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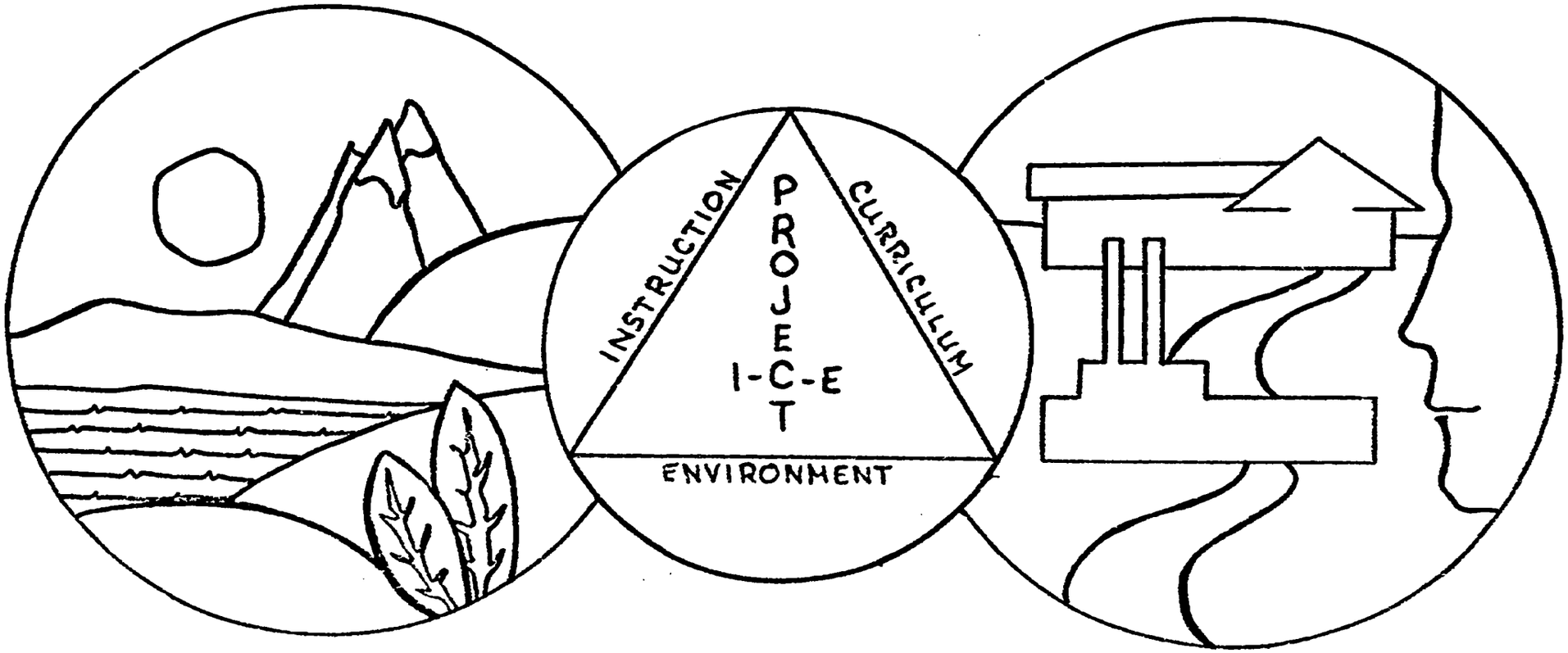
ABSTRACT

This eighth grade mathematics guide is one of a series of guides, K-12, that were developed by teachers to help introduce environmental education into the total curriculum. The guides are supplementary in design, containing a series of episodes (minilessons) that reinforce the relationships between ecology and mathematics. It is the teacher's decision when the episodes may best be integrated into the existing classroom curriculum. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Although the same concepts are used throughout the K-12 program, emphasis is placed on different aspects of each concept at different grade levels or subject levels. This guide focuses on aspects such as radius, geometry, and average and percent. The 12 concepts are covered in one of the episodes contained in the guide. Further, each episode offers subject area integration, subject area activities, interdisciplinary activities, cognitive and affective behavioral objectives, and suggested references and resource materials useful to teachers and students. (Author/TK)

ENVIRONMENTAL EDUCATION GUIDE



MATHEMATICS

8

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FORWARD TO PROJECT I-C-E ENVIRONMENTAL EDUCATION GUIDES

In 1969, the First Environmental Quality Education Act was proposed in the United States Congress. At the time of the introduction of that legislation, I stated:

"There is a dire need to improve the understanding by Americans of the ominous deterioration of the Nation's environment and the increasing threat of irreversible ecological catastrophe. We must all become stewards for the preservation of life on our resource-deficient planet."

In the three years since the Environmental Education Act was passed by the Congress, much has happened in the United States to reinforce the great need for effective environmental education for the Nation's young people. The intensive concern over adequate energy resources, the continuing degradation of our air and water, and the discussion over the economic costs of the war against pollution have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution. That is necessary, but not sufficient." The race between education and catastrophe can be won by education if we marshall our resources in a systematic manner and squarely confront the long-term approach to saving our environment through the process of education.

As the incessant conqueror of nature, we must reexamine our place and role. Our world is no longer an endless frontier. We constantly are feeling the backlash from many of our ill-conceived efforts to achieve progress.

Rachel Carson's theme of "reverence for life" is becoming less mystical and of more substance as our eyes are opened to much of the havoc we have wrought under the guise of progress. A strong commitment to an all-embracing program of environmental education will help us to find that new working definition of progress that is a pre-requisite to the continued presence of life on this planet.

- Senator Gaylord Nelson

MATH PREFACE

Many people believe that any and every facet of environmental education relates only to science. They seldom associate environmental problems as their problems. It is hoped that this misconception will be rectified with the exercises provided in this booklet. The writers tried to implement environmental education in all areas of the curriculum because the environmental problems involve any and all subject areas. Another reason for developing environmental awareness is that man influences and is influenced by the environment, either directly or indirectly.

The supplementary guide is designed to be an addition to the curriculum and not to replace it. The guide should make the students and teachers aware of our environmental problems. Although the exercises listed in this booklet are designed for junior high school mathematics, revision by the instructor can result in the material being used at a higher or lower instructional level. It is also intended that the users will understand the relationship between ecology and mathematics. For example, in one of the exercises the student can determine the amount of fresh water that is needed in the United States as compared to the amount of fresh water that is available. The lesson points out, through examples, the need for conserving one of our important natural resources, water.

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DIRECTIONS FOR USING THIS GUIDE

This guide contains a series of episodes (mini-lesson plans), each containing a number of suggested in and out of class learning activities. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Further, each episode offers subject area integration, multi-disciplinary activities, where applicable, both cognitive and affective behavioral objectives and suggested reference and resource materials useful to the teacher and students.

1. This I-C-E guide is supplementary in design--it is not a complete course of study, nor is its arrangement sequential. You can teach environmentally within the context of your course of study or units by integrating the many ideas and activities suggested.

2. The suggested learning activities are departures from regular text or curriculum programs, while providing for skill development.

3. You decide when any concepts, objectives, activities and resources can conveniently be included in your unit.

4. All episodes can be adapted, modified, or expanded thereby providing great flexibility for any teaching situation.

5. While each grade level or subject area has its own topic or unit emphasis, inter-grade coordination or subject area articulation to avoid duplication and overlap is highly recommended for any school or district seeking effective implementation.

This total K-12 environmental education series is the product of 235 classroom teachers from Northeastern Wisconsin. They created, used, revised and edited these guides over a period of four years. To this first step in the 1,000 mile journey of human survival, we invite you to take the second step--by using this guide and by adding your own inspirations along the way.

PROJECT I-C-E TWELVE MAJOR ENVIRONMENTAL CONCEPTS

1. The sun is the basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel and power for life systems and machines.

2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.

4. An adequate supply of clean water is essential to life.

5. An adequate supply of clean air is essential for life.

6. The distribution of natural resources and the interaction of physical environmental factors greatly affect the quality of life.

7. Factors such as facilitating transportation, economic conditions, population growth and increased leisure time influence changes in land use and population densities.

8. Cultural, economic, social, and political factors determine man's values and attitudes toward his environment.

9. Man has the ability to manage, manipulate and change his environment.

10. Short-term economic gains may produce long-term environmental losses.

11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

12. Each person must exercise stewardship of the earth for the benefit of mankind.

A "Concept Rationale" booklet and a slide/tape program "Man Needs His Environment" are available from the I-C-E RMC to more fully explain these concepts.

