

C O N N E C T I O N S



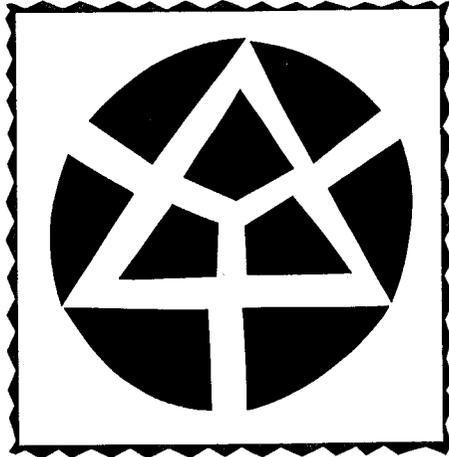
Linking Population
and the
Environment

Teacher's Guide



CONNECTIONS

Linking Population and the Environment



Teacher's Guide

Edited by Kimberly A. Crews and Patricia Cancellier
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Ordering Information: Additional copies of the *Student Resource Book* are \$8.00 each. Complete teacher's kit \$13.00 (includes *Teacher's Guide*, *Student Resource Book*, *World Population Data Sheet* and *World Environment Data Sheet*). Data Sheets are \$3.00 each. Orders under \$50.00 must be prepaid with \$1.00 or 4 percent (whichever is greater) for shipping and handling. Send orders to Circulation Department, Population Reference Bureau (address above).

This Teacher's Guide is part of the CONNECTIONS teaching kit developed to help students understand the links between population and the environment in the context of sustainable development. The ultimate goal of the project is to develop students' concern for the environment, a sense of responsibility for its protection, awareness of the links between population and the environment and the realization that they live in a global village.

The CONNECTIONS project was made possible by support from the Geraldine R. Dodge Foundation, the George Gund Foundation, the David and Lucile Packard Foundation, the U.S. Agency for International Development and the John Edward Fowler Memorial Foundation.

During the summer of 1990 five teachers active in their state Geographic Alliances joined PRB staff to participate in the development of the lessons in this book. They spent a good deal of time and energy previewing materials, developing lessons, reviewing materials and testing the lessons in their classrooms. We sincerely appreciate the help of these dedicated educators.

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Special thanks to the CONNECTIONS Advisory Committee: Barbara Graves, Charles County School District, MD; Martha Sharma, National Cathedral School, Washington, D.C.; Barbara Winston, Northeastern Illinois University.



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Dear Educator:

The CONNECTIONS project is designed to help teachers and students better understand the links between population, environment and sustainable development. This project was inspired by the *Global Edition* project, an effort by the Population Reference Bureau to produce and disseminate materials on the links between population and environmental issues from a Third World perspective. *Global Edition* assists journalists in developing countries in writing articles to help educate their readers about population/environment connections. Most of the articles in the *Student Resource Book* appeared, as part of the *Global Edition* project, in newspapers and magazines in the Third World. While some editing of the articles occurred, an effort was made to leave them in their original state so that students would be able to experience a non-U.S. view of these global problems. (Note: There are, as a result, inconsistencies in the spelling of some words. Some of the articles use international or British English spellings while others use American English. Also, students may be unaccustomed to the writing styles of some of the authors.)

The readings in the *Student Resource Guide* are divided into geographic units: the world, Africa, Asia and Latin America. Within each unit is an article on the region, and when available, articles on specific countries in that region. Terms that appear in the glossary, located at the back of the *Student Resource Guide*, are highlighted in color in the text. Units of measure that may be unfamiliar to your students are defined in the margin. Page-size versions of the *World Population Data Sheet* and *World Environment Data Sheet* can be found at the end of the book.

This *Teacher's Guide* contains 27 lessons that complement the articles, expand on selected concepts and issues and help students make the connections between population growth, environmental concerns and sustainable development. Some of the lessons are specifically tied to a particular region or country. Others are more generic and can be used when studying any of the regions and countries in the package. The lessons can be used alone or as a unit. Accompanying worksheets can be found at the end of the lessons. A learning matrix, showing the countries, topics and skills that are covered in each lesson and reading, can be found on pages 6-9. A resource list containing additional books, articles and audiovisual aids can be found at the beginning of each section (see Table of Contents).

The lessons in the *Teacher's Guide* were developed by geography, social studies and economics teachers in the summer of 1990. They have been field tested in junior high and high school classrooms in several states. Many of the lessons were also evaluated by teachers participating in workshops presented by the Population Reference Bureau. Without the direct participation of these classroom teachers, the development of these materials would not have been possible.

We welcome your comments and suggestions on the CONNECTIONS package. An evaluation form is enclosed. Recommended changes will be considered for incorporation when the package is revised and reprinted.



Kimberly Crews and Patricia Cancellier
Population Education Program
Population Reference Bureau

Matrix of Concepts, Topics and Skills

Geographic/Economic/Development Topics	The Challenge	Africa	Poverty	Sahel	Kenya Pt. 1	Kenya Pt. 2	Egypt	Asia	Bangladesh	Deltas	Philippines	Latin America	Wrap-Up	1.1
Age structure		∅						∅						
Agriculture/Food	●	●		●		●	●	●	●		∅	∅	∅	∅
Aid					●		∅	∅	∅					
Carrying capacity	∅							●						∅
Deforestation	∅	●		∅		●		●	●		●	●		∅
Desertification	∅	●		●			∅	●					∅	∅
Economic concepts				●		∅					∅	●		
Energy/Fuel	∅	∅				●		∅				∅	●	
Erosion	∅					●		∅				∅		
Family planning		∅			●		∅		∅			∅		
Global warming	∅								∅	●		∅	●	
Health/Sanitation	∅						∅					●		
Irrigation/Dams	∅						●	●						∅
Land degradation	∅	●	∅			∅		●	●		●	●		∅
Migration/Movement	∅	∅		●					●		●	∅		
Pollution	∅								∅			●	●	
Population growth	●	●	∅	●	●		●	●	●		●	●		∅
Resources	●	∅	∅			∅								∅
Survival	∅		●			∅			●					
Sustainable development	●	∅	●	∅			∅	●			●	∅	●	∅
Urbanization		∅										●		∅
Water supply/Drought		●		●		∅	●	●	●			∅		∅
Weather/Climate		∅		∅				∅	∅	∅			●	

Regions/Countries

World	●									●			●	
Developed world examples	∅												●	
Africa	∅	●	∅	∅	∅									
The Sahel				●										∅
Kenya					●	●								
Egypt							●							
Asia	∅							●	●					
Bangladesh									●	●				
Philippines											●			
Latin America	∅											●		

Key ● concept/topic/skill focused on ∅ concept/topic/skill mentioned or introduced

Readings and Lesson No.

Skills

	The Challenge	Africa	Poverty	Sahel	Kenya Pt. 1	Kenya Pt. 2	Egypt	Asia	Bangladesh	Deltas	Philippines	Latin America	Wrap-Up	1.1
Acquiring Information Skills														
Identifying locations														
Observing photographic evidence														
Research														
Table, chart and map reading														
Vocabulary development														●
Presenting Information Skills														
Creative and essay writing														
Preparing graphs and tables														
Preparing thematic maps														
Oral Communication														
Persuasive speaking														
Role Playing														
Simulation														
Processing Information Skills														
Classification														●
Computing rates														
Conceptualizing rates and measures														
Analyzing Information														
Brainstorming/speculation														
Critical thinking														
Inductive reasoning/hypothesizing														
Interpreting maps														
Interpreting tables and graphs														
Problem solving/decision making														
Using Data Sheets														

Key ● concept/topic/skill focused on ∅ concept/topic/skill mentioned or introduced



Section I World Overview

The lessons in this section are designed to accompany the reading, "The Challenge of Our Times." This reading is an overview of world population trends and the state of the environment. In this piece the reader is introduced to **Child 5-Billion**, a mythical baby whose birth would have celebrated the human population reaching the 5 billion mark. The author uses **Child 5-Billion** as the centerpiece of his article by hypothesizing about what **Child 5-Billion's** life will be like given current conditions and trends.

The lessons in this section are designed to help students become comfortable with the vocabulary and demographic concepts that are used in all of the CONNECTIONS readings and lessons. They also introduce the student to the *World Population Data Sheet* and *World Environment Data Sheet*, which are used in many lessons in this guide.

The first lesson in this unit, "Connecting Words, Connecting Worlds," is a vocabulary development activity. Lesson 1.2 introduces students to the concept of population growth, showing the relationship between births and deaths; activities in this lesson also help the students become comfortable with the large numbers (millions and billions) that are used to describe population size and change. Lesson 1.3 helps students further increase the ease with which they use data, as they develop a description of a hypothetical **Child 5-Billion**.

Resources

Books

Atlas of Environmental Issues, by Nick Middleton. New York: Facts On File, 1989. 63 pp.

Atlas of World Population History, by Colin McEvedy & Richard Jones. London: Lane, 1978. 368 pp.

GAIA: An Atlas of Planet Management, edited by Norman Meyers. New York: Anchor Press, Doubleday, 1984. 272 pp.

One Earth, One Future (Our Changing Global Environment), by the National Academy of Sciences. Washington, D.C.: National Academy Press, 1990. 196 pp.

Our Common Future, by the World Commission on Environment and Development. Oxford: Oxford University Press, 1987. 400 pp.

Planet Earth, by David Lambert. New York: Facts On File, 1985. 65 pp.

Population Growth, by Eric McGraw. Florida: Rourke Enterprises, Inc., 1987. 46 pp.

State of the Ark, by Lee Durrell. New York: Doubleday, 1986. 224 pp.

Toward Sustainable Development, by The Panos Institute. London: Panos Publications Ltd., 1987.

World Resources 1990-91, by The World Resources Institute, The United Nations Environment Programme and The United Nations Development Programme. New York: Oxford University Press, 1990. 378 pp.

Articles

"**Fighting to Save a Fragile World**," *International Wildlife* (March-April 1990) (special issue).

"**Growing, Growing, Gone**," by P. R. Ehrlich and A. H. Ehrlich. *Sierra* Vol. 75 (March-April 1990). pp. 36-40.

"**The Growing Human Population**," by N. Keyfitz. *Scientific American* Vol. 261 (September 1989). pp. 188-26.

"**Population, Plenty, and Poverty**," *National Geographic* Vol. 174, No. 6 (December 1988). pp. 914.

"**Sustainable Development: Lessons From Success**," by Walter V.C. Reid. *Environment* Vol. 31, No. 4 (May 1989). pp. 6+.

"**Sustainable Agriculture in Developing Countries**," *Environment* Vol. 30, No. 9 (November 1988) (special issue).

"**Will We Mend Our Earth?**" *National Geographic* Vol. 174, No. 6 (December 1988). pp. 766.

Audiovisuals

Earth: The Changing Environment. 1987, 28 minutes, Jr. High-Adult, VHS. Purchase for approx. \$40 from PBS Video, 1320 Braddock Place, Alexandria, VA 22314-1698. (800) 424-7963. Available for rental from PRB.

An examination of the impact that modernization has had on the environment. Scenes from both industrialized and developing nations show the effects that both economic development and lack of economic development have on the environment and resources. The concluding message: development efforts and environmental protection must go hand-in-hand.

The Environmental Revolution (from the "Race to Save the Planet" series). 1990, 60 minutes, High School-Adult, VHS. Purchasing information from the Annenberg/CPB Project at (800) LEARNER, P.O. Box 1922, Santa Barbara, CA 93116-1922. Available for rental from PRB.

This is the opening program of the "Race to Save the Planet" series. It takes a look at the tenuous relationship between humans and their environment and attempts to understand the changes, through time, from coexistence to domination.

Population Patterns and Technology. 1988, 20 minutes, Jr. High-High School, VHS. Purchase for \$150 (plus shipping) from the Agency for Instructional Technology, Box A, 1111 West 17th Street, Bloomington, IN 47404-3098. (800) 457-4509. Available for rental from PRB.

This video is part of the 12-program "You, Me, and Technology" series. It examines world population growth as a result of four technological revolutions: toolmaking, agricultural, industrial and informational. Emphasis is placed on the fact that rapid population growth has been a recent phenomenon caused by a drop in mortality as a result of worldwide improvements in health and hygiene.

Population Change and Economic Development. 1987, 25 minutes, High School-Adult, 3/4" and VHS. Available for rental from PRB.

This film makes very clear the connections between population change and economic development. The film opens with a graphic display of how the world population has grown historically and how it will grow in the future. It explains why most of the growth today is taking place in developing countries and why such rapid growth is a greater burden for these countries than it was for the developed nations during their period of growth. The film also discusses official population policies and their place in the realm of family planning; why family planning is necessary and the various factors that can contribute to the success of such programs.

What is the Limit? 1987, 23 minutes, High School-Adult, VHS. Available for \$15 from the National Audubon Society, 801 Pennsylvania Ave., S.E., Suite 301, Washington, D.C. 20003.

A survey of the environmental problems triggered by modern methods of production, both in the industrial and agricultural sectors all over the world. The film also points to rapid population growth as a factor in the threat to man's prosperity. The following are discussed in the conclusion: 1) What is the responsibility of the developed countries to the poorer ones? and 2) What is the current U.S. policy on family planning?

World Population. 1990, 6 minutes, Elem.-Adult, VHS and 16mm. Available in VHS for \$32.95 (includes postage) from Zero Population Growth, 1400 16th Street, N.W., Suite 320, Washington, D.C. 20036.

A revised version of the classic 1972 film presenting the best-ever graphic simulation of human population growth. In this video, dots are placed on a world map to represent millions of people added to the population from A.D. 1 to the present and projected to 2050. Historic references have been added to this edition to place population changes in context.



Lesson 1.1 Connecting Worlds, Connecting Words

Overview: The purpose of this lesson is to introduce students to the topics, concepts and basic vocabulary of the CONNECTIONS unit. Students will become familiar with vocabulary terms that will be encountered in all of the readings and lessons. **Note: If you do not intend to conduct Lesson 1.2 with your students, please assign the reading "The Challenge of Our Times" Part 1 for homework and follow up with the discussion mentioned in Procedure #2, Day 2 of 1.2.**

Region: World

Grade Level: 7-12

Learning Objectives:

Students will:

1. Classify demographic, environmental and development terms.
2. Interpret demographic, environmental and development terms.

Skills To Be Developed:

1. Classification
2. Vocabulary development

Vocabulary To Be Developed:

25 terms (see Lesson 1.1 Handout)

Time Needed: 1 day

Materials:

1. Copies of "Vocabulary" (Lesson 1.1 Handout)
2. Scissors (1 per 3-4 students)

Procedure:

1. Distribute copies of Lesson 1.1 Handout to students. Have students read over the vocabulary list and take a few minutes to examine the kinds of terms on the list. Clarify terms, as necessary.
2. Students cut up the list of terms so that they have 25 cards, each card having one word and one definition.
3. Have students work individually or in groups to classify the terms into three to five categories. They should be able to describe the rationale for their category headings. Some students may need assistance identifying reasonable headings. (Some

suggestions: population, environment, location, people, development, agriculture, land measures, misc., etc.)

4. If students have worked individually, join them into groups of three or four and have them compare their classification strategies.

5. Compare the category headings for the whole class. Write some on the board. Ask students if they think some words could fit into more than one category. Are the categories related? Do any of the words in one category have a relationship to words in other categories? Choose the term "population growth rate." Ask students to speculate upon the relationship between the population growth rate and some of the other terms. How might a high population growth rate affect land degradation? What about the total population? How does the number of people affect the resources in the area?

6. Have students consider this relationship for homework. Also have them find out the population of the world.

Extensions & Variations:

1. Provide a chart with suggested categories for younger students. Do a follow-up activity of matching vocabulary with definitions ("Concentration" game).
2. Have students turn over their vocabulary cards, write in the term and draw an appropriate graphic for all or selected terms.
3. Play "Review Jeopardy" using selected categories.
4. To review the vocabulary terms, play "Lingo Bingo." (See Lesson 2.5 for instructions and cards.)

<p>Biosphere The part of the earth, including the air and water, that can support life.</p>	<p>Deforestation The loss of trees, due to overcutting of forests. One consequence of deforestation is soil erosion, which results in the loss of protective soil cover and the water-holding capacity of the soil.</p>	<p>Land Degradation To lower the quality of the land making it less suitable for growing crops or raising livestock. Land degradation is caused by overcropping, overgrazing and using farming methods that make the land less fertile.</p>	<p>Population Growth Rate The rate at which a population is increasing (or decreasing) in a given time period, expressed as a percentage of the base population.</p>	<p>Sedimentation (or Siltation) Rock, gravel and other matter in a body of water (such as a river) that is deposited onto the floor of that body of water.</p>
<p>Birth rate The number of births per 1,000 population in a given year.</p>	<p>Desertification The process by which semi-arid grassland becomes desert, usually caused by overgrazing, deforestation, drought and changing climate.</p>	<p>Less Developed Country (LDC) also called developing or Third World A country that has low levels of average wealth, industrialization and modernization and often high levels of population growth and people employed in agriculture.</p>	<p>Natural Increase The surplus (or deficit) of births over deaths in a population in a given time period.</p>	<p>Slash-and-Burn Agriculture A type of farming where a patch of forest is cut and the area is burned. Ashes add nutrients to the soil. Crops are then planted between the stumps. When the soil loses its fertility the farmer moves to a new patch of land leaving the old one to return to its original state.</p>
<p>Carrying Capacity The greatest number of living species that can be supported in an area given its environmental condition.</p>	<p>Ecosystem A community of plants and animals interacting with one another and the environment.</p>	<p>Life Expectancy The average number of years a person can expect to live at the time of birth.</p>	<p>Refugee A person who leaves his native country because he fears for his survival.</p>	<p>Sustainable Development Practices (in agriculture, economic development, etc.) that lead to progress and meet the needs and desires of the current generation without depriving the ability of future generations to meet their needs.</p>
<p>Catchment Basin The area drained by a river or river system. The catchment is where rain water naturally falls. This water then drains to a river.</p>	<p>Finite Resources Resources that are limited in quantity. When they are all used they can not be replaced.</p>	<p>More Developed Country (MDC) also called developed Countries with higher levels of per capita income, industrialization and modernization. They usually have lower levels of population growth. The developed region includes all of Europe, Canada, the U.S., Australia, Japan, New Zealand and the USSR.</p>	<p>Sahel A strip of land on the southern edge of the Sahara Desert in North Africa that stretches across several countries. This area was a grassland at one time, but because of prolonged drought and land degradation, it is becoming a desert.</p>	<p>Urbanization Growth in the proportion of a population living in cities.</p>
<p>Death rate The number of deaths per 1,000 population in a given year.</p>	<p>Irrigation To supply crops with water in excess of what they would get from natural rainfall. Water for irrigation comes from rivers, lakes or reservoirs; channels dug by man; drains built by man; or pumped from underground water sources.</p>	<p>Ozone Layer Chemical layer that protects living things on Earth by blocking out harmful radiation from the sun.</p>	<p>Salinization The build up of salt in the soil. Too much salt build-up can damage and kill plants and destroy the soil's ability to grow plants. This process is caused by irrigation as salts brought with the water remain in the soil as the water evaporates.</p>	<p>Watershed The region from which a river receives its supply of water.</p>



Lesson 1.2 How Much is 5 Billion?

Overview: The purpose of this lesson is to familiarize students with the size of the world population, the rate at which it is currently growing and the historical pattern of growth. **Note: This lesson is intended to follow Lesson 1.1, which gives students an introduction to the demographic, environment and development concepts necessary for successful completion of the readings and lessons in this unit.**

Region: World

Grade Level: 7-12

Learning Objectives:

Students will:

1. Understand the effect of the rate of population growth upon the total population.
2. Interpret a line graph.
3. Demonstrate the relationship between births and deaths.

