screech owl

What are the reasons for your choice?

2. How do you feel about the hunting of animals for man's purposes?

3. What can a person your age do about protecting endangered species?

4. What should other people do to protect endangered species?

5. Which of the following do you believe to be most important? Rank them from most important to least important.
a. Protecting endangered species
b. Finding a cure for cancer
c. The manned space program
d. Developing ways to use sewage in agriculture

6. What living things do you care most and least about? What are the reasons for your choices?

after the investigation

If you are interested in more information about endangered species, contact:

Public Information Department
National Audubon Society
950 Third Avenue
New York, N.Y. 10022

or one of the following regional Service offices listed on the back page.

Mystery Species A: American Bald Eagle (**Haliaeetus leucocephalus**)

"Most of the remaining bald eagles nest in Canada or Alaska. Some, but not all, bald eagles migrate (if food is readily available all year, they are likely to remain near their nesting region) and many of those that are seen in the lower 48 states during the winter months are migrants from Canada. Only about 750 pairs still nest south of the Canadian border."

(**The Endangered Bald Eagle**, Public Information Department, National Audubon Society, 950 Third Avenue, New York, N.Y. 10022)

Mystery Species B: Redwinged Blackbird (**Agelaius phoeniceus**)

The redwinged blackbird, found throughout North America may be the most numerous breeding bird on the Continent. Breeding pairs number in the 10's of millions and in some parts of the United States it is considered a serious agricultural pest.

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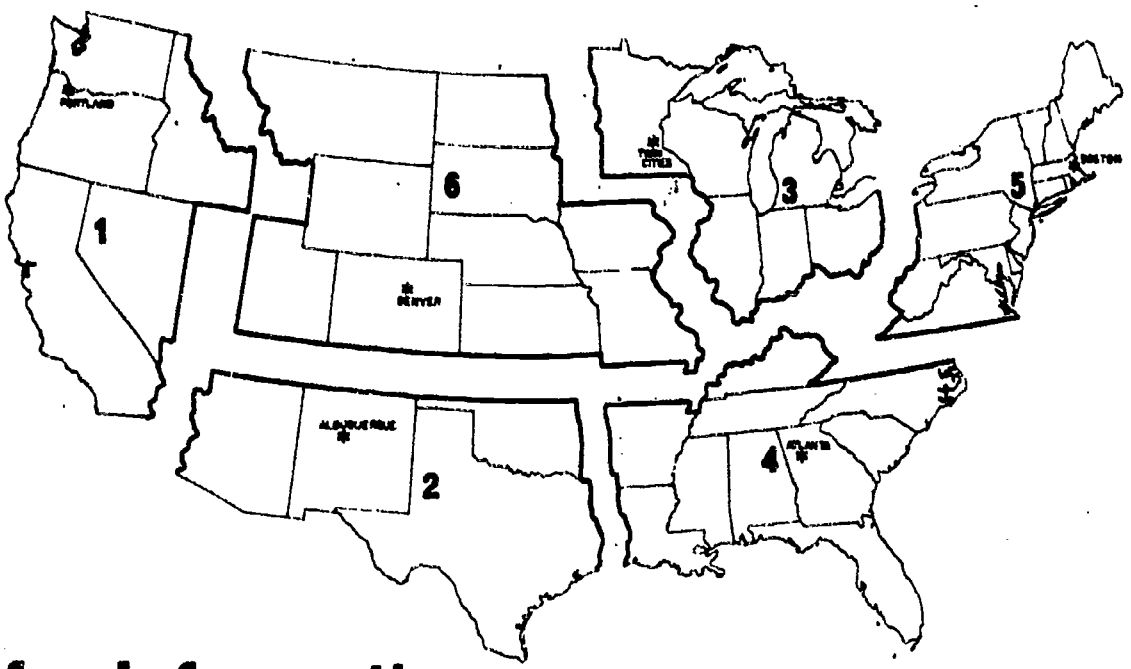

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