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ABSTRACT

Part of a sequential series of curriculum units in environmental education for grades 4 through 12, this sixth grade curriculum guide focuses on man's effect upon the environment. Extensive classroom activities and field trips introduce the student to population, technology, pollution, natural resources, responsibility, career opportunities, and an urban encounter field trip in which students investigate various types of pollution in their own community. The following components are included in the unit: an overview, major concepts, behavioral objectives, daily schedule, lesson plans for classroom activities and field trips, career opportunities in environmental education, pretest and posttest, and student and teacher evaluation forms. The unit requires three weeks of class time, is multidisciplinary in nature, and is structured around student-centered activities in which emphasis is placed upon the study of the local environment. (Author/JR)

LITTLE ROCK ENVIRONMENTAL EDUCATION PROJECT

"A Multidisciplinary and Direct Experience Approach to Teaching Environmental Education"

The Little Rock Environmental Education Project is a Title III ESEA project designed to develop a sequential series of curriculum units in environmental education for grades 4 through 12. Emphasis will be placed upon a different area of environmental education in each curriculum unit as shown below.

GRADE	ENVIRONMENTAL UNIT
4	Nature of the Environment
5	Interaction in the Environment
6	Man's Effect upon the Environment
*7	Types of Environments
*8	Types of Pollution
*9	Local and State Environmental Problems
10	Ecology
11	U. S. Environmental Problems
12	Science and Survival

* Will not be implemented until the 1974-75 school year.

Each curriculum unit, which will require three weeks of class time, will be multidisciplinary in nature and will be structured around student-centered activities in which emphasis will be placed upon the study of the local environment. One off-campus field trip will be included in each unit. Each curriculum unit will include the following components: (a) an overview of the unit, (b) the major concepts in the unit, (c) the behavioral objectives for the unit, (d) a daily schedule for the unit, (e) lesson plans for classroom activities and the field trip, (f) career opportunities in environmental education (g) pre-test and post test for unit, and (h) student and teacher evaluation of the unit.

TEACHER'S GUIDE

ENVIRONMENTAL EDUCATION UNIT

SIXTH GRADE SCIENCE

MAN'S EFFECT ON THE ENVIRONMENT

LITTLE ROCK SCHOOL DISTRICT
ENVIRONMENTAL EDUCATION PROJECT
ESEA - TITLE III 1973-74

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OVERVIEW OF UNIT

The sixth grade unit in environmental education is entitled, "Man's Effect on the Environment". Through a variety of classroom and field trip activities, the student will have an opportunity to explore (1) the ways that man's population growth and technological advances are increasingly polluting the environment, (2) the natural resources of Arkansas and their conservation and, (3) career opportunities in environmental fields.

Hopefully, after studying this unit, the students will want to take part in programs designed to produce and maintain a quality environment upon the earth.

MAN MAKING

We are all blind until we see
that in the human plan
nothing is worth the making,
if it does not make the man..
Why build these cities glorious
if man unbuilded goes?
In vain we build the world, unless
the builder also grows.

Edwin Markham

MAJOR CONCEPTS IN UNIT

1. The earth is threatened and challanged by man's rapidly increasing population and technology.

2. The two chief problems due to man's population and technology are the increased demand for natural resources and the increase in the waste materials that are produced and must be disposed of.

3. Pollution is primarily caused by the waste products produced by man. Some of these wastes are produced faster than natural processes can dispose of them. Others are of a type for which there are no natural forces that can dispose of them.

4. The earth's natural resources are limited and must be wisely used and preserved.

5. To improve and maintain a quality environment upon the earth, individual acts must not violate the rights of nature and mankind.

6. There are many interesting and rewarding careers dealing with restoring and preserving the earth's environment.

OVERALL BEHAVIORAL OBJECTIVES FOR UNIT

Cognitive:

I. Population: The student will demonstrate an understanding of population growth in the Little Rock area compared to population growth in the state and nation as measured by graphs, family trees, maps and tests.

II. Technology: The students will investigate, describe and determine the effect of technological advances found in homes, neighborhoods and communities as measured by tests, group activities and participation in class discussion.

III. Pollution: The students will be able to identify the various types of pollution in the environment and investigate the causes and effects of pollution in the greater Little Rock area as measured by graphs, charts, demonstrations, class discussions and pre and post tests.

IV. Natural Resources: The student will be able to identify six of Arkansas' natural resources and demonstrate an understanding of their uses and misuses as measured by bulletin boards, posters, class discussion and pre and post tests.

V. Responsibility: Students will be able to identify areas of responsibility which will enable them to carry out constructive actions as measured by teacher observation.

VI. Career Opportunities: Students will be able to list occupations connected with preservation of the environment and investigate those of particular interest to them as measured by teacher observation and pre and post tests.

Affective:

I. Population: The students will suggest ways in which the effects of over population in an area can be overcome as measured by class discussion and teacher observation.

II. Technology: The student will evaluate the advantages and disadvantages of technological advances found in the home, neighborhood, and county in which they live as measured by class discussion and teacher observation.

III. Pollution: The student will promote the idea of pollution control in the Little Rock area with special emphasis on air, water, litter, garbage, and noise pollution as measured by class discussion and teacher observation.

IV. Natural Resources: The students will value and appreciate Arkansas' natural resources and will demonstrate interest in their preservation as measured by class discussion.

V. Responsiblity: The student will recommend and demonstrate ways in which he can carry out actions to preserve the environment as measured by class activities and teacher observation.

VI. Career Opportunities: The students will illustrate the career opportunities he has discovered in his studies by making posters, collages and drawings.

SCHEDULE FOR UNIT

DAY	ACTIVITY
1	Introduction to the Unit and Pre-Test
2	Activity 1: Population
3	Activity 1: Population
4	Activity 2: Technology
5	Activity 2: Technology (continued)
6	Activity 3: Pollution - Noise and Litter Pollution
7	Activity 3: Pollution - Solid Waste & Air
8	Activity 3: Pollution - Water and Chemical
9	Activity 7: Urban Encounter Field Trip (Subject to Change)
10	Activity 4: Natural Resources
11	Activity 4: Natural Resources.
12	Activity 5: Responsibilities
13	Activity 5: Responsibilities
14	Activity 6: Career Opportunities
15	Post Test and Student Evaluation and Teacher Evaluation

ACTIVITY 1: POPULATION

"I would rather sit on a pumpkin
and have it all to myself than
be crowded on a velvet cushion."

Henry David Thoreau

ACTIVITY 1: Population

Time Required: 4 Hours

Purpose: To study the effects of population increase on our environment.

Behavioral Objectives:

Cognitive:

The student will demonstrate an understanding of population growth in Little Rock compared to population growth in the state and nation as measured by graphs, family trees and pre and post tests.

Affective:

The student will suggest ways in which the effects of over population in an area can be overcome as measured by class discussion and teacher observation.

Background Information:

In modern times, better living conditions and advances in medicine and public health have dramatically lowered the death rate. This has boosted population growth in two ways. More young people survive to have children, and more older people live longer.

Since about 1650, the growth rate of world population has soared. The time required for the number of people on earth to double has constantly decreased. Shortly after 1800, world population had risen to a billion. The number of people on earth had doubled in less than 200 years. By 1930, world population had jumped to two billion. The doubling time was about 130 years. Today, world population is already over 3½ billion and the doubling time is now about 30 to 35 years.

Like a huge snow-covered hill, human population is not only growing but growing increasingly faster. Population experts refer to this increase in human growth rate as the "population explosion."

At what point can we say that a population has grown too large? Since population is not just a matter of too many people in too little space, no simple answer exists.

A large population is not necessarily good or bad. What matters is how well or poorly the people in that population live. It is not the quantity of human life that counts--it's the quality. From this point of view, we can consider an area to be overpopulated when it cannot provide food, clothing and shelter for the people who live in it.

Does this mean that a country is overpopulated if it cannot grow enough food for its people? Not necessarily--the country may sell manufactured goods abroad and buy food from other countries, as England does.

An areas capacity for supporting a population is limited. The population must also be limited because no area can sustain uncontrolled growth. Either the birth rate must be decreased or the death rate must increase. In nature, the weak or injured animal often becomes the food for predators, but man's humanity causes him to be solicitous of the helpless, the sick and the old. Over population is one of the unsolved problems of our times because we are not willing to let people die nor disciplined enough to satisfactorily control the birth rate.

Vocabulary:

1. Census: a count of a population.
2. Epitaph: an inscription on a tombstone in memory of someone buried there.
3. Obituary: the notice of a person's death usually including a short biographical account.
4. Population: the number of one kind of organisms within an area
5. Population density: the number of individuals in a given area or space:
6. "Population explosion": a term applied to the recent astonishing human growth rate.
7. Death rate: the number of individuals who die over a period of time
8. Growth rate: the number of new individuals minus the number who die.
9. Zero Population Growth (ZPG): a balance between the birth and death rate.

Materials Needed:

To Be Provided by the Project

1. Filmstrip: "Population Statistics"
   "Population Trends"
2. Film: "Boomsville"
3. Worksheets: U. S. Population Growth
   Arkansas Population Density
   Maternal and Paternal Family Trees
4. Transparency: Population Changes in Little Rock

To Be Provided by the Teacher or students:

1. Cassette tape recorder
2. Filmstrip projector
3. Film projector
4. Crayons or colored paper
5. Newspapers

Procedure:

1. Introduce the population increase with the filmstrip "Population Trends". Follow the film with class discussion.

2. Distribute the worksheet on U. S. Population Changes to the students. Each student will graph the population statistics of the United States for the past 170 years. After students have completed the graph, class discussion should emphasize particular times of growth in the United States and reasons for such growth (e.g. times of war, immigration, epidemics, etc.)

3. Each student will be given a maternal and paternal family tree worksheet. The student should fill out the tree to the best of his ability. If a student seems hesitant, the teacher should suggest the option of using an imaginary family tree instead of an actual one. After the students have completed the family trees, they should perform the following exercises:
   (a) Determine the number of descendents in the first, second, and third generations of their grandparents.
   (b) If all aunts and uncles had the same number of children as the grandparents, what would the total number of children be?
   (c) Prepare a graph demonstrating the total number of descendents in the classes' families.

4. Have students to check the daily obituary column to see the number of descendents that are left by different age people. Class discussion should follow as to why some people have more descendents surviving them than others.

5. EXTRA CREDIT ACTIVITY: Go to a cemetery and find the following information.
   (a) Find five graves of persons over five years old dying before 1900 List their birthdate, death date, and the age at which they died. Find the average death age for the five persons.
   (b) Find five graves of persons over five years old who died after 1950. List their birthdate, death date and age at death. Find the average age at which the five persons died.
   (c) Record three interesting epitaphs.
   (d) List different wars represented in the cemetery.
   (e) List different materials found in making gravestones.
   (f) Interpret the information found in answering questions 1 and 2 to draw some conclusions about the reasons for the differences in the average age at which the people died.

6. Show and discuss the filmstrip "Population Statistics".

7. Each student should be given the outline map of Arkansas which gives the official 1970 census for each county. Using the color key given, each student is to color the counties according to their population density. After the map has been completed, classroom discussion should follow with emphasis on the counties having the highest and lowest population densities and the reasons for these differences (geographical reasons, industrial areas, large bodies of water, etc.).

8. Give each student a copy of the Little Rock map which shows the population changes from 1960-70. Using the transparency of this map discuss the population changes that have occurred in Little Rock and the reasons for such change (expressways, slums, industry, etc.).

9. Show the film "Boomsville". Discuss the significance of how increased population and technology has affected the land. Discuss the quote "The world doesn't owe us anything, it was here first."