Skills To Be Developed:

1. Interpreting information
2. Conceptualizing rates and figures

Vocabulary To Be Developed:

rate of natural increase, birth rate, death rate, million, billion

Time Needed: 2 days

Materials Needed:

1. Reading: "The Challenge of Our Times"
2. Transparency of chart "World Population Growth 1750-2100" from *Student Resource Guide*
3. Lesson 1.25 "Stork and Grim Reaper"
4. Film: "World Population"
5. Copies of the *World Population Data Sheet*

Procedure:

DAY 1

1. Remind students of the previous evening's homework assignment. Ask them, "How many people live on this earth?" (5.3 billion in 1990)
2. Ask students, "How much is a billion?" This is a difficult number for most people to comprehend. Use the following examples to help your students appreciate how much one billion is. They will also help students appreciate the difference between one million and one billion.

- a. A stack of U.S. paper currency one inch high will contain 233 bills. If you had a million dollars in thousand dollar bills, how high would the stack of bills be? (4.29 inches high) If you had a billion dollars in thousand dollar bills, how high would the stack be? (357 feet or almost the length of a football field)
- b. How old would you be if you were a million seconds old? (11.6 days) A billion seconds old? (31.7 years)

3. After allowing time for discussion, show the chart, "World Population Growth" on an overhead projector.

4. Ask students to interpret the chart. If they have trouble, some of the following questions will help. When did the population reach 1 billion? (about 1800) Have them point to the population size in 1990. Did the population grow faster in this century or in the 1800s? (this century) Where is most of the population growth occurring now, in developed or developing regions? (developing, Africa, Asia, and Latin America) What does this mean for those regions? This reviews what students discussed during Lesson 1.1. (As population grows more resources and services are needed.) Discussion.

5. Guide them back to the chart. Tell them that it took 130 years for the population to grow from 1 to 2 billion, but just 45 years more to double to 4 billion. Each billion is being added in a shorter period of time. What causes population to grow so fast? (There are more people being born than dying, which means the population growth rate is higher than in earlier times when births and deaths were closer to being equal. The rate of population growth is about 1.8 percent this year.) Have a discussion about what this means. Compare the rate to a checking account interest rate.

6. Conduct the "Stork and Grim Reaper" exercise (see Lesson 1.25) to show the impact that a growth rate of 1.8 percent has on the earth.

Lesson 1.2 Continued

7. Optional: Show the six-minute film "World Population." Discussion.

8. Assign the reading, "The Challenge of Our Times" Part 1, for homework. This may also be read in class. Ask students to note in the reading what **Child 5-Billion's** life is likely to be like.

DAY 2

1. Students have read the "Challenge of Our Times" Part 1, for homework or will read it in class.

2. Discussion. What type of life did the reading predict for **Child 5-Billion**? In your opinion, is this a positive or negative outlook? On what did the author base his predictions? What might happen to change this?

3. Optional: For review and in preparation for the activities using the data sheet, go over the first six columns on the *World Population Data Sheet* with students. Use only the world, LDCs and MDCs to discuss the meanings and variations between these variables.

Extensions & Variations:

1. Have students generate their own ways of representing 1 million, 1 billion or 5 billion.

Here are some other ways of expressing millions or billions.

- a. Imagine a checkerboard with squares one inch on a side. How big would the checkerboard have to be in order to have 5 billion squares? (just over a mile on a side)
- b. Count one second. How many seconds are in a year? (about 31.5 million) How many years is a billion seconds? (31.7 years) What was happening 5 billion seconds ago? (It was the early 1830s. Andrew Jackson was U.S. President. Cherokee were being forced to move from Georgia. Millions of bison still roamed the open prairies.)
- c. Texas is a big state, but how much room would 5 billion people each have if they moved into Texas and were spread out evenly? (about 1.5 square feet each, barely enough to stand on.)
- d. How many words are there in the Encyclopedia Britannica? (about 44 million words) How many complete sets would you need to get 5 billion words? (over 110 full sets)



Lesson 1.25 The Stork and Grim Reaper

Overview: The purpose of this lesson is to illustrate the concept of the rate of natural increase (or population growth rate). This lesson is a spin-off of Lesson 1.2.

Vocabulary To Be Developed:

rate of natural increase, birth rate, death rate, carrying capacity

Time Needed: 15 minutes

Materials Needed:

1. Copies of the *World Population Data Sheet*
2. Clear container (plastic box, fish bowl, or similar; should be at least 1 quart capacity)
3. Old towel to place under clear container to absorb drips
4. Two sheets of paper labeled: "Stork" and "Grim Reaper"
5. Straight pins to attach labels to wearers
6. Bucket of water (the "Great Beyond")
7. Food coloring (add to water in bucket for easier visibility)
8. Two measuring cups or dippers: one large (perhaps 1-cup) and one small (1/3 cup)

Procedure:

1. Tell students that you are going to show them an interesting way to convey the concept of the earth's carrying capacity and to illustrate the effect on that carrying capacity of a birth rate that is larger than the death rate.
2. Tell them that the exercise is called "The Stork and the Grim Reaper." Explain that people will come into the world via the Stork, and, of course, depart it via the Grim Reaper.
3. Select two volunteers from the audience; one to be the Stork and one to be the Grim Reaper. Pin an appropriate sign on each.
4. Hold up the clear container and say: "Now, you may think this is just a container, but actually it

represents the world. The water in the bucket represents people. Our stork will add people--that is add water--to our world and the Grim Reaper will take people out of the world by dipping water out of the container.

5. Instruct the class to help the Stork and Grim Reaper by looking at the *World Population Data Sheet* to find the birth and death rates. Ask: "What is the birth rate for the world?" (28 per 1,000). And what is the death rate? (10 per 1,000).

6. Tell them that the birth rate is almost three times that of the death rate, so we'll give the large dipper to the Stork and the small dipper to the Grim Reaper. Ask the Stork and the Grim Reaper to start doing their tasks--Stork, adding water, and Grim Reaper, removing water--until asked to stop. (Let them proceed until the water level gets dangerously high).

7. Ask students what is happening to the water level. (It's rising.) What will happen if there is no change in the birth or death rates? (Water will overflow.) You may wish to carry on the example to its grim implication: that losing water really means losing people, as the earth's carrying capacity is exceeded.)

8. Discussion: What does this suggest about the carrying capacity of the earth? (It has limits; if the birth rate is not slowed, a crisis could result. It is important to note trends while there is still time for thoughtful analysis and humane problem-solving.)

Extensions & Variations:

1. Show the growth rates for two different countries or regions. Use two containers and have a Stork and Grim Reaper for each; vary the size of the dippers.

Adapted by permission from *EdVentures in Population Education*, Zero Population Growth, Inc., 1984.



Lesson 1.3 In Search of Child 5-Billion

Overview: The purpose of this lesson is to provide students with ways to compare and give meaning to statistical data. The lesson will also give students information about the lives of children in other countries.

Region: World

Grade Level: 7-12

Learning Objectives:

Students will:

1. Locate information in data tables.
2. Interpret information in data tables.
3. Write essays describing hypothetical children from unfamiliar countries.
4. Compare essays describing such children from various countries.

Skills To Be Developed:

1. Reading tables
2. Creative writing

Vocabulary To Be Developed:

developed country, developing country, population density, per capita GNP, life expectancy, calorie consumption, infant mortality, total fertility rate, urbanization, gross domestic product (GDP)

Time Needed: 2 days

Materials Needed:

1. Copies of the *World Population Data Sheet*
2. Copies of the *World Environment Data Sheet*
3. Reading: "The Challenge of Our Times," Part 2

Procedure:

DAY 1

1. Distribute copies of the *World Population Data Sheet* and the *World Environment Data Sheet* (or the *Student Resource Book* containing the data sheets) to each student. Discuss the layout and column headings on each data sheet. Refer students to the glossary or data sheet definitions and notes for explanations of the unfamiliar variables.
2. Choose one country for which there are data on the *World Environment Data Sheet* (the *World Environment Data Sheet* does not contain all the countries that appear on the *World Population Data*

Sheet.) Explain that the entire class will be working together to create a portrait of the people living in the country you picked. The only information sources are the data sheets and their accompanying tables and charts. Ask your students to find answers to the following questions in the data sheets:

- a. Is their country densely populated? (See "Countries, Areas and Densities" in the *World Population Data Sheet*.)
- b. Are the people more likely to live in the countryside or in cities? (See "Urban Population.")
- c. Does it seem to the older people in the country that there are many more people living in their area than there were when they were younger? (See "Population Change 1955-1990/1990-2025.")
- d. Are the people more likely to be poor or wealthy? (See "Per Capita GNP.")
- e. How long can a person expect to live? (See "Life Expectancy.")
- f. Are the people eating well? (See "Per Capita Calorie Supply of Requirements.")
- g. Do they live in families with lots of children or few children? (See "Total Fertility Rate.")
- h. What is the state of health of the babies here? (See "Infant Mortality Rate.")
- i. What is the source of energy used by families here? (See "Per Capita Commercial Energy Consumption," "Electric Energy from Fossil Fuel" and "Years to Halve Forest Cover.")
- j. Are people more likely to be farmers than any other occupation? (See "Gross Domestic Product (GDP) from Sources Other than Agriculture.")
- k. Does the average family drive a car? (See "Motor Vehicles per 1,000 population.")

3. Distribute the reading "The Challenge of Our Times," Part 2 to each student. Remind them of **Child 5-Billion**, to whom they were introduced earlier in the reading. They learned what this child's life might be as a world citizen. Now they will be learning about his life if he were growing up in specific countries. Their reading assignment is to find out how **Child 5-Billion** might live if he grew up in Haiti, Mauritania, Nepal, Yemen or Brazil.

Lesson 1.3 Continued

DAY 2

1. Have students select two countries (other than Brazil, Nepal, Mauritania, Yemen or Haiti), one developed and one developing country. Students should attempt to select countries different from their classmates: teachers may want to assign countries to students or have students pull country names out of two hats. **Note: Once again, select countries from the *World Environment Data Sheet* for reason explained in Day 1, Procedure No. 2.**
2. For each country, have students examine the information on the data sheets and develop an idea of the conditions within the country. The data sheets provide enough information to make a sketch of the countries, however, you may want students to supplement the data with information from other sources.
3. Have students write a paragraph describing what life might be like for **Child 5-Billion**, if he or she were born in that country.
4. After completing their two paragraphs, students should select one story from the reading of **Child 5-Billion** (for example, Child of Nepal) and compare that child to the children described in their stories.
5. In small groups, have students exchange their descriptions. Have each group select a description for a developed and developing country to read aloud to the class. Share the readings and compare stories without noting the country, and ask other students to guess at least the region and country if possible.
6. Ask students to consider how some of the issues raised for one country may have an impact on other countries.

Extensions & Variations:

1. If at least one computer is available, teacher may have students create a computer database of population and environmental statistics. Each student should enter into the computer the data from his/her country/-ies. An extensive data set can be created in this manner.
2. Have students write about the future of **Child 5-Billion** if he/she were living in their neighborhood.



Section II Generic Lessons

The lessons in this section are designed to be used when studying any region or country (even those not covered in this package). They help the student gain background information about the country/region and give instruction in graphing, mapping and vocabulary development.

Lessons 2.1 and 2.2 help students practice their detecting skills as they develop profiles of the environmental and population status of their country/region. Lesson 2.3 outlines the steps for making a climate graph. Students learn how to develop and interpret choropleth (area-value) maps in Lesson 2.4. For a bit of fun, Lesson 2.5 Lingo Bingo, helps students review vocabulary. In Lesson 2.6, students learn how to construct and interpret age/sex pyramids.

Resources

From the Population Reference Bureau

Population Handbook, International Edition, by the Population Reference Bureau. Washington, D.C., 1986. 64 pp.

World Population: Facts in Focus (World Population Data Sheet Workbook), by the Population Reference Bureau. Washington, D.C., 1988. 20 pp.



Lesson 2.1 Connecting Environmental Clues

Overview: The purpose of this lesson is to give students the opportunity to explore the environment of a region prior to their exploration of the impact of humans on the environment. Students will construct graphs and interpret pictures and maps in order to describe the environmental character of the region and speculate about the economic activities that may take place in such an environment. Students then read a description of the environment and economic activity of the region to compare to their description. **Note: This lesson is designed to be used as an introduction to any region or country reading or lesson in this package.**

Grade Level: 7–12

Learning Objectives:

Students will:

1. Construct a climate graph.
2. Interpret information from climate graphs.
3. Interpret photographs.
4. Interpret information from maps.
5. Integrate information and speculate on results.
6. Compare speculations with textual information.

Skills To Be Developed:

1. Preparing and interpreting climate graphs
2. Observing photos and graphic evidence
3. Reading maps
4. Integrating information from diverse sources

Vocabulary To Be Developed:

climate, resource

Time Needed: 1–2 days

Materials Needed:

1. Copies of climate data tables (one source is *Universal Atlas*)
2. Copies of blank climate graph forms (Lesson 2.3 Handout)
3. Photographs of region
4. Atlases with thematic environmental maps of region (sugg. *Rand McNally's Goode's World Atlas*)
5. Current world almanacs or encyclopedias

Procedure:

1. If climate data are available, distribute blank climate graph forms and have students construct them (see Lesson 2.3 for instructions to make climate graphs). If the data are not available, but the atlas contains climate graphs, move to Step 2. If no climate graphs are available, move to Step 3.
2. Analyze information presented in the climate

graphs. What is the regional climate like? Is the climate conducive to agriculture? Are moisture and temperature levels favorable throughout the year or only on a seasonal basis?

3. Display slides or photographs from books or magazine articles about the region. Students should study the pictures and jot down clues about the environment, conditions of human life, productive activities and so on.

4. Distribute atlases and direct students to examine maps portraying the region's environmental character—landforms, mineral resources, climate, soil, vegetation and natural hazards.

5. If a map describing the economic activities of the region is not available, students should speculate on the likely activities, being ready to defend their reasoning. If an economic map is convenient, students should examine the map and identify the variables noted in their earlier exploration that would lead to particular activities in particular places. Students should also speculate on (if no map is available) or note (with map present) the region's relative importance for a given economic activity compared with the rest of the world.

6. Read aloud through the geographic, environmental and economic descriptions of the region contained within an almanac or encyclopedia and have students compare the description with their own.

Extensions & Variations:

1. Have students create a series of climate graphs for different sites within the region and attach them to a large map of the area.
2. Create sub-regional visual displays (pictures, dioramas, etc.) illustrating the impact of environmental factors upon human lives.



Lesson 2.2 Connecting Population Clues

Overview: The purpose of this lesson is to help students explore basic regional population facts and trends and consider the connections between population and the regional environment. **Note:** This lesson is designed to be used as an introduction to any region or country reading in this package.

Learning Objectives:

Students will:

1. Read chart and transfer selected information from one format into another.
2. Speculate on impact of population change on local environment.
3. Interpret a population pyramid.

Skills To Be Developed:

1. Reading tables
2. Conceptualizing rates
3. Interpreting graphic information

Vocabulary To Be Developed:

birth rate, death rate, growth rate, percent of natural increase, percent urbanization, percent of population under age 15, per capita GNP, infant mortality rate, total fertility rate, life expectancy

Time Needed: 1 day

Materials Needed:

1. Copies of the *1990 World Population Data Sheet*
2. Copies of "Connection Population Clues" worksheet (Lesson 2.2 Handout)
3. Copy of population pyramid from the *Student Resource Book*

Procedure:

1. Distribute *World Population Data Sheets* and the "Connecting Population Clues" worksheets. If

students have not had experience working with the *World Population Data Sheet* (i.e., have not completed activity 1.3 or 1.4), take a few minutes to familiarize them with the data categories and notes.

2. Have students complete the worksheet using the *World Population Data Sheet* with the region or country being studied written at the top.

3. Discuss the worksheet. How does this country/region compare to the U.S. and the world? How do you think the human population might impact the environment in this country/region? Look at the *World Environment Data Sheet* for clues.

4. Have students examine the population pyramid for this country/region (if available in the *Student Resource Book*). What is the age structure of the population in this region? Is the population old or young? How does it compare to the U.S.? How might the population structure change in the coming 35 years? Based on the pyramid and your understanding of the environment in this region, what environmental consequences do you anticipate might result from this population structure? What kinds of goods and services are going to be important for this group?



Lesson 2.3 Making a Climate Graph

Climate data show the patterns of temperature and precipitation for a year or several years for a specific site.

The easiest way to interpret this data is to create a climate graph. This will enable you to examine the general pattern of weather conditions. You will be able to tell warm, cold, wet and dry periods. These graphs also lead to easier comparisons between countries and regions.

The scale for the temperatures ($^{\circ}\text{C}$ or $^{\circ}\text{F}$) is located on the left. Make a line graph by plotting the monthly temperatures with dots on the graph above the letter for the corresponding month. Connect the dots.

The scale for the monthly precipitation (in inches or millimeters) is located on the right side. Use vertical bars to represent the monthly precipitation.

Note: This package contains scales for both metric and U.S. measuring systems (see Lesson 2.3 Handout).



Lesson 2.4 Making a Choropleth (Area-Value) Map

A choropleth map is useful in identifying regions. Making such a map is a simple technique. The steps for drawing a choropleth map are:

1. Determine the mapping categories by finding the range of data for that indicator. Determine the number of categories to be used for your map and the interval of each category. Here is one method for determining mapping categories.
 - a. Inspect your data sheet.
 - b. Choose one measure, such as birth rate, for mapping.
 - c. Determine the world's (or region's) **highest** and **lowest** values for that measure.
 - d. Subtract these two numbers in order to calculate the **range** for the data.
 - e. Divide the range by the number of mapping categories planned for your map. Five mapping categories will be adequate for most measures. The number produced by the division will be how many numbers to include in each category. (Note: The best number of classes to use is the one that give you the most useful information. Generally, between three and seven works best. If too few classes are used, important details may be lost. Too many classes mean that the map gets cluttered with unimportant detail.
 - f. Note that the last category contains a larger interval because the range was not divisible by five. Construct categories so that the numbers in one category do not overlap those in adjacent categories.
2. Arrange a color code or shading pattern for each category. Colors or patterns should increase from light to dark, from lowest to highest category.
3. Determine the proper mapping category for each country and color or shade the country on an outline map. Title the map and place a legend on the page.
4. After the map has been drawn, consider the following to guide interpretation:
 - a. Describe the patterns observed on the map.
 - b. What accounts for the variation?
 - c. Discuss the factors that could lead to the range of outcomes within this distribution.

