BGGS Overview

BGGS is the *Britannica Global Geography System,* a modular electronic learning system which combines the latest pedagogical approach to geography learning with interactive multi-media materials enabling students and teachers to immerse themselves in exciting geographic investigations. BGGS is made up of the following components:

- *Geographic Inquiry into Global Issues* (GIGI) Student DataBooks
- Teacher's Guides with Overhead Transparencies in a three-ring binder
- Laminated Mini-Atlases to accompany each module
- BGGS CD-ROM with User's Manual
- 3 BGGS Videodiscs with Barcode Guides
- 3 thematic posters

This section of your Teacher's Guide will examine each component and demonstrate how the components work together to facilitate some very exciting geography learning for you and your students!

I. GIGI

Geographic Inquiry into Global Issues (GIGI) is the foundation of the BGGS. GIGI is a series of modules developed at the Center for Geographic Education at the University of Colorado at Boulder. The modules are independent of one another and can be presented in any order.

They use an inquiry approach and are organized around ten world regions:

South Asia

Southeast Asia

Japan

Former Soviet Union

East Asia

Australia/New Zealand/Pacific

North Africa/Southwest Asia

Africa-South of the Sahara

Latin America

Europe

Each GIGI module is centered around a particular question, such as "Why are people in the world hungry?" and "Is freedom of movement a basic human right?" The lead question is explored in one region of the world, then, in most modules, in a second region, before being investigated in North America.

The modules can be used in geography classes, or selected modules can be used in other courses, such as Earth Science, Global Studies, or Economics. Twelve modules constitute ample material for a full year's geography course. Each module is accompanied by sets of laminated mini-atlases which students can write on with dry-erase markers (provided by the teacher), then wipe clean to be re-used by the next class. This activity works well with cooperative groups of students.

Each module comprises a Teacher's Guide in a three-ring binder which includes Handouts and Activity masters for duplication and Overhead Transparencies; twenty-five Student DataBooks (additional Student DataBooks available) and the Mini-Atlases all packaged in a sturdy box suitable for storage when the class moves on to the next module. Since the Student DataBooks are soft-covered three-hole punched, non-consumable books, we recommend that each student have a binder to protect them. BGGS binders are available from Britannica, or you might ask each student to obtain one at the beginning of the course to keep the books in good condition for the next group of students that will use them. As the class completes a module, you can collect the Student DataBooks, place them in their storage box, and distribute the next module's DataBook to be placed in the student's binder.

GIGI print materials are organized in a unique fashion. The Teacher's Guide explains procedures to use in presenting the material found in the GIGI Student DataBook. Miniature layouts of student pages show the teacher how many pages of student material correspond with a given Teacher's Guide page. The Teacher's Guide includes Activities and Handouts to be copied and passed out to the class and Overhead Transparencies to enhance each lesson. All of a module's Activities, Handouts, and Overheads are located behind the third tab divider in each Teacher's Guide.

The teacher needs to become familiar in advance with both Teacher and Student material in order to effectively engage the class in meaningful geographic inquiries. There is a comprehensive "Memo to the Teacher from the GIGI Staff" in each Teacher's Guide which explains in detail the goals and principles behind the inquiry approach to geography learning.

The electronic components of the *Britannica Global Geography System* further empower students and teachers alike to engage in meaningful investigations. They are explained in detail in the following section.

II. BGGS CD-ROM

The **BGGS CD-ROM** is a resource manager and reference tool designed to help both teachers and students get maximum impact from the *Britannica Global Geography System*. This CD-ROM contains the text of the GIGI Student DataBooks in both Spanish and English, as well as Britannica's innovative geography reference program Geopedia™ all on a single disk. Here are some of the ways you and your class can use this software:

* When preparing to teach a module, you can access the GIGI Student DataBook on the CD to find which other elements of the BGGS are keyed to that lesson. For example, if you are teaching Lesson 3 in the Population and Resources module (What is overpopulation and how is it distributed?), accessing that lesson on the CD-ROM will reveal that there is one clip on the *Economic Development* videodisc called "Population/Wealth Correlation." With this information, you can plan when to reserve your department's videodisc player to preview the clip and show it to your class.

Furthermore, you will discover that there is one GIGI mini-atlas activity related to this lesson, five articles in the Geopedia database, ten entries in

Geopedia's World Data, five maps in the Geopedia Atlas, and five learning activities in the Geopedia BrainTeasers. You may want to assign each student or small group of students a research project using these extra resources to be done over the course of the module, or you can create a set of questions which the students must complete using the information found in Geopedia.

These activities can serve as a performance-based assessment of what students have learned in studying each module.

Since many schools have a limited number of computers with CD-ROM drives available, you may wish to devise a rotating schedule or sign-up system to ensure that each student has a chance to get at the BGGS CD-ROM. If it takes 15 class periods for a class of twenty-five students to do one module, students working in pairs can each have one turn at the computer if they schedule their time at the outset of the module. Using the CD-ROM's resource managing capability, you will have a very good sense of what resources you have at your disposal and how to make the most of them.

- All GIGI lessons are indexed by word and by key topic. If your class is studying food shortages in the Hunger module, you can key in the word hunger, and immediately learn where else in the GIGI modules this word or key topic appears. You can go directly to those occurrences in the text. You will also be directed to appropriate Geopedia references and Brain Teaser activities. Figures, Maps and Tables from GIGI print modules do not appear in the CD-ROM. However, the caption describing each of them is part of the online text.

- If Spanish is the primary language of your students, GIGI lessons can be accessed and printed out in Spanish from the BGGS CD-ROM. The BGGS Videodiscs have a Spanish soundtrack as well.

III. BGGS Videodiscs

More than ever before, today's students are visual learners. The GIGI modules explore issues and regions of the world with which many students are unfamiliar. With this in mind, we have produced three videodiscs, one to correspond to each of three major strands we have identified in GIGI: *Earth's Environment and Society; Economic Development;* and *Global Political and Cultural Change.*

These videodiscs, with English and Spanish soundtracks, can take you and your class to the parts of the world you are investigating with the wave of a barcode wand. Your class will hear how Amazon native peoples feel about the exploitation of the tropical rain forests where they live, witness the eruption of a volcano, and see first-hand the environmental disasters human beings have brought about.

The Barcode Guide which accompanies each disc enables you to access with a light pen or barcode reader, segments which pertain to the lesson being investigated. The Guide includes barcodes in both English and Spanish. Teachers can use the segments to enrich lessons, and students can make use of segments to enhance a report or group presentation.

There is a full-color poster to accompany each videodisc cluster which engages the students by asking "How do these images connect to you?" The posters can provide a colorful springboard for classroom discussion.

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BRITANNICA GLOBAL GEOGRAPHY SYSTEM

GIGI

Geographic Inquiry into Global Issues

Population and Resources

Program Developers
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TEACHER'S GUIDE

Regional Case Study
South Asia

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Contents

Memo to the Teacher from the GIGI Staff

You have in your hands the GIGI Teacher's Guide. Teaching with GIGI is a departure from teaching with a conventional textbook. By taking the time to study this memo—about 30 minutes—you will gain a good understanding of the kind of teaching that's needed to be successful with GIGI. We hope you have a rewarding and enjoyable experience!

Goals

The three major goals of *Geographic Inquiry into Global Issues* (GIGI) are to help you teach your students the following:

1. Responsible citizenship
2. Geographic knowledge, skills, and perspectives
3. Critical and reflective thinking

We believe you can accomplish these goals as well as others by teaching real-world issues. GIGI presents these issues with an inquiry approach, using the information, concepts, skills, and perspectives of geography.

GIGI and the Britannica Global Geography System

GIGI offers you two instructional modules for each of ten world regions (Figure 1 on pages vi and vii). There is no necessary sequence of modules; each one is independent, so you can use them in any order you wish or put together smaller clusters of modules to fit your needs. A leading question frames the issue of each module, and student inquiry proceeds through a sequence of lessons, each of which requires one or more daily periods of class time.

Color photographs at the beginning and end of each Student DataBook graphically illustrate the topic under inquiry.

Modules typically begin with a broad introduction to the global issue. Then, a major case study of three to four lessons examines the issue in a real place within the selected world region. Students also explore, usually in a single lesson, a comparative case study in a *different* region, which gives a variant of the issue and a sense of its global nature. Modules also bring the students "back home" to focus on the issue as it may appear in the United States or Canada. We do this because although North America is not one of the 10 GIGI

regions, frequent comparisons to North America throughout each module achieve additional instruction on this "home region."

Each GIGI module requires from two to three weeks of teaching time (10 to 15 class periods of 50 minutes) and contains a Student DataBook, Teacher's Guide, and Mini-Atlas. These GIGI print materials are at the heart of the Britannica Global Geography System (BGGS), which extends and enhances the inquiry approach to real-world issues with a CD-ROM and three videodiscs.

The BGGS CD-ROM puts the text of the GIGI Student DataBooks on line in both English and Spanish, then enables both teacher and students to search the text by lesson, key topic, or word to find the resources in the system that will enhance each. Geopedia™, Britannica's multimedia geography program, is provided in the CD-ROM for follow-up research. It features an atlas with more than 1,000 new maps, an encyclopedia with more than 1,200 geography-related articles, statistical information on every country from Britannica World Data Annual, a chartmaker for creating charts and graphs, a selection of video clips exploring cities and regions, and an electronic notepad allowing teachers and students to clip and edit text right on the screen.

Three videodiscs, designed to electronically transport students to the regions of the world where GIGI case studies are focused, are another part of the BGGS. The discs emphasize three major strands of the GIGI investigations: *Earth's Environment and Society, Economic Development,* and *Global Political and Cultural Change.* Each videodisc has two soundtracks, English and Spanish, and is accompanied by a Barcode Guide that enables teachers and students to access the segments that accompany the GIGI lesson with a wave of the barcode reader. A poster accompanies each videodisc to reinforce the connnections between your students and the issue being studied.

A full explanation of the Britannica Global Geography System components and how they work together is located in the BGGS overview in the front section of this Teacher's Guide.

Geographic Inquiry into Global Issues (GIGI)
Issues, Leading Questions, and Case Study Locations

South Asia	**Population and Resources**	**Religious Conflict***
	How does population growth affect resource availability?	*Where do religious differences contribute to conflict?*
	Bangladesh	Kashmir
	(Haiti)	(Northern Ireland)
Southeast Asia	**Sustainable Agriculture**	**Human Rights**
	How can the world achieve sustainable agriculture?	*How is freedom of movement a basic human right?*
	Malaysia	Cambodia
	(Cameroon, Western United States)	(Cuba, United States)
Japan	**Global Economy***	**Natural Hazards**
	How does trade shape the global economy?	*Why do the effects of natural hazards vary from place to place?*
	Japan	Japan
	(Colombia, United States)	(Bangladesh, United States)
Former Soviet Union	**Diversity and Nationalism***	**Environmental Pollution**
	How do nations cope with cultural diversity?	*What are the effects of severe environmental pollution?*
	Commonwealth of Independent States	Aral Sea
	(Brazil, United States)	(Madagascar, United States)
East Asia	**Population Growth***	**Political Change**
	How is population growth to be managed?	*How does political change affect peoples and places?*
	China	Hong Kong
	(United States)	(South Korea, Taiwan, Singapore, Canada)

* Under development

Figure 1   Matrix showing GIGI modules. Geographic issues are in bold and leading questions are in italics. Major case study locations are followed by comparison examples in parentheses.

Geographic Inquiry into Global Issues (GIGI)
Issues, Leading Questions, and Case Study Locations

Australia/
New Zealand/
Pacific   **Global Climate Change**   **Interdependence***

What could happen if global   *What are the causes and effects*
warming occurs?   *of global interdependence?*
Australia and New Zealand   Australia
(Developing Countries,   (Falkland Islands, United States)
U.S. Gulf Coast)

North Africa/
Southwest Asia   **Oil and Society***   **Hunger**

How have oil riches changed   *Why are people hungry?*
nations?   Sudan
Saudi Arabia   (India, Canada)
(Venezuela, Alaska)

Africa—south
of the Sahara   **Building New Nations***   **Infant and Child Mortality**

How are nation-states built?   *Why do so many children suffer*
Nigeria   *from poor health?*
(South Africa, Canada)   Central Africa
(United States)

Latin America   **Urban Growth**   **Development**

What are the causes and   *How does development affect*
effects of rapid   *peoples and places?*
urbanization and urban   Amazonia
growth?   (Eastern Europe, U.S. Tennessee
Mexico   Valley)
(United States)

Europe   **Regional Integration***   **Waste Management**

What are the advantages of   *Why is waste management both*
and barriers to regional   *a local and global concern?*
integration?   Western Europe
Europe   (Japan, United States)
(United States, Mexico,
Canada)

* Under development

Figure 1   (continued)

The **Student DataBook** contains the following features:
- Memo to the Student from the GIGI Staff
- An overview of the key questions and places explored in the module
- Lesson objectives
- Data presented in a variety of forms, including text, maps, graphs, tables, photographs, and cartoons
- Questions
- Glossary
- References

Students are not expected to learn the GIGI curriculum through the Student DataBook alone. Rather, they derive meaning from the DataBook when you use the Teacher's Guide to work through the curriculum with them. You may want to explain this process to students. Point out that you will be directing them to carry out various activities that are not specified in their text but are important in the sequence of learning.

Prior to teaching the first lesson, be sure students read the "Memo to the Student from the GIGI Staff" and the two-page overview, which gives the module's objectives in question form. Point out the Glossary and encourage its use as you work through the module, noting that glossary words are listed at the beginning of each lesson. So that students will know what they are expected to learn, they need to read carefully and understand the objectives listed at the beginning of each lesson.

This **Teacher's Guide** contains the following sections:
- Preparing to Teach This Module, a synopsis of the module's leading question, themes, and activities
- Module Objectives
- Number of Days Required to Teach the Module
- Suggestions for Teacher Reading
- Extension Activities and Resources

Most lessons include the following sections:
- Time Required
- Materials Needed
- Glossary Words
- Getting Started (suggested anticipatory sets)
- Procedures (for group and individual work)
- Modifications for older or younger students (in a different type face, printed in color)
- Questions and Answers (shown in tinted boxes)
- For Further Inquiry (suggestions for extensions and/or assessments)

- Masters of Overhead Transparencies and Activity masters and keys (located at the back of the Teacher's Guide)

Each module has its own accompanying **Mini-Atlas,** which provides four-color maps designed especially for use with that module. The Teacher's Guide explains how to use these maps. No additional atlases are required to teach the module, but large wall maps are highly recommended for your classroom. In addition to the maps in the Mini-Atlas, you will find numerous maps in the Student DataBook.

Intended Grade Levels

We believe GIGI enables you to probe global issues in various degrees of depth. This allows for the modules' use both over several grade levels (7–12) and over varying lengths of time at a grade level. The Teacher's Guides suggest alternatives for modifying instruction for different grade levels where appropriate. The reading level varies within each module: The Student DataBooks are approximately at grade 9 level, but some extracts from other sources are more challenging. These extracts are important because they show students that many people have contributed to the data, but younger students may need more time and help to understand them. The Teacher's Guides also include extension activities and resources that can maximize the grade-level flexibility of each module. Using the visuals included in the BGGS videodiscs and the activities built into the CD-ROM, you can further tailor instruction to your students. Obviously, you will determine whether particular lessons suit your students' abilities. When a range of required teaching time is given for a module, for example, 10 to 12 days, the greater amount of time should be planned for younger students. If you believe a lesson might be too difficult for your students, eliminate or simplify it. Rarely will the elimination of a lesson render a module ineffective. On the other hand, try to utilize the suggested extensions if the lesson does not adequately challenge your students.

Issues-Based Geographic Inquiry

In order to foster active learning and higher-level thinking, GIGI stresses issues-based geographic inquiry. Inquiry is essentially the method of science and of good detective work: It poses questions and proposes answers about the real world and it tests its answers with real data. Students do this with GIGI. Because this approach may be different from what students are familiar with, you may wish to pre-

pare them by describing the process and its connection to the real world. Also, their reading and discussion of the "Memo to the Student from the GIGI Staff" will help them understand the inquiry approach. GIGI is based on Frances Slater's inquiry activity planning model (1993). To reach GIGI's goals, your students study specific global issues by pursuing answers to geographic questions (Figure 2). They answer these questions by analyzing and evaluating data, using geographic methods and skills. This "doing geography" approach leads to significant outcomes in knowledge, skills, and perspectives. The progression from questions to generalizations "is crucial as a structure for activity planning and as a strategy for developing meaning and understanding. Meaning and understanding define the process of tying little factual knots of information into bigger general knots so that geography begins to make sense, not as a heap of isolated facts but as a network of *ideas and procedures*" (Slater 1993, page 60).

In truly free inquiry, students work independently, but with GIGI posing questions and providing data, you and your students explore the issues together. This approach supports and encourages your students in learning geography.

By using issues-based inquiry, you promote the development of a critical perspective in your students. They learn the habits of critical and reflective thinking. Multiple and opposing positions are inherent
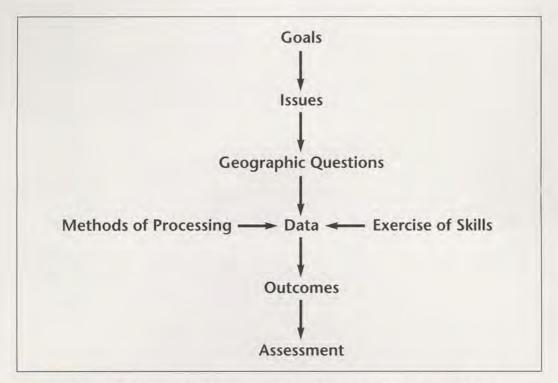
Figure 2   GIGI's model for issues-based geographic inquiry (after Slater 1993).

in these issues. Facts can be used to support different points of view. This is the context in which the habits of the critical perspective can develop, and *interpretation* is the key activity. With GIGI you foster these habits and abilities as you help your students interpret data guided by hypotheses, propositions, arguments, or questions.

An essential element of data-based, issues-oriented inquiry is to challenge your students by giving them opportunities to

- raise new questions,
- question the quality of the data,
- seek more useful or current data,
- articulate relationships they perceive,
- explain their processes of investigation, and
- defend their positions, decisions, and solutions.

Why These Issues Were Chosen

In planning GIGI, we sought timeless issues that are truly global in scope and that are of special concern to geographers. In this way, GIGI fosters what the National Geography Standards calls "the geographically informed person" needed by modern global citizenry (Geography Education Standards Project 1994).

The major case study, chosen to give solid grounding to the issue, is focused on a region where the issue is clearly expressed. The secondary case studies, based in other regions including the United States and Canada, show the *global* scope of the issue.

It is important to stress that, although GIGI contains a wide selection of case studies in all major regions (Figure 1) as well as frequent references to the global distribution of many geographic phenomena, GIGI is not a traditional regional geography. It does not attempt to provide basic geographic information for each region, such as one finds in traditional regional geography textbooks. In teaching a GIGI module, it is important to keep the emphasis on the issue and not get distracted with extraneous regional information.