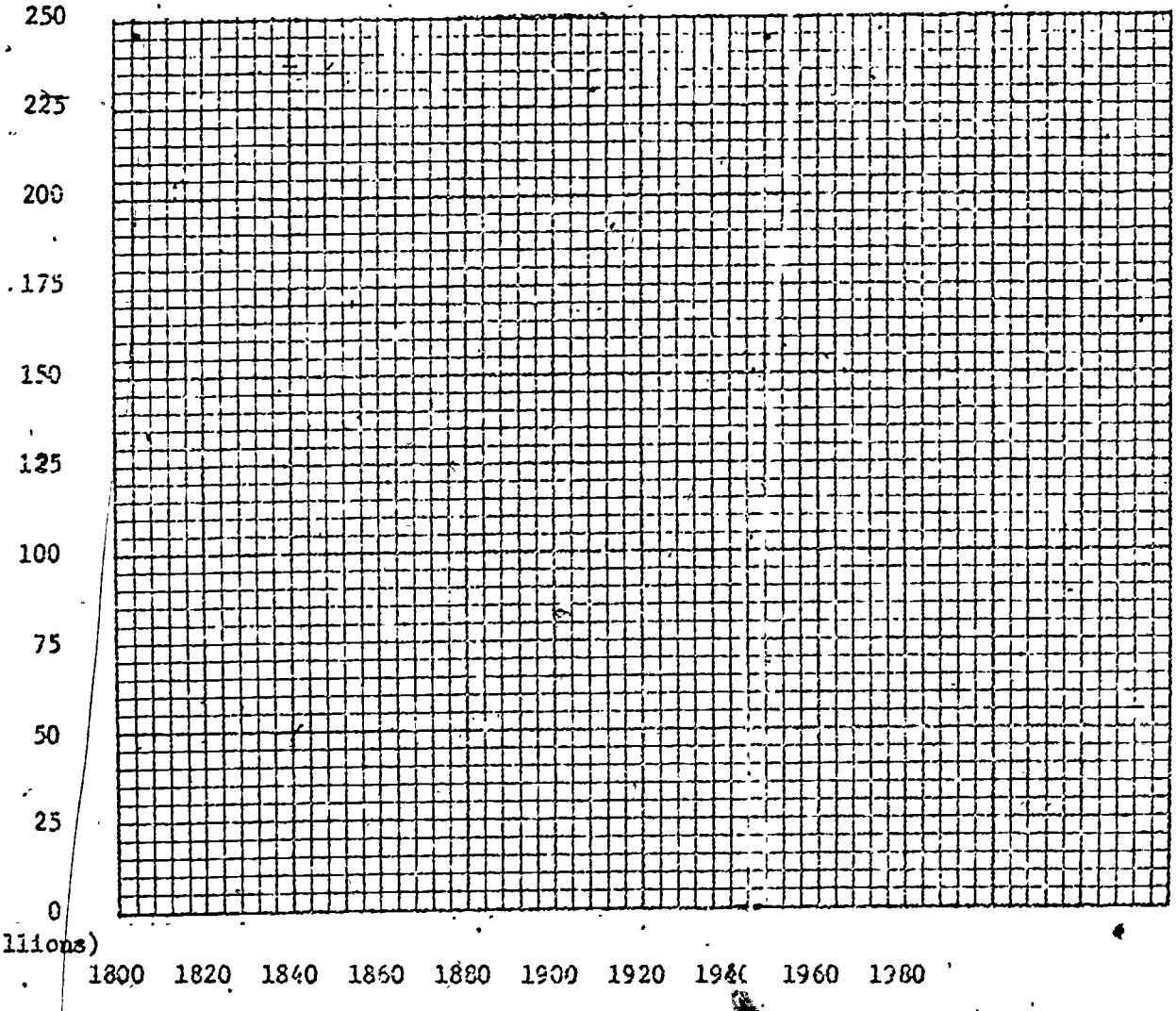
Name _____ Date _____

Worksheet: U.S. Population Growth

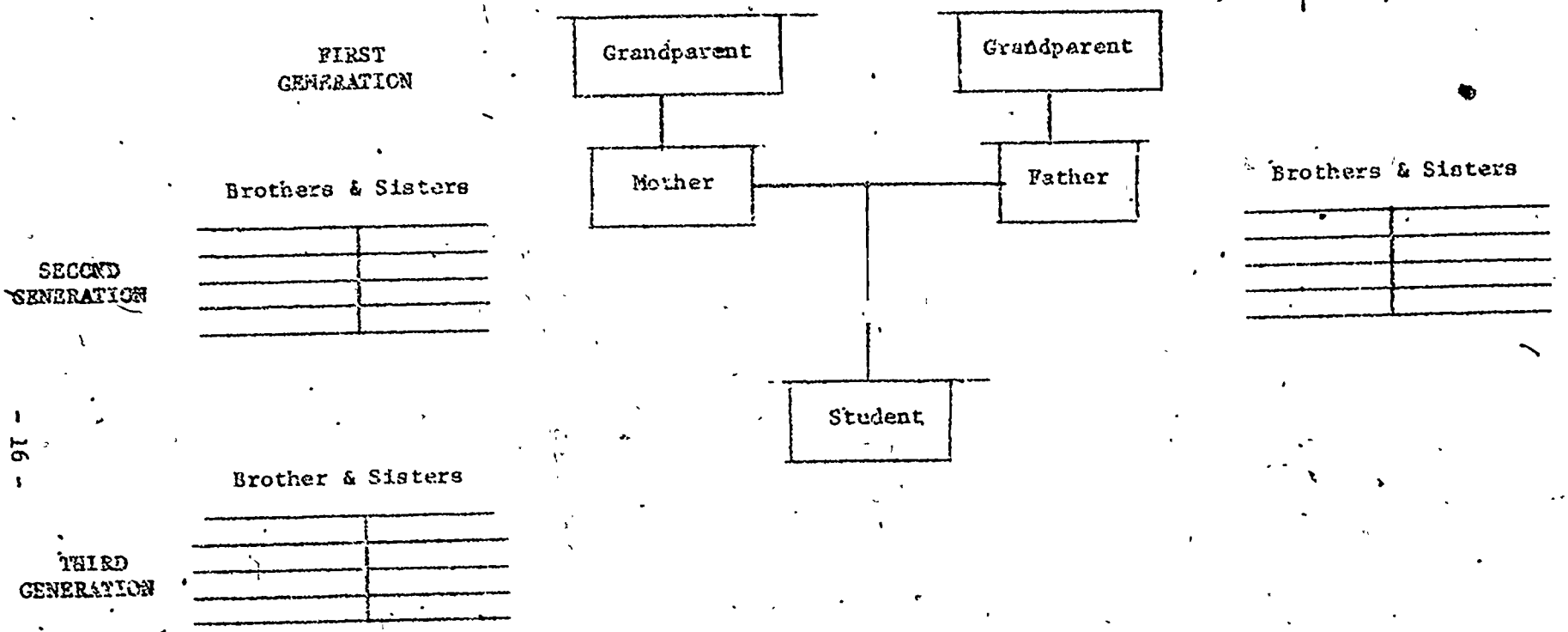
Using the sheet of graph paper and the table below, make a graph showing the increase in population in the United States since 1800.

YEAR	POPULATION*	YEAR	POPULATION*
1800	5,000,000	1900	78,000,000
1820	10,000,000	1920	105,000,000
1840	18,000,000	1940	135,000,000
1860	30,000,000	1960	180,000,000
1880	50,000,000	1980	230,000,000

*Figures are approximate not exact counts. The estimate for 1980 is based upon the present rate of increase. The population for the last census taken (1970) was 200,000,000.



Worksheet: Maternal and Paternal Family Trees



1. Fill out the above family tree. You will have to ask your parents to help you with this.
2. After you have filled out your family tree determine how many people there are in each generation?

   FIRST GENERATION _____ SECOND GENERATION _____ THIRD GENERATION _____
3. If all of your aunts and uncles had the same number of children as there are in your family, what would be the total for the third generation?

Name _____ Date _____

Worksheet: Population Density Map of Arkansas Counties

The Arkansas Census Map gives the number of people residing in each county of Arkansas. Color each county on your map using the key below for population density.

Green - Population under 10,000

Blue - Population between 10,000 and 20,000

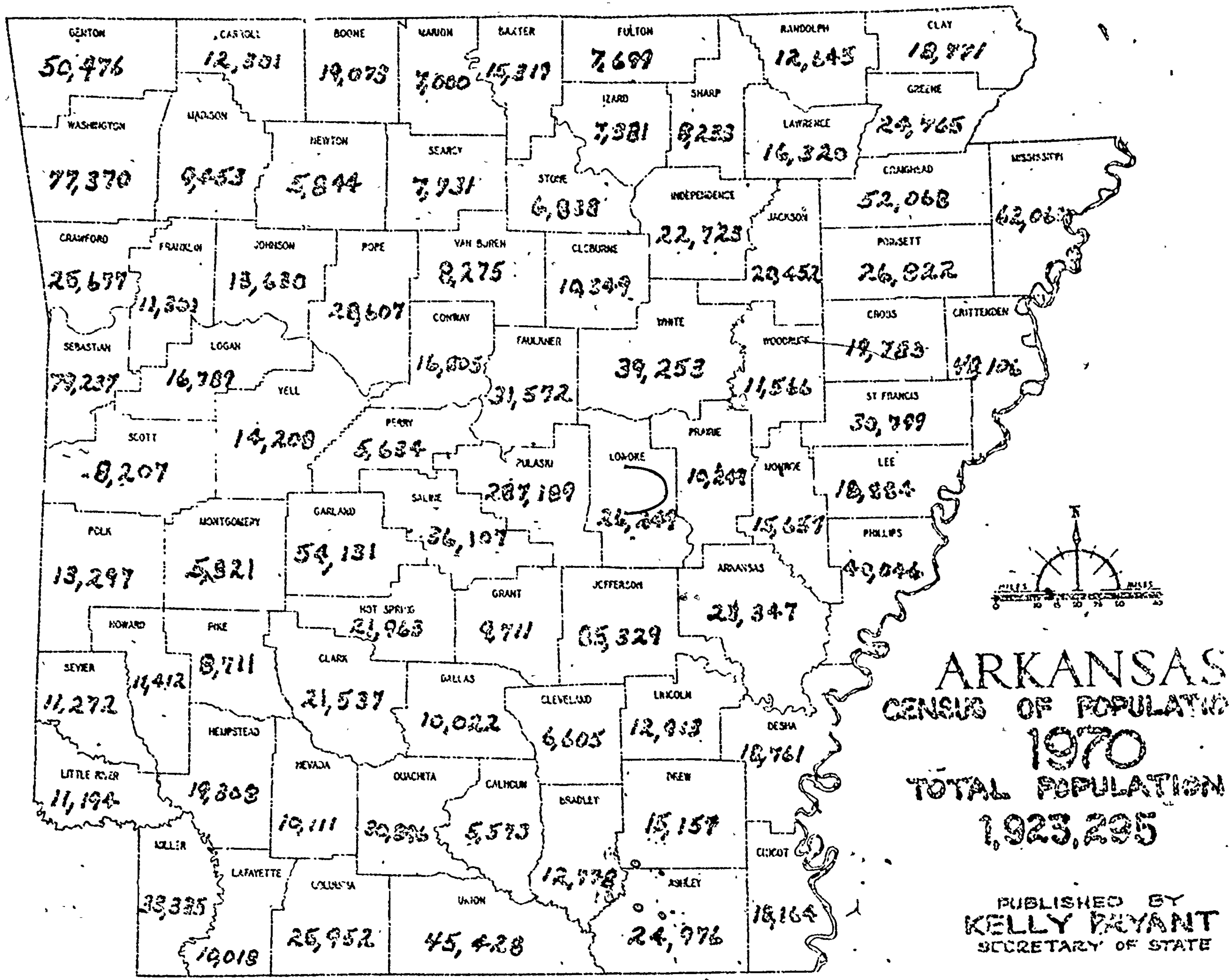
Yellow - Population between 20,000 and 40,000

