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ABSTRACT

This unit on population is one in a series of three prepared for use in classrooms in North Carolina. An interdisciplinary approach encompassing mathematics, science, and social studies is utilized in these environmental units. The material is designed for middle grades and above. Many activities are open-ended. The depth to which students become involved in the utilization of this unit is determined by factors such as grade level, interest of students, and relevance of the material to courses into which it is integrated. Each activity in this unit emphasizes the population crisis that exists today, not only in faraway locations, but in towns like Fox City, North Carolina. Although the name of the town is fictitious, the statistics about a town of its size are factual. Students study how an increase in population will affect transportation, housing and urban renewal, recreation and municipal services. Task sheets list specific goals for the activities and thought directives instruct the students to proceed in a logical manner. Collections of statistics in the form of fact sheets give valuable information needed by both student and teacher. (JP)

This unit on *POPULATION* is one in a series of three prepared for use in classrooms in North Carolina. The other two units are on *POLLUTION* and *NATURAL RESOURCES*. An interdisciplinary approach encompassing mathematics, science, and social studies is utilized in these environmental units.

This material is designed for middle grades and above. Many of the activities are open-ended. The depth to which students become involved in the utilization of this unit is determined by factors such as grade level, interest of students, and relevance of the material to courses into which it is integrated. The unit is not designed to replace mathematics, science, and social studies; rather, it is hoped that skills previously mastered in these areas will be employed in this unit.

Teachers are encouraged to use discretion in the use of this unit. Some may wish to use it over a period of a few days. Others may wish to expand the activities at the suggestions of students and work with it for several weeks.

The first edition of this unit was written by F. W. Stanley, mathematics teacher, Shelby Jr. High School, Shelby, N. C.; Beverly Crotts, social studies teacher, Trinity Sr. High School, Trinity, N. C.; and Patsy Bohlen, science teacher, Page Sr. High School, Greensboro, N. C. Assistance in writing the three units was provided by the Divisions of Science, Mathematics, and Social Studies of the N. C. Department of Public Instruction. After revision, the unit was field tested and again revised to this final edition.

Division of Science Education
N. C. Department of Public Instruction
Raleigh 27611

1972-73

GUIDELINES FOR THE TEACHER

This game is designed for students in the middle grades. It emphasizes the population crisis that exists today, not only in faraway countries, but in North Carolina towns like Fox City. Although the name of the town is fictitious, the statistics about a town of its size are factual. Students may work in groups to study how an increase in population will affect various aspects of town life and what changes will have to occur to accommodate this increase in population. For a game like this to be successful, two ingredients are essential: planning and teacher enthusiasm.

Each group:

I. Transportation
II. Housing & Urban Renewal
III. Recreation
IV. Municipal Services

has a different packet of information which contains:

1. one task sheet
2. one thought directive
3. one letter(s)
4. one problems (to be solved)
5. one Fox City fact sheet
6. three maps

The task sheet lists specific goals for the group to achieve. The Transportation Board may be told to build a road providing access to a highway, but they are not told exactly where it should be built. Since there are no right or wrong answers, students are given freedom for experimentation and self-expression. Thought directives are designed to help the students proceed in a logical manner. Hints may be given to help the students come up with solutions. Practical math applications are possible in helping each group to understand and solve problems associated with their tasks. If one is to build a water reservoir, it is necessary to compute how large the population increase will be during the next 20 years.

Another way to provide additional ideas, and in some cases humor, is with letters from individuals to various groups and the City Council. These range from a suggestion concerning establishment of convenient bus service to a legal matter of polluting the drinking water of a town downstream.

Collections of statistics in the form of fact sheets give valuable information needed by both student and teacher. All areas of the group work help to

develop skills in mathematics, science, and social studies and require the co-operation of the students to arrive at a plan workable for the town.

Materials have been arranged to make it easy for teachers to duplicate essential portions of this game. An individual packet will be needed for each student relating to his particular group. Extra maps should be printed as students are certain to need them. Having only one of the four packets, students will need to consult with one another to assure compatibility of planning. A City Council might be created, composed of one representative from each of the four groups and a Mayor, to coordinate the plans all groups are formulating.

On pages that have "Suggestions to the Teacher" in the right column, simply cover the right column with another sheet of paper before inserting in a duplicating machine. Transparencies of the maps are also valuable. Overlays with each group's work in different colors, which will show up beautifully on the overhead projector, can be made to show the final product.

Suggested class activities and discussion questions provide a means of unifying all of the groups' work. As each group finishes its tasks and problems, they might work on these activities as individuals or as small groups. They cover a variety of topics and are flexible enough to be adapted to students of various ages and ability levels.

Maps of the city square, town, and county are included to show the geography and existing facilities of the town. Each group will make changes, which should be noted on the maps with symbols which they have created. The class might like to make a large scale map of the city on top of a worktable. Buildings could be constructed of various sizes and the town could be depicted during many stages of its development: 1882, 1923, 1945, 1970, and the present. This would give the students an opportunity to see how each group's plans affect those of the others. Interaction between groups helps to show the complexity of government and how various branches work together.

The game can be adapted to a self-contained classroom, the 2- to 3-hour "block," or the 1-hour class period, depending on the time schedule of the individual school. It could last from one week to several weeks depending on the extent to which the teacher and students wish to become involved.

Objectives	Strategies
1. To have the students become aware of some of the many problems which accompany an increasing population.	Involve the class in a concrete and realistic situation.
2. To have the students, through playing their roles in the game, gain an appreciation of the value of their regular classwork.	Students apply their previously acquired knowledge of social studies, science, and mathematics in a nontextbook situation.

By taking an environmental issue of importance and interest, students are required to develop and use skills in these subject areas to reason and solve problems. The burden of work and learning is placed on the students, while the role of the teacher is to provide guidance and materials for them.

EVALUATION

It may be that the teacher who uses this game will elect not to grade students on their play (work). After all, how do we evaluate our own town's Street Department? (Why not have mock elections for these different areas, based on the students' records of achievement, as a form of evaluation?) Nearly everything that is done by any governmental agency is received by some of the populace as a stroke of genius and by some as a move bordering upon idiocy.

Since there are few "right answers" in the game, any evaluation will be quite subjective. Here are some areas you may want to consider:

1. Participation--was the student's role in the group active or passive? (Did the student contribute or ride along?)
2. Tasks--were the tasks done in a logical manner? (Did the student have water running uphill? Did the student put a landfill in the Town Square?)
3. Did the student seem to gain awareness of the complexity of problems that befall a town with an increasing population?
4. Did the student do things "over and beyond" the call of duty, such as making charts, graphs, models, or bulletin boards?
5. To what depth did the student research his/her problems?

You may elect to assign a short paper discussing some of the problems that arise from population increases.

INTRODUCTION TO FOX CITY
(teacher and students)

When we hear of parts of the world that have population problems, we quite often think of China and India. Even towns in the United States are subject to population pressures. Such a place is Fox City, North Carolina, a growing town with a population of 47,000. Founded in 1875, Fox City formed around a railroad station that was used to export the chief crop, cotton. A cotton mill was built in 1882 and converted into a textile plant in 1923. A paper mill was founded in 1912. Before this time, most of the people were small farmers. With the paper mill and the addition of a small furniture factory in 1945, more farmers began to move to the city where they could earn a better living. After World War II, a tremendous population increase occurred, which caused job and housing shortages.

The town has a square with walkways, benches, large trees, and several monuments and statues to Confederate heroes from North Carolina. In past years, it served as a marketplace for cotton and farmers.