Role of Questions

Each GIGI module is divided into six to eight lessons, each titled by a question; subquestions head individual sections of the lessons. Questions guide inquiry in order to merge the process of investigation with the drawing of conclusions. Directly linking questions and answers helps achieve an intellectually satisfying understanding of a problem (Slater 1993). When students are asked to learn only conclusions without learning how they are drawn, we perpetuate the tradition of an answer-centered education bereft of higher-level thinking. Therefore, it is important that students understand they are not

always expected to answer the questions when they first appear, but rather to keep them in mind as guides when they are reading or discussing.

GIGI asks both convergent and divergent questions, trying to reach a balance between the two. Supplement the questions in GIGI by asking your students many more of the types of questions suggested by Slater (1993). These are questions that encourage

- recall,
- classification and ordering,
- the use of data to draw conclusions,
- awareness of the limitations of data or of evaluation of data, and
- awareness of the processes of reasoning used.

According to the National Geography Standards, the "geographically informed person applies a comprehensive spatial view of the world to life situations" (Geography Education Standards Project 1994). In order to foster such a view of the world, GIGI asks *geographic* questions that ask where things are and why. By asking such geographic questions and by having students learn to ask them, you will reinforce GIGI's approach. A good question to begin with is: Where is this issue located? Then proceed to questions such as the following:

- Why does it take place there?
- How and why does this issue affect the people in this place?
- In what other places do people confront this issue?
- How and why are these places related?
- What alternatives do people have to improve their situation, and which alternatives do you recommend?

Fundamental Themes of Geography

In recent years, many geography teachers have learned that the five "fundamental themes" (Joint Committee on Geographic Education 1984) help them ask geographic questions. The theme of **Location** asks where things are and why things are located where they are. **Place** is the theme that inquires into human and physical characteristics of locations. **Human-Environment Interaction** examines how and why humans both adapt to and modify their environments as well as the consequences of these actions. **Movement** investigates not only how and why places are connected but also what is the significance of those interactions. The theme of **Region** seeks to identify and explain similarities and differences among areas and how and why these form and change. An extended explanation of the themes and their concepts, interrelationships, and applications is

given in Hill and McCormick (1989). The themes are useful because they encourage the kinds of questions required to help students develop the geographic perspective.

Importance of Local Examples

GIGI is a world geography, but it shows that issues work at various geographic scales—personal, local, regional, national, and global. Because it is sometimes difficult for younger students to identify with faraway places, success with GIGI in part depends upon the ability of both you and your students to relate the issues to examples in your local community. We strongly recommend that you refer in class to local examples of the issue being investigated. Just as important, we encourage you to have your students conduct local field studies related to this issue whenever possible. Issues having important geographic dimensions abound in every community (see the Extension Activities and Resources section at the end of this Teacher's Guide for examples). Peak educational experiences often come when students see things in the field that relate to their classroom studies. We discuss other reasons for local involvement in the next section.

Familiar people can be as important as familiar places in motivating students. The quality of personal engagement is at the crux of successful instruction. Using the BGGS videodisc segments that accompany most GIGI lessons is a powerful way to help your students find relevance by identifying the GIGI issues with real people. Similarly, you can connect GIGI issues to everyday life at a human scale, especially at the students' own age levels, by using current newspaper accounts or magazines that address the student's perspective.

As you gain familiarity with teaching local examples, as you develop field exercises for your students, and as you learn how to put a human face on these materials, you will begin to customize the GIGI modules to fit your particular environment. Our trial teachers reported that the more they taught GIGI modules, the more comfortable they became in adapting them to fit their needs.

Fostering Optimistic and Constructive Perspectives

The seriousness and complexity of the global issues studied in GIGI can overwhelm students unless you take care to foster optimistic and constructive perspectives toward issues. "Gloom and doom" needs to be balanced with examples of success and prospects for positive change. It is important to help your students develop a

sense of personal efficacy, an attitude that their actions can make a difference in solving global problems. The maxim, "Think Globally, Act Locally," speaks to the need to help students organize and conduct constructive actions that address local variants of the issues they are studying. As we noted earlier, student involvement in local projects enriches their educational experience. There is also good evidence that it actually produces an optimistic feeling—that their actions *can* make a difference—to help them deal with the often difficult and sometimes depressing world issues. GIGI modules often include lessons and activities to show possibilities for positive action.

Certain perspectives foster student optimism and constructive behavior. Geography students, especially, should learn to respect other peoples and lands, and they should come to cherish environmental unity and natural diversity. They should also learn to be skeptical about simplistic explanations, such as the theory that attempts to explain human characteristics and actions in terms of the physical environment alone, which geographers call "environmental determinism." Most important, optimistic and constructive perspectives accompany the development of empathy, tolerance, and open-mindedness. These traits are fostered by avoiding sexist and racist language, discouraging ethnocentricity, and challenging stereotypes, simplistic solutions, and basic assumptions.

References to Data

Unlike most textbooks, GIGI attributes its sources of data with in-text citations and full reference lists, which is another way of encouraging the critical perspective. In the Student DataBook, material that has been extracted from original sources is indented and printed in a different typeface. Long extracts are highlighted with background color. Use of these sources helps your students learn that real people construct ideas and data and that their concepts and information are not immutable. Instead, they often change through the critiques and interpretations of various people. By using these scholarly conventions, we intend to encourage your students to appreciate the tentativeness of knowledge and to value scholarship and academic integrity.

Updating

Real data quickly become obsolete. GIGI addresses this fact by discussing historical trends of data and by stressing concepts. You should reinforce this bias for concepts and also freely acknowledge the datedness of information by explaining why it is still used (for example, the lags between research and writing and publication and

use; the lack of more recent data). Whenever possible, guide students to update materials. Britannica's Geopedia, on the BGGS CD-ROM, contains data based on Encyclopædia Britannica's World Data Annual, which is also available in print form. Have students use these sources to supplement and update GIGI data.

Assessing Learning

Evaluation of student achievements with GIGI can be focused on two broad areas. The first is the developing ability of students to undertake geographic inquiry. The second is the acquisition of knowledge and perspectives about the module issue.

The ability of students to undertake inquiry in geography can be related to the primary questions that guide geographical study. They are noted earlier in this memo. As students work through the module, they are likely to become increasingly adept at asking and answering geographic questions. Seek to extend your students' competence in several clusters of skills that facilitate geographic inquiry. These clusters include the following:

- Identifying problems and issues. This may be done through observation, asking questions, brainstorming, reading, and in other ways.
- Inquiring into the problems and issues in many ways such as through map reading and interpretation, making surveys, and using results of surveys done by others.
- Making decisions and taking action, for example, through reviewing alternatives, establishing priorities and criteria, and communicating cooperatively with people in other ways.
- Reflecting at all stages of the process of inquiry, especially through careful consideration of diverse sources of evidence.

Students will acquire knowledge of the module issue as they make their inquiries. This knowledge can be tested and graded. Assessments may be based on the following:

- Knowledge and skills shown by work on Activities included in this Teacher's Guide and on questions in the Student DataBook.
- Observations of student participation in groups and in class discussions.

Specific assessment ideas are given at the end of some lessons in the section called For Further Inquiry. In addition, the Teacher's Guide ends with Extension Activities and Resources. Some of these extension activities can serve as authentic assessments.

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Potential Uses

In addition to the flexibility offered by the free-standing nature of the modules, GIGI has a number of other characteristics that encourage widespread use. Modules can be extended and enhanced with the BGGS CD-ROM, videodiscs, and posters. Because GIGI's issues-based approach integrates several topics (for example, population, economic, political, physical, and cultural geography) in a single module, the modules are not conducive to using an approach in which topics are taught separately. On the other hand, GIGI may be used with a world regional approach because there are modules for each of 10 world regions. A year-long world geography or global studies course will have more than enough material by using 12 modules. Five to seven modules may constitute a one-semester, issues-based geography course covering several regions. You can define clusters of modules for your own curricular purposes. We have identified three clusters for interdisciplinary studies within the Britannica Global Geography System, each comprising six or seven GIGI modules. They are *Earth's Environment and Society, Economic Development,* and *Global Political and Cultural Change.* BGGS includes a videodisc and poster for each cluster. These strand packages could well be used in Social and Environmental Studies, Earth Science, Global Studies, and Area Studies classes. Activities in the modules also support math, language arts, and arts curricula.

GIGI encourages and facilitates the development of a variety of geographic skills that transfer widely into the natural and social sciences. Among these are skills of asking geographic questions and developing and testing geographic generalizations. These require other GIGI skills including examining and making a variety of maps; analyzing photographs; constructing and interpreting graphs and tables of spatial data; and collecting, interpreting, and presenting geographic information.

Finally, GIGI promotes a wide variety of linguistic, numeric, oral, creative, and social skills as well as geographic skills. In particular, GIGI emphasizes cooperative learning. We believe that one of the great strengths of the GIGI modules is that they give students practice in both group and individual problem solving. As students become more familiar with the global issues, they learn that finding solutions to world problems requires people to work together cooperatively.

References

Geography Education Standards Project. 1994. *Geography for Life: The National Geography Standards.* Washington, DC: Geography Education Standards Project.

Hill, A. David, and McCormick, Regina. 1989. *Geography: A Resource Book for Secondary Schools.* Santa Barbara, CA: ABC-Clio, Inc.

Joint Committee on Geographic Education. 1984. *Guidelines for Geographic Education: Elementary and Secondary Schools.* Washington, DC: Association of American Geographers and National Council for Geographic Education.

Slater, Frances. 1993. *Learning through Geography.* Revised. Indiana, PA: National Council for Geographic Education.

PREPARING TO TEACH THIS MODULE

Population and Resources

How does population growth affect resource availability?

We often agonize over the horrible television images of starving people in Africa and Asia. Unfortunately, today's students will continue to witness these images. Throughout their lifetimes, students may be asked to contribute to private relief agencies working in developing countries, and part of their taxes may be used for foreign aid to combat hunger and poverty. Some students may eventually make decisions on global population and resource policies. Therefore, it is important that their curriculum include the study of the relationship between population growth and resource availability, which is the focus of this module.

The rapidly growing human population, now well over 5 billion, continually increases its pressure on Earth's resources. In Lesson 1, students graph world population growth over the past 2000 years, see its exceedingly rapid increase now compared to the past, and learn the concept of *doubling time* with data from selected countries. In this and subsequent lessons, students are asked to speculate about the effects of rapid population growth. Lesson 2 examines the geographic question: "How and why does population growth vary from place to place?" Students make a choropleth (area-value) map of the world from which they discover regions of high, intermediate, and low population growth. (The themes of *Place* and *Region* are two of the five fundamental themes of geography.) This map is further developed in Lesson 3 with the addition of data on national wealth. This simple GIS (Geographic Information System) allows students to examine the spatial correlation between population growth and wealth (relationships within places), which sets up the concepts of overpopulation and standard of living.

The module's primary case study of Bangladesh begins in Lesson 4: "How poor is Bangladesh?" Students work with an array of quantitative and qualitative indicators of standard of living to learn more

about this place. Relationships between high population densities and land availability in an agrarian society (recalling the theme of *Human-Environmental Interaction*) are explored in Lesson 5. These relationships are examined at the local scale as students divide up an example of a small family farm in Bangladesh to see the effects of traditional inheritance rules. In Lesson 6, students map flooded land and graph climate data in order to examine the effects of natural hazards in Bangladesh on land resources.

Lesson 7 takes a brief look at a second case study, Haiti, in order to demonstrate an extreme case in which a country's entire resource base has been essentially destroyed. Finally, Lesson 8 asks students to discuss the connections between the two case studies and population-resource issues at the global scale. This concluding lesson allows students to see that even resource-related problems in developing countries can have an impact on people in the United States.

Using the BGGS CD-ROM can simplify lesson planning by making it easy to access the resources the system provides for each lesson. It shows exactly which Geopedia™ data and learning activities can be used in long-range and short-term assignments, and which videodisc clips will provide visual reinforcement for each GIGI lesson. The CD-ROM can also show you ways in which a lesson in one module relates to a lesson in another module. And it indicates where to find every reference in GIGI, Geopedia™, the Mini-Atlas maps, and the videodiscs to any key topic—for example, "tsunami" or "Bangladesh." The students will also be able to use the BGGS CD-ROM for further research and short-term or long-term range assignments. The BGGS multimedia components and their uses are explained fully in the tabbed BGGS section in the front of this Teacher's Guide.

The following are general modifications recommended for younger students:

- Plan for fifteen days because the activities will require more teacher explanation and support.
- Provide directions for homework assignments and monitor students' understanding and progress.
- Prior to assigning written activities requiring students to draw conclusions and summarize their findings, ask guiding questions and develop a sample outline on the chalkboard.

Module Objectives

- Relate national population growth rates to levels of wealth.
- Define the term *overpopulation* and identify countries that can be considered overpopulated.
- Identify the relationship between population growth and resource availability.

- Understand how rapid population growth impacts the resource base of poor countries.
- Investigate the global implications of rapid population growth in poor countries.
- Analyze data to compare the standard of living among different countries.
- Explain the relationship between population density and land availability in an agricultural society.

Number of Days Required to Teach *Population and Resources*

Thirteen to fifteen 50-minute class periods

Suggestions for Teacher Reading

Crews, K. A., and Cancellier, P., editors. 1991. *Connections: Linking Population and Environment*. Washington, DC: Population Reference Bureau.

Global Issues. This is an annual publication of The Dushkin Publishing Group, Inc., Sluice Dock, Guilford, CT 06437. Cost: About $9.00. It is a collection of current articles, updated annually, from a variety of publications, covering such issues as population, natural resources, development, conflict, and cooperation.

Refugees. This is a monthly publication of the United Nations High Commissioner for Refugees, 1718 Connecticut Ave. NW, Washington, DC 20009. Cost: Free. English, French, and Spanish language available.

World Environment Data Sheet. This publication is available from the Population Reference Bureau, 1875 Connecticut Ave. NW, Suite 520, Washington, DC 20009. It includes data for environmental resource conditions for nearly 100 countries.

World Watch. This is a bimonthly magazine of the Worldwatch Institute, 1776 Massachusetts Ave. NW, Washington, DC 20036. Cost: $15.00 annually. The timely and well-written articles cover an array of current global concerns, including a sustainable environment, energy, technology, and human-environmental conflicts. It also lists all other recent publications by the Worldwatch Institute.

Articles on Population Growth

Brown, Lester R., and Young, John E. 1990. "Feeding the world in the nineties." *State of the World—1990*. New York: W. W. Norton: 50–78.

The Economist. 1990. "Squeezing in the next five billion," January 20: 19–22.

Mann, C. C. 1993. "How many is too many?" *Atlantic Monthly*, February 1993: 47–67.

Background Articles on Bangladesh Case Study

These titles are useful for follow-up activities requiring student research.

Harris, M. S. 1989. "Ownership and control in Bangladesh." *Urban Anthropology and Studies of Cultural Systems*, 4: 299-308.

Houge, Asraul. 1988. "Farm size and economics-allocative efficiency in Bangladesh agriculture." *Applied Economics*, 20(10): 1353–1368.

How fast is the world's population growing?

⏰ Time Required

Two 50-minute class periods

📓 Materials Needed

Electronic calculator
Copies of Activities 1, 2, and 3 for all students

G Glossary Words

doubling time

population growth

resource

Getting Started

- Have students read the Memo to the Student and the overview on pages 2–3 in the Student DataBook prior to beginning the module. Also make students aware that there is a Glossary in the back of their Databooks.

- During the course of this module, try to provide an ongoing activity that helps students learn that they can be effective agents of positive change. For example, students might be involved in fund-raising for a nongovernmental agency working to ease population-resource problems, such as Red Cross, Oxfam, World Vision, and Habitat for Humanity. Alternatively, students could investigate such agencies to learn where they operate, how they help people, and so on. You might also invite representatives from these agencies to speak at your school.

- Ask students to begin collecting articles from newspapers and magazines and written excerpts from broadcast media illustrating problems caused or made worse by population growth. They should bring these to class. These should be shared and discussed in class and compiled on a bulletin board for continued reference. Encourage students to continue to collect information on population-related problems and report to the class throughout the module. Stories could be connected to countries on a world map with string.

- As a group, count the number of students in the classroom. Ask students how long they think it would take for that number of people to be added to the world's population. Write their guesses on the board. Next, have students read the introductory quote by Nafis Sadik at the beginning of Lesson 1. They will learn that about three people are added to the world's population each second. Have the class recalculate the amount of time it would take to add as many people to the world's population as there are in the class. Were their guesses high or low? What do low guesses mean? [An underestimate of how fast global population is growing]

  Now, using a watch that indicates seconds, have the students sit quietly for the eight, ten, twelve, or however many seconds it would take to add to the world a population equal to that of the class.

- Ask the students to expand their thinking and guess the amount of time to add the population of the school, city, or any other unit of population. Verify the guesses mathematically. Ask the following questions to stimulate discussion:

a. How many people will be added to the world's population during the class period? [Take the number of seconds for the length of the class (the number of minutes times 60), and multiply that number by 3 for the number of people added to the world's population during the class period.]

b. How many more people will there be on the planet when class meets tomorrow? [Three people added per second for 24 hours: 3 x 60 x 60 x 24 = 259,200.]
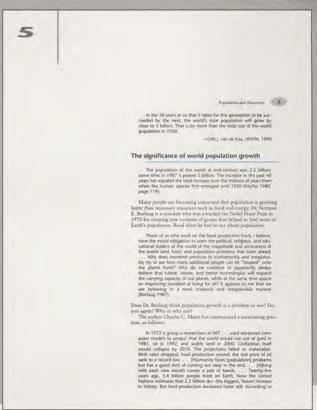
Procedures

Is population growth a problem? (pages 4–6)

A. After students read this section, have them re-read the opening quote from van de Kaa and ask them to discuss the quotes from Sadik and van de Kaa (pages 4–5). The following questions might help foster discussion:

a. Is the population growing very fast on the planet? [Yes, we are adding 90 to 100 million people per year.]

b. Does population growth contribute to any problems? [Some students may not have been exposed to the issue of population growth and will have difficulty speculating about problems. Others will be much more aware of the potential problems of population growth.]

B. Ask students to tell about population-related problems they are familiar with from the news, travel, or other sources. Make a list of the things students suggest. [Lists might include shortages of food and water, jobs, housing, education, health care, and individual freedom, and too much pollution and waste production. Obviously there are more, and all of these might not be listed.]

C. Ask students to discuss the quotes following the title "The significance of world population growth" (page 5). Have them consider whether the speakers think population growth is a problem. Referring to Borlaug and Mann's statement, ask how technology influences population growth and the number of people that can live on the planet. [This should bring out the idea that technology greatly influences carrying capacity. Technology allows humans to modify their environment to extract more

resources. As resources such as food become more abundant, more people can be supported. But modifying the environment often brings environmental costs too.]

D. Ask students if they have ever thought of the planet as being isolated in space and, if they did, whether this caused them to see things differently. Use a globe to stress the notion that Earth is indeed an isolated object in space. A phrase commonly used to convey this concept is "Spaceship Earth." (See *Extension Activities and Resources* at the end of the Teacher's Guide for information about a video series entitled *Spaceship Earth*.) Encourage students to speculate on the nature of population problems that the planet faces. They may revise or add to the list created earlier.