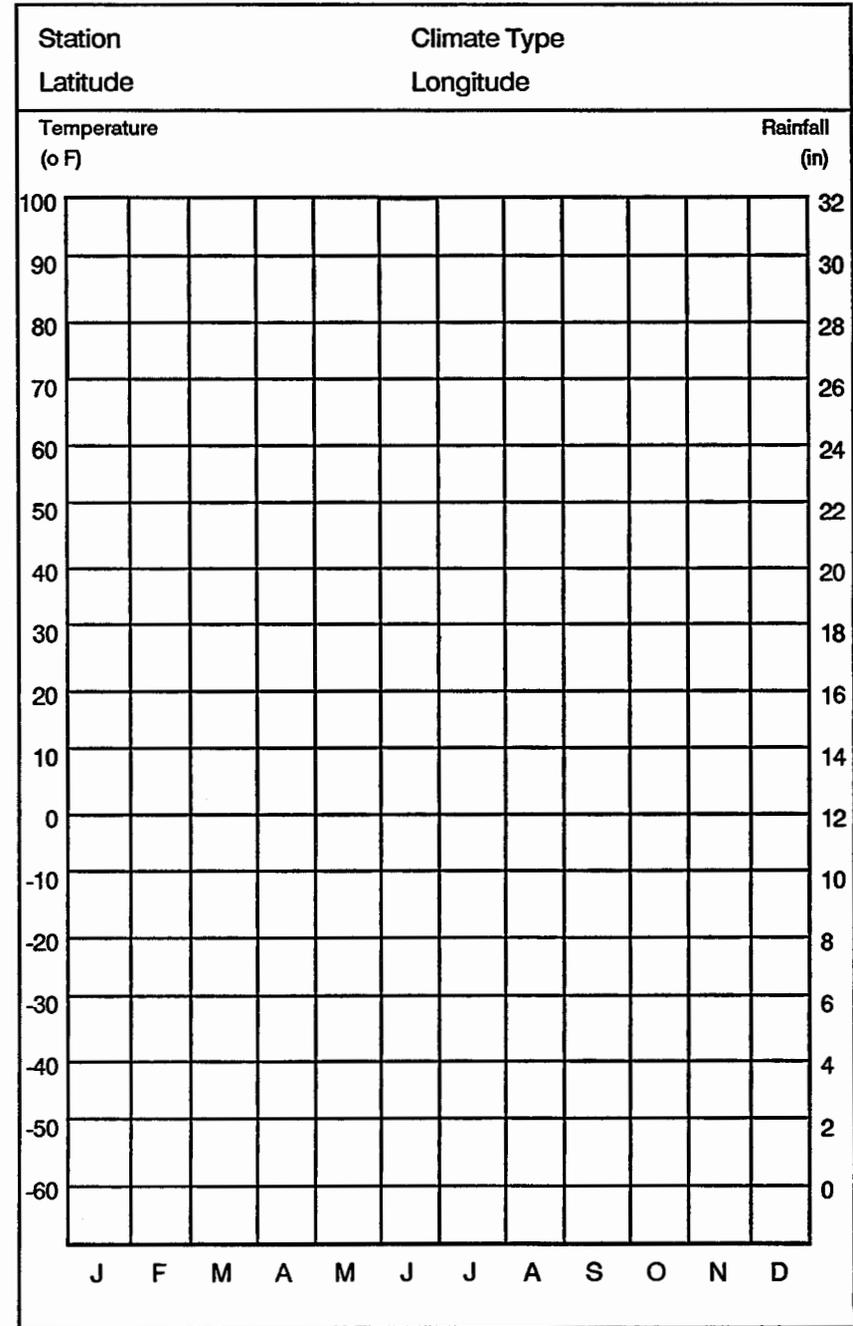
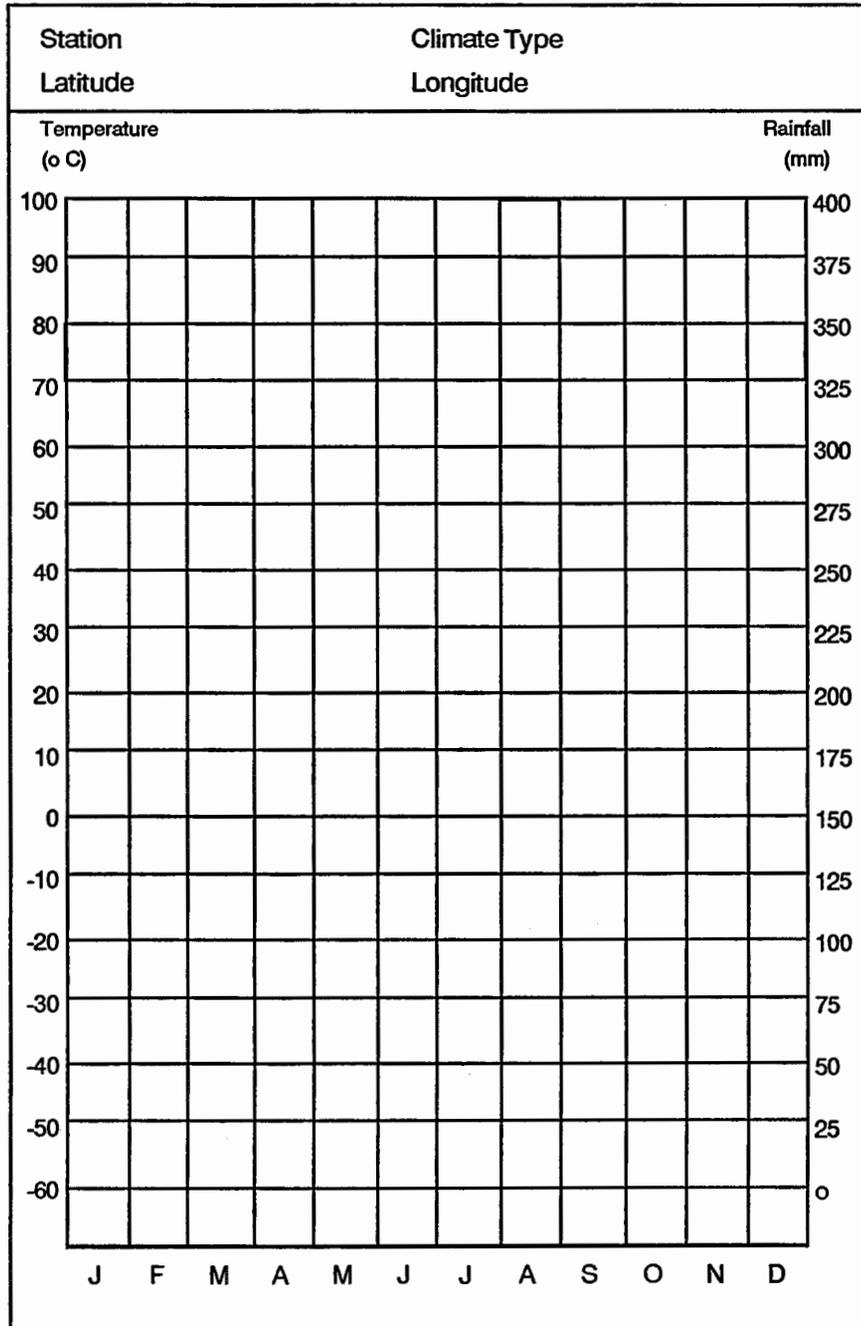
Example of mapping categories for birth rate:

10–18	37–45
19–27	46–54
28–36	

Extensions & Variations:

1. Provide mapping categories for younger students.

Lesson 2.3 Handout





Lesson 2.5 Lingo Bingo

Overview: The readings in this unit have many vocabulary words that should be introduced and reviewed with students. This lesson serves as a tool for review and can be used with any vocabulary list.

Grade Level: 7-10

Learning Objectives:

Students will:

1. Define geographic, environment, population and development terms.

Skills To Be Developed:

1. Vocabulary building

Time Needed: 1 day

Materials Needed:

1. Two Lingo Bingo game sheets per student (Lesson 2.5 Handout)
2. Glossary from the appropriate reading assignment
3. Pieces of paper with the numbers 1 to 30 written on each piece

Procedure:

1. Distribute a Lingo Bingo game sheet to each student. Two rounds can be played on each sheet.

2. Have students randomly place numbers (from 1 to 30) in the 24 empty squares (students may write in the corresponding words if they wish). There are only 24 squares available so some words will not be used.

3. Select one of the numbered pieces of paper from a container. Find the corresponding number from the Lingo Bingo sheet and read the corresponding definition from the glossary. Students locate the corresponding number and word and circle it on the Lingo Bingo card. Continue with another definition.

4. When a student gets five in a row or four corners, they say "Lingo Bingo." They then repeat the words that were circled. If they are correct, they win.

5. Repeat process as necessary. It may take three games before all 30 words have been covered.

Lingo Bingo

Lesson 2.5 Handout

L	I	N	G	O
		X		

B	I	N	G	O
		X		

- 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 _____



Lesson 2.6 Pyramid Building

Overview: The purpose of this lesson is to provide students with the background to understand the importance of age structure on population growth. They do this by creating a population pyramid. This process will also help them understand the meaning of different shaped "pyramids" and the impacts of these different growth patterns.

Region: World

Grade Level: 7–12

Learning Objectives:

Students will:

1. Interpret a standard population pyramid.
2. Create a modified (4-part) population pyramid.
3. Interpret and compare modified population pyramids of selected countries.
4. Map identified countries.

Skills To Be Developed:

1. Interpreting graphic information
2. Preparing graphs
3. Identifying locations

Vocabulary To Be Developed:

population pyramid, age–sex composition

Time Needed: 1–2 days

Materials Needed:

1. Copies of "Modified Population Pyramid" outline (Lesson 2.6 Handout 1)
2. Copies of "Modified Pyramid Data Table" (Lesson 2.6 Handout 2)
3. "Modified Pyramid Data Table Teacher's Key" (included)
4. Small (1"x 2") "Post-It"® notes
5. World wall map
6. Overhead transparency of chart "Three Patterns of Population Change" (included)
7. Overhead transparency of "Modified Population Pyramid" outline

Procedure:

1. Show the chart, "Three Patterns of Population Change," on overhead. If you use the figure with Kenyan and Austrian pyramids, cover these up for the first part of the lesson. Explain that a population pyramid shows the age and sex structure of a

population. Point to the horizontal bars, which show the percentage (or the absolute number) of males and females in each age group.

2. Have students interpret the chart. Which age group has the greatest proportion of people? (30–34) Which bar includes the students in this classroom? (10–14 or 15–19) Are there more people in your age group or in the age group below yours?

3. Explain that a pyramid shows the history of a country's population growth. In the U.S. from 1945 to 1965, people had larger families. These people are now between the ages of 25 and 44 and are called baby boomers. Point to this group on the pyramid.

4. Now show them pyramids for Kenya and Austria. Have them describe Kenya's population structure. How is Kenya's pyramid different from that of the U.S.? (There are more people in the younger age groups.) Which age group in Kenya is the largest? (0–4) What proportion of the population is in this age group? (more than 20 percent; 10 percent are males and 10 percent females). Now look at Austria. How is it different? (The age groups are closer to being equal.) How is it different from Kenya? (There is a greater proportion of older people).

5. Ask students: Why would a country's leaders want to know the proportion of the population in different age groups? What difference does the age of the people in a country make? (People of different ages have different needs.) What kinds of products do young people use? What kinds of services do they need? (diapers, day care, toys, health care, schools, etc.) What about older people? (different kinds of health care, different foods, different products) Is it important for a government leader or planner to know the age of the population they are serving?

Lesson 2.6 Continued

6. Explain that each student is going to draw a population pyramid for a specific country. However, the class will practice first with the U.S. Explain that the pyramid will have only four age categories instead of 16 like the ones shown.

7. Pass out copies of a blank Modified Population Pyramid Outline (Lesson 2.6 Handout 1) (if possible give students a page with a modified pyramid on each side). Put the corresponding transparency on the overhead. Point out that males are on the left, females on the right and that they are measured as a percentage of the population. Read off the age categories. Tell students that 14 percent of females are ages 0–19. Have them draw a line from the bottom of the box at 14 percent up to the next line. Demonstrate. Do the same for the males and continue in the same manner for the other age groups.

U.S. Population by Age
(percent)

Ages	Males	Females
0–19	15	14
20–39	17	16
40–59	10	11
60+	7	10

8. Next, distribute copies of the Modified Pyramid Data Table (Lesson 2.6 Handout 2) and another copy of the blank Modified Pyramid sheet, if necessary. Organize the class into groups of four to six students each. Then assign students to graph the pyramids of particular countries, identified by numbers. (Assign the countries in numerical order. Each group will then be graphing a variety of pyramid styles.)

9. Have students share their pyramids with the other students in their group. They should discuss

similarities and differences in the shapes of their pyramids. What might be some of the reasons for different shapes? For example, Country #12 has many more males than females in the 20–39 age group. (Male workers migrating from other countries.)

10. Now have students group themselves by pyramid shape. (You may wish to post large copies of the different styles of pyramids and then say, "Everyone with a pyramid that looks like Kenya, come to the front of the room...") Students should then line up by pyramid type, with broad-based, narrow-topped pyramids (rapid growth) on the left side of the room, slow-growth pyramids in the center and negative growth on the right side.

11. Students should look at the list of possible countries and guess which country they represent. After students have made their guesses, the teacher (using the key) should identify each of the pyramids graphed by the students.

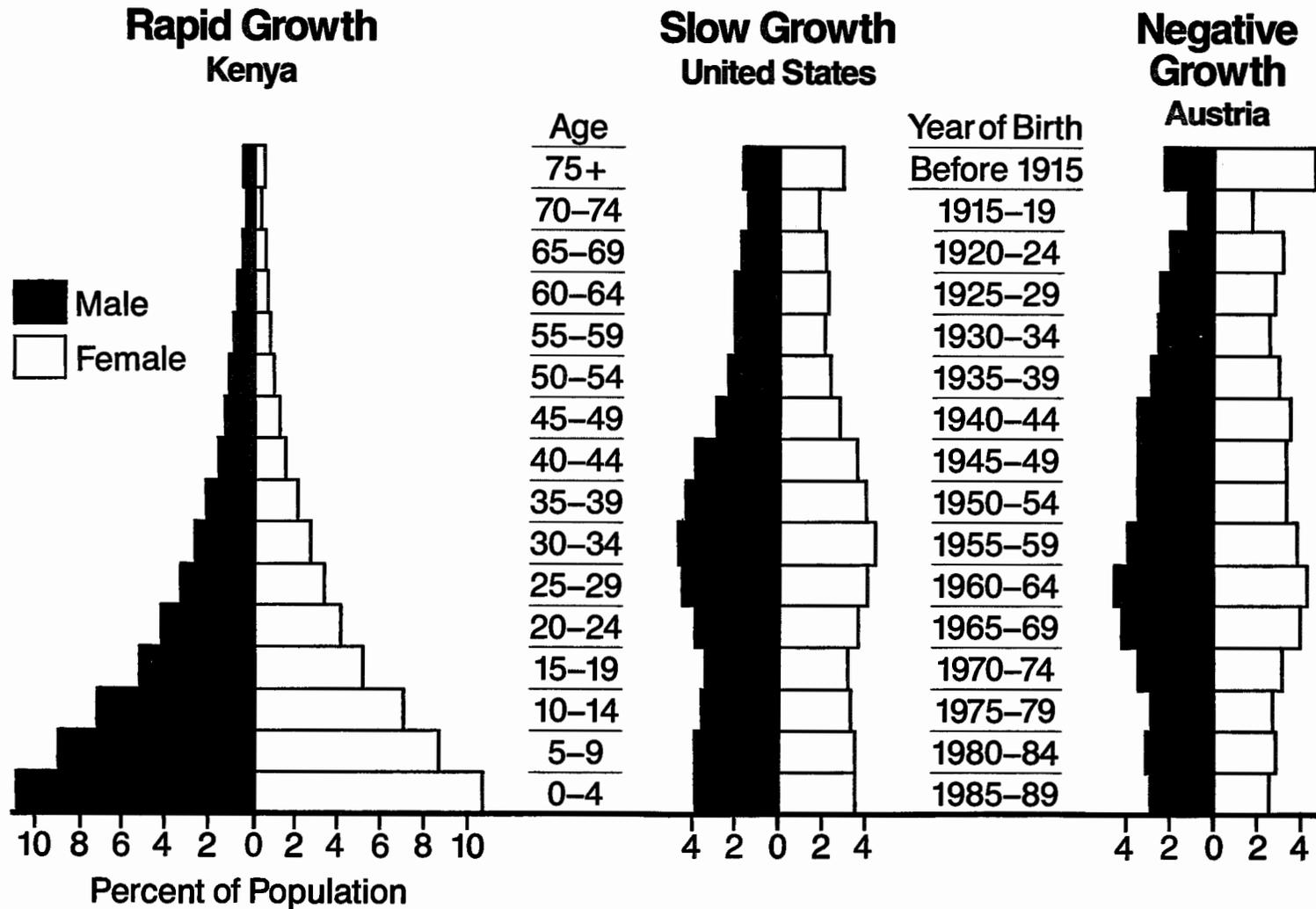
11. Students should write the name of their country on their pyramid. Distribute "Post-It"® notes and have students roughly duplicate (in bold) the pattern of their pyramid on the "Post-It,"® then attach their "Post-It"® to the world wall map.

12. Students should seek patterns among the graphs within the regions.

Extensions & Variations:

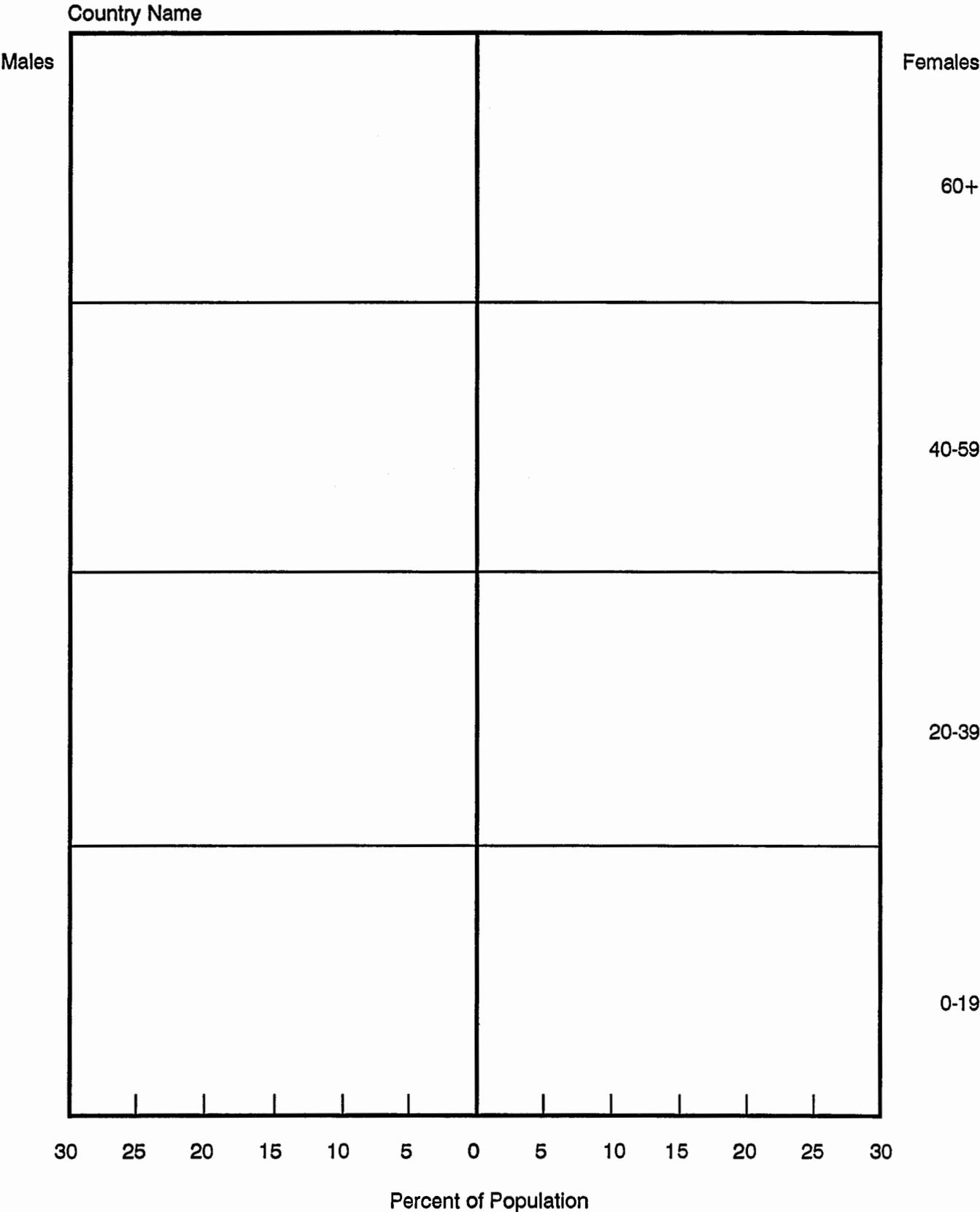
1. Create a population pyramid with 16 or 17 age groups. Obtain data from the *United Nations Demographic Yearbook* or write to the Population Reference Bureau for more information.