TASK SHEET
(student packet)

GROUP I - TRANSPORTATION

As members of the Transportation Board, you are in charge of all types of transportation the city offers. An increase in population has created a transportation problem in the city. Improvements need to be made to relieve these pressures.

1. Build roads that give access to business, recreational, industrial, residential, and commercial areas.
2. Establish bus routes to connect all areas of the city. Determine how many buses would be needed for a city of this size.
3. Determine the location of a proposed interstate highway which will pass near the city. Determine where access roads should be built.
4. Select a site suitable for development of a proposed airport. Consider such factors as noise, expansion of the city limits, and enlargement of airport facilities in future years.
5. Expand parking facilities for cars and trucks.

THOUGHT DIRECTIVE

(student packet)

GROUP I - TRANSPORTATION

To the Student	To the Teacher*
How much room is required for a parking space along the curb?	This might be done by actually measuring a marked space or by measuring a car and estimating additional space needed.
How much space per car is required in a parking lot?	This can be determined by comparing spaces to the size of a lot now in use. You may wish to have someone talk with a parking lot operator.
Check with other groups to see if they are allowing roads in proper places.	Students may jealously guard against "encroachment of authority."

*Cover this column when duplicating page for students. This side can then be used as work space.

LETTERS
(student packet)

GROUP I - TRANSPORTATION

Here are some letters with issues for you to study:

#1 Dear Transportation Board:

We need more parking spaces downtown. As you know, there are only 1,500 parking spaces. Too many people who work in the stores are taking the spaces of would-be customers.

I have heard that the old hotel building is soon to come down. That block would make a fine municipal parking lot.

Sincerely yours,

Walter Wall, President
Local Carpet Center

#2 Dear Transportation Board:

Many of us senior citizens no longer operate automobiles because the traffic is so bad and there is nowhere to park downtown. Since the growing population is creating more traffic problems, we think that the town should have bus service. This bus service would be a help to all, especially to us.

Thank you,

Don Walk Goode

#3 Dear Transportation Board:

I understand that you are soon going to authorize the construction of our airport. I have heard several places suggested as locations. I surely hope that you are not going to put it near my house in Riverwood. Several of us are planning to get a petition signed if you do.

Please announce your decision as soon as possible.

Keye Pitt Downe

#4 Fox City Transportation Board:

This is to advise you that we are calling for a public hearing on the location of Interstate Highway 00 around your city.

Your decision will be needed in the next few days.

Tarzan Feathers
Highway Commissioner

PROBLEMS
(student packet)

GROUP I - TRANSPORTATION

1. What was the total number of cars and trucks registered in 1960?

2. What was the total number of cars and trucks registered in 1970?

3. Which was greater in 1960, the number of cars or the number of people? By how many?

4. Which was greater in 1970, the number of cars or the number of people? By how many?

5. Which do you think will be greater in 1980? Defend your idea.

6. In 1990, which do you think will be greater?

7. If 2,000 parking spaces were enough for the downtown area in 1960, how many additional spaces would be needed for 1970's cars?

TASK SHEET

(student packet)

GROUP II - HOUSING & URBAN RENEWAL

1. During the past 20 years, the increase of industry has drawn farmers from the county to the city to look for jobs. This has created an increased demand for housing. Designate areas of the city to accommodate low to moderate cost housing. This housing should be located conveniently to town work and bus lines since the people may not have their own transportation.

2. Several large old buildings have been condemned in the downtown area (see map). The City Council is unable to decide the best use of this land. Suggestions that have been made for the land include building a park, providing parking spaces, building a new office building or a new public library, or enlarging the school. Make recommendations to the City Council concerning the best use of this land.

3. Because of the growth and addition of new industries, the citizens are pressuring the City Council for zoning regulations. Divide the city so that areas are allowed for commercial, industrial, residential, and institutional (schools, hospitals) purposes.

4. With the expansion of the city, shopping areas are needed other than the downtown stores. The City Council has three possible locations for consideration:

    a. north of town between the railroad and river
    b. east of Fox Creek on Mill Road
    c. southwest of town 10 miles out on Briar Mountain Road

    Which of these areas will be the best location?

    When deciding where to build the shopping center, give consideration to the following questions:

    a. Which way will the city expand?
    b. Is there bus service to the area?
    c. Which of the proposed property sites could be purchased more reasonably?

THOUGHT DIRECTIVES

(student packet)

GROUP II - HOUSING & URBAN RENEWAL

What areas do you feel are immediately "ruled out" for a housing complex?

Will the location of the new airport affect your decision?

Should you consider "annexation" of a suitable out-of-city limits site?

Can you think of areas in which both the housing complex and the shopping center could be located?

Will the zoning regulations affect your choice for either? For both?

Check with the Transportation Board to see where the new bus lines will run.

Check with the Municipal Services to find areas in which adequate water will be available.

LETTER
(student packet)

GROUP II - HOUSING & URBAN RENEWAL

Housing & Urban Renewal Bureau
Fox City
North Carolina

Dear Sirs:

On behalf of the Fox City Chapter of the Hoe-and-Grow Garden Club, I would like to suggest that when the old hotel is removed, a garden be built.

The Hoe-and-Grow Garden Club will be happy to assist in the planning and planting. This new garden would really be an asset to our city.

Sincerely yours,

Ima Gardner, President
Hoe-and-Grow Garden Club

PROBLEMS

(student packet)

GROUP II - HOUSING & URBAN RENEWAL

1. In determining its housing needs, Fox City's Housing and Urban Renewal Department uses as a guide: one housing unit for each five people. On this basis, how many units were needed in 1970?

2. The actual housing available in 1970 in Fox City was 5,890. How many new units were needed to meet the guide?

3. In 1970, about how many people were there for each house?

4. The Department feels that the new complex should be designed so that it can be expanded by 1,500 units in 1980. They plan to rent ¼ of the 1,500 new units for $70.00 per month, ½ for $50.00 per month, and the rest for $100.00 per month. What will be the annual income from the new housing?

TASK SHEET
(student packet)

GROUP III - RECREATION

1. A large recreational area is needed for camping, swimming, fishing, and boating. Determine where this should be placed.

2. Small recreation parks are needed for tennis, a baseball field, and playground equipment. Four areas are authorized within the city limits. Locate these on the map.

3. The City Council has proposed building a golf course within the next 10 years. Propose a location for this.

4. Designate bike paths in the city in areas of light traffic.

To the teacher: (Cover the statement below when duplicating this page for students.)

Many towns have used finished landfill sites as recreational areas, parks, and golf courses.

THOUGHT DIRECTIVES
(student packet)

GROUP III - RECREATION

Does the type of a park influence its location?

Would you put a baseball diamond on the Town Square?

How does the age of the user of a park affect its location?

Why do neighborhood parks tend to have equipment for very small children?

How can parks be of benefit to the increasing senior citizen population?

LETTERS
(student packet)

GROUP III - RECREATION

#1 Recreation Commission
Town of Fox City
North Carolina

Gentlemen:

When making plans for new recreation areas, we hope you will keep us senior citizens in mind. Although we are not inclined to play basketball or football, we do enjoy recreational activities. A nice shady place to play checkers or shuffleboard would be appreciated.

Sincerely,

Ches Player

#2 Recreation Commission
Fox City
North Carolina

Gentlemen:

We think it is a shame that a town the size of Fox City has no public golf course. There are many of us who now have to travel almost 50 miles to play.

We feel certain that a public golf course would attract women and children as well as men. In your long-range planning, please consider a golf course.