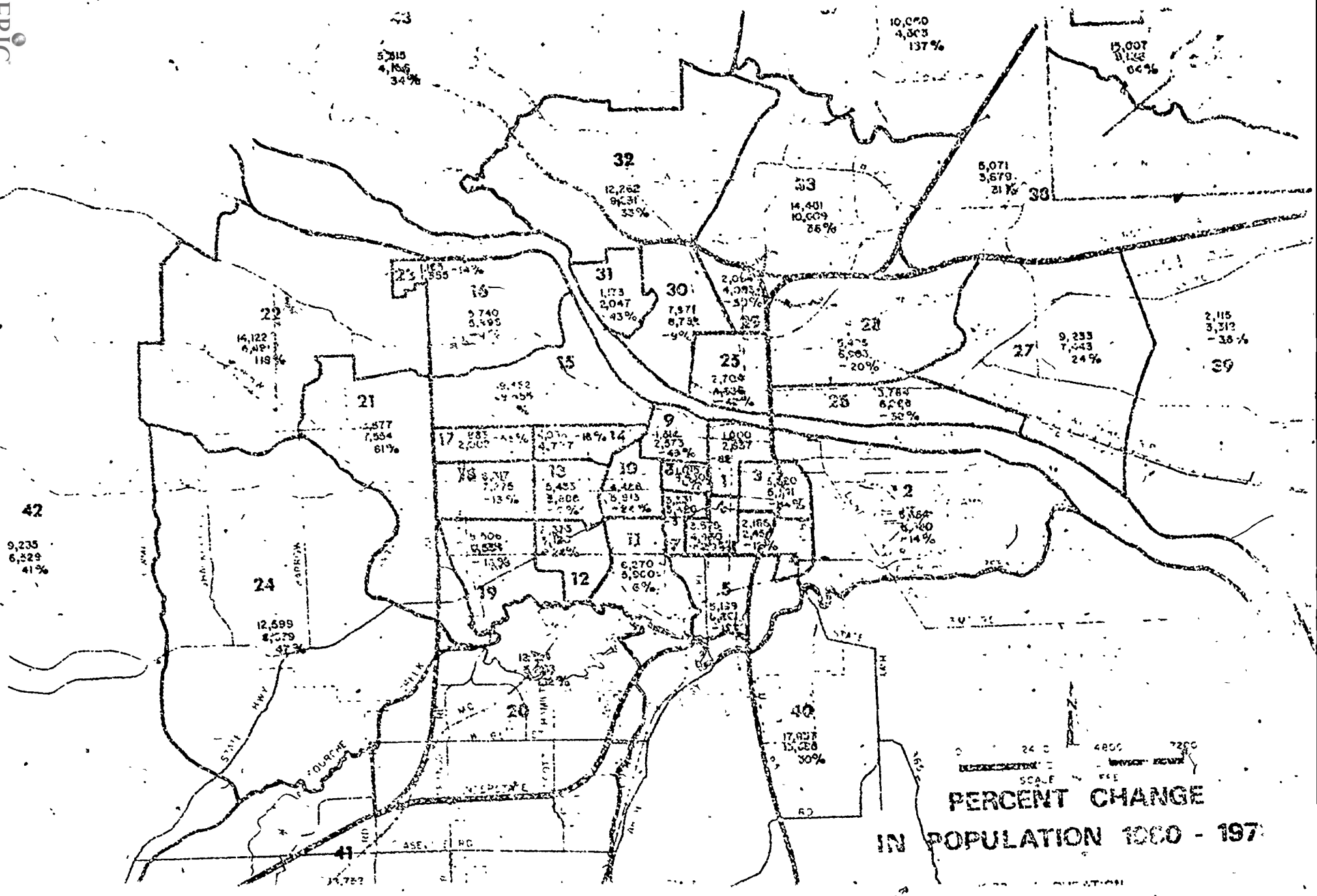
Red - Population between 40,000 and 60,000

Purple - Population between 60,000 and 80,000

Brown - Population between 80,000 and 100,000

Orange - Population over 100,000


ARKANSAS
CENSUS OF POPULATION
1970
TOTAL POPULATION
1,923,295
PUBLISHED BY
KELLY BRYANT
SECRETARY OF STATE
BENTON
50,476
CARROLL
12,301
BOONE
19,073
MARION
7,000
BAXTER
15,319
FULTON
7,699
RANDOLPH
12,645
CLAY
18,771
WASHINGTON
77,370
MADISON
9,453
NEWTON
5,844
SEARCY
7,731
STONE
6,838
IZARD
7,381
SHARP
8,233
LAWRENCE
16,320
GREENE
24,765
CRAIGHEAD
52,068
MISSISSIPPI
INDEPENDENCE
22,723
JACKSON
CRAWFORD
25,677
FRANKLIN
11,301
JOHNSON
13,630
POPE
28,607
VAN BUREN
8,275
CLEBURNE
10,349
POINSETT
26,822
SEBASTIAN
LOGAN
16,789
CONWAY
16,805
FAULKNER
31,572
WHITE
39,253
WOODRUFF
11,566
CROSS
19,783
CRITTENDEN
YELL
14,208
ST FRANCIS
30,799
SCOTT
8,207
PERRY
5,634
PULASKI
287,189
LONOKE
PRAIRIE
10,249
MONROE
15,657
LEE
18,884
POLK
13,297
MONTGOMERY
5,821
GARLAND
54,131
SALINE
36,107
PHILLIPS
40,046
HOT SPRING
21,963
GRANT
9,711
JEFFERSON
85,329
ARKANSAS
23,347
HOWARD
11,412
PIKE
8,711
SEVIER
11,272
CLARK
21,537
DALLAS
10,022
CLEVELAND
6,605
LINCOLN
12,913
DESHA
18,761
LITTLE RIVER
11,194
HEMPSTEAD
19,308
NEVADA
10,111
OUACHITA
30,896
CALHOUN
5,573
BRADLEY
12,778
DREW
15,157
CHICOT
18,164
MILLER
33,385
LAFAYETTE
10,018
COLUMBIA
25,952
UNION
45,428
ASHLEY
24,976
MILES


PERCENT CHANGE
IN POPULATION 1960 - 197

ACTIVITY 2. TECHNOLOGY

"Modern, Resources-Wasting man,
in conflict with our planet's ecology,
treats our planet as if we
had a spare in the trunk.
There not only is no spare planet,
There is no trunk."

Irving S. Bengelsdorf

ACTIVITY 2: Technology

Purpose: To inform and involve students in learning about advances in technology and how these advances affect their environment with emphasis upon the problems caused and their possible solutions.

Behavioral Objectives:

Cognitive:

The students will investigate and describe the advances in technology found in homes and factories and the effects of these developments as measured by pre-test and post tests, group activities, teacher observation and participation in class discussion.

Affective:

The students will recommend activities which they, as sixth graders, can pursue to help preserve the environment and conserve energy and natural resources, as measured by teacher observation.

Background Information:

One of the meanings for the word technology is "any method employed to provide objects necessary for human existence and comfort." In the student's exploration of technology, the emphasis should be upon the conditions that exist in Little Rock, Pulaski County, and Arkansas. They should look for examples relating to technology in their homes and neighborhoods, on the streets, in shopping centers and other business areas, and in industrial areas. They should explore the effects of the machines and processes of technology upon their lives--their existence, their comfort, their safety, and their future employment. Stress should be placed upon the types of pollution due to technology and the possible remedies for the causes of the pollution. The students should also consider man's use of energy--what he uses it for, where it comes from, and what problems now exist or may exist in the future.

Since the students of today will be the voters of tomorrow, each needs to realize the importance of their individual responsibilities in environmental matters. They need to learn to weight the advantages against the disadvantages of our "machine age" and learn to make reasonable decisions concerning what must be done and what their individual responsibility must be.

Vocabulary:

1. Technology: any method employed to provide objects necessary for human existence and comfort.
2. Producer: one that makes goods
3. Consumer: one that uses goods
4. Goods: a product produced for man's use.
5. Services. doing something for someone. (Fixing a car, cleaning clothes, nursing the sick, etc.)
6. Industry: a manufacturing activity as a whole.
7. Factory. a building with facilities for manufacturing.
8. Appliance: a household mechanism such as a stove, fan or refrigerator.
9. Conserve: to preserve or use wisely with allowances made for future needs.
10. Recycling. the reclaiming and reuse of something that would otherwise be wasted.

Materials Needed:

Provided by Project:
1. Film - "Cycles"
2. Filmstrip - "Transportation in the City"
3. Technology Worksheet

Provided by Teacher:
1. Butcher Paper
2. Scissors
3. Glue
4. Construction Paper
5. Crayons or magic markers
6. Old newspapers
7. Filmstrip Projector
8. Tape Recorder
9. Film projector

Procedure:

1. Show the film on "Cycles". This film presents several recycling projects. Technology is utilized in reclaiming waste glass, automobile heaps, and garbage. The film tells us that recycling can be a profitable business if technology, planning, good management and money is available. Following the film, encourage student discussion with questions such as the following:
   a. Why did the film talk about natures cycles? (Nature recycles almost everything, if it did not we would run out of basics such as food and water. Man must learn to copy nature by recycling energy and resources that can be used up.)
   b. Which recycling operation impressed or surprised you the most? (The discussion should lead to technology as the key to recycling by man. Discuss the word technology, ask for personal definitions and explain that technology is using scientific principles and concepts to invent new machines and mechanisms.

Many times technology is simply the putting together of various components (invented by someelse) into a new product (invention).

2. Divide your students into discussion groups. The exchange of ideas in small groups is a good way to get students to examine their thinking, identify problems caused by technology, and examine possible solutions. Give each student a copy of the "Technology Worksheet". Allow time for each student to look over the questions, read the introduction and ask questions about the information. Have each group appoint a recorder and have the members of each group answer the questions and add any original ideas. The questions have not definite answers. Each group should prepare a poster type display. The teacher will provide a stack of old magazines where pupils can get pictures of machines and appliances to illustrate their ideas. The teacher should supply construction paper, paste, crayons or magic markers, scissors and butcher paper. Some students will want to draw instead of using cut-outs. After a suitable time, have each group make a presentation of the groups reactions to the technology questionnaires. This may be followed by a presentation and explanation of group work and poster displays. The teacher should lead a general discussion involving students in drawing conclusions about technology in their homes, and neighborhoods and in Little Rock and Arkansas. The results of the group work may be evaluated at the teachers discretion. Following some discussion of the industries mentioned by the groups, the teacher should produce the listing of industries provided. The teacher should emphasize both the number and vast array of products manufactured in the greater Little Rock area. This list should then be placed where students could glance over it when they have a chance.

3. Show the filmstrip (with tape) on "Transportation in the City." Lead a discussion concerning the film.

Technology Worksheet

The word "technology" covers many areas of our lives. It means factories spewing smoke, But working to make items we need and want. It means airplanes flying in and out of Adams Field taking freight and people to all parts of the world, But polluting the atmosphere with noise and exhaust fumes. It means the development of better and faster cars that ake people to work and to the doctor and to parties, But which use more gasoline and are noisy and have harmful exhaust fumes. It means all of the wonderful washers and dryers and mixers and blenders and t.v.'s and radios and vacuum cleaners which make our lives easier and give us more time for fun, But which use energy, natural resources, and make noise.

In this this exercise, you will explore some of the problems caused by technology and possible solutions for these problems as your group discusses the following questions.

1. We have an imaginary family consisting of a mother, father, a boy and girl. List all of the work saving appliances that this imaginary family might have in their home. Put these appliances in the order you think they should be from the most important to the least important. Did the amount of money each appliance cost affect the way you listed them?

2. What factories do you know about that we have in Pulaski County? What are some of the products manufactured?

3. If factories are causing air pollution, who should pay for this to be corrected? Should the owners of the factory pass along this cost to the consumers of the product?

4. If factories are causing water pollution, who should pay for this to be corrected?

5. If factories are causing noise pollution, is this important to the people who work at the factory? Is this important to the people who live near the factory?

6. Do you think appliances and machines in our homes cause any type of pollution? If so, what?

7. What are five ways each of us could conserve energy (electricity, gas gasoline)?

8. What difference would it make if each of us, in our own homes, made an effort to conserve energy?

9. If you could have only three things in your home which use electricity, what would you keep in your house?

10. What problems, having to do with technology in our lives, need solving first? Why do you think this is so?

ACTIVITY 3. POLLUTION

WHICH AMERICA WILL YOU HELP BUILD?

O beautiful for spacious skies
  For amber waves of grain
For purple mountains majesties
  Above the fruited plain.

America! America!
  God shed his grace on thee
And crown thy good
  with brotherhood,
From sea to shining sea.

Katherine Lee Bates
America the Beautiful

If you visit American City,
You will find it very pretty,
Just two things of which you must beware
Don't drink the water and don't breathe the air.

Pollution, Pollution,
They got smog, and sewage and mud
Turn on your tap and get hot and cold
  running crud.

Tom Lehrer
Pollution

ACTIVITY 3. Pollution

Time Required: 6 Hours

Purpose. To investigate the pollution in our area and offer possible solutions.

Behavioral Objectives.