TABLE OF CONTENTS

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 1 - Energy **SUBJECT** Math

ORIENTATION Energy Systems **TOPIC/UNIT** Radius, Diameter and Area

BEHAVIORAL OBJECTIVES

Cognitive:

Calculate, by similar triangles, that the sun is a very large mass of gases in the heavens. Explain how air pollution reduces the amount of the sun's energy that is received by the earth.

Affective:

Demonstrate alertness to the idea that the sun's energy received by the earth, although very small, is very necessary for all life to exist by finding examples in nature. Generate support for a plan which will reduce the energy necessary each day in the community.

Skills Used:

1. Radius
2. Diameter
3. Area
4. Similarity of triangle
5. Ratio
6. Proportion

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Calculate the radius, diameter and area of the sun. (See attached sheet)

B. Discuss in class the following ideas:

1. Ask the students to suggest the percentage of sunlight that reaches the earth taking into consideration the distance the sun is from the earth and the size of the sun and the earth.
2. Compare the suggested percentages of sunlight reaching the earth to the amount received as found in a scientific source.
   a. Discuss how air pollution may affect the amount of solar energy reaching the earth.
   b. Have the students suggest ideas on increasing the use and amount of solar energy reaching the earth.

Outside or Community:

A. Information for the student-centered activity can be obtained from the library.

B. Outside speakers:

1. A biology teacher--a discussion about the process of photosynthesis. Relate various experiments conducted with different light filters on the process of photosynthesis.
2. An ecologist--relate the air pollution problem to plant growth and development.

Also, Kit 45 (I-C-E RMC)
U.S. Department of Agriculture
The Effects of Air Pollution on Plant Life, 1972.
(3 sets of slides with narrative guide.)

SUGGESTED RESOURCES

Publications:

Books: 110 Energy Sources,
I-C-E TH RMC
Wisconsin Survival Handbook,
Doug LaFollette and Peter Anderson,
1971.
Kit 45 I-C-E RMC.

Audio-Visual:

Film #5553 - Photosynthesis,
$8.75 BAVI 1963.
Film #6753 - Green Plants and Sunlight,
$4.00 BAVI 1966.
Film #4170-4171 - Our Mr. Sun,
$4.00 BAVI 1956.
Film #6949 - Sun's Energy,
$5.00 BAVI 1963.
A World Is Born, #220, I-C-E RMC.

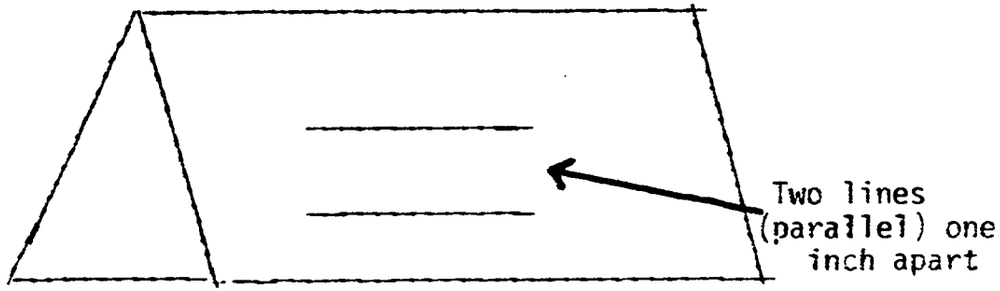
Community:

Library
Biology Teacher
An Ecologist

CONTINUED OR ADDED LEARNING ACTIVITIES

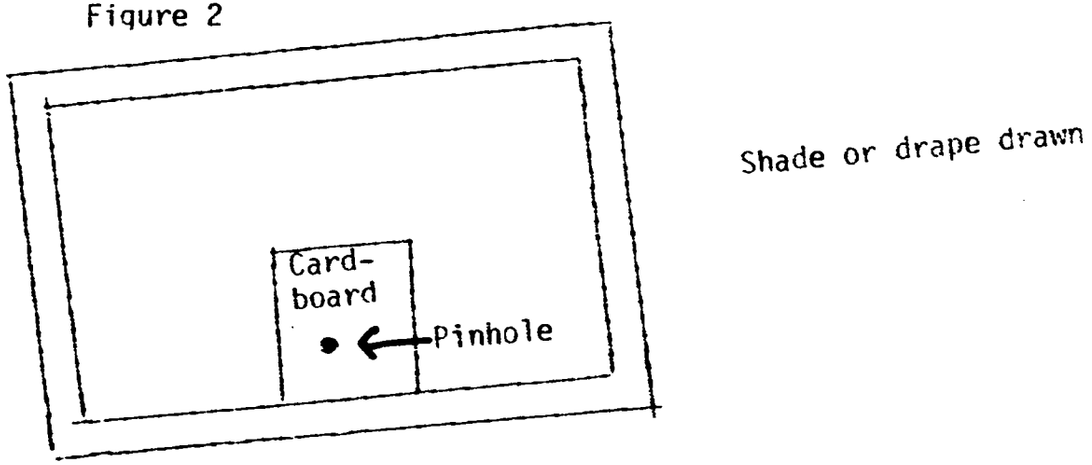
A. 1. Calculating the Radius and Diameter of the Sun.
Draw two parallel lines, one inch apart on a piece of white cardboard and fold. (See figure 1)

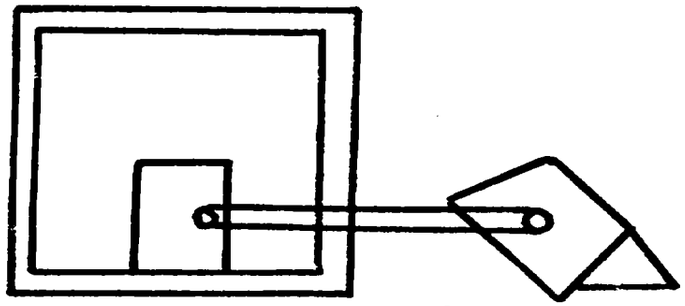
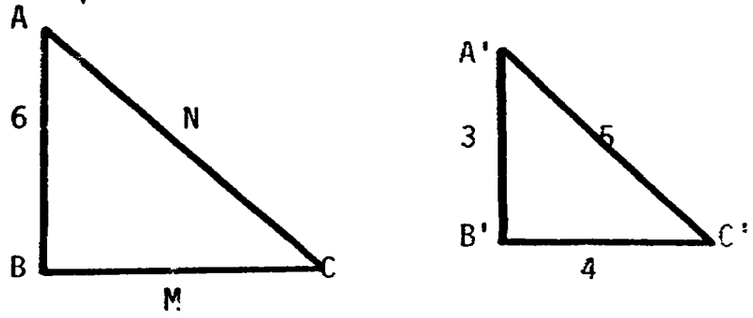
Figure 1



2. Select a room facing the sun. Get the room as dark as possible by pulling the shades or drapes. Allow a small amount of sunlight through a pinhole which is made in a piece of cardboard. Place in the window. (See figure 2)

Figure 2



SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	3. Set up the cardboard in Figure 1 so that the sunlight coming through the pinhole falls directly on it. A small image of the sun will appear on the cardboard. Adjust the cardboard so that the sunlight is found between the one inch lines. The image of the sun is one inch in diameter. Now measure the distance from the image of the sun to the pinhole on the cardboard as accurately as possible. (See figure 3)
Audio–Visual:	Figure 3 
Community:	4. Review the idea of similarity in right triangle from known side which may correspond to unknown sides.  Definition of similarity: Point A corresponds to point A' Point B corresponds to point B' Point C corresponds to point C' Side AB corresponds to side A'B' Side BC corresponds to side B'C' Side AC corresponds to side A'C'

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

4. (Continued) $\frac{AB}{A'B'} - \frac{BC}{B'C'} - \frac{AC}{A'C'}$

   By using the idea of ratios and proportion, the sides $\overline{AC}$ and $\overline{BC}$ ban be calculated.

5. By using this knowledge we can construct two triangles based on the information gathered in the room with the image of the Sun.