Three Patterns of Population Change



Source: The World Bank

Population Reference Bureau, Inc.



Modified Pyramid Data Table
(percent in each age group)

Lesson 2.6 Handout 2

AGES	MALES				FEMALES			
	0-19	20-39	40-59	60+	0-19	20-39	40-59	60+
COUNTRY								
1	24%	16%	8%	4%	23%	14%	8%	4%
2	22	17	9	4	20	16	8	4
3	28	14	5	2	27	14	6	3
4	22	17	8	3	21	17	8	3
5	12	15	13	9	12	15	13	12
6	28	15	6	2	27	14	6	2
7	28	13	6	2	28	14	6	2
8	14	17	12	7	13	17	12	9
9	19	19	9	4	18	17	8	5
10	16	18	11	6	16	17	10	6
11	25	16	6	3	24	16	7	3
12	20	28	18	2	18	9	4	1
13	16	15	11	7	15	14	12	10
14	12	16	12	8	12	15	12	13
15	26	15	7	3	24	15	7	3
16	29	12	6	3	28	14	7	3
17	30	13	5	2	29	13	6	2
18	16	19	11	6	14	18	9	7
19	28	14	6	2	28	14	6	2
20	28	14	6	2	28	14	6	3
21	11	16	13	8	11	15	13	13
22	21	18	9	3	20	17	9	4
23	27	14	8	2	26	13	7	2
24	19	15	10	6	18	15	9	8
25	23	18	5	4	22	18	6	5
26	14	14	14	7	13	14	14	10
27	31	12	5	2	31	12	5	2
28	29	15	6	2	27	14	5	2
29	27	13	6	2	27	14	7	3
30	30	13	6	2	29	13	6	2
31	14	15	12	8	13	14	13	11
32	26	15	7	2	25	15	7	3
33	16	20	11	4	15	19	10	5
34	15	16	11	7	15	16	11	9
35	23	17	8	3	22	15	8	4
36	28	12	7	3	28	13	7	3
37	20	28	18	2	18	9	4	1
38	17	16	10	5	16	15	11	10
39	27	13	6	3	27	14	7	3
40	28	14	5	2	28	14	6	2

Data for 1990.

Source: The World Bank

**Modified Pyramid Data Table
Teacher's Key**

Lesson 2.6

COUNTRY

1. India
2. Albania
3. Algeria
4. Thailand
5. Denmark
6. Bangladesh
7. Zaire
8. Canada
9. China
10. Cuba
11. Mexico
12. United Arab Emirates
13. Czechoslovakia
14. Austria
15. Egypt
16. El Salvador
17. Uganda
18. Hong Kong
19. Ghana
20. Honduras
21. Germany
22. Korea
23. Afghanistan
24. Ireland
25. Jamaica
26. Japan
27. Kenya
28. Pakistan
29. Bolivia
30. Nigeria
31. Hungary
32. Philippines
33. Singapore
34. Australia
35. Turkey
36. Ethiopia
37. Cyprus
38. USSR
39. Cameroon
40. Zimbabwe



Section III Africa

Section III begins with an overview of Africa and then moves to specific concerns in three African countries. The reading "Sustainable Development in Africa," is an overview of population trends and environmental concerns. This piece concentrates on desertification and the population explosion. There are three lessons that accompany this overview. Lesson 3.1 introduces students to the geographic environment and population growth patterns of Africa. In the second lesson, students review Africa's age structure and discuss its economic implications. In Lesson 3.3 students develop mapping skills and learn techniques to develop and test hypotheses about the relationship between economic well-being, demographic and health concerns.

As the students read about the Sahel region of Africa in "Survival in the Sahel," they learn about the complex factors leading to desertification. Lesson 3.4 is a simulation, where students become citizens of a village in the Sahel; they must deal with problems associated with land degradation. Then students develop solutions to environmental problems and evaluate the feasibility of these solutions as they explore the concepts of survival, resources and scarcity in Lesson 3.5.

Students then move east to Kenya, where they participate in a role-playing activity about family-planning and discuss the problem of deforestation in Lessons 3.7 and 3.8.

The last reading in this section, "Egypt: How to Look After the Nile," discusses the importance of water supply in Egypt. In Lesson 3.8, students assess the benefits and costs of the Aswan Dam.

Resources

Articles

"Africa's Stricken Sahel," *National Geographic* Vol. 172, No. 2 (August 1987). p. 140.

"Drought in Africa," *Scientific American* Vol. 256, No. 6 (June 1987).

"The Environmental Effects of the High Dam at Aswan," by Gilbert F. White. *Environment* Vol. 30, No. 7 (September 1988).

"Inside the Sahel," *Earthwatch* Vol. 15, No. 4 (1988).

From the Population Reference Bureau

"Africa's Expanding Population: Old Problems, New Policies," by Thomas J. Goliber. *Population Bulletin* Vol. 44, No. 3 (1989). 52 pp.

Audiovisuals

The Naked Earth. 1986, 25 minutes, Jr. High-Adult, VHS. Available for free loan. Write to: Public Affairs Office, The African Development Foundation, 1625 Massachusetts Ave. N.W., Suite 600, Washington, D.C. 20036. (202) 673-3916.

This film, produced by the National Council of Women of Kenya, presents a picture of life in Kenya and of the urgent environmental problems confronting this rapidly growing East African country. The film focuses on deforestation and the efforts of the Greenbelt Movement, a national tree-planting program. The film is locally made, has poor sound quality and the speakers often have strong accents. However these weaknesses are more than compensated for by the directness and genuineness of the presentation.

Road to Ruin: Only One Earth. 1987, 53 minutes, Jr. High-Adult, VHS. Purchase for approx. \$130 from Social Studies School Service, (800) 421-4246. Available for rental from PRB.

This three-part program explores the causes and effects of the world's environmental problems by highlighting specific concerns in three regions: the Sahel, Mexico and Scotland. The program begins by showing the array of factors contributing to water shortages and the desertification of the Sahel region of Africa. It then explores destruction of the rainforest in Mexico and the elimination of herring off the coast of Scotland. The study of the history, economy and culture of the peoples in each area helps the viewer understand the complex nature of environmental problems and solutions.



Lesson 3.1 Africa's Landscape and Population

Overview: In the past, Africa's ecosystem dictated human activity on the land. In the first part of this lesson, students examine this fragile relationship. Then students examine the rate of population growth in Africa and discuss the impact of rapid population growth on the land.

Region: Africa

Grade Level: 7–12

Learning Objectives:

Students will:

1. Understand the concept and implication of desertification.
2. Identify and state characteristics of the Sahel region of West Africa.
3. Compare the population growth rates of African countries to those of other countries.

Skills To Be Developed:

1. Reading and interpreting maps
2. Reading and interpreting tabular data

Vocabulary To Be Developed:

ecosystems, the Sahel, desertification, population explosion, fallow, deforestation, water cycle, land degradation, population growth rate, doubling time, rate of natural increase

Time Needed: 2 days

Materials Needed:

1. Copies of Reading: "Sustainable Development in Africa"
2. Copies of "Examining Population Growth and Change" (Lesson 2.6 Handout)
3. Map of Africa
4. Copies of the *World Population Data Sheet* and *World Environment Data Sheet*

Procedure:

DAY 1

1. Have students read the introduction to the article (up to "The Major Problems"). Discuss with them some of the indications of ecosystem stress--famine, floods, drought and displacement of people.

2. As students read "The Major Problems" section of the article, highlight the two problems:

Desertification and Population Explosion. Ask

them to speculate about the meaning of these two terms, and possible relationships between them.

3. As students read the section "Desertification" (up to the section entitled "The Population Explosion"), have them write down any words or terms with which they are unfamiliar. Discuss these words, creating a class vocabulary list, either on an overhead, on the board or in their notebooks.

4. When the students have read and discussed the "Desertification" section, have them focus on the world map showing the areas subject to desertification (page 17 of the *Student Resource Guide*). Have them locate the region discussed in the reading. How much of Africa is threatened by desertification? What problems might desertification pose for the people who live in Africa? What problems might desertification pose for people in the U.S.?

DAY 2

1. Have students read "The Population Explosion" section of "Sustainable Development in Africa." Review any unfamiliar terms.

2. Distribute Lesson 3.1 Handout. Have students use the worksheet to compare population growth in Africa with seven major countries. They will be using the rate of natural increase from the *World Population Data Sheet* and population change from 1990–2025 from the *World Environment Data Sheet*. (Explain that the growth rate for a country is indicated by the rate of natural increase on the data sheet. This rate does not include growth from migration, only births and deaths.) **Note: Countries with the same rate of natural increase in 1990 may have different rates of population change between 1990 and 2025; the rates of population change assume a non-constant growth rate.**

3. When students have completed the table, they should answer the following:

- a. What is the relationship between the rate of natural increase and the percent change in

Lesson 3.1 Continued

- population between 1990 and 2025?
- Compare the rates in the African countries with those of countries in other parts of the world.
 - What might be some causes of high growth rates in Africa?
 - What might be some consequences of these high rates?

Extensions & Variations:

1. Examine satellite maps of the Sahel region. What changes do they observe as they compare maps from different times? What seems to be occurring? Have them hypothesize about the appearance of a satellite map from a future year.

2. Research areas of the world where desertification is a problem. Study the climatic factors that produce the patterns of rainfall that typify West Africa. Read about human activities in this type of environment and investigate the current incidences of drought in Sahelian countries.

3. Have students create choropleth maps (see Lesson 2.4) using other variables from the data sheets.

4. Have students hypothesize about the future impact of population growth on the environment of selected countries. What additional information would they need to test their hypothesis?

Examining Population Growth and Change

Lesson 3.1 Handout

1. On the map of Africa, label the 12 countries that share the southern border of the Sahara.
2. Use the *World Population Data Sheet* and the *World Environment Data Sheet* to complete the chart below.

African Countries	<u>Rate of Natural Increase</u>	<u>Projected Population Change (%) 1990-2025</u>
Burkina Faso	_____	_____
Chad	_____	_____
Cote d'Ivoire	_____	_____
Ethiopia	_____	_____
Ghana	_____	_____
Guyana	_____	_____
Mali	_____	_____
Mauritania	_____	_____
Niger	_____	_____
Nigeria	_____	_____
Senegal	_____	_____
Sudan	_____	_____
<hr style="border-top: 1px dashed black;"/>		
Selected World Countries		
Brazil	_____	_____
China	_____	_____
India	_____	_____
Japan	_____	_____
Mexico	_____	_____
United States	_____	_____



Lesson 3.2 What's in an Age?

Overview: Africa's rapid rate of population increase has meant that an extraordinarily high percentage of the population is younger than 15 years old. The purpose of this lesson is to acquaint students with the effect of this "young" population on the productivity of a region and on the generation of capital reserves for future economic growth.

Region: Africa

Grade Level: 9–12

Learning Objectives:

Students will:

1. Explain and calculate age-dependency ratios.
2. Discuss the affect that the percentage of dependents in the total population has on the prosperity and growth capacities of the economy.
3. Examine the economic needs of dependent populations and compare these needs to the contributions to the economy made by dependent populations.

Skills To Be Developed:

1. Interpreting data
2. Computing rates

Vocabulary To Be Developed:

age-dependency ratio, economic surplus, capital investment, dependent

Time Needed: 1–2 days

Materials Needed:

1. Copies of the *World Population Data Sheet*
2. Map of Africa
3. Copies of "Age-Dependency Analysis Worksheet" (Lesson 3.2 Handout)

Procedure:

1. Distribute materials to students. Locate Mali, Kenya, Nigeria and Uganda on map of Africa. Explain that they will be working with these four countries today.

2. Complete the "Age-Dependency Analysis Worksheet" with the whole class using the age-dependency statistics for the U.S. from the *World Population Data Sheet*.

3. Ask students why they think people under 15 and over 65 are classified as dependents. Ask them to brainstorm the special needs of Americans in these two age groups. What kinds of goods and services do they demand? Then ask if these two groups usually contribute to the economic activities of the society? What? How much? Why or why not?

4. Now have students complete the worksheet for the four African nations. (Kenya=108, Mali=100, Nigeria=89, Uganda=104) How do the results compare with the results for the U.S.? Discuss with the class what problems these four nations may have that might not be as problematic for the U.S. To get at this discussion, have students assume that each worker produces enough wealth for two people (him/herself and one other person). In the U.S. the 100 workers will produce enough for 200 people. Now look at the ratio of dependents to workers in the U.S.: 51.5 (52) dependents for every 100 workers. This means that 152 of the 200 units of wealth produced by the 100 workers will be consumed (100 workers + the number of dependents), leaving a surplus of 48 units of wealth for other uses.

5. Have students calculate how much extra there will be in the four African countries. (Kenya = -8, Mali = 0, Nigeria = +11, Uganda = -4) Have students discuss what these results will mean for future economic growth of the region, and brainstorm ways in which capital for future economic investment could be obtained. How might governments go about solving the problem of having too many people and too few resources? In the short-term? What about long-term solutions?

Extensions & Variations:

1. Have students compute the age-dependency ratios for other countries or regions in Africa.

Age-Dependency Analysis Worksheet

Lesson 3.2 Handout

(Country A) (Country B) (Country C) (Country D) (Country E)

1. Percent of population under 15
Percent of population over 65

2. Add the two numbers in #1.
This is the percent of people in the "dependent" ages.

3. Subtract the answer in #2 from 100. This gives you the percent of people in the "working" ages in the total population.

4. Divide the number of dependents (#2) by the number of workers (#3) and multiply this answer by 100.

This gives you the number of people in the "dependent" ages for every 100 people in the "working" ages.



Lesson 3.3 Tools for Hypothesis Formation

Overview: Africa's population will continue to grow rapidly for many years. The purpose of this activity is to provide students with the tools to show relationships between population growth and change, quality of life and economic development.

Region: Africa

Grade Level: 7–12

Learning Objectives:

Students will:

1. Formulate hypotheses about the relationships between per capita GNP and other variables.
2. Construct choropleth maps.

Skills To Be Developed:

1. Interpreting data
2. Hypothesis formation
3. Preparing thematic maps

Time Needed: 1–2 days

Materials Needed:

1. Copies of the *World Population Data Sheet*
2. Copies of outline map of Africa (two per student)

Procedure:

1. Review the following concepts: percent of population under age 15, per capita GNP, life expectancy, infant mortality and rate of natural increase with students.

2. Have students create an area–value (or choropleth) map of Africa showing distribution of rates of per capita GNP (see Lesson 2.3 for instructions). Discuss the patterns in this map.

3. Now have students count off by fives. Assign each group with one of the following variables: life expectancy, infant mortality, total fertility, percent of population under age 15 and rate of natural increase.

4. The students should make a hypothesis about the relationship between their variable and the per capita GNP for Africa. For example: Countries with higher per capita GNPs will have lower infant mortality rates.

5. Have students construct a choropleth map using the second variable. They should then use the two maps to test their hypothesis.

6. Have students present their maps and the results of their hypotheses to the rest of class. Discuss similarities in patterns and reasons for particular correlations.



Lesson 3.4 Living on the Edge

Overview: The factors leading to land degradation are complex. In this simulation, students will play the parts of villagers in the mythical village of "Goma," somewhere in the Sahel region of Africa. As the village evolves from 1960 to 1990, students will be able to examine the roles that natural events (such as droughts), population growth and other human factors play on land use and food supply.

Region: Africa

Grade Level: 7-12

Learning Objectives:

Students will:

1. Understand the relationship between population growth and land use.
2. Describe other human factors and natural influences that affect land use.
3. Explain how these factors may join to affect the rate of desertification in arid and semi-arid regions of Africa.
4. Discuss strategies that could be used to fight desertification or to deal with the factors affecting desertification.

Skills To Be Developed:

1. Simulation
2. Problem solving

Vocabulary To Be Developed:

drought cycles, fallow, desertification, Sahel

Time Needed: 2 days

Materials Needed:

1. Yarn, string or masking tape
2. Paper plate
3. 10 pieces of green tissue paper
4. Two 14 oz. bags of Hershey kisses

5. Thirty spoon-size shredded wheat, unseasoned croutons (or other bland bite-size food item)
6. 12 small plastic bags
7. Sign "Goma Village"
8. Sign "The Big City"
9. Narrators' cards (see end of script)
10. Decision-making cards (see end of script)
11. Videotape: "Road to Ruin"

Procedure:

Preparation:

1. Arrange yarn in a closed circle to represent the village. All of the students in the class should be able to stand in this village. Also arrange yarn for the shape of "The Big City" about half the size of the village.
2. Place the appropriate signs near each area.
3. Cut out the narrators' cards and the decision-making cards. Write the appropriate population size, number of deaths and number of migrants in the blanks on the cards. (See charts and special instructions for numbers, which are dependent on class size.)
4. Count out the appropriate number of kisses and shredded wheat (see instructions in the script) and place in plastic bags. Use one bag for each kind of food for each year.
5. Crumple up the 10 pieces of tissue paper and throw them inside the village area.

Script:

Today we are going to participate in a simulation called "Living on the Edge." This will help give you an idea of the lifestyles of a settled population in the Sahel region of Africa (you may wish to show students this region on a map). Sahel is an Arabic word that means "shore," in this case indicating the fragile belt of grasses and forests that stretches across northern Africa for 3,000 miles, from Senegal to Somalia, and separates the Sahara from the southern equatorial rain forests. These people live in an area where it is important to keep a balance between humans and the environment; people living in this area depend upon the land for their survival.

First, I'm going to need some of you to come up and be Goma villagers. (Quickly count out the number listed on the chart below for 1960. Randomly distribute the Narrators' cards to students, including those not yet villagers.)

(Let students become situated.) This village needs a chief. The chief makes decisions about the use of resources in the town. Who would like to be the chief? (If no one volunteers quickly appoint someone.) We also need someone to be the keeper of the trees? The green paper represents trees; this is your only resource besides your farming land. (Appoint someone.) Your job is to plant or cut down trees according to the instructions of the chief.

Can we hear from the anthropologist please? (While the anthropologist is reading the card, give the chief food [Hershey's kisses] and the decision-making card for 1960.) Chief, this is your food for this year. This is the food that is grown naturally in this area. An adequately-fed person receives one unit of food; each item represents one unit of food. You may distribute the food now.

Now we would like to hear from the Goma Historian. (While the person is reading, quietly send the appropriate number of villagers into the area and give the chief the decision-making card for 1970. For this and future rounds make sure the chief distributes the correct amount of food and orders the keeper of the trees to get rid of the appropriate number of trees.)

Now we would like to hear from the Agricultural Expert. (While the person is reading, send villagers into the area, give the chief the decision-making card for 1975, see that trees are used for fuelwood and make sure that he trades a tree for some food. Give him the appropriate trade [see information on class size], but give him the bland food [e.g. shredded wheat] instead of the candy.)

Now we would like to hear from the Weather Person. (Send in villagers, give chief the 1980 decision-making card, make sure the forest is cut for fuelwood, and see that two trees are used to trade for food.)

Now we would like to hear from the Stork. (It is 1985. In addition to the tasks listed above, the chief must appoint a person to die and send migrants to the city. Decrease the size of the village by one-third by shortening the yarn.)

Now we would like a report on the region. Let's hear from the Reporters. (It is 1991. There are no trees left so natural food is distributed, a donation equal to a tree trade is received, more people die and migrate.)