Cognitive:

The students will be able to list the various types of pollution in the environment and investigate the causes and effects of pollution in the greater Little Rock area as measured by graphs, charts, demonstrations, class discussion and pre and post tests.

Affective

The student will promote the practice of pollution control in the Little Rock area with special emphasis on air, water, litter, garbage, chemical, and noise pollution as measured by class discussion.

Background Information:

"Pollution is the addition of anything to the environment in quantities which are harmful to the forms of life living there." Some pollution can come from natural causes. An earthquake can disturb the earth so that water can enter part of a hot region in the earth's crust and then rise to the surface as a hot spring or a geyser. Most plants and animals cannot live if water becomes very warm. Another example of natural pollution is a volcano erupting where the life may be killed by the gases or lava.

Natures systems of checks and balances are often cruel but the ecosystem is eventually brought back into equilibruim. Regarding man and his effect on the environment, this state of equilibruim is rare. As man's population has increased, non-renewable resources have been exploited and heavy amounts of waste materials have been produced.

Water pollution can be caused by waste products from activities such as: manufacturing, food processing plants, agricultural runoff of fertilizers and chemicals, untreated or poorly treated sewage and various kinds of trash and garbage.

The chemical nature of the air differs with location, weather conditions, and the time of day. Automobile exhaust is the major source of air pollution. Industrial pollutants from smokestacks further increases air pollution. Electric power plants and iron smelters give off sulphur dioxide. This can cause organisms to die, discoloration of metal, damage to painted surfaces and respiratory diseases. Carbon monoxide gas from cars and trucks can cause death. The number of accidents due primarily to carbon monoxide fumes is not known.

Nitrogen oxides and hydrocarbons that are released into the air, when certain materials are burned, may produce smog which can cause damage to lung tissue and destroy plants. Most of the lead added to the air comes from manufacturing processes and the burning of leaded gasoline.

Most soil and water pollution is due to the disposal of industrial or household wastes. Soil and water pollution can also be caused when various chemicals are sprayed on farm fields to destroy weeds and insects. These chemcials can be taken into food products and can be washed into ponds, lakes and streams. People eating the food products can be harmed. Plants and animals living in or drinking the polluted water can be harmed. Noise pollution might be defined as sound loud enough to affect man's well being. Deafness may result from exposure to a very loud sound or to continual noises. Workers in jobs where there is a high noise level over an extended period of time are subject to hearing loss. If noise is loud enough to make people shout to be heard, if noise is loud enough to cause a temporary hearing loss or to cause a ringing in the ears, it is causing hearing damage. Noise of home appliances, TV sets and radios, power lawn mowers, cars and heating and cooling systems are a few of the sounds most people live with in the United States. The Federal Aviation Agency has been working on noise control of aircraft since President Johnson's administration. It is predicted that by 1975, there will be 150,000 privately owned airplanes to add to the noise of government and commercial aircraft.

Pollution by garbage and solid waste amounts to over 400 million tons a year or about 11 daily pounds of plastic, glass, paper, junked automobiles and garbage for every person in the United States. Litter pick-up on highways and scenic areas costs the governments of states untold dollars. Communities are faced with tremendous waste disposal problems. New York City officials have to find places for daily deposits of garbage and solid waste large enough to fill a freight train seve miles long. In smaller towns, waste disposal is often the responsibility of the individual. This infortunate situation results in open dumps and/or the burning of such wastes. Garbage also smells and creates a breeding ground for rodents and insects. However, most garbage eventually decomposes and returns to the natural cycle. The solid wates disposal probelms have reached giganic proportions. Industries generally have had the responsibility of their own waste disposal. In the past, most have had their own dumps, incinerators or landfill areas. Now, businesses are looking into waste disposal methods and prodedures to formulate some solutions to their problems of waste disposal. Recycling is one solution to our solid waste problem. However, is it often cheaper and more profitable for a manufacturer to make new goods rather than to recycle used ingredients which hinders its wider use. But, it is probably the only long-range solution for our solid waste problems. Although much time, knowledge and money will have to be expanded before recycling can become feasible as a solution for this problem.

Vocabulary.

1. Environment: the external conditions that affect the existence or development of a living thing.

2. Urban: city.

3. Pollution. the making of something unclean or unhealthy by the addition of some substance.

4. Pollutant: a substance which is added to another substance to make it unclean or unhealthy.

5. Turbidity. the amount of cloudiness in a liquid due to the presence of finely divided solid particles which will not dissolve.

6. Detergent: a substance used for cleaning purposes.

7. Biodegradable: the breaking down of a substance by the forces of nature.

Materials Needed:

To Be Provided by the Project:

Filmstrips:
1. Pollution, What is It?
2. Solid Waste
3. Our Air
4. Our Waters
5. What Can We Do?

Books:
1. Our Wounded Land
2. An Introduction to Pollution

Other Materials:
1. Aluminum cups
2. Clothespins
3. Candles
4. Aluminum pie pans
5. Plasticine
6. Waxed paper
7. Poster board
8. Vaseline
9. Funnels
10. Paper Towels
11. Salt
12. Measuring Spoons
13. Bottles
14. Hand Lens
15. Medicine droppers

To be Provided by the Teacher:
1. Radio
2. Watch
3. Scotch Tape
4. Scissors
5. Filmstrip projector
6. Tape recorder

To Be Provided by the Student:
1. Samples of garbage
2. Ruler
3. Detergent samples
4. Plastic vials
5. Water samples

Procedure:

1. Introduce the topic with the filmstrip "Pollution, What Is It?". Following a short discussion of the filmstrip, inform the students that pollution will be studied over three days with each day involving two or three of the following types of pollution: Noise, Litter, Waste Air, Water and Chemical.

2. Do the noise exercise.

3. Have students do litter exercise. Class discussion should provide reasons for more or less litter to be found in a particular area. Posters or litter containers utilizing the litter collected can be made by students to be placed in areas in which there was a high degree of litter. Extra Credit: Creative writing on litter.

4. Before doing the assignment on solid wastes, introduce the topic with the filmstrip, "Solid Waste". After disucssion of the film, students will burn solid wastes and make comparisions in regard to the amount of smoke, ashes, and time required to burn each material.

5. Introduce the topic with the filmstrip, "Our Air". After discussion of the film, students will prepare collector papers to be placed throughout the school to establish the amount of air pollution in the area.

6. Introduce the topic with the filmstrip "Our Waters". Following discussion of the film, students utilize filtering devices made in the classroom to filter debris from water collected throughout the Little Rock Area.

7. Using various detergents, have the students prepare experiments that shows the amount of soap suds and the length of time use by suds in different detergents.

8. After completing the studies of some of the main types of pollution, show the filmstrip, "What We Can Do". Following the filmstrip and closing disucssion on the topic Pollution, students may suggest ways in which they can do something about pollution problems. They should be encouraged to organize and follow through on their ideas. After the unit is completed, the students will have most of the school year to investigate problems, implement solutions and organize for corrective action. If students do follow through with additional study or group effort to solve pollution problems, please keep the project informed and if we can be of help, let us know!

Name _____ Date _____

Worksheet: Pollution

A. Noise.

Turn the radio up loud and listen to it for five minutes. Turn the radio off and try to hear your watch ticking when you hold it up to your ear. Note how much time passes before you can hear the ticking of the watch again. Mark the volume dial of the radio so that the same volume can be used again. Repeat the experiment again the next day but only listen to the radio for 3 minutes. Try it one more time on the third day but only listen for 1 minute this time. Record your observations in the table below.

Title _____ Date _____

	Day One	Day Two	Day Three
Listening Time	5	3	1
Time needed to hear ticking of watch.			

1. Which length of listening time produced the longest time for which the watch could not be heard?

2. Predict how long you would be unable to hear the watch if you listened to the loud noise for 20 minutes, 30 minutes, and 1 hour.

3. What do you think would be the result of listening to the loud noise for a month or more?

B. Litter.

Visit several areas around the school campus and collect pieces of litter. As you collect the litter, you should make a record of the place where it was found. After the litter is collected, you will go back to class and make a map below of the school grounds showing places in which litter were found. Use the symbols below for the different types of litter found. The symbol for each kind of litter that you collected should be put on the map where it was found.

Key for Types of Litter.

□ Candy Wrapper	△ Cans	D Paper
○ Facial Tissue	+ Boards	E Cardboard
✳ Fruit peel or core	⊙ Wire	F Wood
• Newspaper	∿ Plastic Cup's	G Plastic
_ Bottles	A Glass	H Concrete
B Metal	C Food	I Cloth

C. Solid Waste.

At the teachers direction, bring samples of the types of materials found in garbage to class. Break or cut a small piece from each material so that each sample is approximately the same size. Burn the samples one at a time by placing them in an aluminum cup held by a clothespin. Heat the cup with a candle, that has been secured in an island of Plasticine on an aluminum foil pie pan, until the material in the cup burns. Since you will be using fire, consider carefully the safety rules concerning hazards such as loose hair, clothing and other flammable materials. Be sure to test such materials as cloth glass, plastics, bubble gum, tin cans, bones, as well as wood or paper products. Record the information given in the table below for each sample tested.

Title _____ Date _____

Type of Material	Time Before Flame Appears	Description of Smoke	Description of Ash	Other Changes Noticed

1. Which type of material produced the most smoke?

2. Which materials produced smoke with an unpleasant odor?

3. Which materials create the worst fire hazard?

4. Which materials took the longest to burn?

5. Which materials left behind the most ash?

6. Which materials do you think would contribute the most to air pollution when they are burned?

7. Which materials were not changed much by the heat applied to them?

8. If something burns is it a physical or chemical change?

9. If you had used a much hotter flame for the experiment, what might have happened?

D. Air.

Obtain a piece of waxedpaper 2½ inches square. Use a pencil and ruler to mark the waxed paper so that it is divided into ½ inch squares. Attach the paper to a piece of poster board with scotch tape. Smear the paper evenly with a coating of vaseline. Place a collector paper in several rooms and areas of the school. Try to select rooms in which you think a variety of results could be obtained. Care should be taken in selecting the spot inside the room where the paper is to be placed. A good location might be in the center of the wall farthest from doors and windows and 3 feet above the floor. After two days remove the collector papers and examine them. Compare the materials found on each paper.

1. On which side of your school was the greatest amount of solid particles found?

2. From which direction did most of these particles come?

3. What can be found in that direction that contributed to air pollution?

4. How did the wind affect the type of solid particles collected?

5. Why should the location of the oollector papers be as identical as possible in each room?

6. In which room was there the greatest amount of air pollution? Why?

E. Water.

1. At your teachers' direction, collect and bring to class samples of water from rivers, lakes, ponds, ditches, etc. You will need a funnel, paper towels and a bottle. The bottles should be tall enough so the mouth of the jar will hold the cone of the funnel and prevent the spout from touching the bottom. Fold the paper towel in half and then in half again to make four nearly square quarters. With scissors make a quarter circle by cutting off the loose (not folder) corners. Hold the first three thicknesses together and separate the fourth to form a cone. This paper towel cone will fit easily into the cone of the funnel. Carefully pour some of each sample into the paper towel cone being sure no liquid touches the funnel above the level of the paper towel or runs down the outside of the funnel. When all the liquid has drained through the paper towel filter into the jar, place this liquid in its original container. Be sure to use a new paper towel filter for each sample you filter. Open up each filter paper and allow it to dry. Examine the dried filter papers with a hand lens.

   a. What types of particles did the filter paper separate from the water samples?

   b. What types of pollution does this method of filtering remove?

   c. Where in your community is filtering used to remove pollution?

2. Completely dissolve a spoonful of salt in a glass of tap water. Taste the water. Filter it and then taste the water which passes through the filter paper. Look for salt on the filter paper. Salt is a chemical. Will filter paper remove this chemcial form water?

F. Chemical.

1. Obtain small amounts of several brands of detergents. Label each brand of detergent.

2. Collect a number of plastic pill vials that are identical in size. You will need two containers for each brand of detergent that you wish to test.

3. Add tap water to half of the containers until each is approximately half filled. Use a medicine dropper to add or remove water until the level is the same in every container.

4. In each of the other containers, make up a soap solution by mixing 1 spoonful of the powdered detergent with 3 spoonsfuls of water. It is very important to keep the strength of each detergent solution the same by using the same amounts of detergent and water each time.