How fast is Earth's population growing? (pages 6–8)

E. Have students study Table 1 on page 6 and use **Activity 1** to graph these data. After the students have graphed the data, sketch the *Key for Activity 1* on the board, roughly drawing the curve of population increase. Verify that all students have achieved similar results. Discuss the meaning of this curve, using the following questions:

a. How many more people will there be on the planet in 2000 than in the year A.D. 1? [Over 5.9 billion more]

b. Is the rate at which population has grown getting faster, slower, or staying about the same? Why? [It is getting faster. Reasons may vary; possibilities include better food, medicine, and shelter, lower death rates or longer life expectancy, and a larger base population today that is having children.]

c. Is there more demand for things such as food, clean water, clothing, housing, health care, and education today than in the past? Why? [Yes, because more people use more resources. For example, more food is needed for a picnic of 100 people than for a picnic of 10 people.]

Younger students may need more concrete analogies to comprehend population increase. Sheets of paper with symbols such as cartoon or stick figures can be used for each time period. Each figure
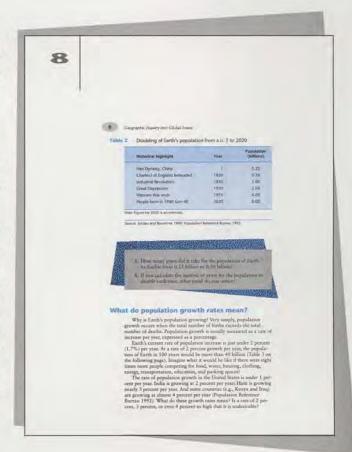
1. During the period covered by Table 1, in what century has population growth been the fastest?

   • Population growth has been the fastest in the last century.

2–3. How many people are predicted to be on the planet in the year 2000? How many more than the current population is that?

   • About 6.2 billion people are predicted to be on the planet in the year 2000. This is about 0.8 billion more than the current population of 5.4 billion.

4. What problems might be caused by the population size estimated for 2000?

   • Answers will vary; students should be encouraged to think creatively and draw problems from their own life experiences if possible.

should represent at least 10 million. (Today's population of 5.5 billion would require 550 symbols.) Paper clips on strings or other objects will work and consume less paper.
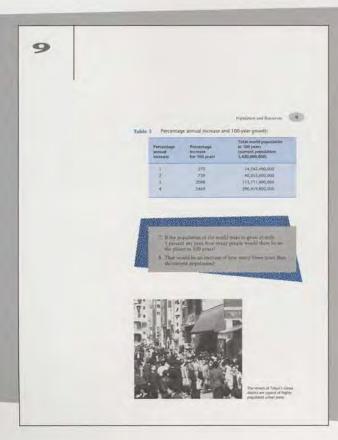
F. Have students answer Questions 1–4 (page 7).

G. Use "How much is a billion?" on page 7 if students have a difficult time comprehending such large numbers. Have students try to find other ways of understanding such large numbers.

H. Later on in this lesson, students will see how to calculate doubling time, but for now, **Activity 2** allows them to discover the historical trend of decreasing doubling times. Distribute Activity 2 and have students plot how long it has taken the world's population to double using data in Table 2 (page 8). They will need to calculate the number of years first. Answering Question 5 on page 8 gives them the first point they need to plot on the Activity. Completing the graph gives students the answer to Question 6.
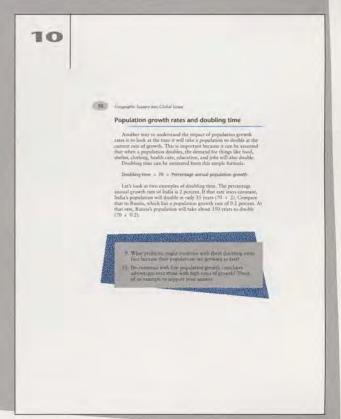
5. How many years did it take for the population of Earth to double from 0.25 billion to 0.50 billion?

   • The answer is 1,649 years. Students will also need to calculate the number of years between each successive doubling in order to complete the graph.

6. If you calculate the number of years for the population to double each time, what trend do you notice?

   • To answer this, students need to connect all of the points on Activity 2. The growth rate has flattened out in recent decades, and the doubling time is steadying at about 45 years.

What do population growth rates mean? (pages 8–10)

I. Often, percentage rates have little meaning for students. This section opens with a series of questions leading students to Table 3 (page 9). No specific answers are expected; the questions are intended to direct the students' thinking. Students should read this section and discuss these questions before working through the data. Ideas about answers come from analyzing the data. At first glance, 2, 3, or 4 percent annual growth may not seem to be very high. Yet, Table 3 shows that even a small annual increase results in large growth over time. Have students answer Questions 7 and 8 to help focus understanding.

7. If the population of the world were to grow at only 1 percent per year, how many people would there be on the planet in 100 years?

   • If the population of the world were to grow at 1 percent per year, over 14.7 billion people would be on the planet in 100 years.

8. That would be an increase of how many times more than the current population?

   • This is an increase of about 2.7 times over the current population.

J. Doubling time is another way to understand rates of population increase. Have students read the text on page 10, then pass out **Activity 3.** This activity gives students an opportunity to calculate doubling time for selected countries. Have students complete the last two columns of Activity 3. Assign this individually, in small groups, or as a class. The simple formula for calculating doubling time is given on page 10 of the text. For example, the percentage annual increase of the United States is 0.8. Dividing 70 by 0.8 yields a doubling time of 88 years.

K. Have students answer Questions 9 and 10 on page 10.

9. What problems might countries with short doubling times face because their populations are growing so fast?

   • Problems include not being able to keep up with increasing demand for things like food, water, shelter, clothing, health care, education, and jobs.

10. Do countries with low population growth rates have advantages over those with high rates of growth? Think of an example to support your answer.

   • Countries with low population growth rates probably have advantages over those with high rates, because resources must increase as fast as population is growing, or else there will be shortages.

Older students may be curious about the doubling-time formula. The number 70 is a rounded value for the natural logarithm of 2 (the actual value is .6931472). Strictly speaking, the calculations for the United States are as follows: .6931472 ÷ .008 = 86.6434 years, but it is much easier to multiply the entire left side of the equation by 100 (for percentage growth) and round off 69 to 70. To find how long it takes for a number to triple, use the natural log of 3 (1.0986123), and divide it by the increase percentage. Encourage students to explore this further in their math classes.

For Further Inquiry

- Divide students into groups and have them draw a poster that conveys the theme of increasing population growth on the planet.

- Assign a creative writing task in which students speculate on the nature of day-to-day life in the future, when population is much larger. Questions like the following might stimulate creative thinking about the nature of the problems and the types of solutions that might be needed:

  a. What might be invented to meet the increased needs of future populations?

  b. Where will people park? Or will they? Will they even have private transportation?

  c. Will parks providing open space for people disappear?

  Alternatively, groups of students can create imaginary audio/video news programs from the future that would address life and its problems in a world with two or three times as many people. Or, have students draw imaginary landscapes of the future resulting from larger populations and write an essay explaining the landscapes.

- Ask the unanswerable question, "How many people are too many people?" Or, phrased differently, "If the population continues to grow, will there *ever* be a time when there are too many people on the planet?" Students could write a brief response to this question and list reasons to justify their answer. Then, have students work in small groups with others having similar opinions. Develop a composite list of reasons supporting the various answers and discuss this in class. Ask the students to reread the passage by Norman Borlaug on page 5, before beginning the discussion. Open discussion with the following questions:

a. Why was population so small 2,000 years ago?

b. Could more people have lived on the planet back then?

c. Could today's population of over 5 billion have lived on the planet 2,000 years ago? Why or why not?

d. What is different about today that explains why so many people can live on the planet now?

e. What problems are associated with population growth? Are there problems in your life that are caused by population growth? This question may be addressed at several levels. At the local level, students may be aware of problems in their own lives such as not enough jobs for their parents, schools that seem too crowded, or long lines at a theater or amusement park. At the global scale, population increase contributes to increased pollution, which may have impacts on global climate and the availability of resources from particular areas of the world. Most of the population problems for students in the United States will probably have far less serious immediate personal consequences than those for people in poorer countries. You may want to make sure students draw this conclusion.

How and why does population growth vary from place to place?

Time Required

Two 50-minute class periods

Materials Needed

Copies of Activity 4 for all students
Several stopwatches with second hands or
   timers (optional)
Mini-Atlas map 1

G Glossary Words

population growth

Getting Started

Ask some students to share the news stories about population they were assigned to bring to class at the beginning of Lesson 1. As they share the information, identify the locations on a globe, wall map, or **Mini-Atlas map 1,** and discuss the population-related problems. Ask the class if population is growing at the same rate in all of the places that the news stories told about. For example, is population in the United States growing faster, slower, or at the same rate as the population of Mexico? [Accept either *yes* or *no* from the students. This will be addressed in the lesson. However, have them explain their answer.]

Procedures

What are the regional differences in population growth? (pages 11–13)

A. After they read this section, ask students to write answers to the questions on page 11 of the Student DataBook. [Most students will probably suspect that population is growing faster in some places than others, but some may think it is the same for all places. Accept any speculation about causes at this point.]

11

Population and Resources 11

Lesson 2

How and why does
population growth vary
from place to place?

Objectives
In this lesson, you will
- Map rates of population growth in different places.
- Speculate on the implications of different rates of population growth.

Glossary Words
population growth

What are the regional differences in population growth?

It is clear that global population is growing rapidly and that some places have faster growth rates than others. This raises two geographical questions:

- What are the regional differences in growth rates?
- What causes these differences?

Table 4 on page 12 provides data for selected countries in several regions. Although these data help answer the first question, a map showing the data from Table 4 would be even more helpful. Geographers often use maps to help analyze global issues. Maps

B. Next, students will investigate regional differences in population growth. Table 4 on page 12 provides population growth data for selected countries. Discuss Table 4 to be sure that students understand the types of data it contains, reviewing Lesson 1 if needed.

C. Pass out **Activity 4.** Have students map the values for annual percentages of population increase from Table 4. (Students should consult Mini-Atlas map 1 to locate the countries listed.) Students should fill in the legend, using the pattern scheme shown on the *Key for Activity 4.* **It is important that the legend clearly show a heavier pattern or darker color for higher rates of population growth.**

For younger students, you may wish to provide the legend scheme.

Important: Students will use this Activity again in Lesson 3, adding data on standard of living for these same countries to create a simple geographic information system (GIS)—a map in which two or more variables are displayed. *For the activity to work, it is essential that all students use the same symbolization.* Instruct students to code each country's annual percentage of population increase according to the Activity key. Tell students to ignore the legend information for the GNP data for now.

D. Have students answer Questions 1–5 on page 13. Their maps will show growth rates ranging from very low in places such as Italy to much higher rates in Asia and Africa.

1–2. Which places have slow population growth? Which places have the fastest population growth?

- Places that have slow growth are generally in Europe, North America, and Australia. Africa, Asia (except Japan), and Latin America have higher rates of population growth.

3. Why do you think the rates of population increase are not the same everywhere?

- Accept speculation. They may identify that in many places where population growth rates are high, having more children is seen as an asset, while the reverse is true in developed countries.

4. Is a rate of 3.13 percent really high? Support your answer.

- A rate of 3.13 percent is very high. This can be supported by using Table 3.

5. Should the people of Africa be concerned? Why or why not?

- People of Africa should be concerned, because this rate of increase will cause the standard of living to go down and human suffering to increase.

The following optional exercise will help younger students grasp the concept of population growth and population-resource ratios.

a. Divide the classroom in half. Masking tape or some other method should be used to identify the halves.

b. Tell the students that this exercise is about population growth and population-resource ratios. Also tell them that each half represents a different country and that students entering the countries will represent population growth. Evenly divide some resource (e.g., 40 pieces of fruit), placing 20 pieces in each half of the room. Alternatively, chairs can be divided equally.

c. Establish 1 percent and 3 percent growth rates for Country A and Country B, respectively. Begin with one student in each "country." Using a stopwatch, have students enter each of the halves according to these time intervals:

Elapsed seconds (representing years)

0	24	48	72	96	120	144

Country A (1%)

1	1	1	2	2	2	4

Country B (3%)

1	2	4	8	16	32	68

Each elapsed second represents one year of elapsed time. For a 1 percent growth rate, the population doubles every 72 years (seconds). For a 3 percent growth rate, the population doubles every 24 years (seconds), as in Country B. Doing this demonstration for just two minutes will involve all of your students, but your class should see that the disparity between the two halves will continue to increase.

d. During this activity, students should be encouraged to discuss their observations regarding what is happening to the availability of resources (candy, fruit, or seats) as population grows in the different "countries."

e. Question the class, asking them to compare the "countries." Questions might include: (1) Are there enough resources for everyone? This question can be asked again each time the population doubles. (2) How soon will there be a person for every resource? (3) How soon will a shortage occur? (4) After a few doublings, the number of resources will be exceeded by the number of people in the half with the shorter doubling time. At that time ask how the problem of too few resources can be solved. [There are only two ways to solve the problem. Either get more resources—implying an economic solution of increasing resource availability—or reduce the number of people—implying a demographic solution. Each has drawbacks.]

Why do the differences between places exist? (page 13)

E. The final part of this lesson poses questions to be used as speculations or hypotheses, which form the heart of geographic inquiry. Making a reasonable guess as to the cause of geographic patterns is the first step to finding an answer. The next lesson provides data to help students reach conclusions, but for now, encourage your class to speculate on the causes of the patterns that are apparent on the maps they have produced (Activity 4). Students could work in small groups to come up with lists of possible causes. If your class is familiar with the terms, have students divide the countries listed in Table 4 (page 12) into Developed and Developing to look for patterns tied to economic development instead of location.

For older students, and if you have the Population Reference Bureau's *World Population Data Sheet* for the current year, assign groups to each continent or sub-continental region. Extracting data from the data sheet, students should try to find general trends for each continent and also note exceptions. For example, in East Asia, Japan is a significant exception to the trend of high population growth, and the People's Republic of China is a minor exception due to limited success with their one-child-per-family policy.

For Further Inquiry

- Have students generalize about the degree to which rates of population growth are different from place to place.

- Ask students to state the significance of growth rates of 1 or 2 percent over a 100-year period.

- Have students identify countries with high and low doubling times and write an explanation of the importance of doubling time.

What is overpopulation and how is it distributed?

⏱ Time Required

Two 50-minute class periods

📓 Materials Needed

Colored pencils
Color advertisements from magazines or
  Sunday newspapers
Copies of Activity 4 (partly completed in
  Lesson 2) for all students
Mini-Atlas map 1

G Glossary Words

gross national product (GNP)

overpopulation

per capita

population density

resource

standard of living

Getting Started

• Ask students if they have heard the term *overpopulation*. Have them write their definition of *overpopulation*, telling them that their definitions should be generic, that is, capable of being used anywhere to determine if overpopulation exists. If some students indicate they haven't heard of the term or don't know its meaning, ask them to guess its definition. Those students can compare their guesses to the answers given by their classmates who indicated a knowledge of the term and its meaning. Discuss the various answers as a class. [Overpopulation is a condition in which the number of people in an area exceeds the availability of one or more essential resources. Resources need not come from the local area to be available to the people in the area. Class discussion and evaluation of student definitions of overpopulation should lead to the development of a composite definition: people exceeding essential resources, such as food, water, shelter, clothing, health care, education, and jobs.]

• Have the class develop a list of resources that, if in short supply, might lead to overpopulation. Categories should include food and/or land, water, shelter, clothing, health care, education, and employment. Use this as a lead-in to Procedure A, in which the concept of *resource* is expanded.

Procedures

A. To expand the concept of resources and tie it to the students' personal life experience, bring in the color inserts from magazines or Sunday newspapers (provided by discount mass merchandisers such as Target and K-Mart). These are filled with items that people in the United States regard as valuable, which is to say, as resources. Students, working individually or in groups, should go through the advertisements and list things that they consider to be resources. Encourage students to decide whether these items would be resources for all people in the world. Many people in the world would have little use for microwave popcorn,

ski boots, ceiling paint, and the like. Following the activity, students should discuss the concept of resources. Ask them what things they consider to be resources. Does everyone in the class agree, or are some items not resources to everyone in the class? The point to emphasize is that resources are culturally defined.

How can you tell if a place is overpopulated? (pages 14–15)
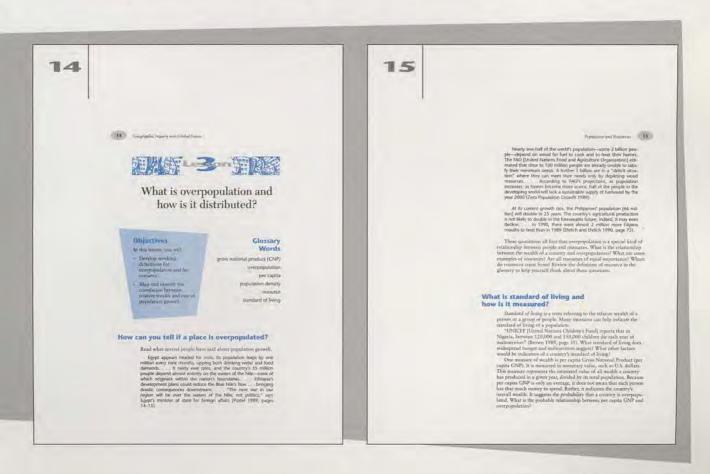
B. Have students read the three introductory quotes on pages 14–15. Ask them to apply their definition of overpopulation to the conditions in each quote and discuss the potential resource shortage problems. This can be expanded to include the news clippings they have been asked to bring to class (posted on the bulletin board). Read the short text following the quotes and be sure that students understand the connection between resource availability and overpopulation.

What is standard of living and how is it measured? (pages 15–18)

C. In this section students are introduced to the relationship between standard of living and resource availability (or wealth). The term *standard of living* is often used to generalize about resource availability. Generally, where standard of living is high, resource availability is high and overpopulation is not a problem. Many measures of standard of living are available, though none are completely satisfactory. Discuss this with the class; explain that when studying issues such as population and resources, abundant and accurate data may not always be available. Hence, we must resort to using what data are available. Per capita gross national product (GNP) is presented as a gross indicator of standard of living. Its major disadvantage is that it tells nothing about how wealth is distributed *within* the population. Bring out **Mini-Atlas map 1** and discuss general patterns of world GNP.