Number of Goma Villagers to be Added per Round, by Class Size

<u>Class Size</u>	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>1991</u>
20	10 (10)	2 (12)	1 (13)	2 (15)	2 (17)	3 (20)
25	12 (12)	3 (15)	2 (17)	2 (19)	2 (21)	4 (25)
30	15 (15)	3 (18)	2 (20)	3 (23)	2 (25)	5 (30)
40	20 (20)	4 (24)	3 (27)	3 (30)	4 (34)	6 (40)
# of trees remaining at end of round	10	7	5	2	0	0

(numbers in parentheses are the total numbers of Goma people to be either in the village or in the city (or dead) at the end of each round)

**Number of Naturally Grown Food Units to be Distributed Each Round
(Hershey Kisses)**

Class Size	1960	1970	1975	1980	1985	1991
20	12	11	11	7	10	8
25	14	13	13	8	12	10
30	18	17	17	11	15	12
40	24	22	22	14	20	16

**Number of Traded or Donated Food Units to be Distributed Each Round
(Bland Food Item)**

Class Size	1960	1970	1975	1980	1985	1991
20	0	0	3	6	6	3
25	0	0	4	8	8	4
30	0	0	4	8	8	4
40	0	0	5	10	10	5

Special Instructions:

If your class size is 20, your trees will trade for three units of food. In 1970 you eliminate three trees due to cutting for fuelwood; one in 1975; and one in 1980. One tree is traded during 1975, two during 1980 and two in 1985. In 1985, one of your residents migrates to "The Big City." In 1991, two of your residents die and six migrate to "The Big City."

If your class size is 25, your trees will trade for four units of food. One tree is traded during 1975, two during 1980 and two in 1985. In 1970 you eliminate three trees due to cutting for fuelwood; one in 1975; and one in 1980. In 1985, one of your residents dies and one migrates to "The Big City." In 1991, there are three deaths and eight migrants.

If your class size is 30, your trees will trade for four units of food. One tree is traded during 1975, two during 1980 and two in 1985. In 1970 you eliminate three trees due to cutting for fuelwood; one in 1975; and one in 1980. In 1985, one of your residents dies and two migrate to "The Big City." In 1991, there are three deaths and eight migrants.

If your class size is 40, your trees will trade for five units of food. One tree is traded during 1975, two during 1980 and two in 1985. In 1970, you eliminate three trees due to cutting for fuelwood; one in 1975; and one in 1980. In 1985, one of your residents dies and three migrate to "The Big City." In 1991, there are three deaths and nine migrants.

Post-Simulation Wrap Up

After the last round, have students return to their seats and discuss and evaluate the decisions that were made by the chief and the results of these decisions. What would they have done? Discuss the problems that the tribe faced and other possible solutions. Watch the videotape, "Road to Ruin."

After students have learned about the Sahel, the simulation could be re-enacted. This time, let the students make their own decisions.

NARRATORS' CARDS

ANTHROPOLOGIST

It is 1960. The Goma tribe, consisting of a population of ___ people, lives in a village in the Sahel region of Africa. This is a semi-arid region, characterized by sparse, low brush, occasional clusters of trees and growing expanses of desert. Because of their new well, dug with the assistance of the Peace Corps, the Goma have been able to settle in this area. They survive by growing crops and raising livestock.

GOMA HISTORIAN

It is 1970. Our population has grown to ___. Our people used to be nomadic, moving every few years to allow the land to regain its nutrients. But we have now become settled because of closed boundaries and the availability of water due to our well. Because we have not left our land fallow, it has lost some of its ability to grow crops, so we cannot produce as much food as before. And we are using more of our trees for fuelwood. But, we still have a decent way of life.

AGRICULTURAL EXPERT

It is 1975. The population is ___. Because of overcropping, overgrazing and the destruction of the forest, the land is becoming severely degraded. The Goma have received donations of fertilizer from a rich donor and managed to maintain their level of food production, but did not grow enough to feed their people. They were forced to sell one of the trees to obtain cash to purchase food. The clearing of the forest is causing erosion, leading to further degradation of their land.

WEATHER PERSON

It is 1980. The population of the Goma tribe is ___. The Goma are in the middle of an area experiencing a drought. Their food production has dropped dramatically. The area in which they live has experienced periodic dry spells from as far back as 100,000 years ago. But because their population has increased and the tribe is settled, they are hit harder. In order to survive they have been forced to sell two more of their trees.

THE STORK

It is 1985. I have brought more people into the Goma village. The population now stands at ___. The drought is over, but the land has been severely degraded. All of the people cannot be supported. They are forced to sell their last two trees to provide food for the people. Still, some of their young men move to "The Big City" to look for work. Infants die from diarrhea. On top of that, the government has decided to use part of their land for cash crops, so that the growing urban population can be supported.

REPORTER #1

It is 1991. The population in the Sahel region has doubled since 1960. Tribes such as the Goma live on the edge of survival. Many members of their tribe have moved to urban areas, where 40 percent of the Sahelian population lives. But even there, they face harsh living conditions. Because these people live in such a precarious environment, because of their rapid population growth, and because of their extreme poverty, they live only to survive today. Saving the environment can only come after they save themselves. Let's go to my colleague who is reporting from the Goma village.

REPORTER #2

The people in this village are facing very difficult times. The drought earlier in the decade, along with deforestation and overcropping, has led to a severe decline in the productivity of the land. The government has taken over the best piece of land for cash crops. Their harvests have been meager. They did receive a donation of food from Japan, but it was not enough. ___ of their young people have moved to "The Big City" and ___ people died this year. Life here is very uncertain.

DECISION-MAKING CARDS

1960

You will have extra food. Hand out one piece per person. Save extra for the next round.

1970

Use the surplus food from the last round and save any extra.

Your tribe has used three trees for fuelwood between 1960 and 1970. Instruct the Keeper of the Trees to get rid of three trees.

1975

You do not have enough food units and your surplus won't add enough. You decide to sell one tree which will get you ___ extra units of food. Unfortunately, this food is not like the natural food in your area and the people in your village are reluctant to eat it. You must decide who gets the foreign food. Save any surplus for the next round.
You also have used one tree for fuelwood.

1980

You do not have enough food units and your surplus won't add enough. You decide to sell two trees for ___ units of food.

You have also used 1 tree for fuelwood during this period.

1985

You do not have enough food units to feed your population. You sell your last two trees for ___ units of food.

You send ___ young men (man) to "The Big City" to work and send money back to the village. ___ infant(s) die(s) from diarrhea.

1991

You do not have enough food units to feed your population. You receive ___ units of food from donor countries.

You send ___ young men to the city to look for work. ___ people die from various infectious diseases.



Lesson 3.5 Survival

Overview: News of environmental disasters and dangers have become more and more common in recent years. In this lesson, students will develop a list of the environmental problems in the Sahel region and discuss how human actions and natural causes contribute to these problems.

Region: The Sahel

Grade Level: 7 - 12

Learning Objectives:

Students will:

1. List solutions to the environmental problems in the Sahel.
2. Evaluate feasibility of suggested solutions.

Skills To Be Developed:

1. Critical thinking
2. Brainstorming
3. Problem solving

Vocabulary To Be Developed:

exports, natural resources, scarcity, desertification, ecosystems, arable, immigration, exodus, refugee

Time Needed: 1-2 days

Materials Needed:

1. Reading: "Survival in the Sahel"
2. Copies of "Evaluation Worksheet" (Lesson 3.5 Handout)
3. Optional: Film, "Road to Ruin: Only One Earth"

Procedure:

1. Divide students into groups of three or four. Have each group select a chairperson and a recording secretary.
2. Distribute copies of the reading.
3. After discussing the vocabulary words, have students read "Survival in the Sahel."
4. Have each group answer the following questions:
 - a. Natural environmental problems contribute to many other problems in the Sahel. What are some of those problems?
 - b. How do human actions contribute to these problems?
 - c. What resources seem to be scarce?

- d. How does scarcity of these resources contribute to other problems?
- e. What are people doing to survive?
- f. List some possible solutions to the problems that the people in the Sahel are facing?

5. Allow 15-20 minutes for group work.

6. Reassemble. Have each group report. Record their lists of problems and solutions on the blackboard.

7. Go back to the solutions and have the rest of the class orally evaluate the feasibility of each.

8. Have the class use the "Evaluation Worksheet" to evaluate one solution from each group. The groups should use points to evaluate each of the solutions based on the following:

- a. How feasible is the plan?
- b. Is the plan a long-term solution?
- c. Is the plan cost effective?

After points have been assigned for each solution, add up the points. List each group's best solution on a transparency to share and evaluate as a class.

9. Follow-up. Have students suggest specific actions that the government could implement to help solve the problem.

Optional: Show the first section (about 20 minutes) of the film "Only One Earth: The Road to Ruin." It is about desertification in Africa. Have students answer the following:

- a. Why has the fertility of the soil declined?
- b. What resources are scarce?
- c. To whom are the products exported? Why?
- d. Why does the speaker say "nature is not to blame?"

Extensions & Variations:

1. Read about strategies that have been attempted to solve environmental problems in this region. Have they been successful? Evaluate them in the same manner as students' lessons were evaluated.

Evaluation Worksheet

Lesson 3.5 Handout

Solutions:

Points

Feasibility Long-Term Solution Cost Effectiveness

Group 1

Group 2

Group 3

Group 4

Group 5

Group 6

Group 7

Group 8

4 points = Excellent
3 points = Good
2 points = Fair
1 point = Poor



Lesson 3.6 A Five-Child Family?

Overview: In a society where tradition often clashes with modern ideology, decision-making may be taxing. In this lesson, students act out the decision-making process of a married couple in an urban area discussing whether or not they will add another child to their family.

Region: Kenya

Grade Level: 9–12

Learning Objectives:

Students will:

1. Discuss attitudes affecting family size in Kenya.
2. Make a decision after listening to opinions.

Skills To Be Developed:

1. Role playing
2. Persuasive speaking
3. Problem solving

Vocabulary To Be Developed:

family planning, birth rate, quality of life, birth control, population growth rate

Time Needed: 1 day

Materials Needed:

1. Reading: "Kenya: From Birth Control to Population Management"
2. Copies of Lesson 3.6 Handout

Procedure:

1. Have students read "Kenya: From Birth Control to Population Management." Then read the background statement explaining Kenya's current population situation, history and government perspective.
2. Read students the scenario that describes a specific situation involving a decision concerning family size in Kenya.
3. Choose 10 students to be the participants in the role playing activity. They will represent the friends and relatives of the couple described in the scenario. Five males and five females should be selected. Give each student a description of their character.

4. It is important to make clear to the role players that they are not to merely read the description of their character. They are to act out the opinions of their character in a spontaneous and persuasive way.

5. All students who are not role players will pretend that they are the couple who must make the important decision about whether or not to have another child.

6. Conduct the role playing activity. If desirable, have some students play the roles of the couple so that the players are actually talking to someone. When it is over, allow the rest of the students to ask questions or have discussions with the role players.

7. Poll the students. Did they choose to have another child? Why or why not? What, if any particular argument, was the most important in affecting their decision?

Extensions & Variations:

1. Have students research attitudes about family planning in other cultures.
2. Have a three-way role-playing discussion/debate involving a Kenyan government family planning official, a local village leader representing the average citizen of Kenya and a World Bank representative who is an economic advisor.
3. List all of the reasons mentioned in the activity in favor of the additional child and those against. Look at these pros and cons from a typical Kenyan perspective. Rate each positive factor in terms of importance (+1, +2, or +3) and rate each negative factor (-1, -2, or -3). Add the positive and negative ratings. Discuss and compare the findings. Would you stick with your numerical answer?

Background:

Kenya has one of the highest rates of population growth in the world—3.8 percent per year. At this rate the population would double in 18 years. The rate of growth for the world is 1.8 percent and 0.8 percent in the United States. Kenya has grown from about 11 million people in 1969 to 25 million today. The average woman in Kenya has six or seven children; the average for women in urban areas is under five. The government believes that the population growth rate is too high and family size should be reduced. The Government introduced the National Family Planning Program in 1967. However, only 20 percent of married women are using modern methods of contraception. Programs must be appreciated and supported at the community level to be effective. It is difficult to achieve support for a variety of reasons—social, cultural and practical.

Scenario:

Jomo Kababu, his wife Patience Kababu and their four children live in the coastal port city of Mombasa, Kenya, where Jomo is a dock worker. He moved his family there three years ago from their rural village about 100 miles away because he needed to make more money to support his family. Patience has a job as a maid in a European Ambassador's home; her job is necessary to supplement the family income. The two oldest children sell fruit on the streets when they are not in school. The family is more financially secure than they were in their rural village; the children go to school, there is enough food to feed everyone and the oldest children have shoes. But, they must work hard to maintain their present standard of living. Jomo and Patience are discussing whether or not to have a fifth child. Jomo thinks they should. Patience disagrees. But, neither is sure because they want to please each other and their families and to raise their children well.

Student Roles:

1. Salim Mubanzi (Patience's Father). He is very strongly in favor of the couple having more children. Besides the fact that it is a strong tradition to have a large family to carry on the family name, having children is their security in old age. When the child reaches age five or six, he/she will be able to earn money. The government has no social security system for the elderly. The more children a couple has, the more children will be available to help take care of them when they get too old to work.

2. Sarah Kababu (Jomo's Mother). She strongly favors the couple having more children because it is Patience's duty to bear many children, especially because her husband wants more. It is a duty not only because large families are a tradition, but also a blessing (from God), a tremendous source of pride and important for social status.

Lesson 3.6 Handout

3. Soja Kimani (Government Employee--Family Planning Officer). He does not clearly advise for or against another child. He encourages the couple to base their decision upon the quality of life desired for the family. He wants them to carefully think about their ability to care for another family member considering their present incomes and work schedule. He encourages them to consider the effect of another child upon the family as a whole as well as upon each individual. He points out the many aspects of daily life that will or could be strained with an added family member (such as food allotments, clothing, child care, space, etc.)

4. Gichuru Adamba (Close Friend of Jomo). He thinks it is perfectly normal and desirable to have another child. He feels that the financial burden upon the family will be more than made up by government programs that will improve the quality of life for Kenyans. He feels that irrigation projects and improved agricultural methods will lower food costs. Transportation improvements will increase trade, which will increase wages and add jobs. He also feels that improved health care and sanitation methods will make life easier for Kenyans.

5. Claudette Martel (Wife of Patience's employer). She urges the couple not to have another child because of the strain that it would put on the wife and the rest of the family. She believes that it is impossible for government programs to keep up with Kenya's population growth, which she says is one of the fastest growing countries in the world. She has visited a semi-arid region of northern Kenya and has seen the results of desertification, which she thinks is largely a result of overpopulation. She fears that the effects of overpopulation will exploit the nation's resources.

6. Tenita Osimo (Patience's Sister). She feels strongly that the couple should not have another child. She points out that there are no family members in Mombasa, where the couple lives. Family members would help care for the children while the parents worked. Besides, the family has little time together now, because of their hectic lives. Another child would make the situation worse. Also, she would like the couple to send some of their income home to help take care of their elderly parents. Another child would make that impossible.

7. Abel Kababu (Patience's Uncle). He strongly feels that the couple should have more children. It is mainly to have a large family, to support them and to teach them how to support each other. He feels it is especially important to have more children because they are no longer close to the extended family back in the rural village and will be lonely without enough relatives to help him in an emergency.

8. Margaret Kete (Friend of Patience from the Neighborhood). She feels that it is time for Patience to take greater control of her life and take a stronger stand against having another child. She feels that, if necessary, the wife should practice birth control without her husband's knowledge to avoid having another child. She encourages the wife to attend school and take greater control in making decisions involving her welfare.

9. Violet Ayemba (Health Technician at the Local Government Clinic in Mombasa). She urges the couple to postpone making a decision about having another child until they can agree and are more financially secure than they are now. She is anxious to make birth control devices available and explain how and when to use them.

10. Olinga Otteno (Respected Tribal Leader from the Couple's Home Village). He is strongly opposed to any form of birth control or actions to limit the family size. Children are a natural part of marriage and it is taboo to interfere with what was meant to be. If necessary, the couple should move back to the village so that the extended family would all be available to help care for the younger children.



Lesson 3.7 Deforestation: Kenya

Overview: Most environmental problems are the result of a variety of complex factors. In this lesson, students outline the human and environmental factors that contribute to deforestation in Kenya.

Region: Kenya

Grade Level: 7–12

Learning Objectives:

Students will:

1. Outline the key points of an article.
2. Identify the factors contributing to and resulting from deforestation in Kenya.

Skills To Be Developed:

1. Reading
2. Classification

Vocabulary To Be Developed:

slash-and-burn, rapid population growth, the Sahel desertification, erosion, humus, watershed, biogas, paraffin

Time Needed: 1–2 days

Materials Needed:

1. Reading: "Kenya: Fuelwood and Population"
2. Worksheet, "Deforestation" (Lesson 3.7 Handout)
3. Optional: Film, "The Naked Earth"

Procedure:

1. In small groups, have students read, "Kenya: Fuelwood and Population." As they read, have them discuss the causes and consequences of deforestation that are mentioned in the article. Complete the worksheet.

2. After students have completed the worksheet and the class has discussed the results, show the film, "The Naked Earth." As students watch the film, have them consider the following questions:

- a. What percent of Kenya's foreign exchange goes to the purchase of energy products?
- b. What percent of Kenya's land remains under forest cover?
- c. What caused the first large-scale decimation of forests?
- d. What is the single largest industrial consumer of fuelwood today?
- e. What percent of Kenya's land is arable? What gets priority for scarce land resources?
- f. Who controls Kenya's export market?
- g. Besides industrial wood use, the greatest demand for wood is where?
- h. What percent of fuelwood is converted to charcoal?
- i. The narrator refers to an "environmental equation" that threatens Kenya's forests. What are the components of this equation?
- j. Give examples of the evidence that is shown of soil erosion.
- k. How much time does a Kenyan woman spend gathering wood each week?
- l. What is the Greenbelt Movement? How does it work? Who is the Greenbelt Ranger?
- m. Why does the Greenbelt Movement especially appeal to women's groups?
- n. What is the greatest contribution of the Greenbelt Movement?
- o. What is the significance of the film's title?

1. Factors Contributing to Deforestation

Natural

Human

2. Consequences Resulting from Deforestation

For the Environment

For the People

3. Addressing Problems Resulting from Deforestation

Solutions

Obstacles



Lesson 3.8 The Aswan Dam: Benefits vs. Costs

Overview: Egypt's pressing concerns include the pressures that a growing population places on food and water supplies. Most of Egypt's land area is desert. The Nile River is the main source of water. Building the Aswan Dam was supposed to solve the water crisis and provide energy for industrial development. Hindsight, however, reveals that there were environmental costs to the dam that its builders did not foresee. Are such high technology developments always an unmixed blessing? This lesson deals with the hidden costs of high technology on the environment. **Note:** Instructors may find it necessary to research the functions of dams so that this may be explained to students. The *Atlas of Environmental Issues* (see resource list at the beginning of this section) has a concise section on dams.

Region: Egypt

Grade Level: 9–12

Learning Objectives:

Students will:

1. Describe the geographic setting of the Nile Valley in Egypt.
2. Examine the human activities that are taking place in that setting.
3. Understand the economic concept of cost/benefit analysis.

Skills To Be Developed:

1. Observing photographic evidence
2. Hypothesizing

Vocabulary to be Developed:

reclaimed land, sustainable development, delta, oasis, salinity, sedimentation, hydrostatic, bilharzia, parasitic disease, irrigation, population growth rate, desertification, agro-management

Time Needed: 1–2 days

Materials Needed:

1. Reading: "Egypt: How to Look After the Nile"
2. Map of Egypt
3. Photographs of activities in the Nile River Valley (sugg. *National Geographic*)

Procedure:

1. **Note:** Complete exercises 2.1 and 2.2 for Egypt. **Or:** Have students look at the map and the photographs of the Nile Valley and make lists of characteristics of the physical environment and lists of all human activities shown in the photographs.