5. Use the medicine dropper to place 10 drops of each soap solution into one of the containers of water. Cap and shake each container 10 times.

6. Measure the height of the soap suds which form on top of the water and record it in the table. Record the time it takes for the soap suds to disappear. Rinse out the medicine droopper and repeat the procedure with the other detergent samples. Be sure to shake each container the same amount and in the same manner. (In order to test the liquid detergents simply add 10 drops of each directly to the containers of water and then shake.)

Name of Detergent	Type of Detergent (Liquid-Powder)	Height of Suds	Time for Suds to Disappear

7. Questions for discussion.

a. Which brand of detergent produced the most suds?

b. Which brand of detergent produced suds that lasted the longest?

c. What connection does the amount of suds have with the detergents ability to clean?

d. How does the amount of phosphate in the detergent compare with the amount of suds or the time the suds last?

ACTIVITY 4 NATURAL RESOURCES

Waste not, want not.

... Benjamin Franklin

ACTIVITY 4: Natural Resources

Time Required: 6 hours

Purpose To help students see that Arkansas has many precious and beautiful resources.

Behavioral Objectives:

Cognitive:

1. The student will be able to list six of Arkansas' natural resources and demonstrate an understanding of their use as measured by bulletin boards, posters, class discussion and pre and post tests.

Affective:

1. The student will value the study of Arkansas' natural resources and will demonstrate interest in their preservation as measured by class discussion.

Background Information: Resources of Arkansas

Fertile Soil. This is one of Arkansas' most prized possessions. Because of the rich soil and the long growing season, agriculture is one of our state's leading industries. There are few crops grown in the United States that cannot be produced in Arkansas. Cotton, soybeans, rice, corn, vegetables, fruits and nuts are some of the main crops. Arkansas' agriculture accounts for many related industries. Wine and vinegar making, canning, and the production of cattle and chickens are a few.

Lumber. Lumbering is one of Arkansas' main industries. Related industries of furniture making, paper manufacture, charcoal production, and box and barrel stave manufacturing account for many jobs for the people of Arkansas.

Water. Arkansas abounds in beautiful lakes and streams. The state has 2,313 lakes larger than five acres. These lakes help supply the 256 million gallons of water used per day for industrial and domestic purposes. The federal reservoirs in Arkansas provide power for making electricity as well as unlimited recreational opportunities for our citizens. The cold water discharge below these dams support an abundance of trout. In fact almost two million trout were stocked in Arkansas' lakes and streams in 1972. The abundance of water in Arkansas allows crops to be irrigated and catfish to be farmed. The hot water springs at Hot Springs, Arkansas, draw travelers from all over the United States.

Oil and Gas. Black gold was discovered in Arkansas in 1920 and 1921 when the oil wells in Ouachita and Union Counties came in.

The oil industry has brought many people and much wealth to the state. Gasoline, kerosene, and motor oil are the major products of crude oil technology. Gas and oil are often found together. Arkansas' first gas well was drilled in 1900 in Fort Smith. Factories frequently locate near gas fields since gas is a cheap fuel when plentiful. Although once plentiful, Arkansas' reserves of gas and oil have been steadily declining since about 1950.

Coal. The coal deposits in the state stretch from Fort Smith to Russellville, covering more than 1,300 square miles. Open-pit mining and shaft mining in the western part of the Arkansas River Valley account for most of the state's coal. In 1972, coal production in Arkansas netted $3, 187, 500.

Bauxite. Bauxite is the raw material from which aluminum is made. Aluminum is so light and strong it can be used in many ways. Alum, which is used in water purification, is made from bauxite. The most valuable bauxite mines are in Saline and Pulaski Counties.

Manganese. Manganese is used as a strengthening agent in the manufacturing of steel and has other industrial uses.

Tripoli and Cinnabar. These minerals are not very well known, but tripoli is used in making scouring powders and explosives. Cinnabar is a mineral from which mercury is made. Mercury is used in thermometers, sign manufacture, the chemical treatment of seed, etc. It is found in the Ouachita Mountains in Howard and Pike Counties.

Diamonds. The diamond-bearing ore covers about 80 acres near Murfreesboro in Pike County. In 1906, the first diamonds were discovered. The state recently purchased the diamond producing area and it remains a tourist attraction where people hunt for diamonds. These diamonds are not to be confused with the Hot Springs "diamonds" which are quartz.

Chalk, Clay, Limestone, Marble. Beautiful marble is found in North Arkansas and is used mainly in building. Marl (crumbling deposits of clay and limestone) is especially good for fertilizers. Pottery made from Arkansas clay is sold throughout the United States. This clay is also used for making bricks and tile.

Lead and Zinc. These are two of the more valuable metals mined in Arkansas. Lead has many industrial uses as does zinc. Zinc is used in the process of galvanizing which prevents rusting. It is also used in roof and gutter manufacture.

Titanium, Antimony, Barite, Bentonite, Fuller's Earth, Gypsum, Vanadium. Titanium is used in paints and steel production. Antimony is used in making some alloys (mixture of metals) and in medicines. Barite is a building stone. Bentonite is a soft rock resembling clay and is used in making wall plaster, soap paper, and wine. Fuller's Earth is used in making different types of filters. Gypsum is found in layers of rock and is used for improving soils and making plaster of Paris.

Vanadium, a metallic element, is used in making alloys. While Arkansas has deposits of all of these minerals, some of them have not been fully investigated and their quantities are not known in all cases.

Wildlife. Arkansas' only big game mammal, the white-tailed deer was at an all time low in 1930, when there was an estimated 500 deer in the state. The establishment of federal game refuges in 1926 and the Arkansas Game and Fish Commission refuge system in 1927 stimulated the growth of the deer population. 2,343 deer were stocked between 1929 and 1951. In 1971, the estimated statewide population of over 250,000 deer was based on a reported kill of over 26,000, about 10% of the herd. Annual revenue from Arkansas deer hunting approximates 26 million dollars, this figure being based on approximately 150,000 hunters. In 1972, the harvest was 31,415 which may indicate too much population growth.

The wild turkey is another game animal that is fighting back from a low population. In 1957, the legal turkey kill was 461, in 1973, the legal kill was 1,935. It is difficult to estimate the number of turkeys in Arkansas because the state lacks a tagging program, but the head of the game division estimates that the legal kill reflects from 3% to 5% of the population. Utilizing these figures, the 1957 population was approximately 12,300 and the 1973 population is approximately 51,600. Other estimates indicate the population in 1973 may be over 100,000.

Furs purchased by Arkansas dealers during the 1972-73 season amounted to $216,516. These furs were made up of nutria, otter, oppossum, raccoon, mink, skunk, civet cat, muskrat, grey and red fox, weasel, coyote, bobcat and beaver.

The Arkansas Game and Fish Commission has started a new program designed to increase the numbers of small game, particularily quail. The program, 'acres for wildlife', enlists the farmers help in setting aside part of his land as good wildlife habitat. The quail population in Arkansas has been cut considerably due to modern farming practices. Squirrel and rabbit populations are in fairly good condition although the squirrel population in the Ouachita Mountains is expected to be quite low this fall due to the failure of the mast crop last year.

The Commission operates the world's largest state owned warm water fish hatchery and concentrates its stocking program on new impoundments and corrective stocking of existing lakes. Arkansas' fishing opportunities are at an all time high. The commercial fishing industry netted $35,000 during the last fiscal year.

Shelter for Arkansas' game animals is an important facet of game management. There are four federal refuges in Arkansas. The White River Refuge occupies 113,000 acres of bottomland. The Holla Bend Refuge (near Russellville) occupies 3,500 acres. Wapanocca (near West Memphis) and Big Lake (near Blythville) are about 5,000 acres in size. Two million acres of National Forest land is managed by the Arkansas Game and Fish Commission, and the Commission owns 300,000 acres.

The Commission spends about $1 million a year to buy new land, and the cost of the type of land that the commission buys is posing a serious problem. In 1950, land desirable for wildlife was sold to the Commission for less than $10 an acre. By 1970, the same type of land was purchased for $74 an acre and in 1972, the price was up to $140 an acre. $1 million does not purchase even 10% of the land today that it did in 1950. The solution is obvious, the budget available for land purchases will have to be increased considerably. Wildlife means the wild plants as well as the animals. The two have to come together because of their roles in the balance of nature.

Vocabulary

Some additional terms are defined in the background material.

1. Balance of Nature : the balance that exists between all of the living things in a natural environment which tends to keep the environment stable.
2. Conservation: to preserve or use wisely allowing for future needs.
3. Energy: the ability to do work.
4. Impoundment: a lake that is made by holding water with a dam.
5. Mast: nuts accumulated on the forest floor and often serving as food for hogs, deer, turkeys, squirrels, etc.
6. Natural Resources: those things we depend on in our environment which are supplied by nature.
7. Nutria: a small mammal that looks like a muskrat, reproduces rapidly and is often a pest.
8. Opportunity: a good chance for advancement or progress.
9. Organism: anything that carries on life functions.
10. Wildlife: living things that are neither human or domesticated.

Materials Needed

To Be Provided by the Project.

1. Posters and pictures showing natural resources.
2. Poem- America the Beautiful .
3. Film- 'Lakes and Rivers of Arkansas'.
4. Background Information Sheets- Resources of Arkansas.
5. Outline map of Arkansas (2 per student).
6. Math worksheets.
7. Copies of the 'Wilderness Bill'.
8. Individual Life Style Survey.

Procedure

1. Display the visual aids depicting natural resources and lead a discussion regarding their beauty and aesthetic value.

   Questions: What is beauty?
   Is beauty a luxury or a necessity?
   Is there anything in nature that is not necessary?

   After a short discussion, produce two posters. Things That Are Necessary In Nature and Things That Are Extras. Let the students add to these posters and discuss their reasons for adding certain things in nature under the specific caption. After the exercise, some students may wish to collect or draw pictures of things they think are necessary or unnecessary in nature and glue these to the posters.

   Questions: Where can you find beauty?
   Did you see anything ugly as you traveled to school today?
   How are ugly places brought about?
   What is meant by the term "natural beauty"?

2. Give each student a copy of the poem America the Beautiful . Ask them to read the poem carefully and try to feel and visualize each word. Read the poem in unison, then ask for comments about the truth of the poem when it was written and today.

3. Show the film. Lakes and Rivers of Arkansas. After the students have made personal comments, discuss the natural beauty of our state.

4. Give each student a copy of the natural resources that are in the State of Arkansas (Resources of Arkansas). After the students have read the resume, discussion should follow concerning the natural resources that are available in our state and how they are being used or misused. On an outline map of the state, students should draw, write or use symbols to depict the natural resources that are found in specific areas of the state.
5. Students may work individually on the math worksheets concerning natural resources or the work may be done at home. Discussion should follow grading the papers or the teacher may use another method.
6. Each student should write a letter to his state senator or legislator discussing the wilderness bill. Copies of the bill should be distributed to the students. If time for this activity is not available, this could be an extra credit activity.
7. Each student is to be given an outline map of Arkansas. Inside the borders of the state, students should write an essay on, "Why Arkansas is Called the Land of Opportunity, ", "The Wonder State", or a topic chosen by the teacher or student.
8. Students are to be given a copy of the Individual Life Style Survey (4 pages). The teacher will briefly go over the questions contained in the survey, then assign it as homework over an appropriate period of time. Parents may be asked by the students to help in answering certain portions of the survey.

America the Beautiful

O beautiful for spacious skies,
For amber waves of grain,
For purple mountain majesties
Above the fruited plain.

America! America!
God shed his grace on thee
And crown thy good
With brotherhood
From sea to shining sea!