Sincerely,

Juan Ovapar

PROBLEMS
(student packet)

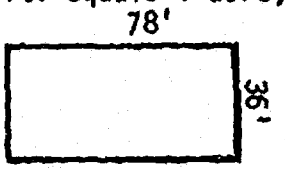
GROUP III - RECREATION

1. How many acres of parks should the town of Fox City have in 1990?

2. How many acres of parks should the County of Mulberry, excluding Fox City, have in 1970?

3. In 1970, how many acres of parks should there be in Mulberry County if Fox City and the county had planned jointly?

4. How many acres would be required for 4 tennis courts?
(NOTE: 43,650 sq. ft. equals 1 acre)



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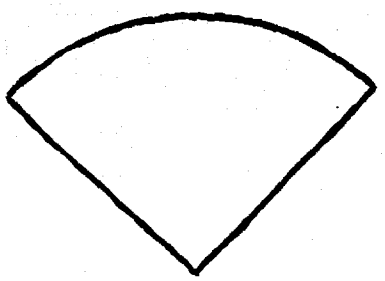


How much acreage is needed for:

a. a Pony League baseball field?
b. a Little League baseball field?
c. a Babe Ruth League baseball field

Pony League	Radius	250'
Little League	"	180'
Babe Ruth League	"	310'

Let π equal 3.14
(NOTE: A baseball field is 1/4 of a circle.)

TASK SHEET
(student packet)

GROUP IV - MUNICIPAL SERVICES

1. A new reservoir is needed to provide drinking water for the town's growing population. Make it large enough to accommodate the needs of the town for the next 20 years.

2. Locate a new water treatment plant in the vicinity of the new reservoir. Indicate the pipeline from the plant to the tower.

3. Locate a new water tank. The tank is to be 100 feet high.

4. Select a site for a sanitary landfill. The present city dump is unsanitary and is creating health problems.

5. Expand the sewage treatment plant.

THOUGHT DIRECTIVES

(student packet)

GROUP IV - MUNICIPAL SERVICES

To the Student	To the Teacher*
Many factors have to be considered when building a water tower. Some of these are listed below:	
1. Which way does water run?	1,2,3 - Since water runs downhill, seeking the lowest level, water tanks are quite tall so that the water will gravitate not only to ground floor taps, but also to upper floor connections. Water is pumped to the tanks.
2. Why are water tanks quite tall?	
3. How does water get to the tank?	
4. Does the location of the tank matter?	4. The location of the tower affects the pressure. For example, we would not logically choose a "low spot" for the tank. Also, we can deduce that Fox City "slopes from North to South."
5. Where are waterlines usually located?	5. Waterlines are usually placed along street bed.

*Cover this column when duplicating page for students. This side can be used as work space.

LETTERS
(student packet)

GROUP IV - MUNICIPAL SERVICES

#1 Fox City Municipal Services
Fox City
North Carolina

Dear Sir:

It is long past the time to do something about the city dump. Not only does it have a bad smell, but it is also dangerous to the health of the citizens. Pools of water in the area promote the growth of insects which may carry disease.

Sincerely,

Amos Keeter

#2 City Council
Fox City
North Carolina

Gentlemen:

Once again, the citizens of Oak Grove have directed me, as Mayor and Town Attorney, to demand that immediate attention be given to the high level of pollutants being introduced into Fox Creek by your inadequate treatment of sewage.

We understand the problems involved in treating sewage for a growing population. However, the situation is intolerable. We hope to build our own water facility in the near future. We must have water less polluted and objectionable than that which you are sending to us from Fox City.

Unless a concrete proposal on your part to correct this situation is forthcoming, we have no course other than to turn to the courts for relief.

Sincerely,

C. U. Encorte
Mayor and Town Attorney
Town of Oak Grove

PROBLEMS

(student packet)

GROUP IV - MUNICIPAL SERVICES

1. Increases in population mean increases in sewage treatment. How much more sewage per day was treated in 1970 than in 1960? (In pounds, in tons?)

2. Compute the predicted amount of sewage per day in 1980.

3. How much water was needed in 1970 per day?
(NOTE: Cities figure water amounts on the basis of 150 gallons a day per person.)

4. How much more water was needed per day in 1970 than in 1960?

5. The population increase during 1960-1970 alone will require 2,663,820,000 gallons over the next 5 years. How many swimming pools 12 ft. deep, 30 ft. wide, and 50 ft. long would it take to hold that water?
(NOTE: 7.5 gallons equals 1 cubic foot of water.)

6. Fox City likes to hold 6 months of reserve water in its reservoir. In 1960, the present reservoir could hold that amount. They want to build another reservoir to handle the additional water which will be needed in 1990. What should the volume of the new reservoir be?
(NOTE: Six months equals 180 days.)

7. Oak Grove is still complaining about the pollution in Fox Creek. The present plant, which has been inadequate since 1950, must be expanded to take care of disposal for the next 20 years (1990). The capacity of the present plant is 45 tons of raw sewage per day. How much should the capacity be expanded?

FOX CITY FACT SHEET

(teacher's use and each student packet)

I. POPULATION

Year	Number of People
1890	1,033
1900	4,610
1910	5,759
1920	12,871
1930	17,093
1940	21,313
1950	23,069
1960	37,276
1970	47,142

	Number of Automobiles	Trucks
1930	1,398	
1960	20,034	3,585
1970	32,705	5,932

$$\text{Birth Rate} = \frac{\text{total number of births per year}}{\text{total population}} \times 1{,}000$$

$$\text{Death Rate} = \frac{\text{total number of deaths per year}}{\text{total population}} \times 1{,}000$$

Rate of natural increase = birth rate - death rate

Projected rate of population increase = 24%/10-year period

1980 = 58,456

1990 = 72,485

II. GENERAL

Downtown parking spaces	1,500	Located around Town Square and on streets within one block of square.
Recreation area allotted	10	acres/1,000 people
Avg. American water use (in home)/day	60	gallons
Avg. American nonhome water use/day (industrial, commercial, recreational)	90	gallons (10-gallon loss through leakage)
Avg. total American water use/day	150	gallons
Avg. toilet flushing water use	6	gallons
Avg. Am. solid waste produced/day	4	pounds
Avg. Am. solid waste produced/day by 1980	5½	pounds
County land area	348	square miles

A sanitary landfill is an area where solid waste is disposed of, flattened with a bulldozer, and covered with several feet of dirt at the end of each day. Layers are added on top of this and finally covered with thick layers of dirt. Grass and trees can then be planted and a new landfill can be begun.

POPULATION EXERCISES

(teacher and students' use with *FOX CITY FACT SHEET*)

There are several ways to measure population changes. One of them is to compute the difference from one period to another. Another way is to compute the rate of change.

We will show one way of doing each computation using the 1930-1940 period as our example.

EXAMPLE:

Difference measure

last date	1940	population	21,313
first date	1930	population	17,093
		ANSWER	4,220 increase in population

Rate of change

1940	21,313
1930	17,093
	4,220

$$17{,}093 \overline{)4{,}220.0} = .247 - 25\%$$

3 418 6
801 40
683 72
117 680
102 558
15 122

EXERCISES:

1. Find the periods (10 yrs. each) of greatest and least differences.
2. Find the periods (10 yrs. each) for which the rate of change is greatest and least.
3. Were your answers to 1 and 2 the same?
4. If during the period 1970-1980 the difference remains the same as for 1960-1970, what would the 1980 population be?
5. If during the period 1980-1990 the difference is the same as for 1970-1980, what would the 1990 population be?
6. If the increase remains the same for each 10-year period, how long will it take for the town's population to reach 100,000?
7. If during 1970-1980 the rate of change remains the same, what will the 1980 population be?
8. If during 1980-1990 the rate of change remains the same as the 1970-1980 rate, what will the 1990 population be?