What kind of a place is this?

2. Ask students to hypothesize about the natural resources that will be especially valued in a desert environment. Now have students read the article. As they are reading they should try to answer the question: "Should the Aswan Dam have been constructed?" Review with them, if necessary, any vocabulary terms with which they are unfamiliar.

3. When students have completed the reading, divide them into groups of three or four. As a group they are trying to make a decision about whether the dam should have been built. Have them list the costs of the dam on one side of the page and the benefits on the other. As a group, students prioritize the costs and benefits. The group should attempt to agree on a decision and be able to rationalize their priorities.

4. Have the groups share their findings with the class. Compare the priorities and discuss their rationales. Have students discuss who, from the following group, might benefit the most from the dam:

- a. a farmer along the Nile who has received Aswan Dam water to irrigate his fields
- b. a farmer who received no water
- c. an Egyptian government official
- d. an industrialist in Cairo
- e. an urban worker in Cairo
- f. a sardine fisherman;
- g. a person who contracted bilharzia.

Extensions & Variations:

1. To show the population distribution of Egypt, pretend that the classroom is the country. Have students decide on the location of the Nile River, assuming that the front of the classroom is the Mediterranean coast of Egypt. Discuss with students

Lesson 3.8 Continued

where the largest percentage of the population lives. Have all but one or two students move into the region of the class that is the "Nile Valley." Why do so many people live in such a relatively small portion of the country?

2. In groups, students role play the characters listed in Procedure #4 above. Students may need to do additional research to adequately portray their character and his/her lifestyle, position or plight. Each person in the group should individually decide whether or not he/she would be for the dam. Then the group should list all their viewpoints. As a follow-up activity after the role play, assign a short essay asking students to summarize the costs and benefits of a high technology project like the Aswan Dam.

3. Using the *World Population Data Sheet*, have students find the population growth rate for Egypt. What will happen to the population density of the Nile Valley if that growth rate continues? How will this change in population density affect the lifestyle of the people of the Nile Valley?

4. Discuss the effects that such a change in population density will have on the ecosystem of the Nile Valley.

5. Brainstorm solutions to the problems that might be created by these changes in the population density of the valley.



Section IV Asia

Section IV begins with a reading, "Asia: The Land and Its People," that gives an overview of human population growth and land use patterns. Particular attention is paid to changing weather conditions and the impact on food production. The piece considers the amount of damage done to the environment by people trying to exist on the land and the effect that this interaction might have on weather conditions and future levels of food production. Two lessons go with this reading. Lesson 4.1 guides students in an examination of the connections between climate and food production. In the second lesson, "Connecting Regions: The Ganges Watershed," students define and describe a watershed, examining the Ganges watershed in detail.

The reading "Balancing Population and the Environment: The Challenge for Bangladesh" concentrates on the changes that have occurred in Bangladesh as a result of rapid population growth. In Lesson 4.3, students classify problems in Bangladesh as physical or human and discuss the relationship between the two. In Lesson 4.4, Bangladesh's precarious position as a low sea-level country is highlighted in a discussion of the causes and sources of global warming and the impact of sea-level rise on Bangladesh.

The effect of a growing human population on land and water resources is the focus of the last Asia reading, "People-Resource Balance: A Must in the Philippines." In Lesson 4.5, students examine the causes and results of environmental degradation and rank environmental problems by their level of importance.

Resources

Books

"The Greenhouse Trap," by Francesca Lyman. Boston: Beacon Press, 1990. 190 pp.

"Long Journey of the Brahmaputra," by Jere Van Dyk. *National Geographic* Vol. 174, No. 5 (November 1988). pp. 672-711.

Articles

"At the Crossroads of Kathmandu," by Douglas Chadwick. *National Geographic* Vol. 172, No. 1 (July 1987). pp. 33-65.

"The Mighty Himalaya: A Fragile Heritage," *National Geographic* Vol. 174, No. 5 (November 1988). p. 624.

"China: The Ecological Challenge-Population Pressures on Resources and the Environment," *Earthwatch* No. 34 (1989). pp. 8-9.

"Pakistan Linking Population to Conservation," *Earthwatch* No. 40 (4th quarter 1990). pp. 3-5.

"The Good News: Thailand Controls a Baby Boom," *Time* Vol. 133, No. 50 (November 1988). pp. 672-711.

From the Population Reference Bureau

"India's Population: Second and Growing," by Pravin and Leela Visaria. *Population Bulletin* Vol. 46, No. 4 (1981).

Audiovisuals

The Fragile Mountain. 1983, 56 minutes, Jr. High-Adult, VHS. Purchase for approx. \$250 from Sandra Nichols productions, Ltd., 502 Tideway Drive, Alameda, CA 94501. (415) 655-8753. Available for rental from PRB.

This excellent film shows how man must live in balance with nature in the Himalayas, where the mountainous landscape is the watershed for the Indian sub-continent inhabited by one-tenth of the world's population. The film shows how the number and intensity of floods has increased in the region

as the number of people has increased. Human interactions with the land—including farming in marginal areas, the use of livestock and the cutting of the forest for fuelwood—have led to deforestation and erosion, thus effecting the drainage system for the Himalayas. Programs to stem the problem, including alternate sources of energy, are discussed.



Lesson 4.1 People in an Uncertain Environment

Overview: With more than half of the population dependent on agriculture for their livelihood, the countries of Asia are often at the mercy of the environment, especially the climate. In this lesson students will construct climate graphs for a station in South Asia and consider the connections between climate and food production.

Note: The procedure includes reading "Asia: The Land and Its People." However, you may wish to have students read the piece before beginning this lesson.

Region: South Asia

Grade Level: 8–12

Learning Objectives:

Students will:

1. Construct a climate graph.
2. Compare climate graphs for different periods.
3. Describe connections between climate patterns and food supply.
4. Relate variations in climate to the meeting of basic needs.

Skills to be Developed:

1. Preparing graphs
2. Critical thinking

Vocabulary to be Developed:

climate graph, monsoon, drought

Time Needed: 2–3 days

Materials Needed:

1. Reading: "Asia: The Land and Its People"
2. Copies of climate data tables (Lesson 4.1 Handout)
3. Copies of blank climate graphs (see Lesson 2.3 Handout)
4. Graph paper
5. Copies of blank map of South Asia
6. *World Environment Data Sheet*

Procedure:

1. Discuss the term "monsoon." Explain to students that the monsoon (Arabic word meaning "wind") is a pattern of seasonally changing winds that dominates life in the South Asia region. The agricultural cycle depends upon the regular pattern of the summer monsoon, which brings rain for the staple grain crops upon which many people rely. In most years the monsoon rains arrive on schedule;

but, occasionally the rains are late or just do not come at all. In such years, drought leaves crops withering in the fields.

2. Have students read pages 1 to 3 in the reading (stop at "Carrying Capacity"). Discuss the results of the drought mentioned in the reading.

3. To help them understand the impact of drought, have students construct climate graphs for several years in the mid 1980s. Instead of having students construct all four climate graphs, have them "count off" and construct only one graph each. When they are finished, they should find students with the other three graphs and compare for variation. (See Lesson 2.1 "Connecting Environmental Clues" for instructions.) Data for this time period for the Amritsar station in the wheat producing region of India's Ganges Valley are found in Table 1.

4. Ask students if they think drought is a common occurrence or a chance, one-time event. In order to test their answer, have students construct a graph showing the average rainfall for June, July and August from 1960–1989, using data in Table 2. (A three-color line graph would be the best way to do this.) What pattern does this graph reveal?

5. Discuss the implications of variations in rainfall for people dependent on agriculture to meet their basic needs. Refer to the *World Environment Data Sheet* to determine the "Daily per Capita Calorie Supply as a percentage of the FAO Minimum Requirement" for the countries of South Asia. What would happen if the food supply were diminished due to drought?

6. Describe the connection between climate patterns and food production in South Asia. What are some social and political implications of this connection?

7. Have students read the rest of the Asia paper.

Lesson 4.1 Continued

Discuss the implications of population growth on food production in Asia. What implications does population growth have on land use for food production? What is the relationship between population growth, climate patterns and food production?

Extensions & Variations:

1. Investigate patterns of rainfall for the U.S. Are some regions in the U.S. subject to cycles of drought. Locate any such regions on a map and

construct climate graphs to illustrate patterns of climate. Is the risk of drought more or less serious for the U.S. than for South Asia? Why or why not?

2. Conduct research in order to compare recent patterns of drought in Africa's Sahel region with patterns identified in South Asia. What are the similarities or differences?

TABLE 1. Temperature and Precipitation Data for Amritsar, India (31 N, 74 E)

1985	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temp. (C):	12	15	21	26	31	32	29	30	29	23	18	14
Prec. (mm):	19	5	106	39	24	49	269	178	205	133	2	71
1986												
Temp. (C):	11	14	18	24	30	32	30	29	27	23	18	12
Prec. (mm):	2	61	20	36	29	24	180	193	93	5	11	23
1987												
Temp. (C):	12	15	19	25	26	31	31	30	29	24	17	13
Prec. (mm):	32	12	44	4	119	29	66	95	17	38	0	6
1988												
Temp. (C):	12	15	18	26	31	32	29	29	28	23	18	13
Prec. (mm):	12	15	88	12	0	49	218	144	309	5	0	47

Source: Joint Agricultural Weather Facility

TABLE 2. Precipitation Data for Amritsar, India: 1960 - 1989 (mm)

	June	July	August		June	July	August
1960	55	181	123	1975	83	229	140
1961	26	257	274	1976	80	208	--
1962	9	130	155	1977	117	127	167
1963	11	103	65	1978	113	230	351
1964	42	330	192	1979	95	177	13
1965	0	223	108	1980	91	404	162
1966	118	149	140	1981	0	365	36
1967	4	139	388	1982	17	47	115
1968	17	313	217	1983	5	123	101
1969	12	218	123	1984	40	284	245
1970	237	59	200	1985	49	269	178
1971	117	199	340	1986	24	180	193
1972	63	80	51	1987	29	66	95
1973	151	174	332	1988	49	218	144
1974	24	224	176	1989	34	275	75

Source: Joint Agricultural Weather Facility



Lesson 4.2 Connecting Regions: The Ganges Watershed

Overview: The Ganges—sacred river of South Asia, giver of life, deliverer of destruction—is the focal point of one of the earth's great watersheds. Up to 450 million people live within the catchment area of this great river, and depend upon it for life. But the ever-increasing numbers of people have created pressure on the land that threatens to destroy the delicate environmental balance which has supported life in the region for so long. In this lesson students will use maps and visual aids to understand the watershed and its problems. Then they will seek solutions through a role-play activity.

Region: South Asia

Grade Level: 9–12

Learning Objectives:

Students will:

1. Define and locate a watershed.
2. Describe the physical, demographic and economic characteristics of the Ganges watershed.
3. Identify problems associated with human activities within a watershed.
4. Suggest possible solutions for problems affecting watersheds.

Skills To Be Developed:

1. Reading maps
2. Interpreting maps
3. Problem solving

Vocabulary To Be Developed:

watershed, region, environmental degradation, deforestation, erosion, siltation, tributary, floodplain

Time Needed: 3–4 days

Materials Needed:

1. Copies of sketch map of river systems (Lesson 4.2 Handout)
2. Copies of blank map of South Asia, including rivers
3. Comprehensive atlas (sugg. *Rand McNally's Goode's World Atlas*)
4. Videotape: "The Fragile Mountain"

Procedure:

1. a. To help students understand the concept of a watershed, distribute copies of Lesson 4.2 Handout. Instruct students to use colored pencils to enclose each separate river system (draw a box around the river and the tributaries that go to that river). Point out that each enclosed area is a watershed.

b. Now encourage students to formulate a definition of "watershed." Have students share their definition and decide on one good definition.

2. Review the definition of a "region." Ask students to explain how a watershed is an example of a region.

3. Distribute copies of a blank map of South Asia. Have students identify and label the Ganges River and its major tributaries. Instruct students to enclose the Ganges watershed using a colored pencil.

4. Have students compare their map of the Ganges watershed with a physical map of South Asia in an atlas. Identify the major physical sub-regions of the Ganges watershed: mountains (Himalayas), floodplain, delta. Have students indicate these sub-regions on their maps of South Asia.

5. Now direct students to examine a population distribution map of South Asia in the atlas in order to describe the distribution of population within the watershed.

6. Finally, have students examine a map of the predominant economies of South Asia, and describe the main economic activities within the Ganges watershed.

7. To reinforce their observations, have students develop a narrative description of the physical, demographic and economic characteristics of the Ganges watershed.

8. As a class, watch "The Fragile Mountain." (The video is 60 minutes long; it may be best to show it in two parts.) While watching, direct students to:

- a. Compare the visual images in the film with the map and narrative descriptions that they have developed;
- b. Note problems, both causes and effects, that are shown in the film.

Lesson 4.2 Continued

After watching the film, guide students in a brainstorming session to develop a list of human and environmental problems that could or do affect the entire Ganges watershed. Once the list has been prepared, have students classify the problems according to the sub-region(s) affected: mountain, floodplain, delta.

9. Engage students in a problem-solving activity by announcing that they will participate in a "Ganges Watershed Regional Planning Conference."

- a. Divide the class into four groups representing Nepal, India, Bangladesh and the United Nations Environmental Program. Instruct each group to prepare a position paper and a list of proposals, representing their particular point of view, for addressing the most serious human and environmental problems facing the watershed region. (See Table 1 on this page for suggestions if students find it difficult to develop their proposals.)
- b. When each group has prepared proposals, convene the conference. Allow time for each group to present its proposals. Then allow each group to raise questions or objections concerning recommendations of other groups. Students must now negotiate for a regional plan that serves the interests of their group and of the region as a whole.

10. As a wrap-up exercise, have students discuss the connections between:

- a. Human activity and the local environment,
- b. Human activity in one place and the regional environment,
- c. Problems and solutions in one location and problems in another part of the region.

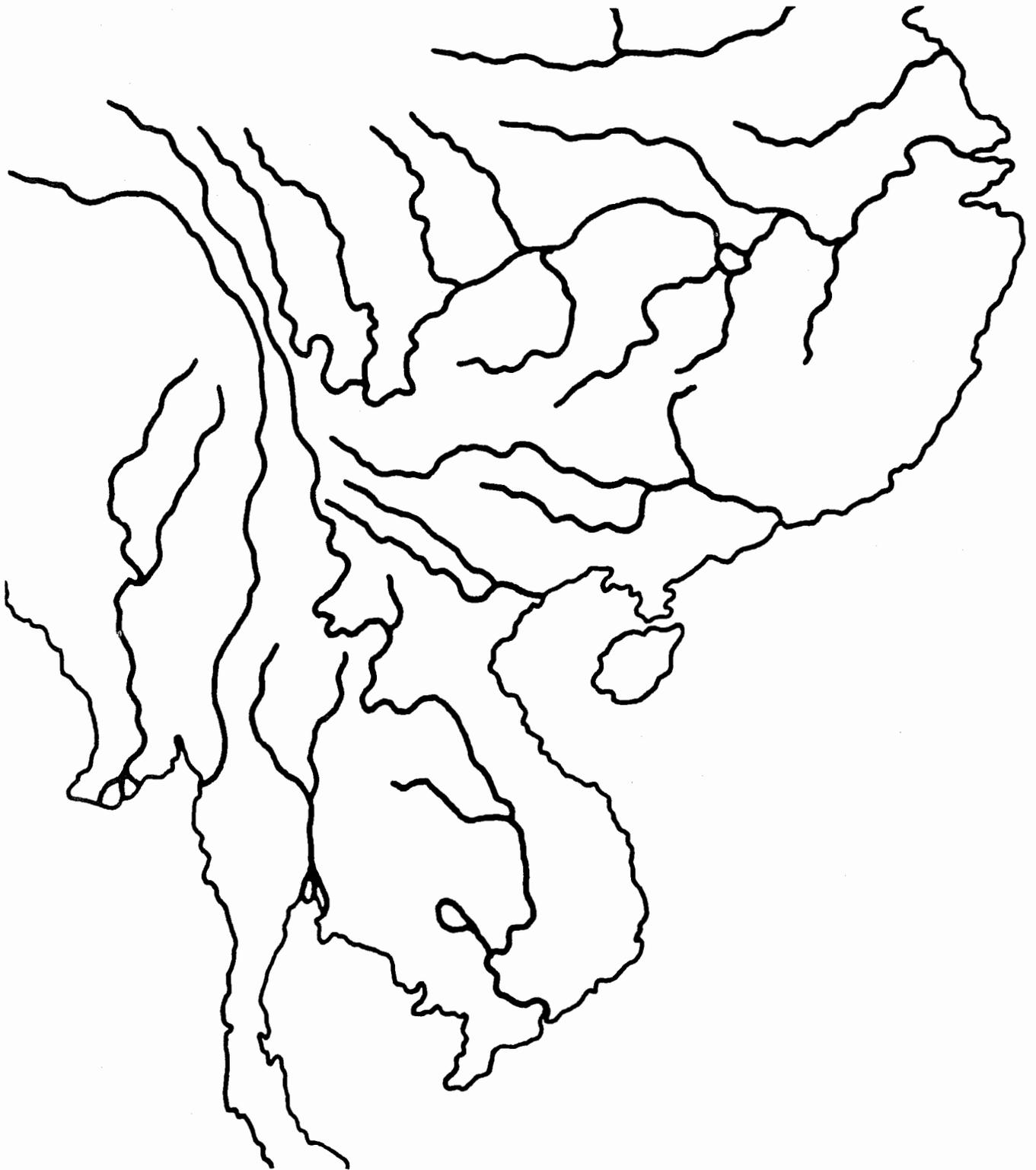
Extensions & Variations:

1. Have students create a poster or bulletin board depicting the Ganges watershed that incorporates pictures or illustrations of problems affecting the people and environment of the region.
2. Have students, working in small groups, research other watershed regions in the world to compare both problems and solutions with those studied in the Ganges watershed.
3. Encourage students to prepare a map of the watershed of a river near your community or in your state. Have them identify human and environmental connections between various uses of the watershed and problems or potential problems which may exist. How might use of the watershed in one area affect its potential use elsewhere? What laws exist to protect the watershed from abuse?

Some Ideas for Addressing Problems Facing the Ganges River Watershed

1. Pass laws forbidding the cutting of trees on the mountain slopes.
2. Build several flood control dams.
3. Relocate people living in areas affected by environmental degradation.
4. Pass laws limiting family size.
5. Establish tree nurseries that employ local farmers.
6. Apply for assistance from other countries.
7. Initiate programs of reforestation.
8. Open training centers to teach new farming techniques.
9. Limit the number of cattle or goats that each family can own.
10. Encourage the development of tourist attractions to generate income within the area.
11. Purchase dredging equipment to remove silt from the main channels of the river.
12. Build a new highway so that fuel oil can be purchased as a substitute for fuelwood.

NOTE TO TEACHER: The above list is in random order and includes suggestions only. It is not meant to be comprehensive, and students should be encouraged to develop ideas of their own as well. It should also be noted that not every suggestion in the list is either practical or good for the region. Students should be encouraged to question the list and consider the consequences of any course of action.





Lesson 4.3 Profiling Human–Environment Interaction

Overview: Following the format for developing a country profile, students will use readings, maps, data sheets and photographs to understand the conditions that affect life in South Asia's poorest country.

Region: Bangladesh

Grade Level: 7–12

Learning Objectives:

Students will:

1. Describe the physical environment of Bangladesh.
2. Describe the population of Bangladesh, including size, distribution and standard of living.
3. Explain the relationships between population pressures and environmental problems, and quality of life.