....Katherine Lee Bates

Name _____ Date _____

Mathematics Exercises on Uses of Forests and Woodland Resources

1. A farmer's woodland is divided by a road. In his spare time the farmer cuts logs out of his forest on both sides of the road. This gives him something to sell to pay him for his work. He uses his own truck to haul the logs to the mill. He moved 75 logs out of the woods on each side of the road: What was the total number of logs he sold? _____

2. One day the fish-hatchery truck drove up to restock the farm pond. The fish were in nine big cans. How much did the fish population of the pond rise when they released the fish?_____ _____

3. A forest fire burned an average of 360 acres a day. It took three days to put the fire out. How many acres were burned?_____

4. At a sawmill, one truckload of logs made 343 boards while another truckload made only 276 boards. How many boards were made from the two truckloads?_____ _____

5. A man was selling Christmas trees from his plantation and he cut every other tree. If there were 600 trees on his plantation, how many did he cut?_____

6. Trees are cut into logs that will bring the best price at the mill. One good tree was cut into four logs, two were 12 feet long, one was 10 feet long and the last was 14 feet long. How long was the tree trunk after the top was cut off but before it was cut into logs?_____ _____ ____

7. Sometimes a sled and team of horses is used to haul logs. If you had 76 logs piled in the woods and could haul ten at a time, how many full loads would you haul?_____

8. In 1972, John helped his father cut the first trees out of their forest plantation which was planted in 1930. How old were the trees when they were mature for cutting?_____

9. To produce just one bushel of corn requires 6,250 gallons of water. A bushel of wheat needs 7,500 gallons. How much more water does it take to produce a bushel of wheat than a bushel of corn?_____ _____

10. There are 43,560 square feet in an acre. A forester, wanting to grow food for wildlife in a clearing, bought 25 lbs. of grass seed which according to directions, required 1 lb. of seed for 3600 square feet. Approximately how many acres could the 25 lbs. sow?_____ _____ _____ _____

Individual Life Style Survey

I. Use of Natural Resources: Water

1. How much water do you use in one day? _____
   Use the information in the table to help you to decide.

Water Used In Homes

Activity	Quantity
Bath	30-40 gal.
Shower	5 gal./min.
Toilet	13-20 gal.
Automatic Dishwasher	13-20 gal.
Automatic Washing Machine	30 gal.

2. How many quarts of water do you drink in an average day?_____
3. How many gallons do you use to wash yourself each day?_____
4. How much water do you use for other purposes?_____
5. How much water does your mother use to clean clothes, fix food, and do dishes?_____
6. What fractional part of that is used for you?_____
7. How many gallons are in that fractional part?_____.
8. Now answer the first question - How much water do you use in one day?
9. Water is also used in other ways for your health, safety, and enjoyment. List as many of these uses as you can:_____

_____

_____

_____

_____

II. Use of Natural Resources: Air

Every time you breathe you take in about one pint of air or 15,000 quarts per twenty-four hours. That amount is contained in a room 40 feet square and 8 feet high.

1. Can you determine how many times you take a breath in one minute? (Remember to breathe normally.) _____

2. Pure air is a mixture of gases. Nitrogen makes up 78%, oxygen fills 21%, and the other 1% is a combination of other gases. Polluted air contains other gases and particles. From the graph below answer the following questions:

   a. What kind of fuels add the greatest amount of pollution to the air? _____

   b. What percentage of air pollution are solid waste particles in the air? _____

   c. What are some sources of solid waste particles? _____

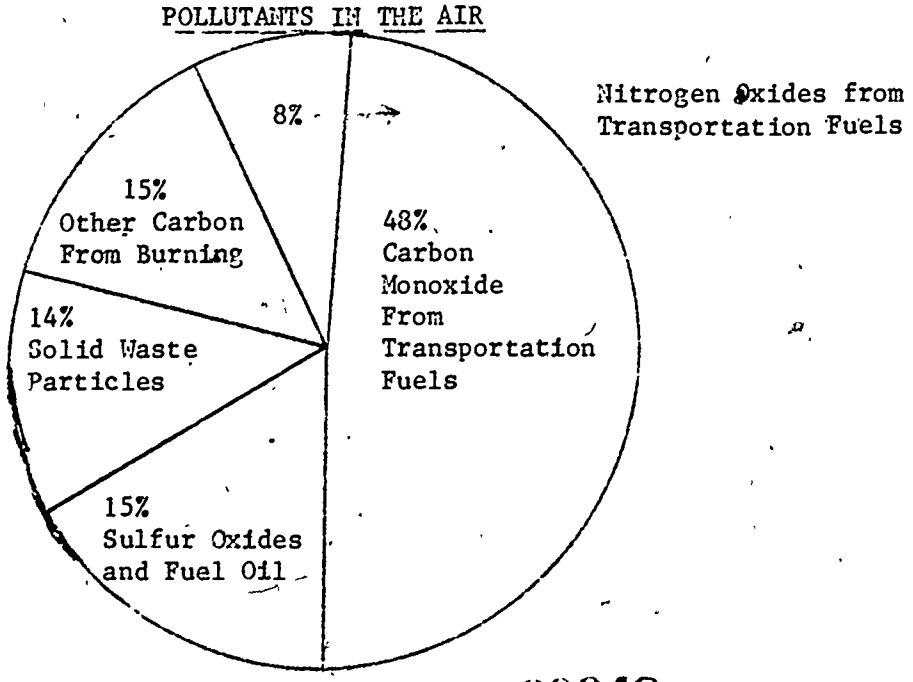
   _____

   d. Sulfur dioxide (SO_2) and Nitrogen dioxide (NO_2) can effect the health of the human respiratory system. How much of these two oxides are contained in polluted air? _____

   _____

   e. What are the sources of SO_2 and NO_2? _____

   _____



III. Use of Natural Resources: Energy

The United States has only 6% of the world's people but uses 36% of the world's energy. How much energy do you use in just one day? To answer this question, make an Energy Journal of one day's use of energy in the space below:

Energy Journal

Date:		
Kind of Energy	Length of Time Used	Energy Using Activity

Under the heading Kind of Energy, name the type of energy that you use such as electric, gas, fossil fuel (cars and trucks), solar energy (eating plants as food). Measure the length of time the energy was in use in minutes or hours. Under the heading Energy Using Activity, describe what the energy was used for (washing clothes, playing a radio or TV, transportation, etc.).

IV. Use of Natural Resources: Land

From the busy hive of a bee to the bustling crowds in a city, all organisms need space to live. A home is one part of everyone's living space.

1. What places other than home, make up your living space?

2. How much space is taken up by the solid waste or garbage you produce in one day? In one week? In one year? Determine this by guessing at the amount of waste you produce.

3. What other uses does man make of the land of our planet? Is it always used wisely?

V. Use of Natural Resources: Living Things

Man is only one of earth's many living things. He has dominated all other organisms and controlled them for his own use and protection.

1. How has man controlled plants for his own use?

2. How has man controlled animals for his own use?

3. Do you control plants or animals? (Consider the living things in the classroom and at your home.

4. Has man always used these living natural resources wisely?

5. Why are some of these resources disappearing, that is becoming extinct? _____

_____

_____

6. What can you do to stop the abuse of natural resources?

_____

_____

_____

_____

_____

ACTIVITY 5: RESPONSIBILITY

We travel together, passengers on a little space ship, dependent on its vulnerable reserves of air and soil, all committed for our safety to its security and peace; preserved from annihilation only by the care, the work, and I will pray, the love we give our fragile craft.

Adlai Stevenson

ACTIVITY 5: Responsibility

Time Required: 4 hours

Purpose: To show the student that each of us has a part in the protection of our environment and the improvement of the quality of life in our state.

Behavioral Objectives:

Cognitive:

Students will be able to identify areas of responsibility which will enable them to carry out constructive actions as measured by teacher observation and class discussion.

Affective:

The student will recommend ways in which he can carry out actions to preserve the environment and then carry these out as measured by teacher observation and class activities.

Background Information:

The survivial of human beings depends on the knowledge we use and the actions we take. We face an environmental crisis, not in the years to come but right now. What is the crisis? As one scientist put it, "We cannot make the world uninhabitable for other forms of life and have it habitable for ourselves." Where is the crisis happening? The crisis is happening in every town, country and nation. Man's future existence is in question all over the world. Why has this crisis occured? There are too many people in some areas. There is not enough usable water or pure air because of pollution. Man and other forms of life lived on this planet for thousands of years in relative harmony and balance with nature. About four hundred years ago the industrial revolution started and now we are in the nuclear and space age. Technological advances in these four hundred years have upset the environment and contributed to our problems. Suddenly, man has realized that if other life stops--man stops. Who can correct our errors? We have not abused the land and created our problems deliberately, but we are all guilty of some harm to the environment and all of us must work toward solutions. How can we solve our environmental problems? We can acquire a knowledge of our problems and we can create an awareness of our basic needs. Each individual must learn to make decisions about his environment and to pass judgements and make choices. He must prepare himself to learn, investigate and develop ideas about solutions and then be prepared to give time and effort to this great work.

Man has only a short time to take on his responsibilities and to live in true harmony with the world. How soon and how well he faces this challenge will decide the fate of life on earth.

Vocabulary:

1. Conservation: a careful preservation and protection of the environment.

2. Inhabitable: capable of being lived in.

3. Mobile: a construction or sculpture of different materials that can be set in motion by air currents.

4. Responsibility: something for which one is accountable.

5. Uninhabitable: Incapable of being lived in.

Materials Needed:

To Be Provided by the Project:
1. Films:
   Litter Monster
   Man's Effect on the Environment
2. Filmstrip:
   Environmental Crisis
3. Copies of Conservation Pledge.

To Be Provided by the Teacher or Student:
1. Bulletin board materials.
2. Assorted discarded objects.
3. Material for making posters, mobiles, toys, collages, etc.
4. Film Projector.
5. Filmstrip projector.
6. Cassette Tape recorder.

Procedure:

1. Prepare a bulletin board with the title "My Responsibility". Students will then be given the chance to write their individual feelings on the board any time during the study of responsibility.

2. Show the filmstrip "Environmental Crisis". After the filmstrip has been viewed, discussion should follow concerning ways in which the student can help stop pollution of the earth.

3. On a table, put a piece of citrus peel candy, a leather boot string, a rubber ball, a small rag, empty thread spools, and a bottle of glue. Ask the students what word they can think of that would classify the items on the table? Write leftovers on a piece of paper and put it on the table.

   Questions for Discussion:
   a. How were patchwork quilts made by the early settlers?
   b. How is hash made?
   c. Is there a use for wrecked automobiles: (They can be recycled but presently their reclaimation is not economically sound, therefore we see many rusting away.)

d. Can you think of other useful, discarded items? (Examples are old tires for swings, boat bumpers, shoe soles; innertubes for water recreation, toy drums, chair bottoms, sling shots; discarded tin cans for collages, pictures, containers, etc; worn nylon stockings for stuffing toy animals; rags for cleaning cloths at home, in industry and in making paper; tree bark for medicine dyes, and insulation; sawdust and glue for making building material; scrap paper for making scratch pads; watermelon rind pickles, orange peel candy, pork rinds). Ask pupils to arrange the leftovers discussed under the appropriate headings; plants, animals or minerals. Assignment for the next day. Bring to class as many leftovers as can be found around your home. Teachers should specify clean dry discards.

4. Show the film: "Litter Monster". This film will aid in activity five, because the students will be able to see what was done with leftovers that other students found.

5. From the leftovers that have been brought from home, students should prepare sculpture, mobiles, toys, collages, etc.

6. Show the film: "Man's Effect on the Environment:. Discussion should relate to changes in the environment due to overcrowding and technology and what the individual student's responsibility is in alleviating some of these problems.

7. Read the students' reactions and feelings that were expressed on the bulletin board concerning the child's responsibility to his environment.

8. Students who want to accept individual responsibility in conserving their natural resources and environment should stand and repeat the conservation pledge (the teacher may lead them in repeating the pledge). A certificate of award will be given to the students who do so.

CONSERVATION PLEDGE

I give my pledge as an American
to save and
faithfully to defend from waste
the natural resources of my country—
its soil and minerals,
its forests, waters, and wildlife.

Approved:

UNIT LEADER | SIGNATURE

ACTIVITY 6: CAREER OPPORTUNITIES

Be the Best of Whatever You Are

If you can't be a pine on the top of the hill,
Be a shrub in the valley, but be
The best little shrub by the side of the rill.
Be a bush if you can't be a tree.
If you can't be a bush
Be a bit of the grass some highway happier make
If you can't be a muskie
Then just be a bass
But the liveliest bass in the lake.
We can't all be captains
We've got to be crew
There's something for all of us here,
There is big work to do, and there's lesser to do
And the task we must do is the near.
If you can't be a highway, then just be a trail,
If you can't be the sun, be a star;
It isn't by size that you win or you fail—
BE THE BEST OF WHATEVER YOU ARE.