SUGGESTED CLASS ACTIVITIES

(teacher's use)

1. Students can write letters to agencies requesting information to help in this game. It is suggested that the teacher screen letters to avoid repeated requests for information from the same agency. Also, using school letterhead stationery and including the teacher's signature is advisable. Be specific in the request of information, not "send me everything you have on..." Information should be requested two months in advance of the game.

2. Students can make cartoons on population issues.

3. Students can make a large map of the city on top of a table to show how the proposed changes of one group will affect the work of others.

4. Individual groups should complete maps and transparency overlays that are compiled by the City Council (if one has been organized) for evaluation of their planning.

5. In addition to the study of Fox City, the class could study these same problems in their own town. At the conclusion, they could write letters to their own City Council with suggested solutions to various population problems.

6. Guest speakers can be invited to talk with the class and give background material on such topics as sewage treatment, water purification, housing development, city government and many others.

7. Field trips to factories, utility companies, or water treatment facilities would be useful.

8. Compare population trends within the state, nation, and other countries of the world. Give special attention to comparisons of developing countries, such as Costa Rica, India, and Ethiopia to developed countries, such as the United States, Great Britain, and the USSR. (Developing countries were formerly called Underdeveloped Countries "UDC's" by Dr. Paul Ehrlich in his book, Population Bomb.)

9. Investigate the birth and death rates over the past 50 years in your town. Make a graph showing the net population increase. Obtain statistics from the earliest dates available to the present on the number of births by unwed mothers and abortions.

10. Have students debate the pros and cons of abortion legalization, free distribution of birth control contraceptives, and the affects these would have on population control.

11. Check with local Recreation Commission concerning location of new recreational areas.

12. Check with local City Council about locations of new industries.

13. Bulletin boards may be created by students concerning their own town.

THOUGHT QUESTIONS FOR CLASS DISCUSSION

(teacher's use)

1. As a result of urbanization, what new skilled labor will be needed in the town of Fox City?

2. How can the people of Fox City be made aware of the need for population control? Is it possible to change the public's attitudes regarding population?

3. With the expansion of the city, what additional town services and personnel must be added to serve the increased population?

4. With the increased population in Fox City, additional housing must be provided. What are some factors you must consider in housing?

   a. Best type of heat. What is the climate?
   b. Local and available building materials.
   c. Apartments or housing units.
   d. Size of families to determine size of housing.
   e. Incomes of families to determine cost of housing.
   f. Topography of land for structure and architecture of house. Should it be one or two levels? Would a basement be suitable?

5. Urbanization has brought an increase in leisure time to the residents of Fox City. Discuss ways this leisure time may be used. What changes will this bring about in the town facilities?

6. In order for a population to remain stable, the birth and death rates must be equal. How would the following things affect the population of a town?:

a. The Family Planning Council encourages couples to have planned pregnancies.	If each couple had only two children, this would result in less than Zero Population Growth and a stabilization of the growth rate.
b. A new maternity unit is added to the hospital to handle special emergencies and provide better care for mothers and newborns.	Decreased infant mortality and maternal death due to delivery will cause a rise in the population rate.
c. A drug is discovered that will cure many forms of early detected cancer.	Once again medicine devises a way to reduce the death rate. Unless comparable steps are taken to reduce the birth rate, a population increase will occur.

7. Why don't animal populations reach the overcrowded conditions that man faces in his environment? Consider the effects infant mortality, maternal care, predation, and man's technology would have.

Many of the young die or are killed before reaching maturity in animal populations because maternal care is not always as extensive as in humans. Medicine has produced many drugs and techniques which allow people to live longer. Animal populations have no such method of lengthening their lives. Certain phenomena not completely understood help control animal population, such as the mass suicides of lemmings when food and space are short due to overcrowding. Man often hesitates to control either his birth or death rate because of religious or moral reasons.

ANSWERS TO PROBLEMS

(teacher's use)

GROUP I - TRANSPORTATION

1. 20,034 cars
   3,585 trucks
   23,619 total

2. 32,705 cars
   5,932 trucks
   38,637 total

3. 37,276 people
   20,034 cars

   There were 17,242 more people than cars.

4. 47,142 people
   32,705 cars

   There were 14,437 more people than cars.

5. Open-ended. Some responses--equally valid.

   (a) People by 1980--the cars are gaining on the people but they will not have caught up. They gain about 3,000 every 10 years, so it will take quite a while.

   (b) People--because cars are increasing at the rate of 63% every 10 years. Therefore, in 1980, we can expect an increase of 68% or a total of 53,309 cars. People are increasing at the rate of 25% every 10 years, so in 1980, we would have 58,937 people. People will be ahead by about 5,000.

6. People--cars gain 3,000 a year. People were 14,000 ahead in 1970, will be ahead around 11,000 in 1980, and 8,000 in 1990.

7. (a) Any logically argued answer should be accepted.

   (b) The ratio of spaces to cars in 1970 was $\frac{2,000}{32,700} = \frac{20}{327}$

   So $\frac{X}{53,000} = \frac{20}{327}$ So X is about 3,500

ANSWERS TO PROBLEMS

(teacher's use)

GROUP II - HOUSING & URBAN RENEWAL

1. 1970 population was 47,142

$$\frac{47,142}{5} = 9,428\ 2/5 \text{ or } 9,429 \text{ units were needed}$$

2. 9,429 units were needed
   5,890 units were available
   3,539 units were still needed

3. $\frac{47,142 \text{ people}}{5,890 \text{ available units}} = 8+$ About 8 people for each house.

4.

¼ of 1,500 is 375	@	$ 70 per month	$ 26,250	
½ of 1,500 is 750	@	50 per month	37,500	
remainder is 375	@	100 per month	37,500	
			$ 101,250	per month
			12	
			$1,215,000	per year

ANSWERS TO PROBLEMS

(teacher's use)

GROUP III - RECREATION

1. By "rule of thumb" from the *FOX CITY FACT SHEET*, there should be 1 acre for each 100 persons. Since the projected population for 1990 in Fox City is 72,485, there should be 724.85 acres of parks.

2. 1970 county population 132,000 (see map)
   1970 Fox City population 47,142
   In county, excluding Fox City, 84,858, therefore 848.58 acres.

3. Fox City is included in the county population of 132,000.
   1,320 acres of parks are now needed in Mulberry County.

4. The dimensions of a tennis court are 78' x 36', hence the area is
   $78 \times 36 \times 4 = 11{,}232$ sq. ft.

   $\frac{11{,}232 \text{ needed}}{43{,}560 \text{ sq. ft./acre}} = \frac{156}{605}$

   or approximately .26 acre

5. Using $A = \pi r^2$ with $\pi = 3.14$:

   a. $\frac{1}{4}(3.14 \times 250^2) = 49{,}072.5$ sq. ft.
      equals 1.12 acres (approximately)

   b. $\frac{1}{4}(3.14 \times 180^2) = 25{,}434$ sq. ft.
      equals $\frac{1{,}413}{2{,}420}$ acres (.58 acres)

   c. $\frac{1}{4}(3.14 \times 310^2) = 76{,}145$ sq. ft.
      equals 1.75 acres (approximately)

ANSWERS TO PROBLEMS
(teacher's use)

GROUP IV - MUNICIPAL SERVICES

1. There was an increase of 9,866. From the *FACT SHEET*, we note that the average amount of waste generated daily is 4 pounds. 9,866 x 4 = 39,464 lbs. This is 19.732 or nearly 20 tons daily!