Skills to be Developed:

1. Classification
2. Reading tables
3. Interpreting data
4. Observing photographic evidence

Vocabulary:

migration, silt, delta, tidal wave, water table

Time Needed: 1–2 days

Materials Needed:

1. Reading: "Balancing Population and the Environment: The Challenge for Bangladesh"
2. *World Population Data Sheet* and *World Environment Data Sheet*
3. Atlas
4. Maps of Bangladesh
5. Photographs of Bangladesh (sugg. *National Geographic*)

Procedure:

1. Have students read "Balancing Population and the Environment: The Challenge for Bangladesh." As they read, have them make a list of problems confronting people in this country. When they have completed the reading, direct them to classify their list of problems as either physical or human. Allow time for students to discuss and compare their lists.
2. Follow the format described in Lessons 2.1 and 2.2 of this guide for developing environment and population profiles of a country.
3. When students have completed the profile of Bangladesh, discuss the relationship between the physical and human characteristics of the country and the problems described in the reading.

Extensions & Variations:

1. Create a timeline tracing the history of Bangladesh (previously East Pakistan) from 1947 until today. Speculate on how political circumstances in Bangladesh may have contributed to problems faced by the country today.



Lesson 4.4 Global Crisis--Local Disaster: Bangladesh

Overview: Global warming, resulting from a buildup in the earth's atmosphere of certain gases (known as greenhouse gases), is the focus of much attention and concern. In this lesson, students will use tables, charts, and maps to identify: 1) gases associated with global warming; 2) countries which have high net emissions of greenhouse gases; and 3) Bangladesh's connection to this global dilemma.

Region: Bangladesh

Grade Level: 7-12

Learning Objectives:

Students will:

1. Identify greenhouse gases and their sources.
2. Relate increasing concentrations of greenhouse gases to population growth.
3. Locate major producers of greenhouse gases.
4. Explain some consequences of global warming.
5. Relate the physical and human characteristics of Bangladesh to consequences of global warming.

Skills to be Developed:

1. Reading charts and tables
2. Interpreting data
3. Interpreting thematic maps
4. Hypothesizing

Vocabulary to be Developed:

global warming, greenhouse gas, carbon dioxide, methane, nitrous oxide, chloroflourocarbons

Time: 2-3 days

Materials Needed:

1. Readings: "Balancing Population and the Environment: The Challenge for Bangladesh" and "Disappearing Deltas"
2. Data table "The Greenhouse Index" (Lesson 4.4 Handout)
3. *World Population Data Sheet* and *World Environment Data Sheet*
4. Maps of Bangladesh
5. Atlas

Procedure:

1. Review "The World in 2000 AD" in the article "Balancing Population and the Environment: The Challenge for Bangladesh." Review the environment and demographic profiles (see Lesson 4.3 or

conduct Lessons 2.1 and 2.2 for this section) of Bangladesh, identifying major problems faced by this country.

2. Read "Disappearing Deltas."

3. Using the table, "Greenhouse Gases," discuss the following questions:

- a. What is the cause of global warming?
- b. Which gases are responsible for most global warming?
- c. What is the connection between global warming and population growth?

4. Examine the *World Population Data Sheet* and *World Environment Data Sheet*. Which columns tell something about energy use in a country? What information is not provided? Based on this information, try to determine the countries that are the greatest contributors to global warming.

5. Now examine the table, "Greenhouse Gas Producers," consider the following questions:

- a. Which countries are the six major producers of greenhouse gases? (Did these match the guesses from examining the data sheets?)
- b. What are the sources of greenhouse gases in these countries? What variations do you observe? How might you explain these variations?
- c. Compare Bangladesh to the top producers of greenhouse gases, in terms of amount and sources of emissions.
- d. Since it is only a minor contributor of greenhouse gases, do you think Bangladesh should be concerned about global warming? Explain your answer.

6. Based on the readings and discussion, have students identify some consequences of global warming. (Be sure that sea level rising and changes in precipitation patterns are mentioned.)

7. Direct students to review the physical and human

Lesson 4.4 Continued

characteristics of Bangladesh. Then allow time for brainstorming ways in which Bangladesh might be affected by global warming.

8. Distribute or project on an overhead, maps showing the distribution of population in Bangladesh and the coastal elevation of Bangladesh. To stimulate thinking, have students consider the following possible conditions:
- Assume a rise in sea level of one foot; on the elevation map, shade the area that would be inundated pink.
 - Assume a rise in the sea level of two feet; on the elevation map, shade the area that would be inundated red. Compare the elevation maps with the population distribution map; speculate on the effect of sea level rise on the people of Bangladesh.
 - Assume a change in precipitation patterns in South Asia. How would the population and economy of Bangladesh be affected by increased precipitation? Decreased precipitation?
9. Using Bangladesh as an example, explain the connection between changes in the global environment and local conditions at a particular place.

Extensions & Variations:

- Using the table "Greenhouse Gas Producers," encourage students to examine world patterns of greenhouse gas production by constructing a choropleth map.
 - Classify the producers into four categories on the basis of emissions produced.
 - Assign related colors (darkest for highest, lightest for lowest, etc.) to the four groups. Shade and label the countries on a world map.
- Using the table "Greenhouse Gas Producers," reclassify the countries according to the major source of emissions. Examine the new lists for patterns according to the type of emission.
- Working in small groups, have students consider the effects of global warming on other countries or regions of the world, such as coastal areas; major grain producing areas or the area in which they live.

Table 1. The Greenhouse Index: 50 Countries with the Highest Greenhouse Gas Net Emissions, 1987

Country	Greenhouse Index Rank	Greenhouse gases			Total	Percent of Total
		Carbon Dioxide	Methane	CFCs(a)		
United States	1	540,000	130,000	350,000	1,000,000	17.6
U.S.S.R	2	450,000	60,000	180,000	690,000	12.0
Brazil	3	560,000	28,000	16,000	610,000	10.5
China	4	260,000	90,000	32,000	380,000	6.6
India	5	130,000	98,000	700	230,000	3.9
Japan	6	110,000	12,000	100,000	220,000	3.9
Germany, Fed. Rep.	7	79,000	8,000	75,000	160,000	2.8
United Kingdom	8	69,000	14,000	71,000	150,000	2.7
Indonesia	9	110,000	19,000	9,500	140,000	2.4
France	10	41,000	13,000	69,000	120,000	2.1
Italy	11	45,000	5,800	71,000	120,000	2.1
Canada	12	48,000	33,000	36,000	120,000	2.0
Mexico	13	49,000	20,000	9,100	78,000	1.4
Myanmar	14	68,000	9,000	0	77,000	1.3
Poland	15	56,000	7,400	13,000	76,000	1.3
Spain	16	21,000	4,200	48,000	73,000	1.3
Colombia	17	60,000	4,100	5,200	69,000	1.2
Thailand	18	48,000	16,000	3,500	67,000	1.2
Australia	19	28,000	14,000	21,000	63,000	1.1
German Dem. Rep.	20	39,000	2,100	20,000	62,000	1.1
Nigeria	21	32,000	3,100	18,000	53,000	0.9
South Africa	22	34,000	7,800	5,800	47,000	0.8
Cote d'Ivoire	23	44,000	550	2,000	47,000	0.8
Netherlands	24	16,000	8,800	18,000	43,000	0.7
Saudi Arabia	25	20,000	15,000	6,600	42,000	0.7
Philippines	26	34,000	6,700	0	40,000	0.7
Lao People's Dem. Rep.	27	37,000	1,000	0	38,000	0.7
Viet Nam	28	28,000	10,000	0	38,000	0.7
Czechoslovakia	29	29,000	2,200	2,700	33,000	0.6
Iran	30	17,000	6,400	9,000	33,000	0.6
Argentina	31	13,000	12,000	5,500	31,000	0.5
Korea, Rep.	32	21,000	2,900	5,400	29,000	0.5
Turkey	33	16,000	3,600	9,200	29,000	0.5
Romania	34	25,000	3,100	0	28,000	0.5
Venezuela	35	19,000	4,700	3,200	27,000	0.5
Yugoslavia	36	15,000	2,800	8,200	26,000	0.4
Malaysia	37	22,000	1,400	2,500	26,000	0.4
Belgium	38	12,000	1,200	12,000	25,000	0.4
Algeria	39	8,400	12,000	4,100	25,000	0.4
Peru	40	22,000	870	0	23,000	0.4
Bangladesh	41	2,300	20,000	0	22,000	0.4
Ecuador	42	19,000	570	1,700	21,000	0.4
Greece	43	7,000	1,100	12,000	20,000	0.4
Korea, Dem. People's Rep.	44	18,000	2,300	0	20,000	0.3
Portugal	45	3,700	1,000	13,000	17,000	0.3
Egypt	46	9,000	3,100	5,100	17,000	0.3
Bulgaria	47	15,000	660	1,600	17,000	0.3
Austria	48	6,500	960	9,100	17,000	0.3
Zaire	49	16,000	790	0	16,000	0.3
Cameroon	50	16,000	580	0	16,000	0.3

(a) Chlorofluorocarbons

Carbon dioxide heating equivalents, 000 metric tons of carbon

Source: World Resources Institute.



Lesson 4.5 Balancing People and Resources

Overview: The fragile resource base of the Philippines is threatened by its rapidly growing population. In this lesson students will exercise reading and data collection skills to evaluate and propose solutions to human and environmental problems in the Philippines.

Region: Philippines

Grade Level: 8–12

Learning Objectives:

Students will:

1. Identify and explain causes of resource degradation.
2. Explain the connection between population pressure and environmental degradation.
3. Suggest and evaluate possible solutions for environmental problems.

Skills to be Developed:

1. Classification
2. Reading tables
3. Interpreting tables
4. Problem solving

Vocabulary To Be Developed:

natural resource, population growth rate, upland, sedimentation, erosion, mangroves, migration, slash-and-burn farming, quality of life, sustainable economic growth

Time Needed: 2 days

Materials Needed:

1. Reading: "People–Resource Balance: A Must in the Philippines"
2. Copies of *World Population Data Sheet* and *World Environment Data Sheet*
3. Copies of "Prioritizing Grid" (Lesson 4.5 Handout)

Procedure:

1. Have students read "People–Resource Balance: A Must in Philippines." As they read, have them make a list of problems contributing to or resulting from environmental degradation. In particular, students should note the following root causes and effects on land and water resource degradation, listed in paragraph 3 on page 4:

- a. high population growth rate
- b. poverty
- c. skewed distribution of resources
- d. undervaluation of natural resources
- e. ineffective government controls
- f. greed

2. Divide the class into six small groups and assign each group one of the conditions listed in #1 above. Using information found in the reading and in the data sheets, have each group develop an explanation, supported by facts and examples, of the condition that they have been assigned.

3. Allow time for each group to present a summary of their findings to the class. They should explain how the assigned condition contributes to environmental degradation and give examples of both causes and consequences. And they should speculate on the reasons why the condition exists.

4. When each group has made its presentation, have students discuss the problems they consider to be most serious. Working as a class, or again in small groups, have students classify the problems that they have identified in terms of priority. This can be done through discussion or by using the "Prioritizing Grid."

5. Once students have established the problems they consider most important, guide the class in a discussion of possible solutions. Remind students that even solutions have consequences that may not be obvious at first.

6. In conclusion, ask students why it is important to establish priorities in problem solving. Also ask them why different groups often set different priorities, even when presented with the same set of problems.



Section V Latin America

"Latin America: Population Growth and the Environment," is an overview of the population, environment and economic conditions in this region. Lessons 5.1, 5.2 and 5.3 deal with urbanization, a major concern in Latin America. In Lesson 5.1, students locate the major cities in Latin America and examine their geographic, political and economic characteristics. In Lesson 5.2, they examine the rapid population growth in these urban areas through a three dimensional graphing activity. The third lesson, "The Urban Environment," leads students to a discussion of urban environmental problems and the obstacles to solving these problems in both developed and developing countries.

Resources

Articles

"Andean Settlers Rush for Amazonia,"
Earthwatch No. 39 (3rd quarter 1990). pp. 7-9.

"Hug a Tree, Kiss an Herb," by S. Seibert.
Newsweek Vol. 113, No. 50 (May 1, 1989).

"A Prescription for Slowing Deforestation in Amazonia," by Philip M. Fearnside. *Environment* Vol. 31, No. 4 (May 1989).

"Rondonia: Brazil's Imperiled Rainforest,"
National Geographic Vol. 174, No. 6 (December 1988). pp. 772+.

"Saving the Rainforests," *Scholastic Update* (Teacher's Edition) Vol. 122, No. 11 (Nov. 3, 1989).

Audiovisuals

The City: Implications for the Future. 1972, 21 minutes, High School-Adult, 16mm. Available for rental from PRB.

The film is a study of the problems that come with urbanization, using Bogota, Colombia, as an example. It examines the reasons for flight from the rural areas to the urban centers, and the need for services (for example, the PROFAMILIA family planning program) and jobs to accommodate rural migrants.

The Urban Dilemma. 1987, 28 minutes, Jr. High-Adult, VHS. Purchase for approximately \$40 from PBS Video, 1320 Braddock Place, Alexandria, VA 22314-1698. (800) 424-7963. Available for rental from PRB.

This program tracks and compares urbanization in developed and developing countries and discusses problems such as pollution, sanitation and housing.



Lesson 5.1 The BIG Cities of Latin America

Overview: The city has dominated social and cultural horizons of Latin America because opportunities and hope for a better future are generally found in the city. In this lesson students will locate cities in Latin America, discuss the reasons for city sites and examine the character of large cities.

Region: Latin America

Grade Level: 7–12

Learning Objectives:

Students will:

1. Locate large cities in Latin America.
2. Speculate about the urbanization patterns in Latin America.

Skills To Be Developed:

1. Identifying locations
2. Preparing maps
3. Classification
4. Hypothesizing

Vocabulary To Be Developed:

urbanization

Time Needed: 1 day

Materials Needed:

1. Map of Latin America
2. World Atlas (sugg. *Rand McNally's Goode's World Atlas*)
3. Copies of blank political map of Latin America
4. Overhead transparency of chart "Largest Urban Areas in the World in 1950, 1990 and 2000" (included)

Procedure:

1. Have students use the atlas to locate the following Latin American cities: Belo Horizonte, Bogota, Buenos Aires, Caracas, Guadalajara, Lima, Mexico City, Monterrey, Porto Alegre, Rio de Janeiro, Santiago and Sao Paulo.
2. By using inquiry methods and the atlas (thematic maps), have students develop a list of the common characteristics of these cities. Use an overhead projector or the board to construct a chart or have students develop their own charts. The following is a list of possible characteristics to examine.

- a. Location (coast or inland, geographic features at site, hemisphere)
- b. Political (capital city)
- c. Economic (role in country's economy)
- d. Cultural life

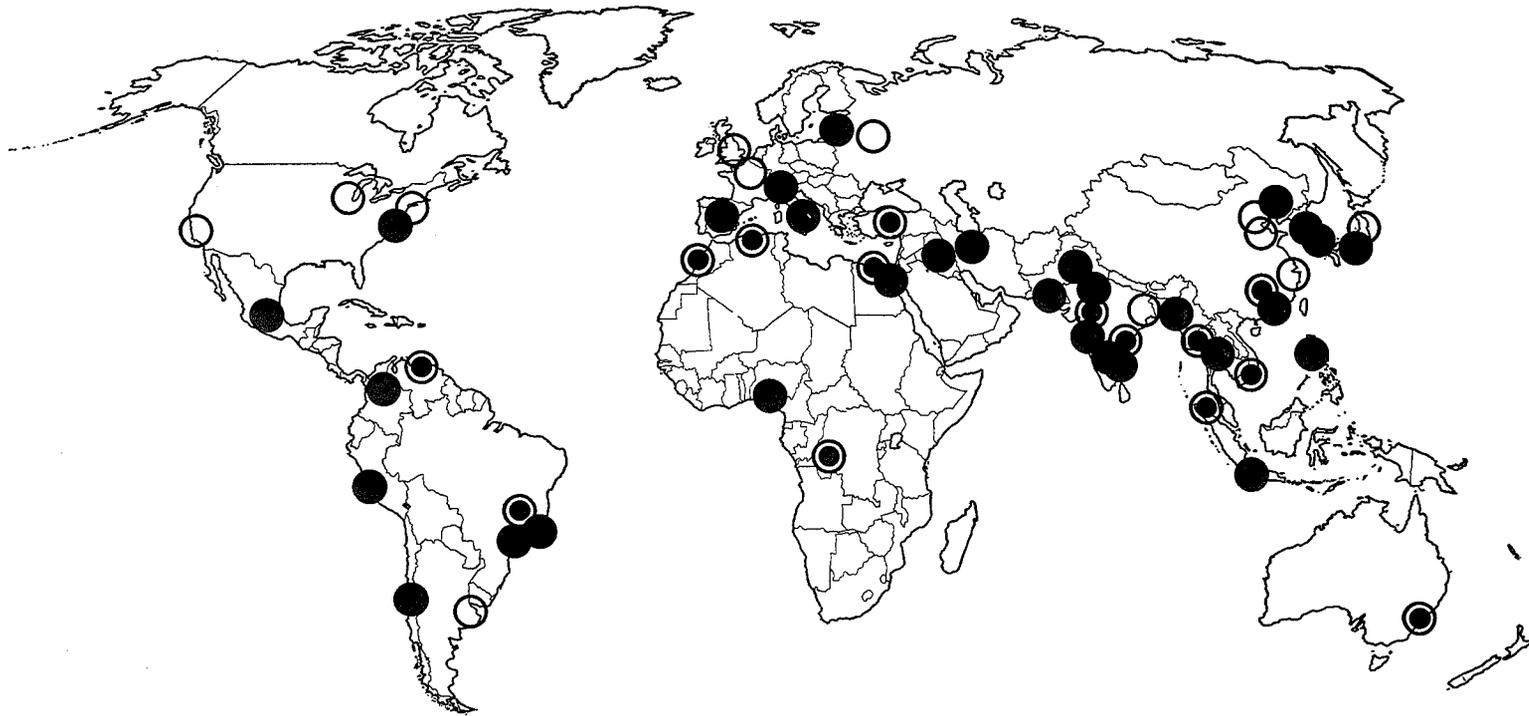
3. Now have students compare Latin American cities to other large cities in the world. Show a transparency of the chart, "Largest Urban Areas in the World in 1950, 1990 and 2000." Are most of the world's large cities located in the northern or southern hemisphere? Why are more cities located north of the Equator? Is this a surprise? Where are other cities of similar size located? Are more in Europe? Asia? America?

4. Look at other thematic maps of Latin America. Do these cities have similar climates, topography, sources of energy, natural hazards, economic patterns, and most importantly, what is the population pattern surrounding these cities? What conclusions are you able to draw about Latin American "millionaire" cities?

Extensions & Variations:

1. A city is called a "primate city" if it is by far the largest city in a country and dominates in terms of size and political, economic and cultural importance. Examine the 12 cities listed in Procedure #1 and determine if any of these cities fits the definition of "primate city." Some questions: What proportion of the country's population resides in that city? Is it the capital city? What is the country's economy like? Where is the country's economic center? Where do people who are seeking a "better life" migrate?
2. Further examine the background of Latin American cities. Are they former colonial regions? Is migration from the countryside a major factor in their growth? Is technology or industrial development in the country a factor in their growth? What other nations are providing incentives for growth in these countries?

Largest Urban Areas in the World in 1950, 1990 and 2000



- 4 million and over since 1950
- 4 million and over since 1990
- ◐ 4 million and over in 2000 (projected)



Lesson 5.2 Millionaire Latin American Cities

Overview: There are more cities of over 2 million people in Latin America than there are in the U.S. In this lesson, students will construct three dimensional graphs to demonstrate growth of urban regions in Latin America. **Note:** This lesson is designed to follow Lesson 5.1 "The BIG Cities in Latin America." Students learn about the location of these cities in this lesson.