Douglas Hallock

ACTIVITY 6: Career Opportunities

Time Required: 2 Hours

Purpose. To inform the students of career opportunities in the field of conservation and the environment.

Behavioral Objectives.

Cognitive:

Students will be able to list occupations connected with the preservation of the environment and to investigate those of particular interest to them as measured by teacher observation and pre and post tests.

Affective

The students will illustrate the career opportunities he has discovered in his studies by use of posters, collages, drawings, as measured by teacher observation and the pre and post tests.

Background Information:

Public awareness of the importance of a clean environment is a new development in our country. National goals change with the needs of the people and job opportunities change the same way.

National parks, forests, and wildlife refuges had their start at the turn of the century. In the 1930's we had a great deal of unemployment, drouth, poverty and public panic. From these problems came soil conservation programs and reforms. In the 1960's there was a steady growth of interest in pollution control and the changing of industries that put factory wastes in the air and water.

Interest in conservation gradually spread from a handful of sportsmen to other citizens. Investigation of diseases, such as polio and hepatitis, made people interested in seeking cures for polluted water. Rachel Carson's Silent Spring warned of the dangers of excessive uses of DDT and other insoluble pesticides. Political figures, at all levels of government realized that the business of clean air and water made good sense. Creating a better environment had become everybody's business.

In the decade of the sixties the National Recreational Policy, the Bureau of Outdoor Recreation, expansion of conservation programs, The Water Quality Act, the Endangered Species Act and many other policies came into being. The public began to realize that his nation cannot go on hurting the environment without damaging the people. Protection of the environment began to assume national importance.

Between 1960 and 1969 there was a large increase in the number of people employed in conservation-related jobs.

The 1970's should produce many more environmental-related bills from Congress. Main concerns center around preventing and reducing air and water pollution and improving the use of the nation's land. Proposals included increased funds for the construction of municipal waste treatment facilities, banning the dumping of wastes in the oceans and coastal waters, the location of power plants, bringing parks closer to centers of population, the authority to set noise standards and limiting the use of pesticides and other controls to halt the trend toward the deterioration of the environment.

Trained people are needed in increasing numbers to do the job. Action means people on the job--people who know what needs to be done and how to do it. Many skills with various degrees of training are needed. The job opportunities are boundless because in our complicated culture we need many people to solve the problems affecting ours and future generations.

Jobs in the field of conservation offer wide ranges in salary, fringe benefits and location. Some jobs are in relatively isolated areas, yet a great number of them offer a change to live in the most scenic parts of the nation.

Vocabulary.

1. Career: a profession for which one trains and which is undertaken as a permanent calling.

2. DDT: a colorless, odorless and dangerous water-insoluble crystalline insecticide.

3. Occupation: an activity in which one engages.

4. Pesticide: an agent used to destroy pests.

Materials Needed:

To Be Provided by the Project:
1. List of occupations with description of job.
2. Film: "People Who Fight Pollution"

To Be Provided by Teacher:
1. Bulletin Board and poster materials (construction paper, butcher paper, magazines, scissors, glue, etc.)

Procedure:

1. The teacher will give each student a slip of paper with a job description of a particular career in environmental work. After the child has received his slip of paper, he will work on a poster, drawing, collage, etc., to illustrate the particular career.

After all students have completed their work, they will be given the chance to explain the career they have been working on to the class. Their illustrations should be placed on a bulletin board, entitled "Career Opportunities" after their explanation to the class.

2. Show the film: People Who Fight Pollution (a film designed to demonstrate that the pollution problem can be solved by the active participation of concerned people. The film shows that ordinary jobs can be approached with as much dignity, dedication, pride and enthusiasm as unusual ones.) After the film has been shown, discussion should follow with the above points being emphasized.

Environmental Career Opportunities

1. Inorganic Chemist: The inorganic chemist primarily conducts experiments on substances that are free from carbon--such as metals, ores, gases, and heavy chemicals--to develop and improve such materials for productive purposes.

2. Meterologist. The meterorologist studies the atmospheric phenomena of the earth. He is interested in and attempts to describe and explain the motions, components, influences, and processes of the atmosphere.

3. Hydrographer: The hydrographer performs activities primarily related to the study of water resources. He samples, measures, and tests river levels, water flow, silt accumulation, water temperature, and water control equipment.

4. Oceanographer: An oceanographer studies the ocean, its contents, and its movements.

5. Economist: The economist is primarily engaged in the study and evaluation of man's activities directed toward satisfying his material requirements. He is concerned with the problems of the efficient use of scarce or limited supplies of land, materials, manpower, and natural resources and in meeting the demands of those supplies.

6. Biophysicist: The biophysicist is trained in biology and physics. He is concerned with the physical prinicples of living organisms and living cells. He studies the organism's response to such physical forces as heat, light, radiation, sound and electricity.

7. Geophysicist: A geophysicist studies and analyzes the earth's atmosphere and hydrosphere to determine the effect that changing climate, thermal, radiation, pollution, and electric conditions have on the earth.

8. Biochemist: Biochemists study all living organism and their chemical biological processes. They are primarily involved in a research oriented profession that studies the impace of chemical changes on plants and animals.

9. Organic Chemist: The organic chemist conducts experiments with substances of which the essential element is carbon, such as paint, rubber, wood, dye, petroleum, etc. The field of organic chemistry includes as one area of specialization the agricultural chemist who conducts research in chemical problems related to commercial agriculture. His work includes protecting crops against infestation, promoting soil conservation, eliminating soil poisons, developing better and less harmful insecticides, fungicides and rodent poisons.

10. Aeronautical Engineer: An aeronautical engineer engaged in a career relating to environmental problems is involved in the design and development of aircraft which decrease the amount of air and noise pollution.

11. Combustion Engineer. The combustion engineer designs heating equipment that will efficiently burn fuel and then tests it in the burning process.

12. Hydraulic Engineer: The designing and construction of large power, irrigation and navigation projects that control as well as use water is the special interest of the hydraulic engineer.

13. Watershed Manager: The watershed manager is responsible for the management and maintenance of the country's large water storage facilities such as reserviors and aquaducts.

14. Landscape Architect: The landscape architect plans, designs, and in many cases supervises the transformation of land areas into useful and attractive sites.

15. Industrial Health Engineer: The industrial health engineer is engaged in planning, analyzing, coordinating and reporting on health conditions in a plant or industry.

16. Nuclear Engineer: The nuclear engineer is involved with scientific research and its application to problems in the use and controlled production of nuclear energy, and is particularly concerned with the hazard of using radioactive materials in nuclear reactors.

17. Agricultural Engineer: An agricultural engineer's work can apply in both areas of pollution control and resource conservation. He is interested in applying engineering principles to obtain more efficient design and use of agricultural equipment, farming techniques, the use of electrical and mechanical devices to farming methods, and the efficient use of soil and water resources.

18. Soil Conservationist: The soil conservationist is interested in and concerned with the productivity, general management, and alternative practices of soil use and oonservation.

19. Environmental Inspector: The inspector dealing with various aspects of our environment such as air, smoke, water, and waste is primarily concerned with determining environmental purity by using a variety of mechanical and chemical tests.

20. Mechanical Tester: The role of the test engineer evaluator overlaps that of the environmental tester in that it is concerned with the pollution of the air through the sound and emissions from engines.

21. Nuclear Technician (Radiation): The nuclear technician usually works as an assistant to a nuclear engineer. He may conduct tests on nuclear waste disposal methods, write reports and assist in the development of machines and equipment, or monitor the plant facilities and working environment to detect any radiation contamination.

22. Incinerator Plant Attendant: The incinerator plant attendant is the functional member of the incineration team. He operates the incinerator under the supervision of the foreman; provides direction and assistance for the weighing and unloading of rubbish trucks; repairs, lubricates, dismantles and replaces inoperable machinery; and handles recording and collecting fees for incineration activities.

23. Water Treatment Plant Operator: An operator of a water treatment plant is responsible for seeing that all assigned plant equipment is operating properly. He is responsible for reading, recording, and maintaining the correct chemical balance in the water as it is processed through the plant facility.

24. Recycling Operator: The operator will determine the types of materials to be salvaged and direct laborers in sorting, storing, and redistriburing materials to be recycled.

25. Power Plant Operator: The power plant operator's role is vital in several areas of environmental controls. He operates the boilers, turbines, generators and other auxiliary equipment.

26. Conservation Officer: He is responsible for enforcement of state game and fish laws in an assigned district or land and water management area.

27. Waterways Patrolman Supervisor: He supervises fish and boating safety law enforcement programs in an assigned region of the state.

28. Federal Park Ranger: He makes field surveys of forests, range and wildlife management, forest and insect disease control, fire hazards, drafts, guides for law enforcement, rescue services, campgrounds and trails.

29. Stream Improvement Foreman. He conducts operations to clear streams of debris and obstructions to permit migrations of fish during various seasons of the year.

30. Forest Entomologist: He plans and directs large-scale projects designed to prevent, detect and suppress dorest insects.

31. Forest Patrolman: Patrols an assinged area to detect and suppress forest fires and direct volunteer fire fighters.

32. Conservation Education Specialist: He Emphasizes the importance of environmental education with modern teaching methods and practices.

33. Photographic Specialist: He takes and processes color and black and white pictures and slides for publicity, educational, informational, legal and record purposes.

34. Roadside Development Engineer: A professional position in development and maintenance of roadside grounds and recreational areas--controls erosion, plants nursery stock, seed and sod for highway beautification and conducts weed-control programs.

ACTIVITY 7: URBAN ENCOUNTER FIELD TRIP

"I go amongst the building of a city and I see a man hurrying along--to what? The creature has a purpose and his eyes are bright with it."

Keats 1819

ACTIVITY 7 Urban Encounter Field Trip

Time Required: About three hours

Purpose: The purpose of the urban encounter is for students to investigate various types of pollution in their own community and try to devise solutions for pollution problems in Little Rock.

Behavioral Objectives:

Cognitive:

The student will demonstrate an understanding of the different types of pollution and the extent of pollution in and around Little Rock to be measured by charting observations and answering written questions for teacher appraisal.

Affective:

The student will suggest possible solutions to pollution problems and how these solutions can be implemented as measured by teacher observation of class discussion.

Materials Needed:

1. Urban Encounter Worksheet
2. Urban Encounter Discussion Guide for Classroom Follow-up

Background Information:

The students will take a 3 hour trip to points of interest from an environmental standpoint. The trip will serve to bring the student face to face with current environmental problems and things that are being done or not being done to improve them.

To make the trip more meaningful to the students, definite plans as to what the trip will include will not be finalized until shortly before the trip is to be taken. This will allow the environmental education staff more flexibility in locating sites that will interest the student and at the same time not overload or inconvenience the personnel of the plant or project to be visited.

Ideally, four classes will take the urban encounter trip on each day that a trip is scheduled. If circumstances dictate, 6 classes will be handled in one day. Each bus will carry two classes of students, one environmental education teacher and one aide. The classroom teacher will go with one of the groups. Two or more sites will be visited by each group, and they may or may not be identical sites. If the groups visit identical sites, they will do so at different times. The classroom teacher will receive background information, urban encounter worksheets, and follow-up forms prior to the trip.

LITTLE ROCK PUBLIC SCHOOLS
ENVIRONMENTAL EDUCATION PROJECT
FIELD TRIPS

1. No students will be allowed to participate in an off-campus educational field trip until he has returned to this teacher a Field Trip Permission Form signed by his parent or guardian. This signed statement should give the parent's permission for this child to go on the trip and absolve the school and the bonded bus carrier of any responsibility regarding accidents which may occur to the child while on the trip.

2. The students must participate in all planned activities.

-Cut along this line-

(This section to be returned to classroom teacher)

Little Rock Public Schools
Environmental Education Project
Field Trip Permission Form

An educational field trip is planned for your child's class or group to visit _____ on _____ _____ _____
Month Day Year

The pupils will be transported by bonded bus carriers.

I, as the parent of legal guardian, give permission for _____
(Pupil's Name)
to go on this educational field trip and understand that by doing so I absolve the school and the bonded bus carrier, of any responsibility regarding accidents which may occur to the child while on the trip.