2. In 1980, the population is projected to be 58,456. 58,456 x 5½ = 321,508. This is almost 161 tons. (160.754)

3. 47,142 x 150 = 7,071,300 gallons

4. 9,866 x 150 = 1,479,900 gallons

5. 19,732 swimming pools needed.

$$\frac{2,663,820,000 \text{ gal. for next 5 yrs.}}{7.5 \text{ gal. (1 cu. ft.)}} = 355,176,000 \text{ cu. ft. needed for next 5 yrs.}$$

12' x 30' x 50' = 18,000 cu. ft. of water in one pool

$$\frac{355,176,000}{18,000} = 19,732 \text{ swimming pools needed.}$$

6. 950,643,000 gal.

37,276	1960 population
150	gal./person/day (*FACT SHEET*)
5,591,400	gal. needed daily in 1960
5,591,400	gal. needed daily in 1960
180	days for 6 months
1,006,452,000	6 months supply in reserve for 1960
72,485	1990 population (*FACT SHEET*)
37,276	1960 population
35,209	additional people for 1990
35,209	additional people for 1990
150	gal./day/person
5,281,350	additional gal. needed daily
5,281,350	
180	
950,643,000	additional gal. for 6 months

7. From *FACT SHEET*, daily production of waste is 4 pounds (it will become 5½ lbs. in 1980) per person. We have a 1990 projection of 72,485 population, hence we will need:

   a. 72,485 x 5½ = 398,667½ lbs. per day

   Present capacity is 90,000 lbs. (45 tons) per day. We need additional capacity for 308,667½ lbs. per day.

   Students may elect to extend total capacity to 400,000 lbs. per day--an increase of 310,000 lbs.

   b. To go from 90,000 to 400,000 lbs., we need an enlargement of 444%.

$$\frac{400,000}{90,000} = 4.44+$$

   c. It may be that the decision will be to expand above these figures. (The figures given here will get Oak Grove off their backs!)

ANSWERS TO POPULATION EXERCISES

(teacher's use)

1. The period of 1950-1960 was the greatest.
   The period of 1900-1910 was the least.

2. The period of 1890-1900 was the greatest.
   The period of 1940-1950 was the least.

3. No

4.
```
 47,142  1970 population
 37,276  1960 population
  9,866  population growth
```

```
 47,142  1970 population
  9,866  population growth
 57,008  1980 population
```

5.
```
 57,008  1980 population
  9,866  population growth
 66,874  1990 population
```

6.
```
100,000  desired population
 47,142  1970 population
 52,858  amount of growth needed
         to reach 100,000
```

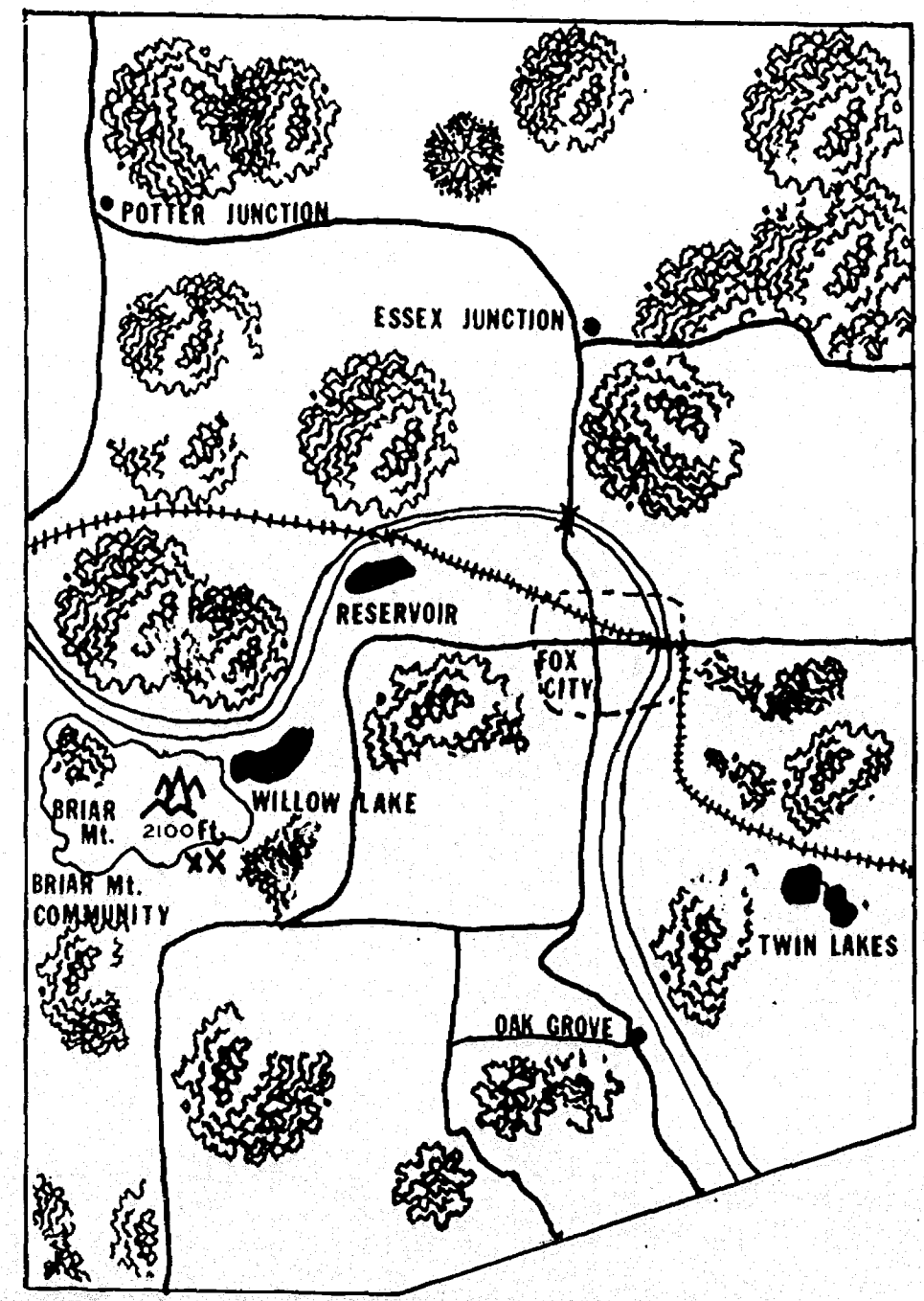
52,858 (amount of growth needed to reach 100,000) ÷ 986.6 (average growth/1 yr. from 10 yr. growth in problem #4) = 53+ so 54 yr.