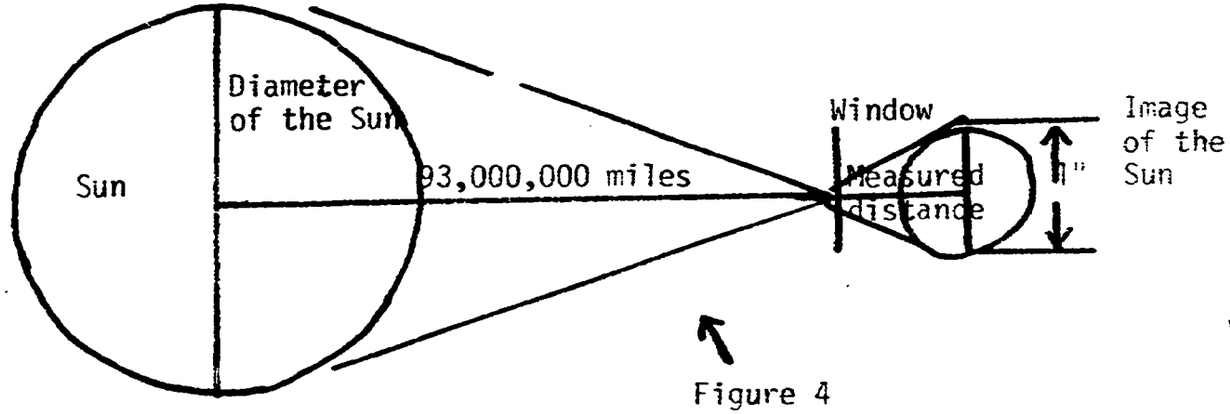


Figure 4

Audio–Visual:

By referring to the above figure, we can form our imaginary triangle by using on-half of the figure shown.

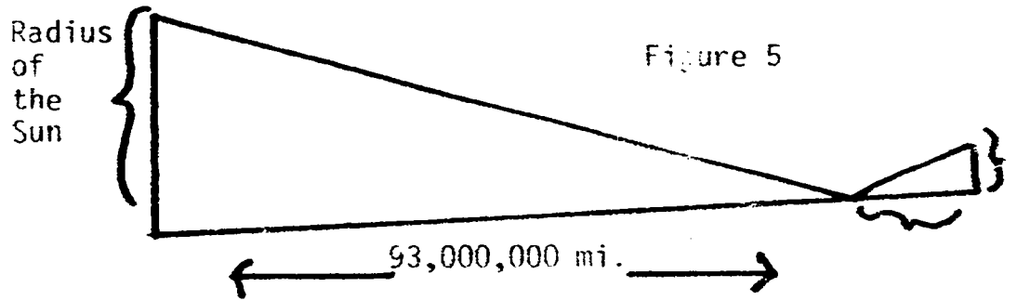


Figure 5

Community:

Using a proportion, we can calculate the radius of the Sun.

$$\frac{\text{Radius of the Sun}}{93{,}000{,}000 \text{ miles}} - \frac{\text{Radius of the circle (1/2 in.)}}{\text{Measured distance from window to image}}$$

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 2 - Ecosystem **SUBJECT** Math

ORIENTATION Land Use **TOPIC/UNIT** Graphing, Map Construction

BEHAVIORAL OBJECTIVES

Cognitive:

Differentiate among a cover map, aerial photo and a plot map. Calculate distances and areas on given maps having a scale of feet, miles, etc. Construct a cover map of a given 40 acre plot showing the various terrain types.

Affective:

Suggest, using examples, that the balance of nature is a delicate system which may be changed and affected easily by man. Believes that individuals should be held responsible for severe damage to the environment.

Skills Used:

1. Map reading
2. Scale drawing
3. Compass reading

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Review the use of scales in map reading. Then determine the scale to be used in constructing a cover map.
   1. Use the metric system relief maps found in the classroom to show that various scales may be used on different maps.
   2. Use the plot map and aerial photographs in the classroom for understanding of scale drawing.
B. After the field trip is completed, each group will construct a cover map for the area. (Suggested that a 40 acre plot will be sufficient.)

Outside or Community:

A. Obtain the plot map and aerial photo from the county courthouse for use in the classroom.
B. Contact the Department of Natural Resources for cover map examples which they have made through surveys.
C. Conduct a field trip through 40 acres of land.
   1. Measure fields and draw to scale (meters).
   2. Measure hills and draw to scale (meters).

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

Klausner, Samuel, 1971,
On Man in His Environment.
Subarsky, Azc Hariah, 1969,
Living Things in Field and Classroom.
Urban Systems, Inc., 1970,
Ecology's The Game of Man and Nature.

Audio-Visual:

Movie:
#210 Nature's Half Acre, color,
16 mm., Project I-C-E RMC.
#200 One Day at Teton Marsh,
(2 parts) color, 16 mm. I-C-E RMC.
#2359 This Vital Earth,
10 minutes, color, $3.50 BAVI.

Community:

County seat or courthouse
DNR

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 3 - Carrying Capacity **SUBJECT** Mathematics

ORIENTATION Environmental Economics **TOPIC/UNIT** Average and Percent

BEHAVIORAL OBJECTIVES

Cognitive:

Compute averages and percents to show the effect of corn blight on the U.S. corn crop; state corn crop given information on corn blight. Compute the number of acres of corn needed to supply the food needs of a given community, given the average yield per acre. Calculate the number of additional acres required (Continued)

Affective:

Deduce that certain environmental factors (such as disease) limit the amount of certain agricultural crops a farmer can produce.

Skills Used:

1. Averaging
2. Finding percents
3. Computations involving percents

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Class discussion pertaining to the given worksheet* on corn crops. Have the students set up and work the problems from the worksheet on the board.
B. Having discussed the worksheet, combine the information obtained from the sheet and the two outside activities. What conclusions can the student draw from the information?
C. Students that have completed library research on the history of corn blight, will consolidate their findings and present an oral report to the class. Findings should include such mathematical ideas as:
   1. Percent of corn affected in an area.
   2. Number of counties affected.
   3. Comparison of affect in the last couple of years.

*NOTE: Worksheet on reverse side.

Outside or Community:

A. Contact the local agricultural agent in regard to obtaining information on how corn blight has affected the local area.
B. The students will do library research on past history of the effects of corn blight.
C. The students that have checked with their local agricultural agent will hand in a written report on their findings. After the reports are checked, post them on a bulletin board.

SUGGESTED RESOURCES

Publications:

Numbers In the News, Subject: The Threat to Our Corn Crop, published by Christopher Lee Pub.
P. O. Box 331
Glencoe, Illinois 60022.

Agencies:
U.S. Department of Agriculture
Washington, D.C. 20250.
State Farm Bureau.

Audio-Visual:

Food For a Modern World, #0704, BAVI, color, 22 min.
Corn Farmer, 2nd Ed., color, #5884, BAVI, 14 min.

Community:

Local Library
Farm Bureau (county level)
State Dept. of Agriculture

CONTINUED OR ADDED LEARNING ACTIVITIES

COGNITIVE: (Continued)

to make up for the corn production lost if yield per acre is lowered by a given percentage.

CLASSROOM: (Continued)

D. Numbers in the News Subject: The Threat to our Corn Crop

This summer, agricultural people became very concerned about the threat to corn production. Southern Leaf Blight began to damage large amounts of corn in the field. Soon, it was discovered that the blight had spread to corn fields in the Midwest. As corn is our most valuable farm crop, it is big business. And, as corn, either directly or indirectly, is a major portion of our diet, the threat to the corn crop is important to all of us. Directly, we eat about 45 lbs. of corn per year, per person, as many kinds of food are made from corn. We also eat large quantities of meat that was raised on corn.

UNITED STATES CORN CROP

	1967	1968	1969	Avg. 3-yr. Per.
Acres of Corn Harvested (in 1,000 acres)	60,557	55,707	54,573	(1) _____
*Yield per acre (in bu.)	78.6	78.5	83.9	(2) _____
Production (million bu.)	4,760	4,375	4,578	(3) _____
Price (per bushel)	$1.04	$1.05	$1.09	(4) _____

*A bushel of corn weighs 56 lbs.