Region: Latin America

Grade Level: 7-12

Learning Objectives:

Student will:

1. Construct three dimensional graphs.
2. Describe the patterns of population growth in Latin American cities.
3. Examine the urban and rural population distribution in Latin America.

Skills To Be Developed:

1. Preparing graphs
2. Interpreting data

Time Needed: 1-2 days

Vocabulary To Be Developed:

urban, rural

Materials Needed:

1. 32 blue poker chips, 95 red poker chips, 114 white poker chips
2. Large map of Latin America
3. Copies of Table 1 with population figures for selected Latin American cities (Lesson 5.2 Handout)
4. Copies of the *World Population Data Sheet*
5. Reading: "Latin America: Population Growth and the Environment"

Procedure:

1. Break students into 12 groups with two or three students per group. Using Table 1 (Lesson 5.2 Handout) showing the list of the 12 largest cities in Latin America, assign a city to each group of students. Have students construct a three dimensional graph of the population growth from 1960 to 2000 for their city. To do this: use the poker chips in the following manner: each chip represents 1 million people. Blue = 1960, Red = 1990, White = 2000. Round off the population figure given for each of the 12 cities to the nearest

million. Stack the appropriate number of chips for each year on the map close to the city location.

Note: Instructor may want to demonstrate with the whole region of Latin America. 1960 = 107 million, 1990 = 324 million, 2000 = 416 million. Use two chips per 100 million people for this example.

3. Have students explain the growth patterns for these cities. Have students speculate on reasons for the rapid growth. What would likely be the average age of people in these cities? Look at the *World Population Data Sheet* to determine the percent of the population under age 15 in that country. (The average age is probably fairly young.) How is that going to influence future population growth? (These people will be adding to the population by having children.)

4. Now have students use the poker chips to represent the urban and rural populations of Latin American countries and compare them to other regions of the world. Assign one of the following regions/countries to each group: Latin America, Africa, Asia, North America, Europe, Brazil, Argentina, Chile, Peru, Colombia, Mexico and Venezuela. Using the *World Population Data Sheet*, find the column showing the percentage of population residing in urban areas. Using one poker chip to represent 10 percent, graph the urban and rural populations for each area. Use blue poker chips for urban and red for rural.

5. Have the students compare the graphs for the five regions. How does the urban population in Latin America compare to other regions? How do the urban populations in Latin American countries compare to one another?

6. Discuss the consequences of rapid urban growth in terms of the environment and in meeting the needs of the urban population. How difficult is it to provide services, particularly those that will reduce environmental pollution (such as rapid transit) or

Lesson 5.2 Continued

health problems (such as providing sanitary water), to a large and rapidly growing population? Here are some U.S. examples:

- a. The cost to build the Washington D.C. subway system to-date is \$5.6 billion. In 1990 the system was 73 miles long. Plans are to build to 101 miles at a total cost of \$10 billion. Building began in 1969 and 89 miles are expected to be completed in 1993.
- b. In 1853, the construction of the Washington D.C. water system began. When it opened in 1859 it was already inadequate to serve the population. It was expanded and was completed in 1907. The total cost \$4.5 million. Between 1850 and 1910 the population grew from 52,000 to 331,000.

Extensions & Variations:

1. Students might enjoy going further with this activity by creating a list of the largest urban areas in the world for 1960, 1990 and 2000 and repeat the exercise using the chips. For a vivid visual effect, a world map could be placed on the floor.
2. Have students research the growth patterns of cities in more developed countries.

Table 1

Lesson 5.2 Handout

**Latin American Cities
Population Size 1960, 1990 and 2000 (projected)
(in millions)**

City	1960	1990	2000
Belo Horizonte	0.87	3.81	5.01
Bogata	1.30	5.59	6.94
Buenos Aires	6.69	11.58	13.05
Caracas	1.28	3.96	4.79
Guadalajara	0.88	3.06	3.89
Lima	1.69	6.50	8.78
Mexico City	4.93	19.37	24.44
Monterrey	0.88	2.88	3.75
Porto Alegre	1.01	3.11	3.94
Rio de Janeiro	4.93	11.12	13.00
Santiago	2.03	4.70	5.58
São Paulo	4.71	18.42	23.60

Source: United Nations



Lesson 5.3 The Urban Environment

Overview: Rapid growth in Latin America has been one contributor to environmental problems in some cities—air pollution, lack of sewage, inadequate waste disposal, etc. In this lesson students will read about specific incidences of environmental problems in Latin American cities, discuss the origins of those problems and compare them to environmental problems in more developed countries.

Region: Latin America

Grade Level: 7–12

Learning Objectives:

Students will:

1. Discuss the sources of environmental problems in Latin American cities.
2. Research environmental problems in developed countries.
3. Compare and contrast efforts to correct environmental problems in Latin America with developed countries.

Skills To Be Developed:

1. Classification
2. Speculation
3. Research skills
4. Analysis of problem solving

Time Needed: 2–4 days

Materials Needed:

1. Reading: "Latin America: Population Growth and the Environment"
2. Copies of newspaper page, "Tales From An Urban Diary" (Lesson 5.3 Handout)

Procedure:

1. Review or read, "Latin America: Population Growth and the Environment." Discuss the environmental problems that are mentioned in the article. Ask students to list the causes and explain how they impact the environment. Point out the extra stress from growing populations, the difficulty governments have in adapting to such rapid change and the effect of the economy.
2. Review the last part of the discussion from Lesson 5.2. What are the consequences of rapid population growth on the environment?
3. Explain to students that they are now going to

read about some specific environmental incidents in Latin America cities. Pass out the newspaper page, "Tales From An Urban Diary," to students. Have them read the page.

4. Ask students if they think any of the stories are true. Have them indicate the stories that they believe are true and ask them why they think these are valid. Tell them that all of the stories are true.

5. Ask the following: How could these problems happen? Why don't they just clean them up? What are the obstacles to correcting these problems?

6. Ask them if they can think of similar problems occurring in the U.S. or other developed countries. What was done in these situations?

7. Have students select a specific situation in the U.S. or other developed nation. Possible topics include: toxic waste dumps, medical waste, landfills, nuclear testing, water pollution, acid rain, smog, sewage. Use periodicals and newspapers from the library for research. Students should try to answer the following questions. How did this happen? How much time passed between the time the problem started and the public reacted or a disaster occurred? Why wasn't the problem taken care of immediately? What were some of the obstacles to solving the problem? (Consider: technology, political and monetary factors.)

8. Have students present reports to the class. Compare U.S. problems with Latin American problems.

Extensions & Variations:

1. Have students write an issue of "Tales From An Urban Diary."
2. Have students calculate the age-dependency ratio (see Lesson 3.2) for Latin American countries. Do they think that these countries have the money to attack environmental problems?

The Environmental Review

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Tales From An Urban Diary Environmental Nightmares

School's Out for Local Children

Smog Delays Classes

Mexico City schools opened two hours late to protect schoolchildren in this severely polluted city from the hazards of atmospheric inversions, most common on winter mornings. During the last week of January 1987, respiratory problems were 23 percent higher than in the six previous weeks.

Washing the Sky Out With Soap?

Air-Cleansing Spray Linked to Respiratory Disease

In Santiago, Chile, a mixture of water and detergent has been sprayed over the city in order to fight smog. The airplane service that sprayed the detergent claims that it helps particles stick to the water, which then drizzles downward. The service says that the drizzle is so light that residents do not notice it, but physicians have reported an increase in respiratory illnesses, especially among children.

Cardboard Houses Built on Swamp of Human and Animal Waste Lead to Epidemic of Sanitation-Related Diseases in Port-au-Prince Haiti

Knee Deep in Muck

Balboa Street, in Colon, Panama, is knee deep in a fetid, week-old pool of dark water, half-covering mounds of garbage and emitting a stream of maggots. A resident remarked, "The stench is overwhelming. It disgusts me." She believes that the clogged sewer and rotting garbage is the reason that her baby is always sick.

Birds Dropping Like Flies

Fowls Fall to Foul Air

The air of Mexico City is so polluted that thousands of robins and cedar waxwings, flying over the city on their annual migration last year, died. Their bodies unexpectedly rained down on the city below. Alarmed residents gathered the birds and presented hundreds of them to the environment ministry. The government claimed that the birds died both from pesticide poisoning they received in the United States and from exhaustion.

More on page 2

And on the Fifth Day—No Car

Mexico City's Innovative Way of Curbing

Air Pollution

Residents in Mexico City must leave their cars at home one day a week or face fines equivalent to \$115. The program, "Day Without a Car," was started by government policymakers to help combat air pollution. Ecologists say that the 3 million vehicles are responsible for two-thirds of Mexico City's air

pollution. Studies have shown that the air was three times as noxious this year as in 1986.

More Babies Suffering Blood Poisoning

According to a study, 70 percent of all newborns have unacceptable levels of lead in their blood. Lead in children has been shown to cause reduced intellectual capacity. At least 85 percent of air pollution comes from motor vehicles. Many still use leaded gasoline.



Lesson 5.4 You Can't Hear a Tree Fall If You Are Not Listening

Overview: Deforestation is a major global ecological issue. However, a variety of viewpoints on this issue exist within one culture. Students investigate and develop proposed solutions to the questions raised by this environmental issue and adapt them to a Latin American culture.

Region: Latin America

Grade Level: 7–10

Learning Objectives:

Students will:

1. Develop a working understanding of opportunity costs.
2. Research and evaluate the issue of deforestation.
3. Organize researched information and prepare responses for panel/debate format.
4. Present findings to class based upon their assigned role in society.
5. Establish criteria for evaluating viewpoints.

Skills To Be Developed:

1. Critical thinking
2. Research skills
3. Role playing
4. Decision-making

Vocabulary To Be Developed:

deforestation, greenhouse effect, opportunity costs

Time Needed: 3–5 days

Materials Needed:

1. Reading: "Latin America: Population Growth and the Environment"
2. Copies of "Panel Considerations and Viewpoints" worksheet (Lesson 5.4 Handout 1)
3. Copies of "Decision Making Grid" (Lesson 5.4 Handout 2)
4. Overhead transparency of excerpt from *The Next One Hundred Years*

Procedure:

DAYS 1 and 2

1. If time allows, have students review the reading, "Latin America: Population Growth and the Environment." If they have not already read it for

another activity, ask them to read from the beginning to the "Watershed Management" section.

2. Lead students in a discussion of how the environment affects their quality of life. As part of the discussion, ask students to focus their attention on Latin America. Poll them as to which environmental issue has the most significance for the region and what are the reasons for their choices. Recognize the validity of all opinions, but focus on the issue of deforestation and its economic impact.

3. Project the excerpt from *The Next One Hundred Years* on an overhead projector (or pass out copies) and ask students to read it. Keep the quotation available throughout the activity.

4. Divide the class into the following six groups: Subsistence Farmers, Loggers, Cattle Ranchers, Environmentalists, U.S. Government Observers and Latin American Government Officials.

5. Groups' objectives: Through library research each group will defend the group's position on the following statement: "Deforestation releases carbon dioxide into the atmosphere and reduces the absorption of this greenhouse gas through photosynthesis, in this way adding to the global warming threat." They need to prepare:
 - a. their reaction to the statement,
 - b. their reasons for this stand and
 - c. a list of the immediate versus long-term results of their position.

6. Suggestions for preparing and conducting presentations: Ask groups to delegate responsibilities for providing data to all group members. Each group should provide statistical information, an oral report and visual aids. All group members should appear in costume for the presentations. (Presentations may be videotaped to be used as a future teaching aid.)

Lesson 5.4 Continued

DAYS 3–4

1. Distribute the handout entitled, "Panel Considerations and Viewpoints" to every student. Inform students that the handout is for personal note taking purposes. They will use their notes during the question and answer session which will follow the six presentations.
2. You will act as the moderator. Introduce the first group. (Recommended order of presentation: a) Cattle Rancher, b) Subsistence Farmer, c) Logger, d) Environmentalist, e) National Government Official, and f) U.S. Government Observer.) The group responds to the objectives outlined in Procedure #5 (Days 1–2).
3. Have as many groups as time allows do their presentations. If you must continue on Day 4, summarize the day's activities and instruct the students to formulate a synopsis for each viewpoint presented that day. Do the same thing when the presentations are finished on Day 4.

DAY 5

1. Distribute the "Decision-Making Grid" (Handout 2) to every student. Using their notes from the "Panel Considerations and Viewpoints" sheet, students should review the viewpoint of each group and indicate on the grid whether they would respond positively or negatively to each of the criteria. (Note: Space has been left for two additional concerns that may be drawn from class suggestions.)
2. Discuss the results of the completed grids as a class. Contrast the incidence of personal economic choices with those of more general concern. Explain to your students the need to understand that every viewpoint or opinion is susceptible to biases and subjectivity. The result of subjective choices is opportunities gained or lost. Recognizing opportunity or indirect costs of a decision may result in more informed choices—those that benefit not only individuals, but society and its future.

Excerpt: *The Next One Hundred Years* by Jonathan Weiner

"Climatologists believe the [forest] clearings may raise local temperatures in large areas of the tropics by as much as 3 to 4 degrees Centigrade—a local warming that is larger than the tropics can expect from the greenhouse effect. That may drive the climate of the tropics beyond the conditions that gave rise to the forests in the first place. In the next hundred years large portions of the equatorial rain forest belt, the greenest wilderness in the world, could turn into some of the fiercest desert."

Panel Considerations and Viewpoints

Statement: Deforestation releases more carbon dioxide into the atmosphere and reduces the absorption of this greenhouse gas through photosynthesis, in this way adding to the global warming threat.

Reactions and Viewpoints

1. Cattle Rancher
2. Subsistence Farmer
3. Logger
4. Environmentalist
5. Latin American Government Official
6. U.S. Government Observer



Section VI World Wrap-Up

The reading for the final section, "World Citizens Must Change Their Ways," describes how a variety of people from different countries all contribute to the "greenhouse effect." It details the contributions of these citizens and suggests possible ways that they might change their behavior to reduce their contribution to global warming. This article stresses that although there is such diversity among people on the globe, they all contribute to a common problem. Therefore, finding solutions must also be a joint effort.

Lesson 6.1 encourages students to think about their connections to people in other places and how local consumption may affect global resource availability. It also gives students the opportunity to consider ways that they can help improve the environment.

Resources

Books

Earth. The Earth Works Group. Berkeley, CA: Earthworks Press, 1989. 96 pp.

The Global Ecology Handbook: What You Can Do About the Environmental Crisis. The Global Tomorrow Coalition. Boston: Beacon Press, 1990. 414 pp.

Audiovisuals

Do We Really Want to Live This Way? (from the "Race to Save the Planet" series). 1990, 60 minutes, High School-Adult, VHS. Purchasing information from the Annenberg/CPB Project at (800) LEARNER, P.O. Box 1922, Santa Barbara, CA 93116-1922. Available for rental from PRB.

The price of progress--smog, toxic wastes and contamination of once-pristine waters--is examined as this program investigates the byproducts of Western industrial lifestyles.

Only One Atmosphere (from the "Race to Save the Planet" series). 1990, 60 minutes, High School-Adult, VHS. Purchasing information from the Annenberg/CPB Project at (800) LEARNER, P.O. Box 1922, Santa Barbara, CA 93116-1922. Available for rental from PRB.

This program explores the global commons of the atmosphere. The worldwide impact of global warming demands an international response that may be the biggest environmental challenge that society has ever faced.

Articles

"Twenty-Five Everyday Ways to Help Clean Up Our Planet," by D. MacEachern. *Ladies Home Journal* Vol. 107, No. 244 (April 1990). pp. 224.

"Will Changing Your Lightbulbs Save the World?" by C.A. Moore. *International Wildlife* Vol. 19 (May-June 1989). pp. 18-23.

"Your Contribution to Global Warming," by G. Barnwell. *National Wildlife* Vol. 28, No. 53 (February-March 1990) (special issue).

Spaceship Earth: Our Global Environment. 1990, 25 minutes, Jr. High-High School, VHS. Purchase for \$32.95 (includes postage) from WORLDLINK, 8755 W. Colgate Ave., Los Angeles, CA 90048. (213) 273-2636.

This award-winning production does an excellent job of illustrating the critical problems of global warming, deforestation and ozone depletion, while at the same time presenting workable solutions. Hosted by young people, the film takes viewers around the world and to outer space as they discuss the ways consumption in one part of the world may affect life in another. The music-video style of this production makes it appealing to a wide audience. This presentation includes interviews with rock musician Sting, the director of the United Nations Environment Programme, and words from world astronauts and cosmonauts.



Lesson 6.1 Wrapping Up: Making Global Connections

Overview: The products and resources that an individual consumes can have an impact on the global environment and other world citizens. The purpose of this lesson is to help students understand that the actions of people in one part of the world may affect people in other regions. Students also evaluate their own actions.

Region: World

Grade Level: 7-12

Learning Objectives:

Students will:

1. Explore the impact of local actions on the global environment.
2. Explain the consequences of one person's actions.
3. Relate the physical and human characteristics of an area with respect to an environmental problem.

Skills To Be Developed:

1. Brainstorming
2. Speculation
3. Problem solving

Vocabulary To Be Developed:

campesinos, methane, carbon dioxide, slash-and-burn agriculture, deforestation, chloroflourocarbons, greenhouse gas, greenhouse effect

Time: 2-3 days

Materials Needed:

1. Reading: "World Citizens Must Change Their Ways"
2. Videotape: "Spaceship Earth"

Procedure:

1. Ask students to come up with some ideas of how things they do and products they use may affect people living in other countries or the global environment. Give them time to brainstorm.
2. Have students read, "World Citizens Must Change Their Ways."
3. When students have finished reading, discuss the impact that the actions of each person described in the article could have on the environment. Who do you think contributes the most to the "greenhouse effect?" Discuss some of the solutions described to limit contributions to the greenhouse effect. Can

you think of other solutions?

4. Now have students break up into smaller groups. Have students choose a topic (such as deforestation, acid rain, land degradation). Have them pick some "world citizens" and list some ways that each may contribute to this problem.

5. Share each group's "world citizens" with the class. Discuss contributions, possible solutions and the viewpoint of each citizen.

6. Watch the videotape, "Spaceship Earth."

7. Discuss the videotape. Have students review the impacts of citizens' actions on other citizens. Have students again discuss how their actions might affect other world citizens. Have them brainstorm about programs in their community being implemented to help the environment. Have them evaluate these programs. What else can they do?

Extensions & Variations:

1. Have students record the products they use in a diary. Discuss the implications of their choices.

2. Have students carry their garbage in trash bags for a week (one bag for recyclable and one for non-recyclable items, dispose of perishables). Have them weigh them, analyze the garbage, discuss the impact on the environment and the global links.

3. Analyze the garbage used in your school or home in a day.

4. Have students put on a play. Each student takes on the role of a piece of garbage in a trash can. They discuss where they came from, their purpose, their life expectancy, etc.

5. Have students analyze the changes on an uninhabited island, which would derive from activities of humans on other lands. How is the island connected to the rest of the world? How is it affected by natural systems such as water, air

Lesson 6.1 Continued

currents and animal movements? What comes to the island by way of these global links?

6. As a creative writing exercise, have students develop their own versions of the nursery rhyme, "The House That Jack Built." The poem should show the interconnections between practices or desires in one part of the world and environmental problems elsewhere. For example, students could connect the desire for fast-food burgers in the developed world to cattle ranching and deforestation in the less developed world.

7. Lead students in a discussion of the complex nature of solutions to environmental problems. Use styrofoam containers as an example. Is styrofoam packaging an environmental problem? If yes, brainstorm solutions to the problem. Follow the discussion of the implications of those solutions (such as resources, factories, individuals who would be affected).





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