D. In the section titled "Are standard of living and population growth related?" (pages 16–17), students map relative resource availability using indicators of wealth. Return **Activity 4** to each student and have them map the per capita GNP data from Table 5 on page 17 on Activity 4 (note that these are the same 28 countries listed in Table 4 on page 12). As in Lesson 2, students should consult Mini-

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14

15
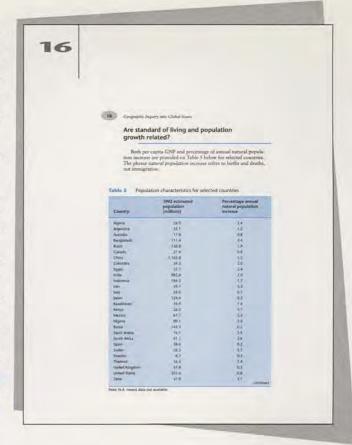
Atlas map 1 to locate the countries listed. Have students use colored pencils to shade in the four categories of per capita GNP defined in the legend. Students should use a color scheme with progressively darker shades for higher levels of per capita GNP to complete their maps. One possible scheme is as follows:
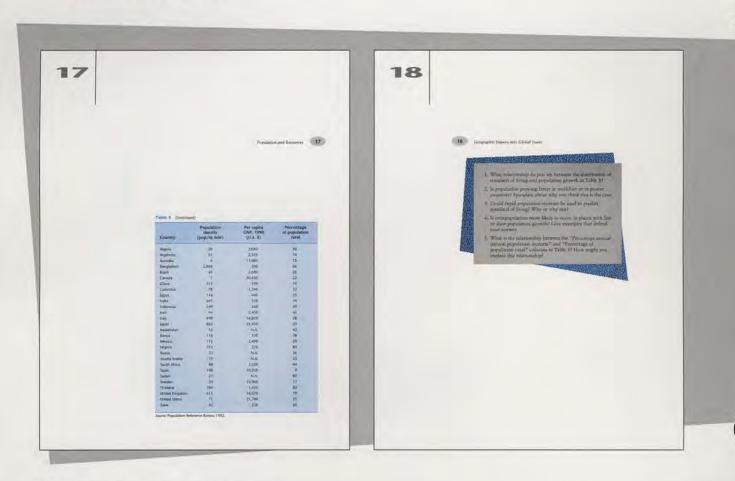
Category 1 = yellow; Category 2 = orange; Category 3 = red; Category 4 = brown.

Again, be sure all students use the same symbolization. (Note that the *Key for Activity 4* uses numbers to identify the category into which each country falls.)

Inform the class that by overlaying the GNP data on the population growth rate data, they are using a technique known in geography as GIS—geographic information systems. With both variables now mapped on Activity 4, students should be able to identify the high degree of spatial (or locational) association between population increase and standard of living. [It is an inverse correlation: High annual population growth rates are associated with low per capita GNP.]

After students complete the map, address Questions 1–5 on page 18.

1. What relationship do you see between the distribution of standard of living and population growth in Table 5?

   • Students should observe that poorer countries generally have higher rates of population growth than relatively wealthier countries.

2. Is population growing faster in wealthier or in poorer countries? Speculate about why you think this is the case.

   • Population is growing faster in poorer countries. Possible reasons include that in poor countries, large numbers of children are viewed as a valuable asset. (This issue is explored in greater depth in another GIGI module, Population Growth.)

3. Could rapid population increase be used to predict standard of living? Why or why not?

   • Yes, because rapid population growth occurs with low standard of living.

4. Is overpopulation more likely to occur in places with fast or slow population growth? Give examples that defend your answer.

   • Overpopulation is more likely to occur in places with fast population growth because they tend to be poorer and their resources must be shared by increasing numbers of people. This question defines the key relationship between population increase and wealth. Students should note the connection among relative wealth, population growth, and resource availability. Be sure students understand that less wealth is closely associated with the probability of overpopulation, because essential resources are out of reach for more people. However, be aware that several exceptions to the expected growth rate/GNP trend exist. For instance, in oil-exporting nations (e.g., Saudi Arabia), standard of living and population growth are both high. Discuss these exceptions if students bring them up.

5. What is the relationship between the "Percentage annual natural population increase" and "Percentage of population rural" columns in Table 5? How might you explain this relationship?

   • Generally, countries with high population growth rates have large rural populations because rural families are usually larger than urban families.

Older students can *graph* the GNP and population growth rate data from Table 5 to show the relationship between rate of population growth and poverty. On a scattergram, each country in Table 5 would be shown as a point located from the horizontal (GNP) and vertical (growth rate) axes. The spread of points will trend downward (greater GNP associated with lower growth).

For Further Inquiry

• Provide students with a list of objects and have them evaluate whether it is a resource, and if so, to whom? What makes it a resource?

• Using a news article from the bulletin board that contains population and resource issues, ask students to determine if overpopulation is a factor in the topic and to justify their answer based upon resource availability.

- Ask students to identify ways in which a short doubling time might contribute to overpopulation and shortage of resources.

- Ask students to explain the relationship between level of relative wealth in a country and the likelihood of overpopulation.

- Have students identify some nations with high and low standards of living and describe the correlation between relative wealth and rate of population growth.

   Older students may also be able to explore migration as a common response to resource shortages in a place. Students can investigate the relationship between overpopulation and migration in either the present or the past. For example, in the Great Plains during the 1930s, the "Dust Bowl" population exceeded resource availability. This stimulated a massive migration to California. Migration from Latin America to the United States is partly a product of overpopulation. Other factors such as political strife can also trigger migration, but many migrations have resulted from overpopulation. In their investigation, students should document the nature of the resource shortage and how the migration was perceived to be a solution. Students should also evaluate whether migration really eased the resource shortage problem. In the case of the Dust Bowl migration, few problems were really solved by migrating.

Lesson 4

How poor is Bangladesh?

⏱ Time Required

One to two 50-minute class periods

Materials Needed

None

G Glossary Words

gross national product (GNP)

life expectancy

per capita

resource

standard of living

Getting Started
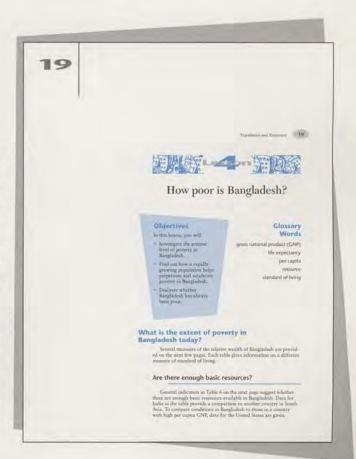
- Ask the class to list the richest countries in the world during ancient times. For younger students, you may want to assign this the day before, so they can explore outside sources for answers. Exceptionally wealthy places included China, Egypt, and Rome. Students may even discover that Bangladesh was also wealthy, although it will be harder for students to learn this because the area has only recently been called Bangladesh.

- Record the countries on the board, then have students look for those countries in Table 5 in their DataBooks (pages 16–17). For every country on the list that is also found in Table 5, have students report the GNP. With the exception of Rome, wealthy regions of the past
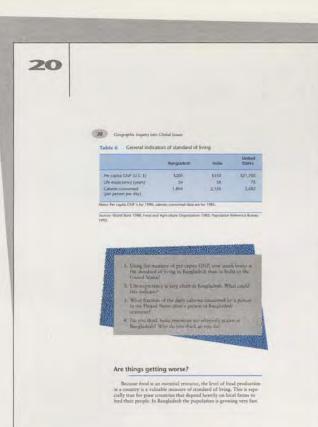
are no longer wealthy. Ask the class: How does a country go from wealth to poverty? Encourage speculation.

Procedures

What is the extent of poverty in Bangladesh today? (pages 19–24)

A. This lesson consists of text followed by several tables about basic resources in Bangladesh. Analysis of these data will help students answer the questions following each table.

19

How poor is Bangladesh?

Objectives

In this lesson, you will

- Investigate the present level of poverty in Bangladesh.

- Find out how a rapidly growing population helps perpetuate and accelerate poverty in Bangladesh.

- Discover whether Bangladesh has always been poor.

Glossary Words

gross national product (GNP)

life expectancy

per capita

resource

standard of living

What is the extent of poverty in Bangladesh today?

Several measures of the relative wealth of Bangladesh are provided on the next few pages. Each table gives information on a different measure of standard of living.

Are there enough basic resources?

General indicators in Table 6 on the next page suggest whether there are enough basic resources available in Bangladesh. Data for India in the table provide a comparison to another country in South Asia. To compare conditions in Bangladesh to those in a country with high per capita GNP, data for the United States are given.

Table 6 General indicators of standard of living

	Bangladesh	India	United States
Per capita GNP (U.S. $)	$200	$350	$21,700
Life expectancy (years)	54	58	75
Calories consumed (per person per day)	1,804	2,126	3,682

Note: Per capita GNP is for 1990; calories consumed data are for 1985.

Source: World Bank 1988; Food and Agriculture Organization 1985; Population Reference Bureau 1992.

1. Using the measure of per capita GNP, how much lower is the standard of living in Bangladesh than in India or the United States?
2. Life expectancy is very short in Bangladesh. What could this indicate?
3. What fraction of the daily calories consumed by a person in the United States does a person in Bangladesh consume?
4. Do you think basic resources are relatively scarce in Bangladesh? Why do you think as you do?

Are things getting worse?

Because food is an essential resource, the level of food production in a country is a valuable measure of standard of living. This is especially true for poor countries that depend heavily on local farms to feed their people. In Bangladesh the population is growing very fast.

Every day many more people want and need food. In order to keep up with demand, farmers must be able to produce more food each year. Table 7 below summarizes what has actually happened in recent years.

Table 7 Change of agricultural production in Bangladesh

Dates	Change
1976–1980	Decrease 0.6%
1981–1985	Decrease 0.6%
1986–1989	Decrease 2.3%

Source: Department of International Economic and Social Affairs 1990. © United Nations 1990. Reproduced with permission.

5. Has agricultural production kept up with population growth? How do you know?
6. Is the amount of food per person increasing or decreasing in Bangladesh? How can you tell?
7. If current trends continue, what is the outlook with regard to hunger in Bangladesh?

What is housing like in a poor country such as Bangladesh?

Along with food, shelter is also a basic resource. Tables 8 and 9 on pages 22 and 23 give data on the number of people per household and on the types of construction used for houses in Bangladesh.

Table 8 Population of households in Bangladesh

Number of occupants in home	Percentage of households	Percentage of population
1–2	10.6	4.4
3–4	24.3	16.3
5–7	39.8	40.8
8 or more	23.3	38.5

Note: About 70 percent of the homes have only one or two rooms.

Source: Bangladesh Bureau of Statistics 1986.

8. What percentage of the households have five or more people living in them?
9. What percentage of the population lives in houses that have five or more people living in them?

Figure 1 on page 23 is a plan of a typical house in Bangladesh. Note the overall size and that it consists of only one room. Imagine if you lived in this house with five, six, or more other people.

Extended families live and work together in Bangladesh.

Figure 1 Diagram of a typical house in Bangladesh.

Source: Johnson 1982.

To learn more about what housing is like in Bangladesh, see Table 9 below.

Table 9 Materials used for home construction in Bangladesh (thousands of homes)

Walls	Roof			
	Straw/bamboo	Tiles	Metal/wood	Cement
Straw/bamboo	6,720	71	2,576	—
Mud/adobe	1,911	214	800	—
Metal/wood	93	29	1,593	—
Cement/brick	19	3	269	416

How to read Table 9: The numbers tell you how many houses (remember to multiply by 1,000) are made of certain wall and roof materials. The rows across show how many homes have each kind of wall material. The columns show the number of homes having each kind of roof. The combination of types of roof and wall is shown by the numbers where the rows and columns meet. For example, there are 19,000 homes with walls made of cement or brick and roofs made of straw or bamboo. There are only 3,000 homes that have cement/brick walls and tile roofs.

Source: Bangladesh Bureau of Statistics 1986.

Divide the class into groups of three or four. Each small group should read the text and then, as a group, work through Tables 6–9 and Figure 1 on pages 20–23, answering the questions as a group.

Table 6 on page 20 compares general economic indicators among Bangladesh, its neighbor India, and the United States. Table 7 on page 21 reports how declining food production has failed to keep up with population growth in Bangladesh. Table 8 on page 22 gives data on the number of people per household in Bangladesh, making clear that average household size is fairly large. Table 9 on page 23 has information about construction materials used to build houses in Bangladesh.

Figure 1 on page 23 is a plan of a typical house in Bangladesh. Have the class discuss what it would be like to live in this house. Emphasize the number of people (from Table 8 on page 22) per house as related to the house's size. Consider using masking tape to outline the house in your classroom and have seven students get "inside" to experience the crowding sensation.

Questions and Answers for pages 20–24

1. Using the measure of per capita GNP, how much lower is the standard of living in Bangladesh than in India or the United States?

   • Bangladesh's GNP is about half of India's and less than 1/100 that of the United States.

2. Life expectancy is very short in Bangladesh. What could this indicate?

   • Short life expectancy indicates inadequate health care, inadequate nutrition, and so forth.

3. What fraction of the daily calories consumed by a person in the United States does a person in Bangladesh consume?

   • People in Bangladesh consume only about one-half the daily calories of U.S. residents.

4. Do you think basic resources are relatively scarce in Bangladesh? Why do you think as you do?

   • Clearly food and health care appear to be lacking in Bangladesh, which can be concluded from the short life expectancy and the low number of calories consumed in a day.

5. Has agricultural production kept up with population growth? How do you know?

   • Table 7 shows that agricultural production is declining; population is increasing.

6–7. Is the amount of food per person increasing or decreasing in Bangladesh? How can you tell? If current trends continue, what is the outlook with regard to hunger in Bangladesh?

   • If food production is declining as population increases, this means that the amount of food per person is decreasing in Bangladesh. If current trends continue, hunger will worsen.
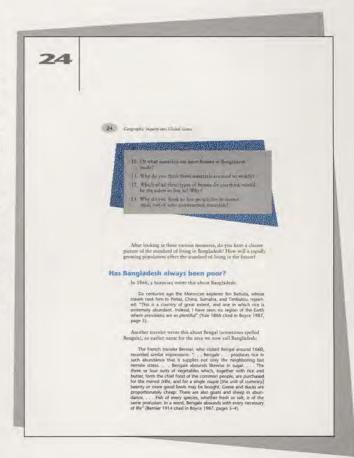
8–9. What percentage of households have five or more people living in them? What percentage of the population lives in houses that have five or more people living in them?

- About 63 percent of the households have five or more people. Nearly 80 percent of the total population lives in houses with five or more people.

10–11. Of what materials are most houses in Bangladesh made? Why do you think these materials are used so widely?

- Walls and roofs of most houses are made of straw and bamboo. These materials are available at little or no cost.

12. Which of all these types of homes do you think would be the safest to live in? Why?

- Answers will vary, but wood/metal or cement would probably be most durable and protect people from the elements. Students may ask questions about the climate, such as how cold it gets. Climate will be addressed in detail later. Provide students with the basic information that it is warm all year and rains hard part of the year. Keeping dry can be a major problem.

13. Why do you think so few people live in homes made out of safer construction materials?

- You may need to help students realize that stronger materials such as cement or brick are beyond the means of most Bangladeshis.

Has Bangladesh always been poor? (pages 24–25)

B. Have students read the extracts on page 24 to help them see that Bangladesh was once resource-rich, with a relatively small population. This gives students an opportunity to think about the impact of a rapidly growing population on future living conditions. Discussion should clarify the point that because Bangladesh is so poor, a rapidly increasing population will place more stress on resource availability, leading to greater scarcity of basic resources.

Students may ask how such extreme poverty came to exist in Bangladesh. This provides an excellent opportunity for you to provide information on the topic. Use the following background note as needed.

Background Note
A Brief History of Bangladesh

During the period of British colonial control, Bangladesh and Pakistan were included in British India. Colonial rule had as its objective the extraction of profits from Bangladesh. Local industry was discouraged, and Bangladesh was largely reduced to an exporter of raw materials and an importer of finished goods. Hence, this period witnessed a general dismantling of Bangladesh's economy and its ability to provide for its own population.
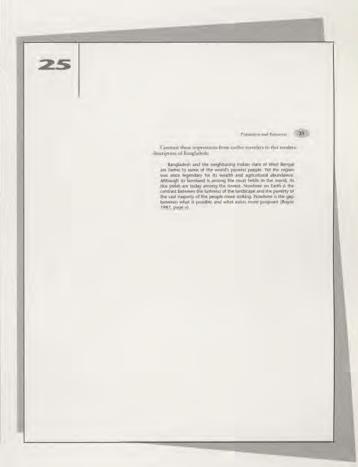
British colonial rule ended in the region in the late 1940s; the colony was split into India and Pakistan. The new state of Pakistan was divided into two separate parts, west and east. Modern day Pakistan was known as West Pakistan; Bangladesh was East Pakistan. Political and economic control resided in West Pakistan.

Many differences existed between the peoples of the two Pakistans. The East Pakistanis, who thought of themselves as Bengalis, felt that the more powerful West Pakistanis were taking advantage of them and cared little for them. They were convinced they could run their own affairs better than the "outsiders" from West Pakistan. When West Pakistan refused to give them their independence, they rose in rebellion and a civil war followed.

In 1972, their struggle ended in independence and the country of Bangladesh was born. But years of rule by outsiders had contributed little to economic development in Bangladesh, and the people had fallen deeper into poverty. The war for independence was also extremely costly. When it won its independence, Bangladesh was a very poor nation with a rapidly growing population. This trend continues today, and poverty has become even more serious.

For Further Inquiry

- Have students describe the caloric intake of the people of Bangladesh and compare it to their own diets. You may want to consult a nutrition textbook or U.S.D.A. handbook on nutrition.

- Ask students to explain whether hunger is becoming more or less of a problem in Bangladesh and why.

- Invite students to describe in as much detail as possible the average house in Bangladesh and what it would be like to live there.

25

Population and Resources   **25**

Contrast these impressions from earlier travelers to this modern description of Bangladesh:

Bangladesh and the neighboring Indian state of West Bengal are home to some of the world's poorest people. Yet the region was once legendary for its wealth and agricultural abundance. Although its farmland is among the most fertile in the world, its rice yields are today among the lowest. Nowhere on Earth is the contrast between the lushness of the landscape and the poverty of the vast majority of the people more striking. Nowhere is the gap between what is possible and what exists more poignant (Boyce 1987, page v).

How do high population densities affect land availability?

⏰ Time Required

Two 50-minute class periods

📐 Materials Needed

Copies of Activities 5 and 6 for all students
Mini-Atlas map 2

G Glossary Words

agricultural population density

arable land

arithmetic population density

carrying capacity

population density

population growth

resource

Getting Started

Drawing on the fact that most people in Bangladesh rely on agriculture to feed themselves and make a living, ask students to decide what is the *most important* resource to the people in Bangladesh. Divide the class into small groups and allow about five minutes for them to come up with some ideas. List the groups' ideas on the board. Discussion should make it clear that in an agricultural society, land is one of the most important resources. Land provides food, jobs, a place to live, and in general, opportunity.

Procedures
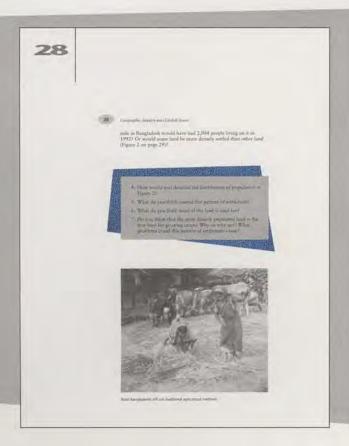
How crowded is Bangladesh becoming? (pages 26–29)
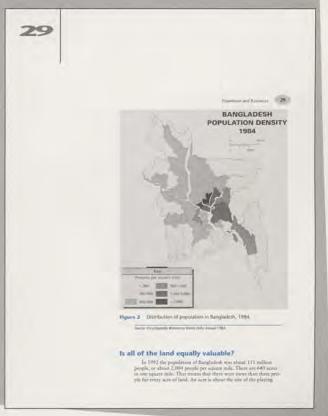
A. Have students read the opening text on pages 26–27. One of the impacts of rapid population growth in a poor, agriculturally oriented country is reduced land availability and smaller farm size. These paragraphs discuss the problems in Bangladesh and make comparisons to the United States. Discuss the term *population density* to make certain that everyone understands the concept.