4. Using the average of the past 3 years (see answer 3) what will be the 1970 production of corn if: (in million bushels)
   20% destroyed 30% destroyed 40% destroyed
5. What was the average value of an acre of corn to a farmer in 1969? 1968? 1967? (nearest cent)
6. What will probably happen to the price of corn if a large amount is destroyed by the blight?
7. Using the 3-year average, what was the weight of the corn harvested for one year on one acre? (nearest pound)
8. How many people can receive enough corn that they eat directly in one year from one acre of corn? (to nearest person)

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	CLASSROOM: (Continued) D. 9. Using the 3-year average, what is the value of 1 acre of corn to the farmer? (to nearest cent) 10. Using the answers from problems 8 and 9, how much does the farmer receive for supplying enough corn to feed one person for one year? (to nearest cent) 11. What would be the gross income of a farmer who had 150 acres of corn? (use 1969 figures) 12. What would we need to know to compute the net income of the farmer? Copr. Christopher Lee Pub., P. O. Box 331, Glencoe, Illinois 60022
Audio–Visual:	
Community:	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 4 - Water **SUBJECT** Math

ORIENTATION Water Shortage **TOPIC/UNIT** Rates, Equations, Computations

BEHAVIORAL OBJECTIVES

Cognitive:

Predict whether or not by the year 2000 there will be enough water to supply the needs in this country by comparing the water needs to the water supply.

Affective:

Actively participate in a class discussion suggesting ways of conserving the usable water supply. Form a judgment as to the responsibility of the individual and governments in maintaining an adequate water supply to meet the needs for survival of plants, animals and humans in the future.

(Continued)

Skills Used:

1. Writing equations for finding percentage rate
2. Computing rates

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Introduction:
   1. On an average, 1,800 gallons of water is consumed per person each day. We are now using 355 billion gallons per day in this country.
   2. The population of the U.S. in 1950 was about 150 million, 1965 about 200 million and in 1980 it will be over 300 million.
   3. An estimate of the dependable supply of fresh water is 650 B.G.D. (billion gallons per day).

NOTE: Sample problems and a chart are on the reverse side.

Outside or Community:

A. Visit a local sewage system. Have these questions in mind:
   1. How much used water comes into the plant?
   2. Is the water usable when it leaves?
   3. For what purposes can it be used?

B. Visit a local water system. Have these questions in mind:
   1. What is the source of the community water supply?
   2. How much water is used each day?
   3. At this rate, how long will the supply last?

SUGGESTED RESOURCES

Publications:

Water Pollution, George Berg, 1970 #VF, I-C-E RMC.
Running Water, I-C-E RMC, 120 Ma 1-6.
140 So, Water Use: Principles and Guidelines for Planning and Management in Wisconsin, I-C-E RMC.
SG 3, Simulation Game, Dirty Water, I-C-E RMC.

Audio—Visual:

Investigations in Ecology, Kit #43, I-C-E RMC.
The Gifts, #280, I-C-E RMC.
FS St 22, Conserving Our Natural Resources, #3 Enough Water For Everyone.
Kit #12 Water Pollution, I-C-E RMC.

Community:

Local sewage plant
Local industries which make use of water
Local water system

CONTINUED OR ADDED LEARNING ACTIVITIES

AFFECTIVE: (Continued)

Re-evaluate the use of water for lawn watering, etc. for purely aesthetic purposes.

CLASSROOM: (Continued)

B. Chart of the three primary users of water from 1900-1980.

	1900	1960	1980
Industry	15 BGD	160 BGD	394 BGD
Agriculture	22 BGD	141 BGD	166 BGD
Municipal	3 BGD	22 BGD	37 BGD
Totals	40 BGD	323 BGD	597 BGD

(BGD - billion gallons per day)

Sample Problems: Write equations and solve.
1. Rate of increase from 1900 to 1960 for industry.
2. Industries' rate of increase from 1960 to 1980.
3. Same for agriculture and municipal and total as for industry.
4. Predict total amount of water needed by these three users in the year 2000.
5. It is estimated that 650 BGD of fresh water will be available in the year 2000. Compare the prediction for problem 4 with the amount of water available.
   1. How much more? How much less?
6. Discuss ways of conserving water.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 4 - Water **SUBJECT** Math

ORIENTATION Usable Water **TOPIC/UNIT** Percents and Fractions

BEHAVIORAL OBJECTIVES

Cognitive:

Calculate the total water supply and the percent of usable water that exists in a given area or country using the available tables of water statistics.

Affective:

Accept the need for wise usage of water without challenge. Desire to assist in developing a wise usage of water program for the community in which he lives.

Skills Used:

1. Finding percents
2. Computations involving percents
3. Converting fractions to percents

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The students will, individually, complete the worksheet* on "The World's Water." The teacher will assist students with their class work.

B. The students will take the percents they calculated from Part A and convert these percents to decimal numerals.

*NOTE: Sample of Worksheet on "The World's Water" is on the reverse side.

Outside or Community:

A. The students will contact outside sources and get information on how much water is polluted and how much water is usable in certain states of the U.S.
   1. Each student will be assigned a group of three states to contact.
   2. Students will report on their findings to the class.

B. The teacher can contact the city's director of Public Works to come to class and give a talk. His talk should be centered around the amount of usable water and polluted water found in the city.

SUGGESTED RESOURCES

Publications:

Comprehend, Compute and Learn,
Subject: The World's Water Pub. by:
Christopher Lee Publications
P. O. Box 331
Glencoe, Illinois 60022.
Clean Water: It's Up to You,
Izaak Walton League of America
1326 Waukegan Road
Glenview, Illinois 60025.
Book: Death of Sweet Water,
Don Carr, Norton Press, 1966.

Audio-Visual:

Films:
City Water Supply, 10 minutes,
#0433, BAVI.
Water For Farm and City,
14 minutes, #4816, BAVI.
Conserving Our Water Resources Today,
11 minutes, color, #5367, BAVI.
The Stream, #320, I-C-E RMC.

Community:

Director of Public Works

CONTINUED OR ADDED LEARNING ACTIVITIES

The World's Water

A. About the best any of us could do if asked to estimate the amount of water in all of the world's rivers would be to say, "That has to be a lot of water."
Yet, the atmosphere contains 10 times as much water as all of the rivers in the world. The 0.001 percent of the world's total water volume held in the atmosphere is, however, only 1/9th the water contained in the fresh water lakes of the world. Seas and Saline lakes contain 8 times as much water as the atmosphere.
The 2 icecaps, the Antarctic and Arctic, contain 2.150 percent of the world's water. The Antarctic, with 1.996 percent of the total icecap capacity, is much larger than the Arctic.
Second to the Antarctic Icecap in volume is ground water. This source holds .632 percent of the world's water. Ground water within 1/2 mile of the earth's surface contains .315% of the earth's total water.
All quantities of water appear small when compared to the oceans of the world where 317,000,000 cubic miles of the world's water resists our use by being salty.
Man must learn to use water wisely as only about 1/3 of one percent of the world's fresh water is accessible for use.

Complete the following table: The World's Water

		PERCENT OF TOTAL
The Oceans	(A)	
Seas and Saline Lakes	(B)	
Fresh Water Lakes	(C)	
Antarctic Icecap	(D)	
Arctic Icecap	(E)	
Rivers	(F)	
Atmosphere Water	(G)	
Ground Water	(H)	
*Deep Ground Water	(I)	*Below 1/2 mile of surface

J. With few exceptions, only the water in fresh water lakes, rivers, and ground water within 1/2 mile of the surface is available for man's use. Therefore, what % of the total supply is usable? _____

Environmental: **Integrated with:**

CONCEPT NO. 5- Air **SUBJECT** Mathematics, Science

ORIENTATION Air Quality **TOPIC/UNIT** Geometry

BEHAVIORAL OBJECTIVES

Cognitive:

Calculate and record the amount of air needed for his survival for a given period of time, i.e. day, week, etc. Determine number of storage units, i.e. classroom, etc. that would be necessary to hold the amount of air necessary for the needs of an individual for a given period of time.

Affective:

Defend the need for supply of clean air in order that he might survive. Investigate the amount of air necessary for survival of a given population.

Skills Used:

1. Practice in metric systems
2. Computation of volume of rectangular prisms

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Measuring and recording volume of air.
   1. Determine the volume of your classroom (rectangular prism)(length x width x height).
   2. Determine the average amount of air per breath, per child, through the use of plastic bags and immersion (volume). This can be tested in one of the following ways:
      a. Place water in a beaker (half full). Immerse the bag into the water and check the displacement (metric system).
      b. Fill a beaker and place a pan next to the beaker. As the bag is immersed, the water will leave the beaker and go into the pan. Measure the water in the pan (metric system).
   3. Determine the average number of breaths per minute available in the room.
   4. Calculate the number of breaths of air available in the room.