7.
```
 47,142  1970 population
    .24  rate of growth from FACT SHEET
 188568
 94284
11314.08  projected growth
```

```
 47,142  1970 population
 11,314  projected growth
 58,456  1980 population
```

8.
```
 58,456  1980 population
    .24  rate of growth from FACT SHEET
 233824
 116912
14029.44  projected growth
```

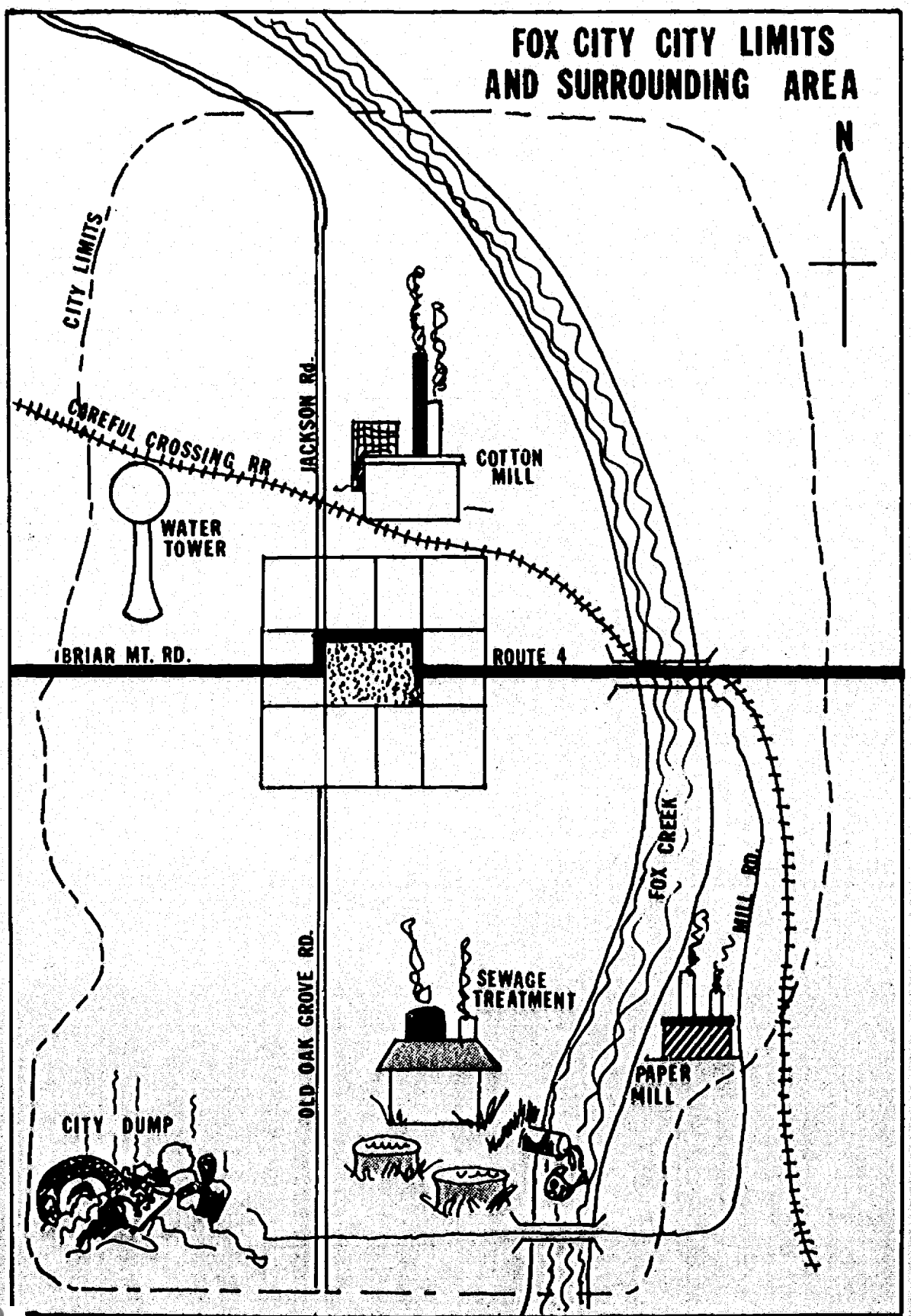
```
 58,456  1980 population
 14,029  projected growth
 72,485  1990 population
```



COUNTY OF MULBERRY NORTH CAROLINA

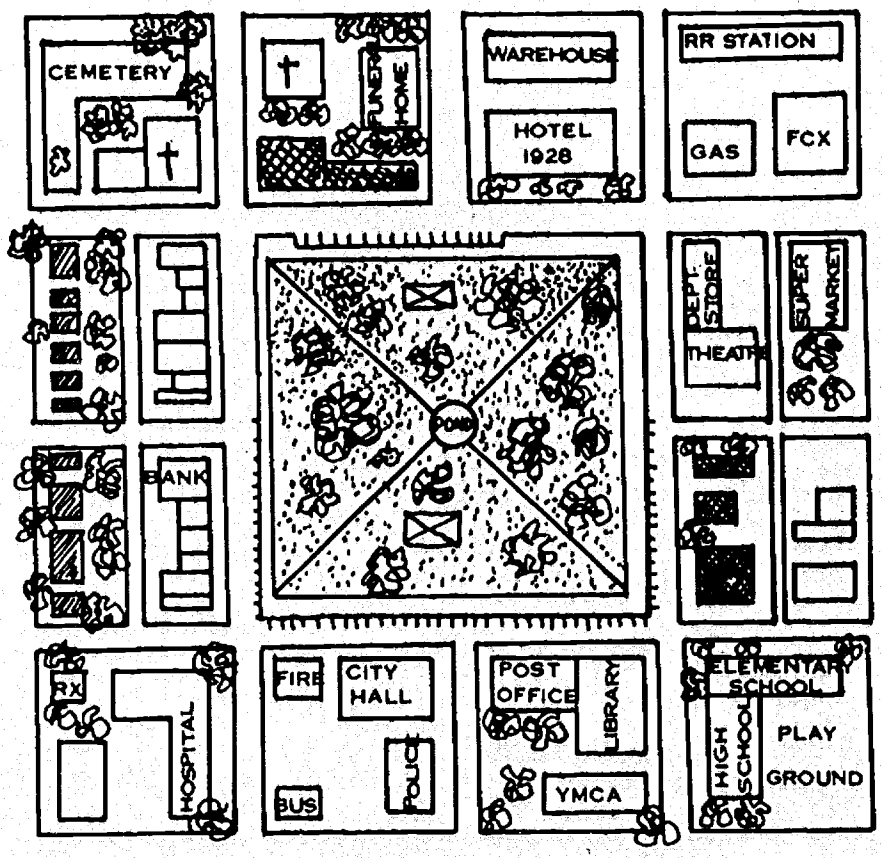
POPULATION 132,000
LAND AREA 358 sq. mi.

FOREST AREA
XX INDIAN BURIAL GROUNDS
BODIES OF WATER
ELEVATED AREAS
WATERWAY
ROAD
CITY LIMITS
RAILROAD


FOX CITY CITY LIMITS
AND SURROUNDING AREA
N
CITY LIMITS
JACKSON Rd.
CAREFUL CROSSING RR
COTTON MILL
WATER TOWER
BRIAR MT. RD.
ROUTE 4
FOX CREEK
MILL Rd.
SEWAGE TREATMENT
PAPER MILL
OLD OAK GROVE RD.
CITY DUMP

N

TOWN SQUARE OF FOX CITY, N.C.



KEY

VERTICAL PARKING

PARALLEL PARKING

TREES

HOUSES

CONFEDERATE MONUMENTS

OLD BUILDINGS

COMMERCIAL BUILDINGS

CHURCH

APPENDIX*

Articles

"Population Education As Exploration of Alternatives," "Population in the Newer Social Studies," and "Sources for Population Education." Population Education reprint from April 1972 issue of SOCIAL EDUCATION, Vol. 36:4. Order from Editor, SOCIAL EDUCATION, 1201 16th Street, N. W., Washington, D. C. 20036.

"Population Education in the United States," by Stephen Viederman, guest editor. April 1972 issue of SOCIAL EDUCATION, Vol. 36:4, p. 337.

"Population Problem: In Search of a Solution," by Joseph J. Spengler. December 5, 1969 issue of SCIENCE, 166: 1234-1238.