Optional Activity: The land area of Texas is five times that of Bangladesh. Texas has 17 million people, while Bangladesh has over 111 million, about seven times the population of Texas. To demonstrate what this difference really means, take students to a gym or outside to a large open area. Measure and mark out two rectangles: Texas will be 10 feet by 14 feet; Bangladesh will be 7 feet by 4 feet. Put four students in Texas and 28 in Bangladesh, or, if your class has fewer students, put seven students in Bangladesh for every one student in Texas. This demonstration allows students to compare the two situations and to experience the overcrowding of Bangladesh. You can add more power to this activity by telling students that almost the entire country of Bangladesh is periodically flooded. Where can people go when they are flooded? Students can readily understand the dilemma that people face in Bangladesh. Later on in this lesson, students will explore this issue in a different activity.

Population and Resources   27

We have already seen that most people in Bangladesh live in rural rather than urban areas (Table 5 on pages 16 and 17). But because Bangladesh is small and crowded, there is a shortage of land for the people. There is only a fixed amount of land in Bangladesh. Thus, as population increases, there is less land available per person.

Population density is a measure used to indicate how crowded a place is. It is the average number of people per unit area of land, usually expressed as number of people per square mile or square kilometre. How much more densely populated do you think Bangladesh is than the United States?

What are the differences in population density between Bangladesh and the United States?

In Lesson 3, you saw in Table 5 that the population density of Bangladesh was 2,004 people per square mile. For the United States, the population density shown was 71 people per square mile.

1. How does the population density of Bangladesh compare to the density of the United States?
2. How do you think the people of Bangladesh use land? How does this view compare to that of people in the United States?
3. How does high population density make life in Bangladesh different than life in the United States?

Is the population density the same everywhere in Bangladesh?

The population density figures mentioned above are averages for the entire country of Bangladesh or the United States. That means that all land, regardless of what it is like, was figured into the calculation. When looking at such data, can we predict that every square

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mile in Bangladesh would have had 2,004 people living on it in 1992? Or would some land be more densely settled than other land (Figure 2 on page 29)?

4. How would you describe the distribution of population in Figure 2?
5. What do you think caused this pattern of settlement?
6. What do you think most of the land is used for?
7. Do you think that the most densely populated land is the best land for growing crops? Why or why not? What problems could this pattern of settlement cause?

Rural Bangladeshis still use traditional agricultural methods.

Population and Resources   29

BANGLADESH POPULATION DENSITY 1984

Key
Persons per square mile

Figure 2   Distribution of population in Bangladesh, 1984.
Source: Encyclopaedia Britannica World Data Annual 1984.

Is all of the land equally valuable?

In 1992 the population of Bangladesh was about 111 million people, or about 2,004 people per square mile. There are 640 acres in one square mile. That means that there were more than three people for every acre of land. An acre is about the size of the playing

1. How does the population density of Bangladesh compare to the density of the United States?

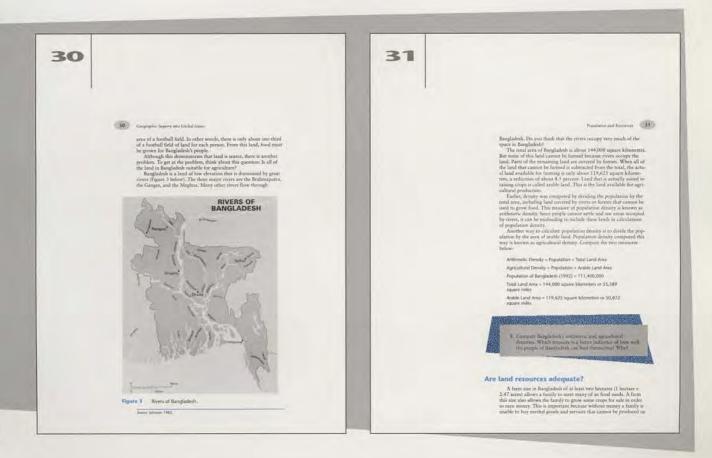   • Bangladesh is about 28 times more densely populated than the United States.

2. How do you think the people of Bangladesh view land? How does this view compare to that of people in the United States?

   • This asks students to speculate. Answers will vary here, but make sure students understand the idea that while Americans have a strong sense of land and its ownership, their concerns are not founded in the reality that even the tiniest piece of land can mean the difference between life and death. To Bangladeshis, land is rare, and wide-open spaces are unheard of. Land means food and survival in Bangladesh; in the United States, it means wealth and status. Inner city students may have the greatest empathy for living in such high-density environments.

3. How does high population density make life in Bangladesh different than life in the United States?

   • Have students think about the implications of high population densities and what impact they have on day-to-day life. Encourage students to draw on their own life experiences.

B. Under the subhead "What are the differences in population density between Bangladesh and the United States?" (page 27), Questions 1–3 compare population density in the two countries. Give students time to answer these questions, either individually or in small groups.

   For younger students, **Activity 5** helps clarify these differences. Older students should skip this basic exercise. A box representing one square mile is provided for both Bangladesh and the United States. Data for density per square mile are provided. Activity 5 has one stick figure, representing 71 people, in the U.S. box. Have students calculate how many stick figures, each representing 71 people, would be needed in the Bangladesh box to depict the population density. [2,004 ÷ 71 ≈ 28.2] Students should then sketch that number of stick figures (28+) in the box for Bangladesh to dramatize its crowdedness.

C. Students should refer to the population density map of Bangladesh, Figure 2 (page 29). This shows that the distribution of people is uneven, with some places being more crowded than others. Questions 4–7 on page 28 direct students to think about density and prepare them for the next lesson. After being asked to simply observe the difference over space, they are asked to give reasons why they think the differences exist. Students are also asked about land use and whether a relationship might exist between land use and density. Although students have not been told that higher densities tend to occur on fertile farm land, they may guess that this is the case since farming is so important. Bring out **Mini-Atlas map 2** at this time. Working in small groups, students should compare this map with Figure 2 on page 29. They should describe the relationship they see and use it in answering Questions 5–7.

Questions and Answers for page 28

4. How would you describe the distribution of population in Figure 2?

   • Answers will vary here but should emphasize the population centers in urban areas along the major rivers. The southeastern portion of the country is less populous.

5. What do you think caused this pattern of settlement?

   • Answers will vary but may include quality of land, topography, climate, and other reasons.

6. What do you think most of the land is used for?

   • Most of the land is used for agriculture, to grow food.

7. Do you think that the most densely populated land is the best land for growing crops? Why or why not? What problems could this pattern of settlement cause?

   • This does suggest that the most densely populated land is also the best farmland. The mini-atlas map should confirm this. Let students speculate on the problems this can cause.

Is all of the land equally valuable? (pages 29–31)

D. This part of the lesson expands on the concept of density. In the preceding section, students learned that density is an average measure that doesn't account for the uneven distribution of human beings. Now a method of computing density that excludes nonproductive land is introduced. Density based upon total land is *arithmetic density;* when computed using arable land only, it is known as *agricultural density.*
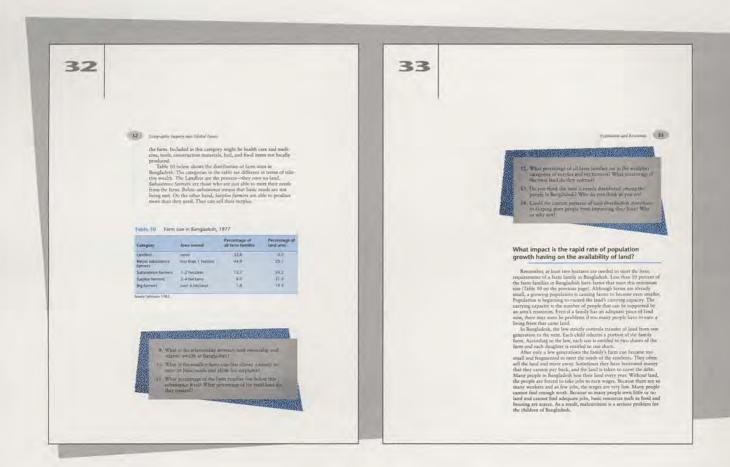
Have students read the text, which explains that rivers and forests cover about 8.5 percent of Bangladesh's land, reducing the amount of arable land per person. Figure 3 on page 30 depicts the amount of land covered by rivers. To compare the two measures, have students compute both arithmetic and agricultural densities for Bangladesh using the data on page 31 in the text. [Arithmetic density is about 2,004 people per square mile or 774 people per square kilometer; agricultural density is 2,190 people per square mile or 931 people per square kilometer.]

E. Discuss Question 8 on page 31.

Question and Answer for page 31

8. Compute Bangladesh's arithmetic and agricultural densities. Which measure is a better indicator of how well the people of Bangladesh can feed themselves? Why?

- Agricultural density more accurately reflects land scarcity and the ability of Bangladesh to feed its people because it indicates population pressure on the farmland.

Are land resources adequate? (pages 31–33)

F. This part of the lesson shows students that another part of the problem of poverty in Bangladesh is the present system of land distribution. Have students read the introductory paragraphs and study Table 10 (page 32). Questions 9–14 help make the connection between land—or the lack of it—and poverty.

Questions and Answers for pages 32–33

9. What is the relationship between land ownership and relative wealth in Bangladesh?

   • The poor own very little of the land.

10. What is the smallest farm size that allows a family to meet its basic needs and allow for surpluses?

    • The smallest farm size that meets subsistence requirements is one to two hectares.

11. What percentage of the farm families live *below* this subsistence level? What percentage of the total land do they control?

    • About 77 percent of the farm families live below the subsistence level. They control one-fourth of the land.

12. What percentage of all farm families are in the wealthier categories of surplus and big farmers? What percentage of the total land do they control?

    • About 9 percent of the farm families are in the two wealthiest categories; they control about half of the land.

13. Do you think the land is evenly distributed among the people in Bangladesh? Why do you think as you do?

    • Land is clearly not evenly distributed among the people in Bangladesh.

14. Could the current patterns of land distrubution contribute to keeping poor people from improving their lives? Why or why not?

    • The current pattern of land distribution does keep the poor from improving their lives because they do not have adequate access to land.

G. The final section, "What impact is the rapid rate of population growth having on the availability of land?" (page 33) explores why traditional laws of land inheritance lead to decreasing farm size. Have students read the text.

Provide students with both pages of **Activity 6.** Help students use them to try to parcel out a piece of land over two generations in order to discover the problem arising from the inheritance laws. Split the class into small groups for the activity. Be sure students understand the inheritance laws. Males get two shares; females get one share. For example, if three males and two females divided a 4 hectare farm, each male would get two shares (a total of six shares), and each female would

get one share (a total of two shares). That equals 8 shares in all. Hence, each male gets 2/8 or 1/4 (1 hectare) of the farm, and each female gets 1/8 (.5 hectare) of the farm. To emphasize this inequity, arrange the groups so each has a mix of boys and girls. Have each group divide the land on the map according to the law. After dividing the land, ask groups to answer the questions on page 2 of the Activity.

a. About how much land will each of the children have? [Answer will depend on each group's makeup.]

b. Will each new farm have enough land to support the growing families? [It will be tight, and there will probably not be enough; refer to earlier discussion of minimum subsistence requirements.]

c. What will happen when this generation ages and dies and the land is divided again? [Land availability will become even less adequate to meet people's needs.]

Next, have groups divide the land for the following generation. Have students pretend that each of them has two sons and one daughter, so each of their small farms must be split into three more farms. It will probably be impossible, but the experience may convey some of the frustration Bangladeshis experience in such land division. After the attempt at a second division of the land, discuss with students what has taken place. In just two generations a family has gone from having enough land to meet its needs to having too little land. More than likely, they are now living in poverty. Use these questions to explore this evolving problem.

d. How is population growth affecting the availability of the land resource? [Fewer and fewer people have enough land to meet their basic needs.]

e. What is the outlook for the future of the small family farm in Bangladesh after just one or two more generations? [Refer back to Table 10 on page 32 to verify how desperate conditions already are to help answer this. The outlook is very bleak at this time. Overpopulation, that is, too many people for the land's carrying capacity, seems to be inevitable.]

f. Do you think there is very much vacant farmland in Bangladesh? [Probably none! This question points the way to the next lesson.]

For Further Inquiry

- Have students explain how population density in Bangladesh affects land availability and the ability of each family to grow enough food to meet its needs.

- Ask students to write a paragraph that conveys how crowded conditions are in Bangladesh.

- Have students explain why agricultural population density is a better measure than arithmetic density of the ability of people to feed themselves.

- Invite students to write an essay addressing these questions: Is land ownership distributed evenly in Bangladesh? What is the relationship between relative wealth and access to land?

- Ask students to explain problems of land distribution in Bangladesh and to discuss how land inheritance laws might contribute to hunger and poverty.

How does Bangladesh's high population density increase the hazard from floods?

⏱ Time Required

Two 50-minute class periods

📓 Materials Needed

Colored pencils
Copies of Activities 7 and 8 for all students
Mini-Atlas maps 2 and 3

G Glossary Words

chars	natural hazard
cyclone	population density
drainage basin	typhoon
monsoon	

Getting Started

Tell the class something along these lines, to put this lesson's study of natural hazards into a more familiar context:

Every region and every country in the world is, from time to time, afflicted by some sort of natural hazard. For instance, earthquakes endanger the lives and property of people in Mexico, Armenia, and California; tornadoes slice through the American Midwest; droughts starve the Sahel; and blizzards blanket Europe. Bangladesh too is often threatened by severe environmental dangers. In this lesson, we will see how the climate and landforms of this crowded country challenge its people even more.
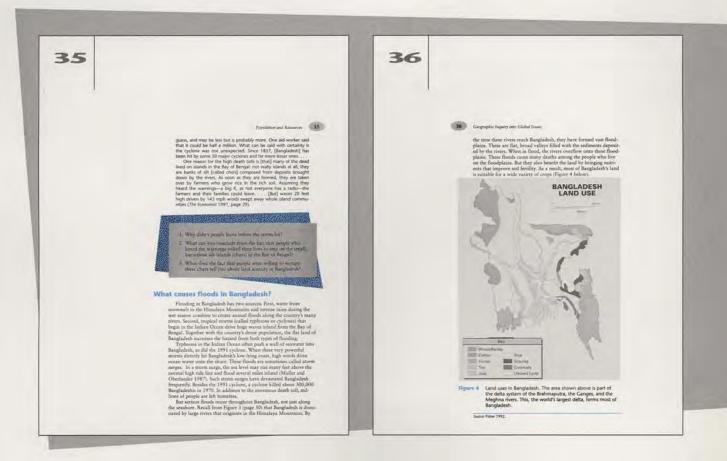
Procedures

Why do cyclones in Bangladesh kill so many people? (pages 34–35)

A. Have students read the extract on pages 34–35 describing the 1991 Bangladesh cyclone. Ask them to look for information in the extract demonstrating how desperate the people in Bangladesh are for land. Then work through Questions 1–3 on page 35.

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34 *Geographic Inquiry into Global Issues*

How does Bangladesh's high population density increase the hazard from floods?

Objectives

In this lesson, you will

- Assess some major natural hazards of Bangladesh.
- Explain how high population densities increase the number of people at risk from natural hazards.

Glossary Words

chars
cyclone
drainage basin
monsoon
natural hazard
population density
typhoon

Because Bangladesh is so crowded, there is no land to spare. As a result, people live on land subject to serious natural hazards. The worst hazards are floods along the many rivers and coastal floods next to the Bay of Bengal. These occur when the ocean is driven by powerful storms known as tropical cyclones (what we call hurricanes). One such cyclone struck Bangladesh in April 1991, killing over 200,000 people.

Why do cyclones in Bangladesh kill so many people?

One reason is described in this quotation from a newspaper article published not long after the 1991 cyclone.

[The 1991 cyclone] is said to have been the worst for 10 years, or it may have been 20 or 30. . . . The figure for the dead is a

Questions and Answers for page 35

1. Why didn't people leave before the storm hit?

   • It may have seemed better to take the risk of staying rather than leave and lose their land to others, or it may not have been possible for them to leave.

2. What can you conclude from the fact that people who heard the warnings risked their lives to stay on the small, hazardous silt islands (chars) in the Bay of Bengal?

   • Land is very important, perhaps the most important thing in one's life.

3. What does the fact that people were willing to occupy these chars tell you about land scarcity in Bangladesh?

   • The people will take great risks in the pursuit of land.
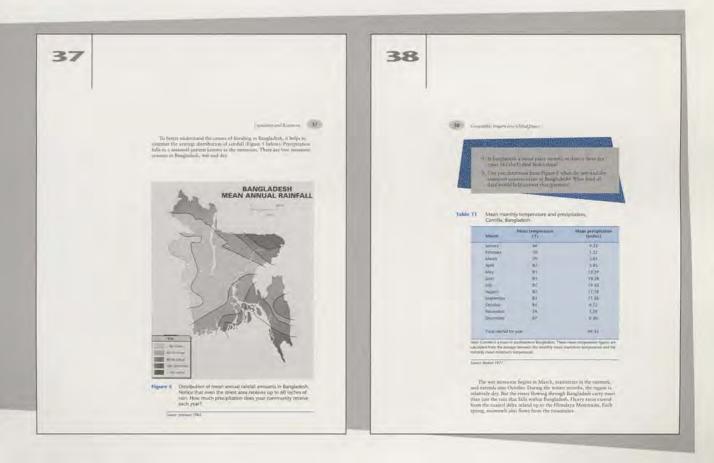
What causes floods in Bangladesh? (pages 35–41)

B. Have students read the text on pages 35–36 and examine Figure 4 on page 36, which shows the land uses of Bangladesh. Make sure students understand that nearly all of the land in Bangladesh is suitable for some form of crop agriculture. Students can note that little of the country is classified as "forest," "grazing," or "unused land" (the latter being primarily marshland). Ask students what the large percentage of cropland suggests about the topography of Bangladesh. Relate this to students' awareness of what productive farmland looks like in the United States: generally flat, with deep, rich soils. Have students examine **Mini-Atlas map 2** to emphasize this.

Ask the class why land in Bangladesh is so flat and fertile. Refer back to Figure 3 on page 30 to remind students that nearly the entire country occupies a river delta system.

Photographs of similar deltas (e.g., the Mississippi) will reinforce the idea that such landforms are very flat. If students do not know why this would also lead to soil fertility, remind them that floods deposit fresh silt rich in plant nutrients (here it may help to invoke the familiar example of the Nile River floods). Stress the agricultural benefits of flooding, but also mention the dangers to life and property. You might wish to ask the class what other countries they can think of that are very flat and exposed to flooding (e.g., The Netherlands). Students should see that, in addition to sea flooding when the Bay of Bengal rises in response to storms, the potential for river flooding in Bangladesh affects nearly every place in that country.

C. Next, have students examine Figure 5 on page 37, which shows the pattern of mean annual precipitation. Have students answer Questions 4–5 on page 38.

37

To better understand the causes of flooding in Bangladesh, it helps to examine the average distribution of rainfall (Figure 5 below). Precipitation falls in a seasonal pattern known as the monsoon. There are two monsoon seasons in Bangladesh, wet and dry.