(Continued)

Outside or Community:

A. Calculate the cubic feet (meters) of area in the students' home.
B. Research the average amount of air used by the average adult.
C. Investigate the effects of vigorous physical activity on breath per minute.

SUGGESTED RESOURCES

Publications:

Aylesworth, Thomas G.
This Vital Air
This Vital Water: Man
Environmental Crisis,
Rand McNally, 1968, $4.95.

Audio-Visual:

Air Pollution, Part A
Pergamon Publishing Company
Maxwell House, Fairview Park,
Elmsfor, New York, 10523.
With Each Breath, 29 minutes, color,
Health Educational Services
Box 7283 Albany, N.Y., 12224.
Air Pollution: Take a Deep Deadly
Breath, 3 parts total 54 minutes,
color, free.
National Medical Audio-Visual Center,
Chamblee, Georgia.

(Continued)

Community:

City Health Department

CONTINUED OR ADDED LEARNING ACTIVITIES

CLASSROOM: (Continued)

B. Enrichment:
   1. Make allowances for the area of the room occupied by tables and chairs and other fixtures.
   2. Make allowance for the amount of oxygen not actually used per breath.
   3. Remember you are breathing "used" air to begin with.

C. Simulation Game - Smog.

AUDIO-VISUAL: (Continued)

The 2nd Pollution, #460, I-C-E RMC.
Air Pollution, BAVI #0678.
Simulation Game - Smog: The Air Pollution Game, I-C-E RMC.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: **Integrated with:**

CONCEPT NO. 5 - Air **SUBJECT** Math

ORIENTATION Air Quality **TOPIC/UNIT** Graphs and Percents

BEHAVIORAL OBJECTIVES

Cognitive:

Identify major sources of air pollution and the pollutants using percentage mathematical calculations and graph constructions using the results of the calculations.

Affective:

Re-evaluate the difficulty of controlling the sources of air pollution.

Skills Used:

1. Constructing graphs
2. Computation involving percents

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Air Pollution Calculation
   1. First the instructor will hand out the worksheet pertaining to sources of air pollution. The students will be asked to follow the instructions at the bottom of the worksheet.
   2. The students will find what percent of the total each of the four categories encompass.
   3. Go over the results of this exercise in class the next day.

*NOTE: A sample of the worksheet on sources of air pollution is on the reverse side.

Outside or Community

A. The students can write to the major auto producers for a list of pollution control devices on cars today.
   1. The students should compare any percentages they have obtained with the results of their class activities.
   2. The students can orally report on their findings to the class.
B. Have an outside speaker from local industry talk to the students on pollution control (especially air pollution within local industry).
C. Have a DNR representative talk to the class on air pollution caused at land fill sites.
   1. How many land fill sites are used?
   2. How big of an area?
   3. Types of air pollution.
   4. Suggestions to eliminate the air pollution.

SUGGESTED RESOURCES

Publications:

VF U.S. Dept. of HEW,
Clean Air for Your Community,
Environmental Health Service
I-C-E RMC.
Books:
Quest for Cleaner Air and Water,
I-C-E RMC.
Conserving Our Waters and Cleaning
the Air, I-C-E RMC. 170 Pe.

Audio-Visual:

Simulation Game:
SG 1 Smog: The Air Pollution Game,
I-C-E RMC.
Films:
Air Pollution, #0678, BAVI.
Poisoned Air, Carousel Films,
1501 Broadway
New York, N.Y.

Community:

Local
Industry Representative
DNR Representative

CONTINUED OR ADDED LEARNING ACTIVITIES

AIR POLLUTION IS ONE OF AMERICA'S GREATEST PROBLEMS

MILLION TONS POLLUTION

Sources	Carbon Monoxide	Sulphur, Nitorgen Cases	Hydro-Carbons	Particulates	Total
90 Million Motor Vehicles — 99% burn gasoline, with pollution from exhaust pipe, crank case, carburetor and gas tank	65	8	18	1	92
Factories and Power Plants — Especially pulp and paper mills, iron and steel mills, refineries, smelters and chemical plants. Over 90% of power plants in 1969 burned coal and oil containing sulphur to generate electricity.	12	38	5	17	72
Refuse Disposal and Miscellaneous — Each person creates about 1800 lbs. of waste per year.	17	2	4	4	27
	94	48	27	22	191

TOTAL MILLION TONS AIR POLLUTION PER YEAR

Using the data above, construct a circle graph for each category: motor vehicles, factories and power plants, refuse and miscellaneous. Construct a bar graph showing total air pollution comparisons between carbon monoxide, sulphur and nitorgen gases, hydrocarbons, and particulates.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 6 - Resources

SUBJECT Math

ORIENTATION Water Quality

TOPIC/UNIT Charts and Problem Solving

BEHAVIORAL OBJECTIVES

Cognitive:

Construct charts that can be used in determining amounts of waste produced by given numbers of specied animals. Use information contained in the charts to explain why it is necessary to develop ways of treating all animal wastes, not just human waste.

Affective:

Suggest ways that farming affects the purity of the water supply. Support governmental water regulations as a way to maintain pure water for the individual and community usage.

Skills Used:

1. Finding area
2. Finding averages
3. Basic computation

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Compare the 5 Great Lakes
   1. Work computations on the worksheet of the Great Lakes.*
   2. Construct a chart showing the information.
B. Waste from animals compared to human waste.
   1. Waste of 1 cow equals waste of 16 humans.
   2. Waste of 1 pig equals waste of 2 humans.
   3. Waste from 7 chickens equals waste from 1 human.
C. Given the above information, have the students calculate the waste material given off on an average Wisconsin farm. (The students should investigate what is the average farm.) NOTE ON BACK.
D. Make the reverse comparison of a local city and the waste products given off would equal the amount given off by the various farm animals.

*Worksheet on reverse side.

Outside or Community:

A. Find out how much water is needed by some of our local cities for human consumption and compare this to the amount needed by local industries. This information may be obtained from city water department and from the public relations of industries.
B. Together with the service department test various water sources from the lakes, rivers and streams in community.
C. Have your home water supply tested. Information may be obtained by writing to the state health board.
D. Find out if Wisconsin has set up water standards. Try to find out if other states have standards.
E. Field trip to local water supply system.
F. Compute your own water bill.

SUGGESTED RESOURCES

Publications:

In Quest of Cleaner Air & Water, I-C-E RMC.
Conserving Our Waters and Cleaning the Air, I-C-E RMC.
Bay Lakes Regional Planning Commission, Green Bay.
Great Lakes Basin Commission
P. O. Box 999, 3475 Plymouth Road, Ann Arbor, Michigan 48106.

Audio–Visual:

Simulation Game:
Dirty Water: The Water Pollution Game, I-C-E RMC, #SG 3.
Films:
The Water Cycle, 10 minutes, Encyclopedia Britannica Films.
Life in a Drop of Water, 10 minutes, BAVI, #1252.
Natures Half Acre, #210 I-C-E RMC.

Community:

Field trip to a farm near your community
Field trip to your local water supply

CONTINUED OR ADDED LEARNING ACTIVITIES

The Great Lakes

No other group of fresh water lakes is as large as the Great Lakes. The largest, Lake Superior, covers 31,820 square miles and has the record depth of 1,302 feet.

Lake Michigan, the only Great Lake that is entirely with the boundaries of the United States, covers 22,400 square miles and has a maximum depth of 923 feet.

Lake Huron, second of the Great Lakes in size, has an area of 23,010 square miles and a maximum depth of 750 feet.

The shallowest of the Great Lakes is Lake Erie with its maximum depth of 210 feet. Its area is 9,940 square miles.

Lake Ontario, the smallest, has an area of 7,540 square miles and a maximum depth of 778 feet.

The natural flow of Great Lakes water is from west to east and eventually to the Atlantic Ocean through the St. Lawrence River. The reason for the west to east flow is that Lake Superior is 602 feet above sea level and Lake Ontario on the east is only 247 feet above sea level. A large portion of this change in sea level takes place between Lake Erie and Lake Ontario with a 326 foot drop.