Population Trilogy: "Obituary Motherhood," by E. Peck; "Abortion, Population, and the Birth Control Gap," by M. Ross; and "Legal Briefs: 'Operation Lawsuit'," by J. Beattie. January 1972 issue of ENVIRONMENTAL QUALITY MAGAZINE, Vol. 111:1, p. 54. Good articles.

"Sources and Resources in Population Education," by Kathryn Horsley. Reprint of article in April 1972 issue of SOCIAL EDUCATION. Free from Population Reference Bureau, Inc., 1755 Mass. Ave., Washington, D. C. 20036. Excellent annotated bibliography.

"Population: A Challenge to Environment." THE VICTOR-BOSTROM FUND REPORT FOR THE INTERNATIONAL PLANNED PARENTHOOD FEDERATION, 1730 K Street, N. W., Washington, D. C. 20006.

Bibliographies

Ecologs. Spring 1972. $0.10. A listing of standard, recent, and forthcoming books on ecology and related environmental sciences. Available from: Sidney Kramer Books, 1722 H Street, N. W., Washington, D. C. 20006.

Environmental Education Bibliography. Thirteen pages free from: Environmental Education Center, 13 Veterans Drive, Oteen, N. C. 28805. Also ask for bibliography on population.

Planned Parenthood Federation of America, Information and Education Office, 810 Seventh Avenue, New York, N. Y. 10019, offers the following for only $0.25 each:

A Small Library in Family Planning for the General Reader (#108)
Paperbacks on Population, Family Planning, and Related Subjects (#107)
A Selected Bibliography for Professionals (#102)
Planned Parenthood Publications (#100)
Guide to Information Sources (#103)
Population Research and Study Centers in the U. S. A. (#104)

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*This appendix contains lists of printed materials and films the teacher may desire to use. Printed materials must be ordered a month or more in advance and films, two to three months in advance. Since good population films are hard to find and very popular, it is advisable to order films at the beginning of the school year to insure getting them when desired.

Books

ECOLOGY OF POPULATIONS. Arthur S. Boughey. New York: The MacMillan Company, 1968. $2.50. The aspects of population, plant, animal, and human development are concisely discussed. Though written for the general reader, some biological background is helpful.

ENVIRONMENTAL EDUCATION: CONCEPTS, ACTIVITIES, BIBLIOGRAPHY. Free from: Division of Science Education, Department of Public Instruction, Raleigh, N. C. 27611. Listing of ideas and things to do, with a bibliography.

HOW MANY ARE TOO MANY? Vivian Sorvall. Pendulum Press, Inc., The Academic Bldg., Saw Mill Road, West Haven, Conn. 06516. $0.95. This book is written for junior high level students and is part of The Total Environment Series.

PEOPLE. Cook and Lecht. 1968. $1.50. This book is designed for grades 7-9. It is part of the Student Books on Population Series.

POPULATION. Valerie Oppenheimer. $1.00. Order from Foreign Policy Association, 345 E. 46th Street, New York City 10017.

POPULATION EDUCATION. Edited by Judith Seltzer and Kathryn Horsley. 1972. $1.00. Order from Population Reference Bureau, Inc., 1755 Mass. Avenue, Washington, D. C. 20036. 118 pages. Shows how to incorporate population education into schools.

POPULATION/RESOURCES/ENVIRONMENT, 2nd Edition. Paul and Anne Ehrlich. San Francisco: W. H. Freeman and Co. 1972. $9.50. 509 pages designed for junior/senior high or college level. Good bibliography. Teacher's Guide free.

POPULATION/RESOURCES/ENVIRONMENT: ISSUES IN HUMAN ECOLOGY. Paul and Anne Ehrlich. San Francisco: W. H. Freeman and Co. 1970. $8.95. (Hardback source book). Teacher's manual free.

RAPID POPULATION GROWTH: CONSEQUENCES AND POLICY IMPLICATIONS. Baltimore, Md.: John Hopkins Press. 1971. $2.45. 105 pages. Shows problems resulting from population explosion.

SOCIAL EDUCATION. April 1972 edition, 144 pages. $1.50. Designed for teachers and devoted entirely to population education, curriculum development, and teaching aids. Available from the National Council for the Social Studies, 1201 16th Street, N. W., Washington, D. C. 20036.

THE DO-IT-YOURSELF ENVIRONMENTAL HANDBOOK. Dayton Museum of Natural History, Ohio. Little, Brown, and Company. $1.95. A good overall book of environmental ideas that are beneficial to the individual.

THE POPULATION BOMB. Paul R. Ehrlich. New York: Ballantine Books. 1968. $0.95. Overpopulation is with us now and will be the root cause of major world problems unless it is brought under control. The author proposes a set of solutions which require the cooperation of the private citizen and warns of inevitable government control of birth rate if citizens fail to recognize the implications of a geometrically-increasing population rise. He also cautions about what is likely to occur on a worldwide basis if an effective means of limiting spiraling birth rates is not sought.

THE WORLD POPULATION DILEMMA. $2.00. This book is designed for grades 10-12 and is part of the Student Books on Population Series. 79 pages. May be ordered from Population Reference Bureau (address above) or Columbia Books, Inc., 917 15th Street, N. W., Washington, D. C. 20005.

Films

"5,000 Dumps." 21-minute, 16 mm, sound, color. Order No. M2119-X. Shows how communities are solving the problems of closing dumps and initiating sanitary landfills. On loan from National Audiovisual Center (GSA), Attention: Film Order Desk, National Archives & Records Service, Washington, D. C. 20409.

"No Room for Wilderness." 25-minute, 16 mm, optical sound, color. $5.00 rental. Examines the fundamental nature of ecology and indicates the relationship of primitive man to his environment through the use of African examples. Demonstrates the disruptive impact of civilization and the need to preserve the wilderness, and pleads for world population control. Available from Association Films, 600 Grand Avenue, Ridgefield, New Jersey 07657.

"Population Ecology." 19-minute, color, 1964. $9.00 rental; $232.50 purchase. Gives facts of population growth in a variety of organisms. Shows lab demonstrations of different animal responses to the same environmental limits. Portrays fluctuation and limitation of population sizes as the environment changes. Explains population growth curve through the history of man. Concludes with the conviction that man, too, must be governed by natural laws and then indicates alternative ways by which overpopulation might be limited--starvation, disease, war, or birth control planning. Useful for both biology and the social studies. Appropriate for a team-teaching situation across the science and social studies disciplines. Available from Encyclopedia Britannica, Educational Corporation Rental Library, 1822 Pickwick Avenue, Glenview, Illinois 60025.

"Sanitary Landfill: One Part Earth to Four Parts Refuse." 24-minute, 16 mm, sound, color. $12.00/3-day rental. Presents all aspects of landfill planning and operation. On loan from General Services Administration, National Medical Audiovisual Center, Washington, D. C. 20209.

"Too Many People." 6-minute, color, 1971. $9.00 rental; $85.00 purchase. A short collection of images linking human reproduction with environmental degradation. Paul Ehrlich narrates to give some scientific information about biological system breakdown. Relationships drawn are simplistic, so should be used to provoke discussion. Any level. Available from Cross Films, P. O. Box 5409, Milwaukee, Wisconsin 53211.

Jr. High Level Films

"1985." 60-minute, color. $35.00 rental. Available from Pearl Bauer, Preview Sales Correspondent, CCM Films, Inc., 866 3rd Avenue, New York City 10022.