BANGLADESH MEAN ANNUAL RAINFALL

Figure 5 Distribution of mean annual rainfall amounts in Bangladesh. Notice that even the driest area receives up to 60 inches of rain. How much precipitation does your community receive each year?

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Table 11 Mean monthly temperature and precipitation, Comilla, Bangladesh

The wet monsoon begins in March, maximizes in the summer, and extends into October. During the winter months, the region is relatively dry. But the rivers flowing through Bangladesh carry more than just the rain that falls within Bangladesh. Heavy rains extend from the coastal delta inland up to the Himalaya Mountains. Each spring, snowmelt also flows from the mountains.

4. Is Bangladesh a moist place overall, or does it have dry areas like the United States does?

   - Bangladesh has no areas that are very dry. Note that the driest areas still can receive up to 60 inches of rain, about the same as the more humid parts of the southeastern United States.

5. Can you determine from Figure 5 when the wet and dry monsoon seasons occur in Bangladesh? What kind of data would help answer that question?

   - Figure 5 does not indicate anything about seasonality. Data of monthly average precipitation could provide that information.

D. Table 11 on page 38 provides mean monthly precipitation and temperature data for one station in Bangladesh. Using **Activity 7**, students are to create a *climograph* (a climograph gives the average monthly temperatures and precipitation for a given place) for Comilla in order to understand better the seasonal aspects of this monsoon climate. Have students locate Comilla, using **Mini-Atlas map 3** (it is near Dhaka, the capital). Then, for each month, students should use colored pencils to graph the data as follows:

a. Temperature data are graphed according to the left-hand scale. Using one color, place a dot for each month's mean temperature. Connect the dots to form a smooth curve.

b. Precipitation data are graphed according to the right-hand scale. Using a second

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Population and Resources   39

Combined, this water fills and overflows the river banks, causing regular annual flooding. Figure 6 on the next page shows the size of the drainage basins for the river systems that flow into and through Bangladesh. (A drainage basin is an area of land from which all runoff and sediment flows into a stream or river.)

Villagers return to face the devastation caused by the 1991 cyclone that struck the coast of Bangladesh.

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40   Geographic Inquiry into Global Issues

THE GANGES-BRAHMAPUTRA DRAINAGE BASIN

Figure 6   The Ganges-Brahmaputra drainage basin.

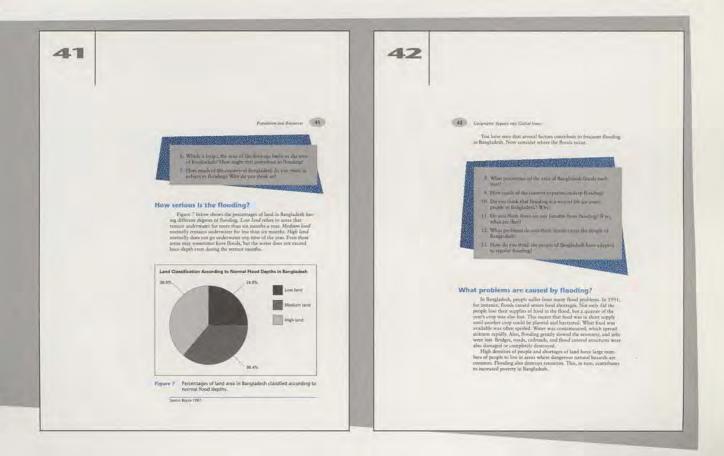Source: Rogers, Lydon, and Seckler 1989.

color, draw a bar showing the amount of rainfall received each month. Lightly shade in the bar to show the annual pattern of precipitation.

Once the climograph is finished, students should conclude that the wet monsoon occurs in the summer and that there is a big difference in the amount of rainfall received by season. In summer, the heating of the landmass creates a large low-pressure center, drawing in moisture from the warm Indian Ocean over the Indian

subcontinent. In winter, the "dry monsoon" occurs as the airflow reverses. The cooling landmass becomes a center of high pressure, and drying winds move from the subcontinent toward the Indian Ocean.

E. Students are next provided with a map, Figure 6 on page 40, showing the enormous drainage area of the rivers that flow into and through Bangladesh. Have students answer Questions 6–7 on page 41.

Questions and Answers for page 41

6. Which is larger, the area of the drainage basin or the area of Bangladesh? How might this contribute to flooding?

   - The area of the drainage basin is much larger than the area of Bangladesh. This contributes to flooding in Bangladesh because a large amount of water from a vast area ultimately accumulates in Bangladesh.

7. How much of the country of Bangladesh do you think is subject to flooding? Why do you think so?

   - Answers will vary; a more precise investigation follows.

How serious is the flooding? (pages 41–42)

F. Figure 7 on page 41 gives the percentage of land in Bangladesh that regularly experiences different degrees of flooding. Have students read the section and examine Figure 7 before you provide copies of **Activity 8**. By coloring in Activity 8, students can see the distribution of the degrees of flooding in Bangladesh. Students should use colored pencils as follows to complete Activity 8.

   a. Categories 1 and 2 experience one degree or another of flooding during the wet season (corresponding to Low and Medium land, respectively). Have students color code these areas according to the degree of expected flooding. They should use a darker color for the more severe category of Low land (1).

   b. Leave Category 3 blank. These are upland areas that effectively experience no flooding. These correspond to the High land of Figure 7 on page 41.

   The completed Activity 8 will be a map of land levels and flooding during the wet monsoon season; the pattern should resemble the *Key for Activity 8*. Have students compare this map to the relief map in the Mini-Atlas. They should note the close correspondence of elevation to flood hazard. Students should then refer back to the population distribution map (Figure 2 on page 29). Ask students why more people don't live on higher land. [The lower-lying land, although hazardous, is more fertile and productive for the agrarian economy.]

G. Students should use Figure 7 and their completed Activity 8 to help answer Questions 8–13 on page 42. If you wish, split the class into pairs to work on these questions, some of which involve speculation.

Questions and Answers for page 42

8–9. What percentage of the area of Bangladesh floods each year? How much of the country experiences deep flooding?

   • According to Figure 7 on page 41, all of Bangladesh experiences some degree of flooding each year. About 1/4 of the country experiences deep flooding (low land). Students should identify these hazard areas as coastal locations (the presence of cyclones) and floodplains (river floods).

10. Do you think that flooding is a way of life for many people in Bangladesh? Why?

   • Clearly, living with flooding is something anyone living in Bangladesh must be accustomed to. Refer back to the population distribution map (Figure 2 on page 29) if necessary to verify this.

11. Do you think there are any benefits from flooding? If so, what are they?

   • Possible answers: Flooding is necessary to saturate rice fields. Flooding also deposits silt on the fields, fertilizing the soil and so increasing crop yields.

12. What problems do you think floods cause the people of Bangladesh?

   • This has already been addressed to some degree, and discussion here provides an opportunity to expand the list.

13. How do you think the people of Bangladesh have adapted to regular flooding?

- Answers will vary, but should include as many adaptations as possible, such as housing, farming, and transportation.

What problems are caused by flooding? (page 42)

H. Have students read this text. Discuss the material to make sure everyone understands the severe impacts that flooding has on the population of Bangladesh. Negative aspects of flooding are perhaps more obvious than its benefits, and include the loss of life, livestock, crops, and houses and other buildings. Because of the high population density and scarcity of land in Bangladesh, many people are forced to live in the most dangerous flood zones. Emphasize that this is one consequence of a low standard of living, because people have few options other than living in these zones of high risk in order to eke out a living off the land.

For Further Inquiry

- Have students write a paragraph to convey how serious the problem of flooding is in Bangladesh.

- Ask students to identify and describe two factors that cause flooding in Bangladesh.

- Have students explain why more people in Bangladesh are likely to lose their lives or property in serious floods than in the United States.

- Discuss with students why so many people live where the risk of flooding is high in Bangladesh.

How has population growth destroyed Haiti's resources?

Time Required

One 50-minute class period

Materials Needed

Mini-Atlas map 4
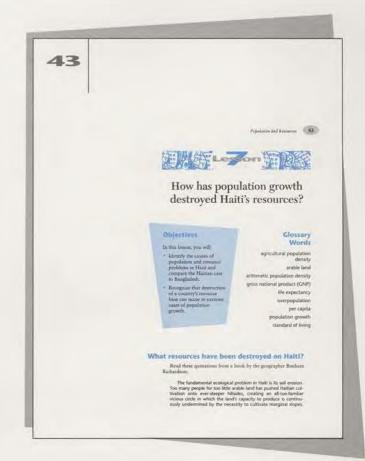
G Glossary Words

agricultural population density

arable land

arithmetic population density

gross national product (GNP)

life expectancy

overpopulation

per capita

population growth

standard of living

Getting Started

- Tell the class that they will now look at a second case study of resource-availability problems related to population growth. In this case, Haiti, the problems are more extreme than in Bangladesh; this lesson emphasizes how severe these problems can become.
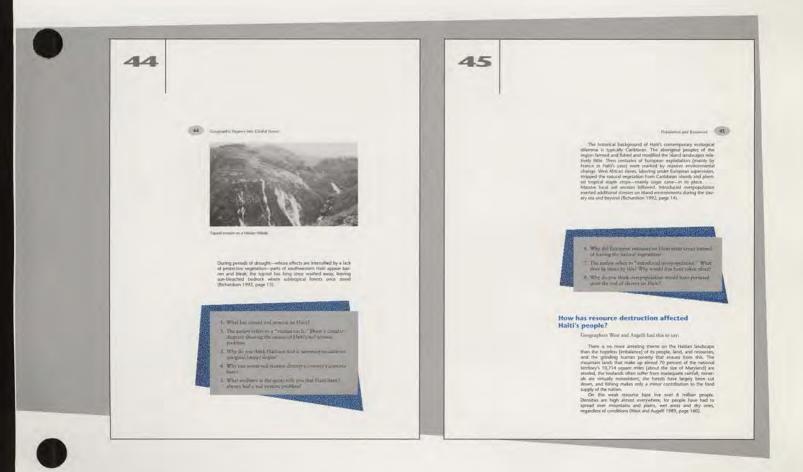
- Divide the class into pairs or groups of three for the duration of this lesson. Bring out **Mini-Atlas map 4.** Have each group estimate, using this map, what proportion of Haiti's total land area is unsuitable for agriculture because it is too steep or mountainous. Any estimate is acceptable, although students should see that most of the country consists of steep terrain, unsuited for farming. Later in the lesson, students will read that about 70% of the country is not considered arable.

Procedures

What resources have been destroyed on Haiti? (pages 43–45)

A. Student groups should read the extract from Richardson's book about the Caribbean on pages 43–44, which summarizes the soil erosion problem of Haiti. It is assumed that students understand that vegetation helps hold soil in place. If this idea is unfamiliar to your

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44 *Geographic Inquiry into Global Issues*

Topsoil erosion on a Haitian hillside.

During periods of drought—whose effects are intensified by a lack of protective vegetation—parts of southwestern Haiti appear barren and bleak; the topsoil has long since washed away, leaving sun-bleached bedrock where subtropical forests once stood (Richardson 1992, page 13).

1. What has caused soil erosion on Haiti?
2. The author refers to a "vicious circle." Draw a circular diagram showing the causes of Haiti's soil erosion problem.
3. Why do you think Haitians find it necessary to cultivate marginal (steep) slopes?
4. Why can severe soil erosion destroy a country's economic base?
5. What evidence in the essay tells you that Haiti hasn't always had a soil erosion problem?

45

Population and Resources 45

The historical background of Haiti's contemporary ecological dilemma is typically Caribbean. The aboriginal peoples of the region farmed and fished and modified the island landscapes relatively little. Then centuries of European exploitation (mainly by France in Haiti's case) were marked by massive environmental change. West African slaves, laboring under European supervision, stripped the natural vegetation from Caribbean islands and planted tropical staple crops—mainly sugar cane—in its place. Massive local soil erosion followed. Introduced overpopulation exerted additional stresses on island environments during the slavery era and beyond (Richardson 1992, page 14).

6. Why did European colonists on Haiti plant crops instead of leaving the natural vegetation?
7. The author refers to "introduced overpopulation." What does he mean by this? Why would this have taken place?
8. Why do you think overpopulation would have persisted since the end of slavery on Haiti?

How has resource destruction affected Haiti's people?

Geographers West and Augelli had this to say:

There is no more arresting theme on the Haitian landscape than the hopeless [imbalance] of its people, land, and resources, and the grinding human poverty that ensues from this. The mountain lands that make up almost 70 percent of the national territory's 10,714 square miles [about the size of Maryland] are eroded, the lowlands often suffer from inadequate rainfall, minerals are virtually nonexistent, the forests have largely been cut down, and fishing makes only a minor contribution to the food supply of the nation.

On this weak resource base live over 6 million people. Densities are high almost everywhere, for people have had to spread over mountains and plains, wet areas and dry ones, regardless of conditions (West and Augelli 1989, page 160).
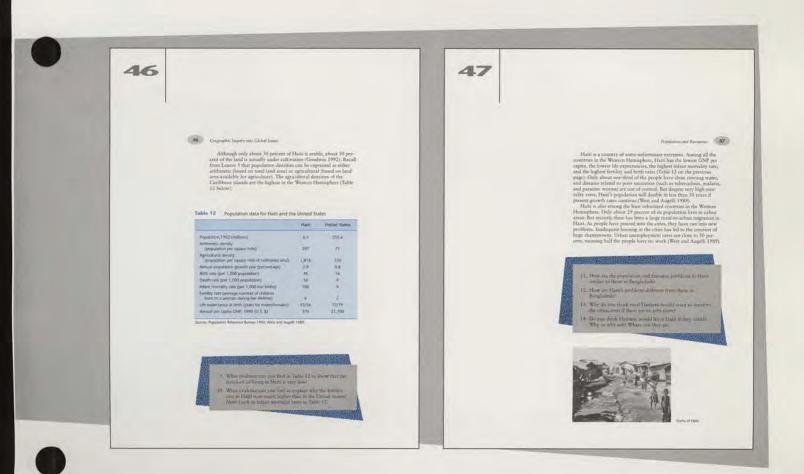
class, spend a moment explaining this. Point out that roots help bind the soil and the canopy of leaves intercepts rainfall, lowering the energy of falling rainwater that otherwise could wash away loose soil. If you wish, demonstrate this with two pots of soil. Have a plant in one pot and bare soil in the other. As you direct a stream of water at each pot, it will be clear how the leaves block the water and lower the erosion. Students should also under-stand that soil erosion is more likely on steep slopes than on flat land. Tip the pot of bare soil to demonstrate this.

B. Have student groups answer Questions 1–5 on page 44.

C. The quote by Richardson on page 45 provides some historical background to Haiti's popula-tion-resource problems. Have groups read this and discuss Questions 6–8 on page 45.

Questions and Answers for page 44

1. What has caused soil erosion on Haiti?

   • Erosion was caused by people farming on steep slopes.

2. The author refers to a "vicious circle." Draw a circular diagram showing the causes of Haiti's soil erosion problem.

   • The elements of the circle are "the land's capacity to produce" and "the necessity to cultivate marginal slopes." By sketching this as a circle, students may see more clearly how complex the problem is. The more people cultivate steep slopes, the lower is the production capacity of the land.

3. Why do you think Haitians find it necessary to cultivate marginal (steep) slopes?

   • Students should see that it becomes necessary to cultivate whatever land is available, even if it is steep, because there are more people on Haiti than can be supported by the small amount of flat, arable land.

4. Why can severe soil erosion destroy a country's resource base?

   • Without soil, there can be no agriculture—and agriculture is a basic and essential resource.

5. What evidence in the quote tells you that Haiti hasn't always had a soil erosion problem?

   • The last sentence mentions the former presence of subtropical forests.

6. Why did European colonists on Haiti plant crops instead of leaving the natural vegetation?

   • Crops, especially sugar cane used for manufacturing rum, were important sources of cash for colonial landowners. A review of the slave and rum trade of the West Indies' colonial era may help students recall this. (Slaves were brought in from West Africa to work the plantations; sugar and rum were exported to Europe.)

7. The author refers to "introduced overpopulation." What does he mean by this? Why would this have taken place?

   • The population "introduced" were the slaves forcibly brought in from Africa. This can be considered "overpopulation" in the sense that the resource base of Haiti was not adequate to support this influx.

8. Why do you think overpopulation would have persisted since the end of slavery on Haiti?

   • The problem would have persisted because the former slaves settled on the island and their population grew over the centuries.

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How has resource destruction affected Haiti's people? (pages 45–47)

D. Continuing with the class divided in pairs or small groups, have students read the section and study Table 12 on page 46. Questions 9–11 should help students focus on the key data in the table.

E. The text on page 47 emphasizes the extreme poverty of Haiti. As this problem has often been in the news in the last few years, you can enhance this reading by bringing in magazine articles on Haiti and Haitian refugees. Alternatively, if you have pictures of shanty-towns from any developing country, they can help make the point about Haiti's abject poverty. Close the lesson with discussion of Questions 11–14 on page 47, with the entire class.

Questions and Answers for page 46

9. What evidence can you find in Table 12 to show that the standard of living in Haiti is very low?

   • Among the data that could be cited here are Haiti's extremely high infant mortality rate, very low life expectancy, and low annual per capita GNP.

10. What evidence can you find to explain why the fertility rate in Haiti is so much higher than in the United States? *Hint:* Look at infant mortality rates in Table 12.

   • Students should be able to speculate that women have more children because the infant mortality rate is so high; many infants die in their first year.

Questions and Answers for page 47

11. How are the population resource problems in Haiti similar to those in Bangladesh?

   • Students may find numerous similarities between Haiti and Bangladesh. These could include the low GNP per capita in both countries, the rapid rate of population growth, and the scarcity of farmland.

12. How are Haiti's problems different from those in Bangladesh?

   • The major difference is that Haiti lacks the good soil resource base that Bangladesh has. Recall that Bangladesh consists almost entirely of arable land.

13. Why do you think rural Haitians would want to move to the cities, even if there are no jobs there?

   • Haitians are leaving the countryside because the soil resource has been so devastated that they cannot make a living off the land any longer.

14. Do you think Haitians would leave Haiti if they could? Why or why not? Where can they go?

- This question is open to discussion, but it could lead into mention of the U.S. policy toward Haitian refugees. It is important here to note that not all Haitian refugees are fleeing because their economic situation is so desperate. Haiti has also had a long history of political repression, which is beyond the scope of this lesson.

For Further Inquiry

As an authentic assessment, have students investigate on their own the population-resource problems in a country of their choice. They should locate economic and population data similar to those used in this lesson and provide some historical background to that country's problem.

Do the problems of Bangladesh and Haiti have global implications?

⏰ Time Required

One 50-minute class period

Materials Needed

None

G Glossary Words

global community

population growth

resource

Getting Started

At the beginning of Lesson 1, students were asked to bring in news items and put them on a bulletin board. To open this lesson, have students share some of their favorite news stories about population growth or resource-shortage problems.