(A) What is the total area of all the Great Lakes?
(B) What is the average depth of the Great Lakes (to nearest foot)?
(C) What is the drop in feet above sea level between Lake Superior and Lake Ontario?
(D) What is the difference in depth between the deepest and the shallowest of the Great Lakes?
(E) What is the drop in height above sea level between Lake Superior and Lake Erie?

CLASSROOM: (Continued)

I.

C. Note:
How does animal waste affect water quality?

E. S. E. A. Title III - PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 7 - Land Use

SUBJECT Math, Science (Team teaching situation)

ORIENTATION Population Density

TOPIC/UNIT Computation

BEHAVIORAL OBJECTIVES

Cognitive:

Graph population density vs. amount of a given resource.

Affective:

Alert to ways that increasing; decreasing population density affects the life of an individual. Re-evaluate the idea that population growth as being good for a community or for the nation.

Skills Used:

1. Computational skills:
   - Addition
   - Subtraction
   - Multiplication
   - Division
2. Research
3. Line graphs

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Group Research
   1. Compute the area of the classroom.
   2. Determine the amount of space each student occupies.
   3. Students should use resource material to find the average amount of oxygen used per student.
   4. Calculate the length of time it would take a student to use up all the air in the room.
   5. Graph (line) the above information.
   6. Calculate the length of time air would be used up with fewer students.
   7. Graph (line) the information found in #6 on the same graph found in #4.

B. Simulation Game:
   Smog: The Air Pollution Game.

C. Kit One: Topics in Ecology.

Outside or Community:

A. City Population
   1. Gather data on the area of the city and the population of the city.
   2. Determine the rate of population growth in the last 30 years.

B. City Nurse
   1. Give information on air intake by humans.
   2. Give information about diseases caused by air pollution.

C. Visit by city planner or any city official.
   1. Discuss air pollution.
   2. Discuss leisure time activity.

SUGGESTED RESOURCES

Publications:

Books:
Too Many People? Kimball, Richard.
Solving the Problems of Over-population,
The Population Explosion,
Kimball, Richard.

Audio-Visual:

Air Pollution: Take a Deep Deadly Breath,
National Medical AV Center
Chamblee, Georgia 30005.
Simulation Game:
Smog: The Air Pollution Game,
I-C-E RMC.
#460 The 2nd Pollution
Kit I Topics in Ecology,
5 single concept lessons.

Community:

Court House for population information
City Library
City or School Nurse

CONTINUED OR ADDED LEARNING ACTIVITIES

Agency

National Air Pollution Control Admin.
Office of Education & Information
U. S. Dept. of Health, Education and Welfare
801 N. Randolph Street
Arlington, Va. 22203.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: **Integrated with:**

CONCEPT NO. 8 - Values and Attitudes **SUBJECT** Mathematics

ORIENTATION Forest Resources **TOPIC/UNIT** Fractions and Multiples

BEHAVIORAL OBJECTIVES

Cognitive:

Solve word problems pertaining to the effects of the newspaper industry on our forests, using principles of fractions and multiples.

Affective:

Promote sound conservation practices as being beneficial to our forest resources. Examine a number of conservation practices used to determine which would be appropriate for a given situation.

Skills Used:

1. Collecting data
2. Finding multiples of a number
3. Calculating fractions

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Given the following information:
It takes 17 trees to make a ton of newsprint; the students will solve the following problems with the teacher's assistance:
1. How many trees would it take to make 51 million tons of newsprint?
2. 53 million tons of newsprint?
3. 119 million tons?
4. 74 million tons?
5. 1 billion tons?

B. Have the students use the above information and weigh all of the magazines and "junk" mail they receive. How many trees or parts of trees were used?

Outside or Community:

A. The students will collect the newspaper used in their home for a week.
1. After the week, they will weigh this newspaper and determine the approximate weight of the newspaper their family would use in a year by multiplying the above weight by 52.
2. Then they will answer how many trees were used in making that amount of newsprint.
3. Next the students will figure out how many trees were used in making the newspaper in their block for a year by multiplying by the number of families living in the block.
4. Finally, the students will figure out how many trees were used in making the newspaper in their town for a year by multiplying by the number of families living in the town.

B. The students will contact local and nearby newspapers to see how many trees they use in publishing their newspapers in a year.

(Continued)

SUGGESTED RESOURCES

Publications:

Trees and Forests,
Stanley M. Jespen 1969
Barnes, $6.95.
130 Mc 1-10, McCue, George, Ecology,
(Series) #2 Forests and Man,
I-C-E RMC.
170 Fo 1A, Forest Service
Conservation Education Materials,
Grades 5-9, I-C-E RMC.

Audio—Visual:

Forest and Conservation,
Color, $.50, General Science BAVI,
1327 University Avenue
P. O. Box 2093
Madison, Wisconsin 53701.
FS St 23, Trees for 2001 - Today's
Foresters in Action, I-C-E RMC.
Kit 46 American Forest Institute,
Washington, D.C. I-C-E RMC.

Community:

Local newspaper
Conservationist

CONTINUED OR ADDED LEARNING ACTIVITIES

OUTSIDE OR COMMUNITY: (Continued)

B. The students will report back to the teacher on their findings in the form of a written report. This information will have to be computed on the basis of the number of tons of newsprint used by the publisher.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 9 - Management

SUBJECT Math

ORIENTATION Forest Resources

TOPIC/UNIT Computation

BEHAVIORAL OBJECTIVES

Cognitive:

Determine the number and importance of different trees by doing a point quarter survey of a given land area. Calculate the diameter of given trees using the measured circumferences.

Affective:

Demonstrate awareness of the number and different kinds of trees and their influence in the forest by tabulating those of each size in a given forest. Defend the use of a procedure, such as a point quarter survey, to estimate the available lumber in the future.

Skills Used:

1. Compass reading
2. Terms:
   a. Diameter
   b. Point quarter survey
   c. Circumference
   d. Area

(Continued)

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Introduce the student to the point quarter survey and the procedures to be used.
   1. The student should know how to use a compass. Give a review lesson to the class.
   2. Review how to find the diameter of a tree when the circumference is known.

$$\frac{C}{\pi(3)} = d$$

   3. Review area of a circle.

B. After the point quarter survey has been completed, determine the importance of the trees by the number of each species found in the plot. (See Chart I on next page.)

Outside or Community:

A. I-C-E Field Activity Guide, Forest Management Session.
B. Conduct a point quarter survey. (See attached sheet.)
C. Have a district forester supply information by speaking to the group.

SUGGESTED RESOURCES

Publications:

11971 EQ Index, National Wildlife Federation, 1412 - 16th St., N.W. Washington, D.C. 20036.
Conservation Education Materials, Grades 5-9, U.S. Dept. of Agriculture.
170 No, U.S. Dept. of Agriculture, Coordinated Resource Use Through Multiple-Use Management, I-C-E RMC.

Audio-Visual:

Visual Aid Library,
Box 450, Madison, Wis. 53701.
Tomorrow's Trees, color, 32 minutes.
FS St 19, Ecological System,
4 filmstrips - use #2) Ecology of a Forest, I-C-E RMC.

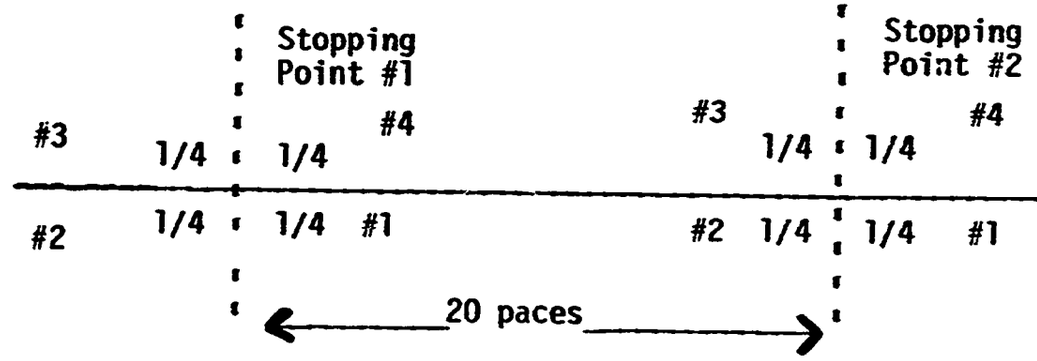
Community:

Community library for information about white pines and the state of Wisconsin.
District forest ranger.