_____
(Signature)

FIELD TRIP ROSTER

Field Trip _____ Date _____

School _____ Teacher _____

Students Taking Trip

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____
26. _____
27. _____
28. _____
29. _____
30. _____
31. _____
32. _____
33. _____
34. _____
35. _____
36. _____
37. _____
38. _____
39. _____
40. _____
41. _____
42. _____
43. _____
44. _____
45. _____
46. _____
47. _____
48. _____
49. _____
50. _____

APPENDIX

1. Pre-test
2. Pretest Answer Sheet
3. Post Test
4. Post Test Answer Sheet
5. Tally Sheet for Pretest and Post Test
6. Student Evaluation Form
7. Tally Sheet for Student Evaluation
8. Teacher Evaluation Form

Name _____ Date _____

Pre-Test
Environemntal Education Unit
Man's Effect on the Environment
Sixth Grade Unit

Write the letter of the best correct answer for each question on the answer sheet. Do not write on the test sheets themselves.

1. Population density means:
   a. number of animals and plants in Little Rock.
   b. number of people in a given environment.
   c. number of people, animals and plants in a given area.

2. Today the world's population is just over
   a. 3½ billion
   b. 1½ billion
   c. 2½ billion

3. The most densely populated area in Arkansas is, the
   a. Fort Smith area
   b. Little Rock area
   c. Hot Springs area

4. We consider the area _____ when it cannot feed, clothe and provide shelter for the people who live there.
   a. over populated
   b. over industrialized
   c. over urbanized

5. The word _____ means the total means used to provide objects necessary for human sustenance and comfort.
   a. energized
   b. pollutionized
   c. technology

6. The energy crisis in the United States is _____.
   a. going to take place in about 20 years
   b. happening now
   c. going to happen in about 10 years

7. There is _____ solution to industrial pollution.
   a. no
   b. one
   c. not a very good
   d. more than one

8. The _____ in the United States cause most of the air pollution.
   a. cars
   b. factories
   c. burning of waste

9. All pollution is caused by _____.
   a. man and nature.
   b. man.
   c. nature.

10. Recycling is probably the _____solution to solid waste problems.
   a. worst
   b. only
   c. best
   d. all of these

11. Natural resources are _____.
   a. soil, water and air
   b. wildlife
   c. something found in nature for man's use
   d. all of these

12. Some of the resources in Arkansas are:
   a. oil, gold, diamonds, coal, lumber,
   b. lumber, air, oil, water, wildlife
   c. diamonds, water, titanium, barite, coal, silver
   d. all of these

13. The wilderness bill is trying to _____.
   a. provide money for land to use as game refuges.
   b. save streams and rivers from pollution
   c. provide money to add more wildlife protection to present game refuges
   d. all of these

14. The _____ River has been dredged, in the last few years to permit large barges to transport freight.
   a. White
   b. Red
   c. Arkansas
   d. All of these

15. Who is responsible for the protection of the environment?
   a. students
   b. adults
   c. government
   d. all of these

16. Jobs dealing with noise pollution will increase by _____percent by 1975.
   a. 50
   b. 148
   c. 100
   d. None of these

17. Pollution by solid wastes and garbage add to _____for each individual in the United States each year.
   a. 5 tons
   b. 1 ton
   c. 15 tons
   d. None of these

18. _____ is responsible for an increase in job opportunities in the field of ecology.
    a. invention of new machines which need operators
    b. great progress in nuclear science
    c. public awareness of the needs for proper environmental practices
    d. all of these

19. We have many large cities in the United States. In fact, _____ people in America live in cities.
    a. 7 out of 10
    b. 2 out of 5
    c. 3 out of 6
    d. None of these

20. National parks, national forests, and wilderness areas had their beginning:
    a. in the late 1800's
    b. about 1900
    c. about 1925
    d. in 1776

Name _____ Date _____

School _____ Teacher _____

ANSWER SHEET: PRE-TEST

SIXTH GRADE UNIT - MAN'S EFFECT ON THE ENVIRONMENT

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

Name _____ Date _____

Pre-Test
Environemntal Education Unit
Man's Effect on the Environment
Sixth Grade Unit

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20. National parks, national forests, and wilderness areas had their beginning:
    a. in the late 1800's
    b. about 1900
    c. about 1925
    d. in 1776

B. Environmental Careers. Identify any twelve of the following environmental careers. Do not do more than the number asked for. If you do, only the first twelve will be graded and counted on your score. Remember to write your answers on the answer sheet.

A. inorganic chemist
B. metrologist
C. hydrographer
D. oceanographer
E. economist
F. biophysicist
G. geophysicist
H. biochemist
I. organic chemist
J. aeronautical engineer
K. combustion engineer
L. hydraulic engineer
M. watershed manager
N. landscape architect
O. industrial health engineer
P. nuclear engineer
Q. agricultural engineer
R. soil conservationist
S. environmental tester
T. mechanical tester
U. nuclear technician
V. incinerator plant attendant
W. water treatment plant operator
X. recycling plant operator
Y. power plant operator
Z. conservation officer
AA. waterways patrolmen supervisor
BB. federal park ranger
CC. stream improvement foreman
DD. forest entomologist
EE. forest patrolman
FF. conservation education specialist
GG. Photographic specialist
HH. roadside development engineer

1. Operates and maintains an incinerator.

2. Concerned with determining environmental purity.

3. By using a variety of mechanical and chemcial tests is responsible for the management and maintenance of the country's large water storage facilities.

4. Plans and directs large-scale projects designed to prevent, detect and suppress forest insects.

5. Studies the atmospheric phenomena of the earth.

6. Responsible for seeing that all assigned water plant equipment is operating properly and is responsible for running chemical tests on the water.

7. Emphasizes the importance of environmental education with modern teaching methods and practices.

8. Performs activites primarily related to the study of water resources.

9. Conducts operations to clear streams of debris and obstructions to permit migrations of fish during various seasons of the year.

10. Makes field surveys of forests, range and wildlife management, forest and insect disease control, fire hazards, drafts guides for law enforcement, rescue services, campgrounds and trails.

11. Conducts experiments on substances that are free from carbon to develop and improve such materials for productive purposes.

12. Responsible for enforcement of state game and fish laws in an assigned district or land and water management area.

13. Plans, designs and in many cases supervises the transformation of land areas into useful and attractive sites.

14. Involved with scientific research and its application to problems in the use and controlled production of nuclear energy.

15. Studies and evaluates man's activities directed toward satisfying his material requirements.

16. Concerned with the pollution of the air through the sound and emissions from engines.

17. Operates the boilers, turbines, generators and other auxiliary equipment in an electrical generating plant.

18. Studies the ocean, its contents and its movements.

19. Designs heating equipment that will efficiently burn fuel.

20. Involved in the designing and construction of large power, irrigation and navigation projects.

21. Professional position in development and maintenance of roadside grounds and recreational areas--controls erosion, plants nursery stock, seed and sod for highway beautification and conducts weed-control programs.

22. Plans, analyzes, coordinates and reports on health conditions in a plant or industry.

23. Applies engineering principles to obtain more efficient design and use of agricultural equipment, farming techniques and the use of electrical and mechanical devices to farming methods.

24. Determines types of material to be salvaged and directs the sorting, storing and redistribution of materials to be recycled.

25. Concerned with the productivity, general management and alternative practices of soil use and conservation.

26. Taking and processing color and black and white pictures and slides for publicity, educational, informational, legal and record purposes.

27. Conducts experiments with substances of which the essential element is carbon.

28. Deals with problems such as the design and development of aircraft which decrease the amount of air and noise pollution.

29. Patrols an area to detect and suppress forest fires and directs volunteer fire fighters.

30. Conducts tests on nuclear waste disposal methods, writes reports and assists in the development of machines and equipment.

31. Supervises fish and boating safety law enforcement programs in an assigned region of the state.

32. Studies all living organisms and their chemcial biological processes.

33. Studies and analyzes the earth's atmosphere and hydrosphere.

34. Concerned with the physical principles of living organisms and living cells.

Part C.

Give five areas of the environment in which we have environmental problems in Arkansas. For each area give one example of the problem and a possible solution for it.

Name _____ Date _____

School _____ Teacher _____

ANSWER SHEET FOR POST TEST

Part A

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

Part B

1. V
2. S
3. M
4. DD
5. B
6. W
7. FF
8. C
9. CC
10. BB
11. A
12. Z
13. N
14. P
15. E
16. T
17. Y

18. D
19. K
20. L
21. HH
22. O
23. Q
24. X
25. R
26. GG
27. I
28. J
29. EE
30. U
31. AA
32. II
33. G
34. F

TALLY SHEET: PRE-TEST AND POST SCORES

SIXTH GRADE SCIENCE

SCHOOL _____ TEACHER _____

NUMBER OF STUDENTS IN CLASS _____ DATE _____

STUDENT'S NAME	PRE-TEST SCORE	POST TEST SCORES		
		PART A & B	PART C	
			PROBLEMS	SOLUTIONS
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

School _____ Teacher _____ Date _____

Student Evaluation Form: Sixth Grade Unit

Man's Effect on the Environment

LIKED
1

INDIFFERENT
2

DISLIKED
3

Place the number that shows how you felt about the following areas of our study of Man's Effect on the Environment. Please feel free to make comments in the space provided.

1 a. The way your teacher felt about you during the unit.

_____ 1. The entire unit on Man's Effect on the Environment. _____

_____ 2. The study of world, state, nation and local population growth.

_____ 3. The study of technology. _____

_____ 4. Our study of the different types of pollution. _____

_____ 5. Our urban encounter around Little Rock. _____

_____ 6. The study of Arkansas' natural resources. _____

_____ 7. My responsibility to the environment. _____

_____ 8. Study of careers. _____

_____ 9. The test over the unit. _____

_____ 10. The teacher's presentation of the unit. _____

_____ 11. Class participation in activities. _____

_____ 12. Worksheets (graph, scales, math sheets.) _____

_____ 13. Extra credit activities. _____

_____ 14. Bulletin board activities. _____

_____ 15. Art activities. _____

_____ 16. Class discussion. _____

_____ 17. Films. _____

_____ 18. Filmstrips. _____

_____19. The time needed to complete the unit. _____

_____20. Working in small groups. _____

_____21. Environmental education. _____

_____22. Staff people from Environmental Education Project (Mrs. McAfee, Mr. Collar and Mr. Glasgow)

_____23. POLLUTION!!!!!!!

School _____ Date _____

Teacher _____

TALLY SHEET FOR STUDENT EVALUATION - SIXTH GRADE

QUESTION	LIKED	INDIFFERENT	DISLIKED
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			

School _____ Date _____

TEACHER EVALUATION
ENVIRONMENTAL EDUCATION UNIT
SIXTH GRADE SCIENCE

A. Overall Program

	YES	NO
1. Do you feel that the unit was effective in your class?	____	____
2. Did the activities used in the unit adequately cover the major concepts?	____	____
3. Were the objectives relevant to the concepts and the activities in the unit?	____	____
4. Were the objectives realistic?	____	____
5. Do you feel that most of these objectives were achieved in your class?	____	____
6. Was the material used relevant to the student and his local environment?	____	____
7. Did you have enough time for the unit?	____	____
8. Omitting the time factor, was the schedule easy to follow?	____	____
9. Were the resource materials provided adequate?	____	____
10. Were your classroom facilities adequate for the activities used?	____	____
11. Was the teacher's guide adequate?	____	____
12. Do you feel that your students have become more aware of their environment and its problems?	____	____
13. Can you see any carry over into the student's activities outside the classroom?	____	____
14. Has there been any carry over in other subjects that you teach or that the student's have?	____	____
15. Do you feel that this unit should be continued next year?	____	____

B. Effectiveness of Program Components

Please rate the effectiveness of the following components.

AREA	Very good	Good	Fair	Poor
1. Population	____	____	____	____
2. Technology	____	____	____	____
3. Pollution	____	____	____	____
4. Natural Resources	____	____	____	____
5. Student Responsibility	____	____	____	____
6. Career Opportunities	____	____	____	____
7. Activities on unit	____	____	____	____
8. Resource Materials	____	____	____	____
9. Background Material	____	____	____	____
10. Pre and Post Test	____	____	____	____
11. Urban Encounter	____	____	____	____

C. Comments:

1. What suggestions do you have for improving any of the above areas?

2. What suggestions do you have for improving the overall unit?