Procedures

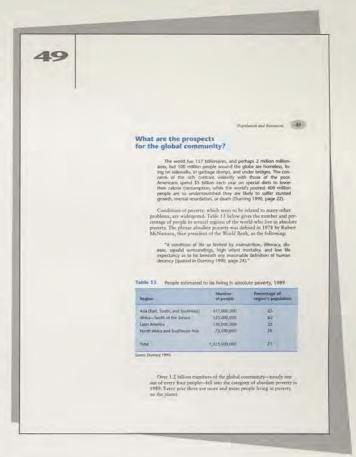### Do these problems occur only in Bangladesh and Haiti? (page 48)

A. This final lesson is intended to help students draw parallels between the conditions currently being experienced in Bangl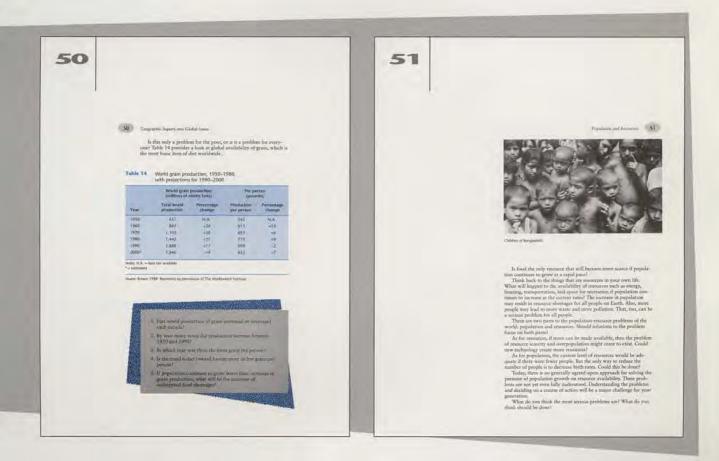adesh and Haiti and potential global problems. Have students read the text on page 48 and ask them to summarize the problems in Bangladesh and Haiti they have learned about. List these on the board. Next, ask the class to focus on the causes of each of the problems. List the causes identified after each of the problems.

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48   Geographic Inquiry into Global Issues

Lesson 8

Do the problems of
Bangladesh and Haiti have
global implications?

Objective
In this lesson, you will

• Evaluate the global nature
of the issue of population
growth and resource
availability.

Glossary Words

global community

population growth

resource

**Do these problems occur
only in Bangladesh and Haiti?**

We have seen that Bangladesh and Haiti are both poor and crowded places with rapidly growing populations. Because poverty is severe, both the absolute numbers of people and the rate of population growth are problems. Many other countries in the world face similar problems. In extreme cases, such as in Haiti, poor countries are sinking further into poverty and destroying their environmental resource bases at the same time. It is possible that this problem will become increasingly severe in your lifetime.

Is this only a problem for the poorer countries such as Bangladesh and Haiti? Or does it have implications for everyone who lives on the planet?

What are the prospects for the global community? (pages 49–51)

C. This section presents information about population-resource problems at the global scale. To underscore how widespread poverty is, Table 13 (page 49) documents the number of people estimated to be living in absolute poverty in 1989. Read the definition of *absolute poverty* and ask the class if they agree that this definition would be understandable to all people. Discuss the table and address the question of whether poverty is a problem for the world's poor or for everyone.

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What are the prospects for the global community?

The world has 157 billionaires, and perhaps 2 million millionaires, but 100 million people around the globe are homeless, living on sidewalks, in garbage dumps, and under bridges. The concerns of the rich contrast violently with those of the poor. Americans spend $5 billion each year on special diets to lower their calorie consumption, while the world's poorest 400 million people are so undernourished they are likely to suffer stunted growth, mental retardation, or death (Durning 1990, page 22).

Conditions of poverty, which seem to be related to many other problems, are widespread. Table 13 below gives the number and percentage of people in several regions of the world who live in absolute poverty. The phrase absolute poverty was defined in 1978 by Robert McNamara, then president of the World Bank, as the following:

"A condition of life so limited by malnutrition, illiteracy, disease, squalid surroundings, high infant mortality, and low life expectancy as to be beneath any reasonable definition of human decency (quoted in Durning 1990, page 24)."

Table 13 People estimated to be living in absolute poverty, 1989

Region	Number of people	Percentage of region's population
Asia (East, South, and Southeast)	675,000,000	25
Africa—South of the Sahara	325,000,000	62
Latin America	150,000,000	35
North Africa and Southwest Asia	75,000,000	28
Total	1,225,000,000	23

Source: Durning 1990

Over 1.2 billion members of the global community—nearly one out of every four people—fell into the category of absolute poverty in 1989. Every year there are more and more people living in poverty on the planet.

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Is this only a problem for the poor, or is it a problem for everyone? Table 14 provides a look at global availability of grain, which is the most basic item of diet worldwide.

Table 14 World grain production, 1950–1980, with projections for 1990–2000

Year	World grain production (millions of metric tons)		Per person (pounds)	
	Total world production	Percentage change	Production per person	Percentage change
1950	631	N.A.	542	N.A.
1960	847	+34	611	+13
1970	1,103	+30	653	+6
1980	1,442	+31	710	+9
1990	1,689	+17	699	-2
2000*	1,846	+9	653	-7

Notes: N.A. = data not available
* = estimated

Source: Brown 1989. Reprinted by permission of The Worldwatch Institute.

1. Has world production of grain increased or decreased each decade?
2. By how many times did production increase between 1950 and 1990?
3. In which year was there the most grain per person?
4. Is the trend today toward having more or less grain per person?
5. If population continues to grow faster than increases in grain production, what will be the outcome of widespread food shortages?

51

Children of Bangladesh

Is food the only resource that will become more scarce if population continues to grow at a rapid pace?

Think back to the things that are resources in your own life. What will happen to the availability of resources such as energy, housing, transportation, and space for recreation if population continues to increase at the current rates? The increase in population may result in resource shortages for all people on Earth. Also, more people may lead to more waste and more pollution. That, too, can be a serious problem for all people.

There are two parts to the population-resource problems of the world: population and resources. Should solutions to the problems focus on both parts?

As for resources, if more can be made available, then the problem of resource scarcity and overpopulation might cease to exist. Could new technology create more resources?

As for population, the current level of resources would be adequate if there were fewer people. But the only way to reduce the number of people is to decrease birth rates. Could this be done?

Today, there is no generally-agreed-upon approach for solving the pressure of population growth on resource availability. These problems are not yet even fully understood. Understanding the problems and deciding on a course of action will be a major challenge for your generation.

What do you think the most serious problems are? What do you think should be done?

Questions and Answers for page 50

1. Has world production of grain increased or decreased each decade?

   • Total world production of grain has increased each decade.

2. By how many times did production increase between 1950 and 1990?

   • Total world grain production nearly tripled between 1950 and 1990.

3. In which year was there the most grain per person?

   • The most grain per person was in the 1980s.

4. Is the trend today toward having more or less grain per person?

   • The trend today is toward less grain per person. It is important that students realize that although production continues to increase, population is growing at a faster rate, so that per person grain amounts are now declining.

5. If population continues to grow faster than increases in grain production, what will be the outcome of widespread food shortages?

   • Discussion of this question may take a number of directions. Increased hunger for some people is one possible answer. In the long term, however, this could mean increased hunger for all, or nearly all, if hunger were to threaten global political and economic stability, and hence, the standard of living in many places.

D. Table 14 (page 50) expands the inquiry by showing the relationship between grain production and population growth. The most recent trend is not an optimistic one: less grain per person. Discuss Questions 1–5 following the table.

E. These questions are followed by a short, concluding text that directs students to the overall implications of the population-resources issue. On a separate sheet of paper, have students record their present perceptions. Under the general heading of "problem," they should list the problems that exist in Bangladesh and Haiti, such as hunger. In a second column they should briefly describe the condition and the severity of the problem in Bangladesh and Haiti. Students ought to be able to cite some of the data from the module.

In a third column, students should identify how this problem might have a world connec-
tion. For example, they could ask if there is less grain per person today than there was just a few years ago. Finally, encourage students to speculate whether the conditions in Bangladesh or Haiti are a preview to population and resource problems that might threaten the entire planet in the future. Ask them to use the news stories that they have gathered over the course of the module about population-resource problems as data.

F. With this sheet of perceptions in hand, students can discuss the final questions of the module on page 51 ("What do you think the most serious problems are?" and "What do you think should be done?"). Discussion can be conducted either in small groups or with the class as a whole. It is not necessary for the class to reach a consensus, but students should identify different perspectives.

For Further Inquiry

- Ask students to identify ways that the problems in Bangladesh and Haiti are related to problems in other parts of the world.

- Have students create a skit or poster dramatizing the connection between present conditions in Bangladesh or Haiti and possible future conditions for the world.

- Ask students to describe the trend of changing world grain production and explain why the amount of grain per person is declining.

- The module may be extended by turning the final questions into a formal debate. Students could investigate the problems identified in greater depth, using more countries (perhaps selected from Table 5 on pages 16–17). A class consensus might be reached following the presentation of arguments regarding the most suitable solutions to the problems.

Extension Activities and Resources

1. **Related GIGI Modules**
   - The question of how countries have sought to manage their population increase is explored in *Population Growth*. This module's primary case study is on China, with a comparison case study of the United States.

   - Investigation of the physical, political, and social factors contributing to the lack of basic food resources underlies the module *Hunger*. The primary case study is the famine in the Sudan; brief comparisons are made to India and to Canada.

   - The problem of hazards in Bangladesh is covered from different angles in brief comparison case studies within two modules. In *Natural Hazards*, the difficulty of preparing for hazards in poor countries is emphasized. In *Global Climate Change*, the potential for major population displacement in Bangladesh from global sea level rise forms the basis for one activity.

2. **Britannica Global Geography System (BGGS)**
   BGGS provides myriad extension activities to enhance each GIGI module. For a complete description of the BGGS CD-ROM and videodiscs and how they work with the GIGI print modules, please read the BGGS Overview in the tabbed section at the beginning of this Teacher's Guide.

3. **Related Videos**
   - EBEC offers the following videos about the issues and regions explored in this module: "Population Story: Collision with the Future"; "Africa: Central and Eastern Regions"; and "Rivers in Danger: The Zambezi and the Nile."
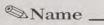
     For information, or to place an order, call toll-free, 1-800-554-9862.
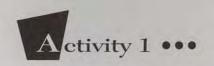
   - Other related videos include: "Living Quarters" (*Spaceship Earth* series, PBS)

4. **Additional Activities**
   - On a state- or county-wide basis, students could map differences in population growth within the United States. The

47

objective is to discover that differences in rates of population growth occur at many scales and in many places. Students should speculate why the differences exist.

- Have students consider marketing campaigns for various goods or services. Then have them map where these items might be successfully sold and where they might not be successfully sold. For example, would lawn mowers be marketable in the Sahara? Would microwave ovens sell in Ethiopia? Would the people of Jamaica find ski equipment valuable? Each group of students can present their maps and the rest of the class can discuss if the marketing area is realistic. The areas should include people who would think of the good or service as a valuable resource.

- Have students explore the following questions: Can level of poverty be measured from country to country easily? For instance, an income of $5,000 in the United States would suggest a very low standard of living. Would an income of $5,000 in Bangladesh suggest the same level of poverty, or would a person who earned that amount in Bangladesh be fairly wealthy by local standards? Students can investigate the relative wealth or poverty of a person earning $5,000 in some of the selected countries.

- Have students keep track of everything they eat, including sodas, gum, and snacks, for a 24-hour period. Use a calorie counter to determine their total caloric intake and compare that with the average given for Bangladesh in Lesson 4 in the Student DataBook (Table 6 on page 20).

- Students could survey the dwellings in their neighborhood to determine the types of building materials as well as the number of rooms and number of inhabitants per family, and compare the information with conditions in Bangladesh, as shown in Table 9 on page 23.

- Have students debate the following question: Does rapid population growth in one country create problems elsewhere? For example, can rapid population growth in Bangladesh affect the United States? A *no* position indicates a local or regional view that places are separate and problems in one place do not have an impact on others. A yes position suggests that all the planet's places and peoples are interconnected and problems in one place will eventually have an effect on other places.

- Have students gather information on flood control along the Mississippi River or in the Netherlands. Ask students to figure out why Bangladesh has not implemented such flood-control programs.
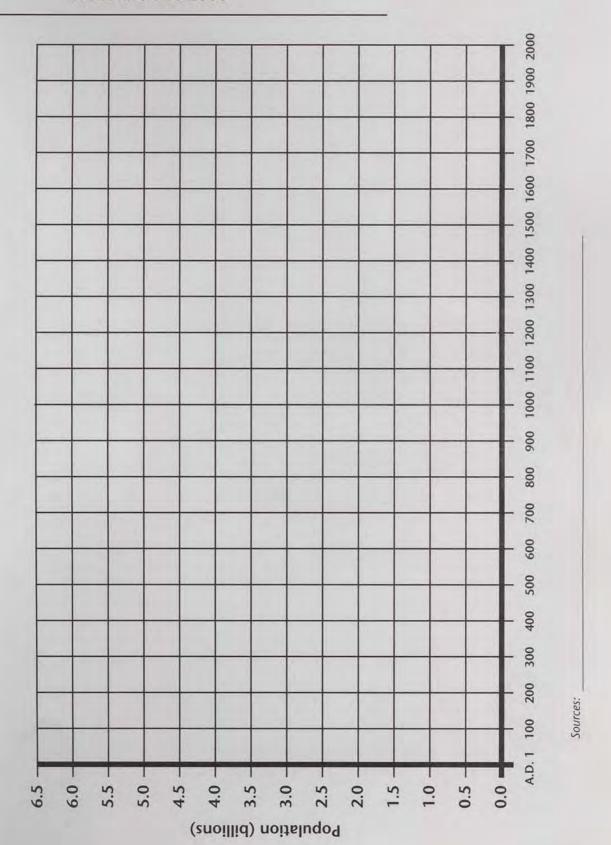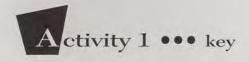
Estimate of World Population Growth, from A.D. 1 to 2000

Sources: _____

Population (billions)

6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

A.D. 1 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000
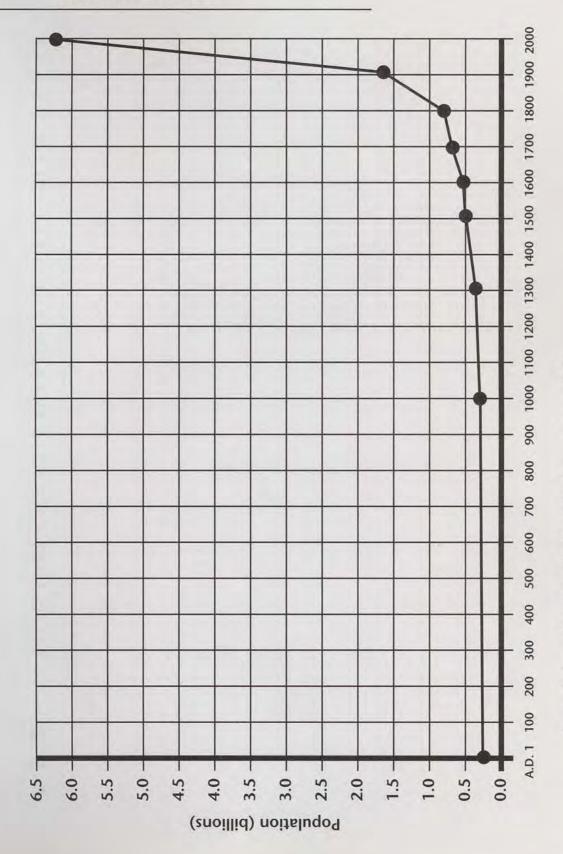
Estimate of World Population Growth, from A.D. 1 to 2000

Sources: Jordan and Rowntree 1990; Population Reference Bureau 1992.

Population (billions)

Changing Rates of World Population Doubling Time
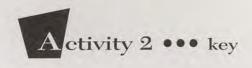
Directions: Use the data in Table 2 (page 8) to calculate how long it will have taken Earth's population to double from .25 billion until the year 2020, when the population is expected to reach 8 billion. Plot those values on the graph, and then connect the points.

1. What trend can you describe?
2. What questions does the growth of the world's population force people to consider?

Number of Years for Population to Double

1,800					
1,600					
1,400					
1,200					
1,000					
800					
600					
400					
200					
0					

Doubled from → .25 to .50 billion   .50 to 1.0 billion   1.0 to 2.0 billion   2.0 to 4.0 billion   4.0 to 8.0 billion

Doubling Events

Sources: _____

Changing Rates of World Population Doubling Time

1. What trend can you describe? [World population doubled in shorter and shorter periods of time, then flattened out, but it still doubles every 45 years.]

2. What questions does the growth of the world's population force people to consider? [This question has no right answer, but was asked to see what students want to know about population growth and its related problems (e.g., resource demand).]

Number of Years for Population to Double (vertical axis: 0, 200, 400, 600, 800, 1,000, 1,200, 1,400, 1,600, 1,800)

Doubling Events (horizontal axis)

Doubled from → .25 to .50 billion | .50 to 1.0 billion | 1.0 to 2.0 billion | 2.0 to 4.0 billion | 4.0 to 8.0 billion

Doubling Time for Selected Countries
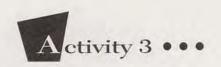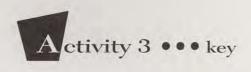
Country	1992 estimated population (millions)	Percentage annual increase of population	Years to double population*	Year population doubles**
Australia	17.8	0.8	_____	_____
Bangladesh	111.4	2.4	_____	_____
Brazil	150.8	1.9	_____	_____
China	1,165.8	1.3	_____	_____
Egypt	55.7	2.4	_____	_____
France	56.9	0.4	_____	_____
Italy	58.0	0.1	_____	_____
Japan	124.4	0.3	_____	_____
Kenya	26.2	3.7	_____	_____
Mexico	87.7	2.3	_____	_____
Poland	38.4	0.4	_____	_____
United States	255.6	0.8	_____	_____

Source: Population Reference Bureau 1992.

* If the percentage annual increase remains the same during the doubling period. The percentage annual increase is used only as an indicator of growth, not as a predictor.

** From 1994.

Doubling Time for Selected Countries
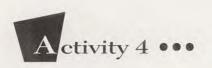
Country	1992 estimated population (millions)	Percentage annual increase of population	Years to double population*	Year population doubles**
Australia	17.8	0.8	88	2082
Bangladesh	111.4	2.4	29	2023
Brazil	150.8	1.9	37	2031
China	1,165.8	1.3	54	2048
Egypt	55.7	2.4	29	2023
France	56.9	0.4	175	2169
Italy	58.0	0.1	700	2694
Japan	124.4	0.3	233	2227
Kenya	26.2	3.7	19	2013
Mexico	87.7	2.3	30	2024
Poland	38.4	0.4	175	2169
United States	255.6	0.8	88	2082

Source: Population Reference Bureau 1992.
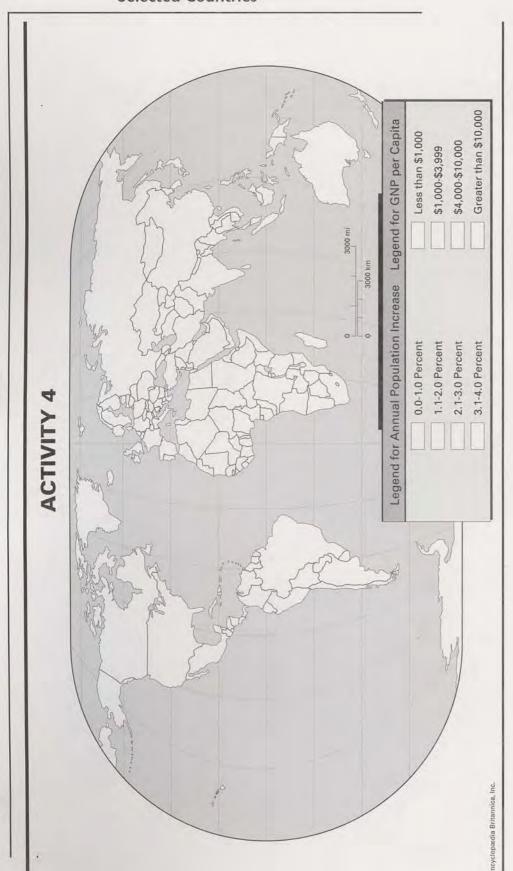
* If the percentage annual increase remains the same during the doubling period. The percentage annual increase is used only as an indicator of growth, not as a predictor.