CONTINUED OR ADDED LEARNING ACTIVITIES

B. Chart I
1. Numerical importance - total the number of trees of each kind.

Tree Name	This Crew	All Crews	Tree Name	This Crew	All Crews
1.			9.		
2.			10.		
3.			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: **Audio—Visual:** **Community:**	OUTSIDE: (Continued) THE POINT QUARTER SURVEY B. 1. Start your crew in a given direction. Use a compass to record that direction. Place your hands and arms out at right angles to the direction of travel. This divides the line into 4 quarters (1/4 circles).  2. (a) Find the closest tree over 4 inches in one quarter. (b) Identify it. (c) Measure its diameter at breast height (d.b.h.). (d) Measure the distance from the center of the tree to stopping point. (Use actual measuretape or by paces.) (e) Record the tree, the diameter, and the distance. (f) Do the same for each remaining quarter. (g) Take notes on the surroundings of the stopping point. 3. Walk 20 paces along the compass line to the next station. Stop and mark the spot. Do the steps of #2 as you did at the last stopping point. 4. Continue with the rest of the stations. (Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

Audio–Visual:

Community:

OUTSIDE: (Continued)

FOREST SAMPLING STUDY TALLY SHEET

Point Quarter		Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Forest Management Session

George Howlett, Jr.
Forest Ecologist - Environmental Specialist
Project I-C-E, Green Bay, Wisconsin

This exercise gives you a chance to do some of the things a forester does. While you experience the work activity of a forester, you may become more familiar with a forest; what things make this place a forest; and how a forest can be a living place for certain plants and animals.

Class _____ Instructor _____

Location _____ Time_____ Date _____

Weather_____

Team Chief Cruiser _____ Observer _____

Tallyman _____ Scaler _____

Supplies: compass, diameter tape, flagging tape, tape measure, or yardstick

Activities

A. Sample plot measurement

Locate a sample plot in the forest area; use flagging tape to mark boundaries.

1. Locate a corner point.

2. Use a compass to sight east-west and north-south boundaries.

3. Measure off a rectangular unit 66 x 66 feet and flag the corners and boundaries. (Use tape measure, yardstick, or pacing methods.)

You now have a 1/10 acre sample plot.
To get per acre estimates when asked for, you must use measurements from the plot times 10.

(10 x 1/10 = one)

B. 1. Measure the diameter breast height (d.b.h.) (4 1/2 feet above ground) of every tree in the plot over 3 inches d.b.h. and record. Use the diameter tape to measure d.b.h.

d.b.h. measurements 1/10 A plot. Record to nearest 1/2 inch.

1. _____	6. _____	11. _____	16. _____
2. _____	7. _____	12. _____	17. _____
3. _____	8. _____	13. _____	18. _____
4. _____	9. _____	14. _____	19. _____
5. _____	10. _____	15. _____	20. _____

2. Convert diameter measurements to circular area values by using the conversion chart. This gives basal area.

1. _____	6. _____	11. _____	16. _____
2. _____	7. _____	12. _____	17. _____
3. _____	8. _____	13. _____	18. _____
4. _____	9. _____	14. _____	19. _____
5. _____	10. _____	15. _____	20. _____

Conversion of Diameter Measurements to Circular Area Values

Diameter	Area	Diameter	Area	Diameter	Area
0.5	0.20	14.0	153.94	27.5	593.96
1.0	0.78	14.5	165.13	28.0	615.75
1.5	1.77	15.0	176.71	28.5	637.94
2.0	3.14	15.5	188.69	29.0	660.52
2.5	4.91	16.0	201.06	29.5	683.49
3.0	7.07	16.5	213.82	30.0	706.86
3.5	9.62	17.0	226.98	30.5	730.62
4.0	12.57	17.5	240.53	31.0	754.77
4.5	15.90	18.0	254.47	31.5	779.31
5.0	19.63	18.5	268.80	32.0	804.25
5.5	23.75	19.0	283.53	32.5	829.58
6.0	28.77	19.5	298.65	33.0	855.30
6.5	33.18	20.0	314.16	33.5	881.41
7.0	38.48	20.5	330.06	34.0	907.82
7.5	44.18	21.0	346.36	34.5	934.82
8.0	50.27	21.5	363.05	35.0	962.11
8.5	56.75	22.0	380.13	35.5	989.80
9.0	63.62	22.5	397.61	36.0	1017.88
9.5	70.88	23.0	415.48	36.5	1046.34
10.0	78.54	23.5	433.74	37.0	1075.21
10.5	86.59	24.0	452.39	37.5	1104.46
11.0	95.03	24.5	471.43	38.0	1134.11
11.5	103.87	25.0	490.87	38.5	1164.16
12.0	113.10	25.5	510.70	39.0	1194.59
12.5	122.72	26.0	530.93	39.5	1225.42
13.0	132.73	26.5	551.54	40.0	1256.64
13.5	143.14	27.0	572.55	40.5	1288.25

3. Add all basal area figures.

   a. Sum of basal area _____. (1/10 acre test plot)

   b. Multiply by 10 to give basal area per acre _____.

   c. Find the average basal area of the forest stand per acre by summing the BA/acre figures of each survey team. Then divide by number of teams.

      Total BA _____ ÷ # of teams _____ = BA/A _____

C. While survey crew records d.b.h. and BA figures in the sample plot, the observer will record information about the environmental factors of the sample plot.

Observer's Notes:

The forest - tree, form, cover, age, condition, successional stage

Other plants - mushrooms, mosses, etc., herbs, shrub layer

Birds - animal sign

Soil (dig some up and feel it; smell it), moisture factors

Rocks - geology and topography

D. Demonstration talk; forester - forest ecologist

1. Method of marking timber

2. Height measurement

3. Timber Stand Improvement (TSI)

Tree Defects

1. Wolf tree

   Takes up too much space. Has poor form and little wood volume for lumber. Represses other trees too much.

2. Crook and Sweep

   Trees bent or with a long curve which would not saw well.

3. Fork Trees

   Trees which lost the leader and had secondary branches take over.

4. Heart Rot

   Trees with fire scar, fungus bodies, hollows, longitudinal scars, etc. which indicate interior defect in log.

5. Over Age

   Overmature tree which has stopped growing and is using forest space. Must use increment borer in outer wood to determine this or keep long-term diameter growth record.

6. Diseased Tree

   Observably damaged or dead tree from virus, fungus or insect attack.

7. "Weed" Tree

   Tree that is undesirable to the stand because it produces poor quality wood and takes up space.

8. Suppressed Growth

   Tree which needs to be thinned because too many others are crowding it and it will die without increasing volume.

E. Timber Stand Judging

Assignment

Determine which trees in this plot should be cut as part of a selective cut program with an improvement and sanitation aspect. Mark no crop trees less than 18 d.b.h. except where competition should be reduced. Mark defective or cull trees which should be removed to improve the forest stand. Use flagging tape to mark. Record the trees in the tally.

Cut trees numbered (explain defect or reason to cut)

1. _____ _____
2. _____ _____
3. _____ _____
4. _____ _____
5. _____ _____
6. _____ _____
7. _____ _____
8. _____ _____
9. _____ _____
10. _____ _____
11. _____ _____
12. _____ _____

F. Forest Cutting Methods

Forests are managed or cut by several methods:

1. Selective management cut
2. Diameter limit cut
3. High grading
4. Improvement and sanitation cut
5. Clear cut
6. Release cut

Selective Management

Cut for continuous yield by selecting mature timber, ripe for harvest. Allows release of sub-dominants to take over stand. Maintains most efficient competition. Removes diseased and defective trees as part of overall management. Used in climax type stands. Has value for long-term continuous yield.

Diameter Limit Cut

All merchantable trees over certain diameter are cut. No management. Done for short-term maximum profit without thought of stand future. Usual diameter 14 inch d.b.h.

High Grading

Cutting only selected species and selected quality of trees. Allows weeds and defective trees to remain. Stand quality declines. Stand competition changes.

Improvement and Sanitation Cut

Stands are thinned because they are too dense. Defective, diseased, and weed trees are removed to improve stand quality. Economic benefits are smaller now but will be greater in the future.