"Boomsville." 11-minute, color, 1969. $15.00 rental; $150.00 purchase. Short animated film produced by the National Film Board of Canada depicting the historical sequences of modern civilization, particularly migration to North America. Little emphasis is placed on population growth, but accurately portrays urban growth and its related problems. No narration. Excellent film. Grades 6-12. Order from Learning Corporation of America, 711 Fifth Avenue, New York, N. Y. 10022.

"Camping: A Key to Conservation." 23-minute, 1963. $8.00 rental. Catalog #NSC-1002. A view of the widespread misuse of public recreational facilities by careless citizens. A thirteen-year old boy takes his first overnight trip and is discouraged by what he sees. Available from Indiana University Audiovisual Center, Field Service, Bloomington, Indiana 47401.

"Challenge to Mankind." 28-minute, black and white. Five world experts speak of the threat of overpopulation. Available from Contemporary Films, 267 West 25th Street, New York, N. Y. 10001.

"EGGS." 10-minute. $20.00 rental. Cartoon about conflict between the Goddess of Fertility and Death. Available from Film Images, 17 West 60th Street, New York 10023.

"For Your Pleasure." Rental is free. Available from Mass Media Ministries, 2116 N. Charles Street, Baltimore, Md. 21218; or 1720 Costeau Avenue, St. Louis, Mo. 63103; or 1714 Stockton Street, San Francisco, Ca. 94133.

"No Time for Ugliness." 24-minute, color, 1965. This film explores the population explosion and indiscriminate construction of living quarters that have spoiled the landscape. By using various communities throughout the country, the film shows land misuse and river pollution and gives a plea for citizens to clean up their environment. Available from American Institute of Architects, 1735 New York Avenue, N. W., Washington, D. C. 20006.

"Pandora's Easy Open Pop Top Box." 15-minute, color. Free. A dramatic presentation of the effects of uncontrolled urbanization. A comparison between the problem of city life and quietness of the country setting. Flashbacks between the two environments throughout. Emphasizes migration from farmlands. No narration. Available from Environmental Control Administration, Attention: Tom Edgar, 12720 Twinbrook Parkway, Rockville, Maryland 20852.

"The Time of Man." 50-minute, color. $40.00 rental. Available from Ealing Co., 2225 Mass. Ave., Cambridge, Mass. 02140.

Filmstrips

"The People Problem." 2 filmstrips/2 records--$35.00, 416 329; 2 filmstrips/2 cassettes--$39.00, 416 345. The problems of an overpopulated world are discussed: food shortages, housing needs, air and water pollution, inadequate public facilities, such as schools, hospitals, etc. Available from Guidance Associates of Pleasantville, New York.

"Transportation: Where Do We Go From Here?" 1 filmstrip/1 record--$18.00, 420 800; 1 filmstrip/1 cassette--$20.00, 4200 826. Examines major problems; urban traffic jams, inadequate highways, railroad systems, airports, and possible solutions through innovation. Available from Guidance Associates of Pleasantville, New York.

Publications

hs popins. A monthly publication on high school activities and resources for teachers. Free from the Population Institute, 100 Maryland Avenue, N. E., Washington, D. C. 20002.

Interchange. A bimonthly population education newsletter for teachers, including news and resources for classroom use. Has "activity sketch" for in-class use. Vol. 1:1-Vol. 1:4 (March 1972-November 1972) are free. Subscriptions are $2.00 per year from Population Reference Bureau, Inc., 1755 Mass. Ave., Washington, D. C. 20036.

Man's Population Predicament. A 40-page bulletin describing our population situation, historical perspective, and future possibilities. Vol. 27, #2, April 1971 from Population Reference Bureau (address above).

"Population Education in the U. S." A report to the Commission on Population Growth and the American Future, by Stephen Viederman, October 1971. Contains bibliography. Write author concerning availability: Mr. Stephen Viederman, Assistant Director, Demographic Division, The Population Council, 245 Park Avenue, New York City 10017.

Population Supplement from the Sunday NEW YORK TIMES, April 30, 1972. A special 28-page magazine sponsored by the Population Crisis Committee. Up to 10 copies = 25¢/copy; bulk orders, less. From: Population Crisis Committee, P. O. Box 6585, Washington, D. C. 20009.

Teaching Notes on Population. A newsletter for teachers on demographic information, sponsored by the National Council of Associations for International Studies. Available from Foreign Area Materials Center, 60 E. 42nd Street, New York City 10017.

We, The Americans. A 16-page booklet for student use on 1970 census. $0.35 from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

ZPG NATIONAL REPORTER. A monthly newspaper of Zero Population Growth, 4080 Fabian Way, Palo Alto, California 94303. Library subscriptions--$5.50/regular--$10.00.

Zero Population Growth--The Crisis. A 16-page bulletin available from Zero Population Growth (address above), for $0.15 each.

Teaching Aids

A Sourcebook on Population. 1969. 50 pages. May be ordered for $0.50 from Population Reference Bureau (address above).

Charts on Population Growth, World Population Data Sheets, and slide sets available from Population Reference Bureau (address above).

GENEOLOGY EXERCISE and MOTHER-OF-THE-YEAR SIMULATION. Latter developed by Ed Havitz, Waverly West Jr. High School, Lansing, Michigan. GENEOLOGY EXERCISE shows population increase in four generations. MOTHER-OF-THE-YEAR SIMULATION has students select M-O-T-Y from list of candidates provided. Both are available by sending a manila envelope with 10¢ postage to Mrs. Janet Woerner, Science Dept., Freeland High School, 710 Powley Drive, Freeland, Michigan 48623.

Handbook on Population Legislation in Congress. Available for $0.25 from ZPG, 620 C Street, Washington, D. C. 20003.

NEW PROGRAMS: POPULATION, ENVIRONMENT, AND SOCIETY. Program being piloted in Connecticut. 3-4 weeks social studies course. Adaptable to natural science. For information contact: Ms. Silver Wyatt, 892 Indian Hill Road, Orange, Conn. 06477. Manual is $2.50. Pilot teachers were wanted last spring. Contact if interested.

"Population." May be ordered through your local bookstore for $10.00-$12.00. Involves filling pyramid with just the right balance of industry, agriculture, medicine, education, and population. May also be ordered from Urban Systems, 1033 Mass. Avenue, Cambridge, Mass. 02138.

Student Poster Packet--Contains 6 student-designed posters with discussion guide. May be ordered for $1.00 from Population Institute, 100 Maryland Avenue, N. E., Washington, D. C.

Agencies

North Carolina Department of Public Instruction, Raleigh, N. C.

The State Library in Raleigh - Documents Section

Mrs. Peggy Busick
U. S. Department of Commerce
P. O. Box 1950
Greensboro, N. C.

Your Local Family Planning Services

Your Local Health Department

Federal Government Offices:

Bureau of the Census
Public Information Office
Department of Commerce
Washington, D. C. 20233

Center for Population Research
(Behavioral Sciences)
National Institutes of Health
Bethesda, Maryland 20014

National Center for Health Statistics
Health Services & Mental Health Administration
Rockville, Maryland 20852

Office of Environmental Education
Department of Health, Education, & Welfare
400 Maryland Avenue, S. W.
Washington, D. C. 20201

Office of Population Affairs
Department of Health, Education, & Welfare
Washington, D. C. 20201

Population Crisis Committee*
1835 K Street, N. W.
Washington, D. C. 20006

Superintendent of Documents
U. S. Government Printing Office
Washington, D. C. 20402

*A nonprofit organization concentrating on public education. Distributes reprints of President Nixon's "Message to Congress on Population" and The Family Planning Services and Population Research Act of 1970.