Clear Cut

All merchantable trees are cut. Pulp and pole trees are sold along with timber trees. Ground may be bulldozed.

a. May be part of management plan for pioneer forest regeneration which needs open sunlight. Will improve game habitat for deer and grouse.
b. May be short term gain condition for perhaps temporary land holder who does not care for forest renewal e.g. real estate developer or agent, farmer who wants to clear for agriculture, or someone who does not understand forest conservation values.
c. May be done to sanitize forest because of pest outbreak.

Release Cut

Overtopping less valuable trees, e.g. aspen, birch, may be cut, when their shade cover value is unneeded, to allow more valuable trees, e.g. spruce, white pine, a chance to grow more rapidly to maturity once they are well established.

To get feet per pace (include fractional feet).

Find the number of paces needed to measure:

a. A plot 1 x 2 chains (66 x 66 feet) or 1/10 acre.

b. A plot 1 x 10 chains (66 x 660 feet) or one acre.

a. _____ x _____paces.

b. _____ x _____paces.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 10 - Economic Planning

SUBJECT Math

ORIENTATION Mineral Resources

TOPIC/UNIT Division and Problem Solving

BEHAVIORAL OBJECTIVES

Cognitive:

Make a comparison between our present and future consumption of natural resources using appropriate data on a chart. Compute the approximate number of years that each of given resources will supply the world needs, at the present rate of consumption and recycling.

Affective:

Advocate more conservative use of our natural resources. Desire to develop a greater awareness in the public for the need for recycling of resources in an effort to make them supply the needs for a longer time period.

Skills Used:

1. Computation
2. Research

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Given problem:
   1. If we have a reserve supply of zinc equaling 10 billion lbs. and a population of 200 million, how long will the zinc last if each person uses 5 lbs. a year?
   2. Make up similar problems using other minerals.
      a. Lead
      b. Tin
      c. Petroleum
      d. Copper
      e. Uranium
      f. Iron Ore
      g. Coal

B. Variation--Have students make up problems and exchange them with fellow students for computation.

C. Share with students the following table of consumption based on current consumption. Number of years reserve minerals will be consumed.

a.	Zinc	20 years
b.	Lead	25 years
c.	Tin	30 years
d.	Petroleum	30 years
e.	Copper	35 years

(Continued)

Outside or Community:

A. Field trip to an area quarry.

B. Have class compose two letters-- one to:
   1. Citizen Nat. Resource Association and Carla Kruse Hickory Hill Farm, Loganville, Wisconsin.
   The other to:
   2. Wisconsin Resource Conservation Council and Vance Van Laanen, Box 1034, Green Bay, Wis., 54305.

C. The information gleaned from above returns could be used to make realistic problems for computation.

SUGGESTED RESOURCES

Publications:

America's Natural Resources,
Charles H. Callison.
Conservation in The United States,
2nd ed., Rand McNally, 1969,
Richard M. Highsmith.

Audio-Visual:

The New York Times,
Crisis of the Environment, I-C-E RMC.
Junkdump, #310 I-C-E RMC.
Kit 48 Field Trips Out of the Ordinary,
I-C-E RMC.
Kit 8 Conservation: A picture discussion kit, (6) Mineral Resources,
I-C-E RMC.
Film #370, Things Worth Saving,
I-C-E RMC.

Community:

Quarry in area
DNR official from area
Library

CONTINUED OR ADDED LEARNING ACTIVITIES

CLASSROOM: (Continued)

C. f. Uranium 35 years
g. Iron Ore 350 years
h. Coal 450 years

D. Discuss possible ways of slowing consumption.

E. S. E. A. Title III - PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Math

ORIENTATION Pollution

TOPIC/UNIT Decimal Numerals and Real Numbers

BEHAVIORAL OBJECTIVES

Cognitive:

Answer questions which show how much one automobile pollutes the air by converting fractions to decimals.

Affective:

Advocate that auto manufacturers should develop some device to help stop automobile air pollution. Participate in a campaign to reduce unnecessary driving in his area using data that illustrates the amount of pollution emitted per mile of driving.

Skills Used:

1. Converting fractions to terminating and repeating decimals.
2. Date conversion
3. Information gathering

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Given material:
In 1967, United States passenger cars totaled 80,414,000. They emitted 61,000,000 tons of carbon monoxide into the air.

Students are to answer the two questions with the teacher's assistance.
1. On an average, each car was responsible for emitting how much carbon monoxide into the air?
2. At that rate, 1 person driving a car for 50 years would have caused how much carbon monoxide to pollute the air?

B. Using the following statistics, answer the same two questions for these chemicals:
1. Hydrocarbons - 16,000,000 tons in 1967
2. Nitrogen Oxides - 6,000,000 tons in 1967
3. Lead - 210,000 tons in 1967

Outside or Community:

A. Divide the students into groups and ask them to find data similar to that given in class; however, gather data pertaining to years since 1967.

B. Visit to the local police station. Here the students will ask local police for data relevant to local pollution caused by autos.
1. How many autos are in the community?
2. When is the busiest time in the community and why?
3. Bring in other forms of transportation.

C. Students could write the Wisconsin Dept. of Trans. Motor Vehicle Div.
1. for recent data on air pollution caused by Wis. cars; and
2. what is the state doing to curb auto air pollution?

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

The Breath of Life,
Donald E. Carr, Norton, 1965, $4.95.
Poisons in the Air, Ed. Edelson
Pocket Books, 1966.
100 Fe, Feder, Bernard, A Matter
of Life and Breath - The Politics
of Pollution, I-C-E RMC.

Audio-Visual:

Film, Poisoned Air, Carousel Films,
1501 Broadway, New York, N.Y.
Discussion with Auto and Oil
Companies.
Air Pollution, color, Journal,
11 minutes, 1968.
Men at Bay, #250, I-C-E RMC.
Later Perhaps, #290, I-C-E RMC.

Community:

Local police information bulletins
Library
Motor Vehicle Department

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 12 - Stewardship

SUBJECT Math

ORIENTATION Land Use

TOPIC/UNIT Averaging and Percents

BEHAVIORAL OBJECTIVES

Cognitive:

Compute the average (mean) size of a farm in the country. Calculate the percent of land area taken by farms in the county. Compare the present average size of farm and percent of county in farm land with that of 10 years ago; 20 years ago.

Affective:

Deduce that the average size of farms is increasing, while the percent of land area in farms is decreasing. Weigh the disadvantages and advantages of farm size and land percentage in farm land before stating that the trend is desirable.

Skills Used:

1. Computation
2. Terms:
   Percent
   Mean
   Land Area

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. See reverse side for information on Outagamie County.
B. Students will gather similar information for their own county and compare the results with Outagamie County.
   1. Number of farms
   2. Size of farms
   3. Increases between any two-year period
   4. Percent of land area in farms
   5. Total increase

(Continued)

Outside or Community:

A. Speaker from Soil Conservation Office.
B. Compare the ratio of privately owned land to publicly owned land within your county.
C. Compare the public park acreage to the privately owned land within your county.
D. Calculate the density of the population to the number of acres available to the public in your county. In the state.

NOTE: Information for B, C, D may be obtained by the students from the DNR office in Madison and/or its regional offices.

SUGGESTED RESOURCES

Publications:

Population Growth and Land Use, Clark, Colin, St. Martin's, 1967.
The Last Landscape, Whyte, William H., Jr., Doubleday, 1968.
"Land: Making Room for Tomorrow," from Saturday Review, March 6, 1971, I-C-E RMC #VF.

Audio-Visual:

Our Vanishing Land, McGraw Hill.
New Word For Farming, BAVI #7127, color, 21 minutes, 1956.

Community:

Speaker from local soil conservation office.

CONTINUED OR ADDED LEARNING ACTIVITIES

CLASSROOM: (Continued)

C. Chart
Outagamie County, Wisconsin, has a total of 405,760 acres. The student will be given the year, the total number of farms and the total farm acreage. The student will find the average size of farms and the percent of land area in farms.

Year	Total Number of Farms	Total Farm Acreage	Average Size of Farms	Percent of Land Area in Farms
1860	1,131	92,861		
1870	2,226	187,470		
1880	2,936	245,186		
1890	3,254	277,394		
1900	3,479	319,569		
1910	3,650	336,007		
1920	3,746	347,824		
1925	3,829	346,089		
1930	3,460	336,179		
1935	3,903	358,022		
1940	3,558	356,833		
1945	3,433	367,639		
1950	3,409	370,626		
1960	[illegible],793	345,935		
1970	?	?		
1975	?	?		