** From 1994.

Annual Population Increase and GNP for Selected Countries

ACTIVITY 4

Legend for Annual Population Increase

- 0.0-1.0 Percent
- 1.1-2.0 Percent
- 2.1-3.0 Percent
- 3.1-4.0 Percent

Legend for GNP per Capita

- Less than $1,000
- $1,000-$3,999
- $4,000-$10,000
- Greater than $10,000

3000 mi

3000 km

Annual Population Increase and GNP for Selected Countries

KEY TO ACTIVITY 4
INCLUDES ANSWERS FOR LESSONS 2 AND 3

Legend for Annual Population Increase   Legend for GNP per Capita

	Less than $1,000
1	
2	$1,000–$3,999
3	$4,000–$10,000
4	Greater than $10,000

0.0–1.0 Percent
1.1–2.0 Percent
2.1–3.0 Percent
3.1–4.0 Percent

3000 mi

3000 km

GNP per capita data made available after publication of Student Data Book. May be used for Activity 4: Sudan $400; Russia $3,220; Kazakhstan $2470; Saudi Arabia $7,070.
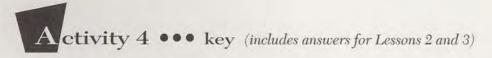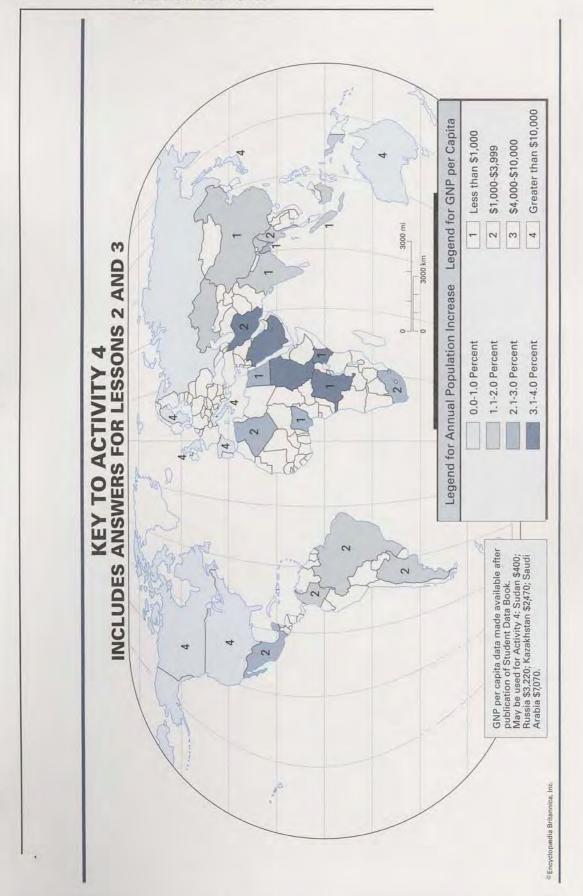
Comparing Population Density in the United States and Bangladesh

Population density of the United States = 71 people per square mile
Population density of Bangladesh = 2,004 people per square mile

One square mile

One square mile

Bangladesh

United States

represents 71 people
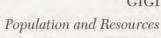
A Family Farm in Bangladesh

← 200 meters →

(total farm size = approximately 4 hectares)

Garden

Houses →

Farmstead

Animal pens

Kitchen

Woodlot
(for fuel and
construction)

IRRIGATION DITCH

Nonirrigated fields

Irrigated fields (rice)

RIVER

Nonirrigated fields

Description of a Family Farm in Bangladesh

The farm shown on the first page is about 4 hectares in size. This is large enough to meet a family's basic needs. The farm lies on land that borders a small river. This land is relatively flat, but it slopes slightly toward the river. Although this farm is on the highest ground, it is only a foot or two above the river and is subject to flooding. An irrigation ditch runs through the farm to provide water to the rice fields that lie between the ditch and the river. These fields are flooded almost every year during the summer. Above the ditch the land cannot be irrigated because of the slightly sloping land. Crops that can tolerate drier conditions are grown in these fields. During some years when the floods are especially large, these fields are also flooded by the river. In other years, they are not flooded.

The farmstead includes houses for the extended family, a kitchen, pens for livestock and for storing feed, and a garden. (The layout of a typical house is shown in Figure 1 on page 23 in the Student DataBook.) There is also a small woodlot in the northeast corner of the farm. From this woodlot, the family can get wood for some of its fuel needs or for construction. The woodlot is getting smaller each year because the family uses wood faster than it can grow back. For fuel, the family is becoming increasingly dependent upon dung and straw.

As the sons marry, they will bring their wives to live on the farmstead and begin families of their own. Perhaps they will build additional houses as their families grow. When the daughters get married, they will go to live on the farms of their husbands, and their shares will be divided among those who remain. The fields are the most valuable asset of the family and must be divided fairly. As the land is passed on from generation to generation, the fields will be divided again and again. Will future families be able to maintain themselves on this farm?

Questions for Discussion
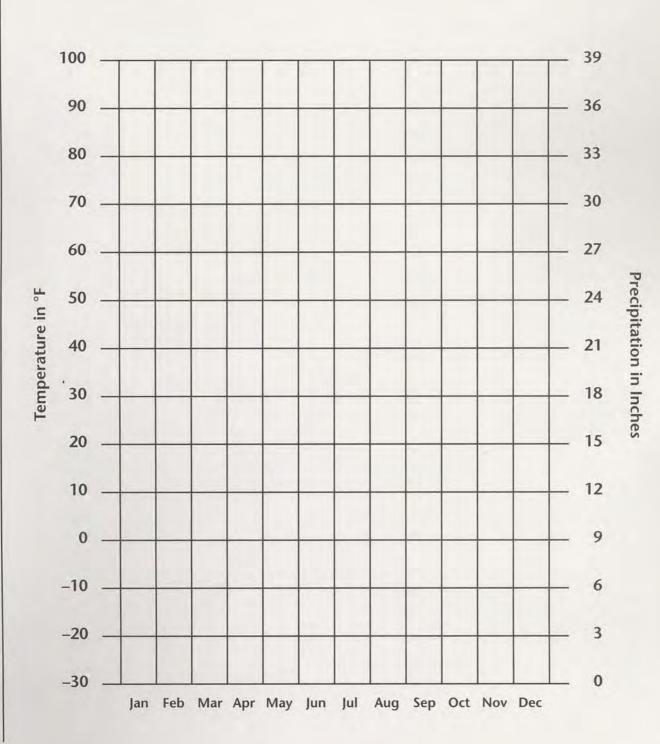
a. If the Bangladeshi family had the same number of boys and girls as are in your group, about how much land will each child have?
b. Will each new farm have enough land to support the growing families?
c. What will happen when this generation ages and dies and the land is divided again?
d. How is population growth affecting the availability of the land resource?
e. What is the outlook for the future of the small family farm in Bangladesh after just one or two more generations?
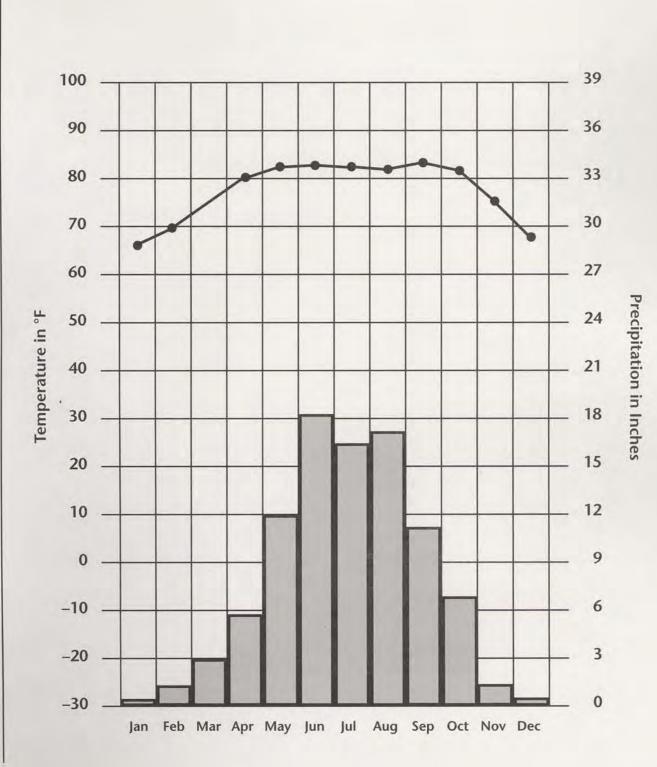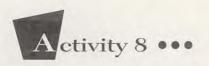f. Do you think there will be much vacant farmland in Bangladesh?

Climograph for Comilla, Bangladesh

Temperature in °F	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Precipitation in Inches
100													39
90													36
80													33
70													30
60													27
50													24
40													21
30													18
20													15
10													12
0													9
−10													6
−20													3
−30													0

Climograph for Comilla, Bangladesh

**Distribution of Summer Flood Depths
in Bangladesh**

ACTIVITY 8
DISTRIBUTION OF SUMMER FLOOD
DEPTHS IN BANGLADESH

0 ————————— 100 mi
0 ————————— 100 km

(All islands = 2 unless otherwise noted)

Key	
1	Low Land (medium and deep flooding)
2	Medium Land (shallow and intermediate flooding)
3	High Land (hills and high terraces)

**Distribution of Summer Flood Depths
in Bangladesh**

KEY TO ACTIVITY 8
DISTRIBUTION OF SUMMER FLOOD
DEPTHS IN BANGLADESH

0   100 mi
0   100 km

Key
■ Low Land (medium and deep flooding)
■ Medium Land (shallow and intermediate flooding)
□ High Land (hills and high terraces)

BRITANNICA GLOBAL GEOGRAPHY SYSTEM

GIGI

Geographic Inquiry into Global Issues

Population and Resources

Program Developers
A. David Hill, James M. Dunn, and Phil Klein

Regional Case Study
South Asia

Contents

GIGI National
Field Trial Locations

Anchorage, AK
Juneau, AK
Birmingham, AL
Grove Hill, AL
Ventura, CA
Arvada, CO
Boulder, CO
Colorado Springs, CO
Lakewood, CO
Westminster, CO
Wilmington, DE
Nokomis, FL
Lithonia, GA
Marietta, GA
Beckemeyer, IL
Red Bud, IL
Lafayette, IN
La Porte, IN
Merrillville, IN
Mishawaka, IN
Eldorado, KS
Morgantown, KY
Lowell, MA
South Hamilton, MA
Westborough, MA
Annapolis, MD
Baltimore, MD
Pasadena, MD
Detroit, MI
Mt. Pleasant, MI
Rochester Hills, MI
South Haven, MI
St. Joseph, MI
Jefferson City, MO

Raymondville, MO
St. Louis, MO
McComb, MS
Boone, NC
Charlotte, NC
Oxford, NE
Franklin Lakes, NJ
Lakewood, NJ
Salem, OH
Pawnee, OK
Milwaukie, OR
Portland, OR
Armagh, PA
Mercersburg, PA
Spring Mills, PA
State College, PA
Swiftwater, PA
Easley, SC
Alamo, TN
Evansville, TN
Madison, TN
El Paso, TX
Gonzales, TX
Houston, TX
Kingwood, TX
San Antonio, TX
Tyler, TX
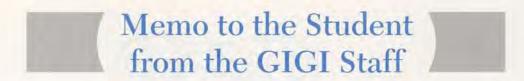Centerville, UT
Pleasant Grove, UT
Salt Lake City, UT
Monroe, WI
Racine, WI
Cheyenne, WY
Worland, WY

Memo to the Student from the GIGI Staff

GIGI stands for *Geographic Inquiry into Global Issues,* which is the name of a series of modules. Each module inquires into a different world issue. We wrote this memo to explain that GIGI is different from most textbooks you have used.

With GIGI, you can have fun learning if you think like a scientist or detective. The main business of both scientists and detectives is puzzle-solving. They use information ("data" to the scientist and "evidence" to the detective) to test their solutions to puzzles. This is what you do with GIGI. GIGI poses many puzzles about important global issues: Each module centers around a major question, each lesson title is a question, and there are many other questions within each lesson. GIGI gives you real data about the world to use in solving these puzzles.

To enjoy and learn from GIGI, you have to take chances by posing questions and answers. Just as scientists and detectives cannot always be sure they have the right answers, you will sometimes be uncertain with GIGI. But that's OK! What's important is that you try hard to come up with answers, even when you're not sure. Many of GIGI's questions don't have clear-cut, correct answers. Instead, they ask for your interpretations or opinions. (Scientists and detectives are expected to do this, too.) You also need to ask your own questions. If you ask a good question in class, that can sometimes be more helpful to you and your classmates than giving an answer.

The data you will examine come in many forms: maps, graphs, tables, photos, cartoons, and written text (including quotations). Many of these come from other sources. Unlike most textbooks, but typical of articles in scientific journals, GIGI gives its sources of data with in-text references and full reference lists. Where an idea or piece of information appears in GIGI, its author and year of publication are given in parentheses, for example: (Gregory 1990). If the material used is quoted directly, page numbers are also included, for example: (Gregory 1990, pages 3–5). At the end of the module you'll find a list of references, alphabetized by authors' last names, with complete publication information for the sources used.

To help you understand the problems, GIGI uses "case studies." These are examples of the global issue that are found in real places. "Major case studies" detail the issue in a selected world region. You will also find one or two shorter case studies that show variations of the issue in other regions.

We hope your geographic inquiries are fun and worthwhile!

Population and Resources
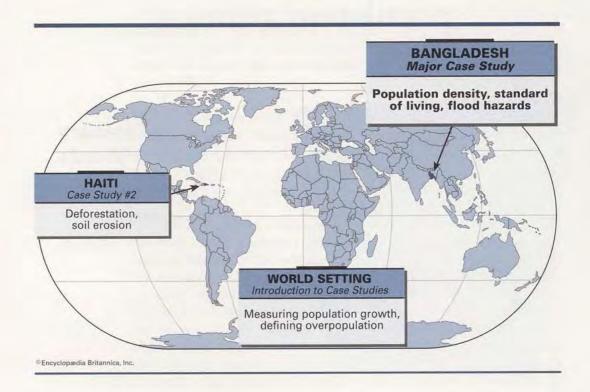
How does population growth affect resource availability?

- What is life like in a poor, densely populated country?
- What does *overpopulation* mean?
- How do countries become overpopulated?
- What will happen if Earth's population growth outruns its resources?

In this module, you will study how fast the world's population is growing and where it is growing the fastest. A serious imbalance between rapidly increasing numbers of people and availability of essential resources is found in some countries. You will conduct case studies of two such countries, Bangladesh and Haiti.

BANGLADESH
Major Case Study

Population density, standard
of living, flood hazards

HAITI
Case Study #2

Deforestation,
soil erosion

WORLD SETTING
Introduction to Case Studies

Measuring population growth,
defining overpopulation

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Questions You Will Consider in This Module

- Which countries can be considered overpopulated?

- Why is a country's population growth related to its wealth?

- How is population growth related to resource availability?

- What are the consequences of overpopulation on resources?

- What kinds of data provide measures of standard of living?

- What is the significance of population density in an agricultural society?

Lesson 1

How fast is the world's population growing?

Objectives

In this lesson, you will

- Graph and assess the rate of global population growth over the past 2,000 years.

- Speculate about problems that might result from continued rapid population growth.

Glossary Words

doubling time

population growth

resource

Is population growth a problem?

Read what two experts have to say.

The world's population, now 5.3 billion, is increasing by three people every second—about a quarter of a million every day. Between 90 million and 100 million people—roughly equivalent to the population of eastern Europe or Central America—will be added every year during the 1990s; a billion people—a whole extra China—over the decade. . . . Progress in reducing birth rates has been slower than projected. . . . The world could be headed towards an eventual total of 14 billion people.

—Dr. Nafis Sadik, Executive Director of the
United Nations Population Fund (UNFPA), 1990

In the 30 years or so that it takes for this generation to be succeeded by the next, the world's total population will grow by close to 3 billion. That is by more than the total size of the world population in 1950.

—Dirk J. van de Kaa, UNFPA, 1990

The significance of world population growth

The population of the world at mid-century was 2.5 billion; some time in 1987 it passed 5 billion. The increase in the past 40 years has equaled the total increase over the millions of years from when the human species first emerged until 1950 (Keyfitz 1989, page 119).

Many people are becoming concerned that population is growing faster than necessary resources such as food and energy. Dr. Norman E. Borlaug is a scientist who was awarded the Nobel Peace Prize in 1970 for creating new varieties of grains that helped to feed more of Earth's population. Read what he had to say about population.

Those of us who work on the food production front, I believe, have the moral obligation to warn the political, religious, and educational leaders of the world of the magnitude and seriousness of the arable land, food, and population problems that loom ahead. . . . Why does mankind continue to inadvertently and irresponsibly try to see how many additional people can be "heaped" onto the planet Earth? Why do we continue to apparently always believe that future, newer, and better technologies will expand the carrying capacity of our planet, while at the same time assure an improving standard of living for all? It appears to me that we are behaving in a most irrational and irresponsible manner (Borlaug 1987).

Does Dr. Borlaug think population growth is a problem or not? Do you agree? Why or why not?

The author Charles C. Mann has summarized a contrasting position, as follows:

In 1972 a group a researchers at MIT . . . used advanced computer models to project that the world would run out of gold in 1981, oil in 1992, and arable land in 2000. Civilization itself would collapse by 2070. The projections failed to materialize. Birth rates dropped; food production soared; the real price of oil sank to a record low. . . . [H]umanity faces [population] problems but has a good shot of coming out okay in the end. . . . [A]long with each new mouth comes a pair of hands. . . . Twenty-five years ago, 3.4 billion people lived on Earth. Now the United Nations estimates that 5.3 billion do—the biggest, fastest increase in history. But food production increased faster still. According to

the Food and Agriculture Organization (FAO) of the UN, not only did farmers keep pace but per capita global food production rose more than 10 percent from 1968 to 1990. The number of chronically malnourished people fell by more than 16 percent. . . . An FAO study published in 1982 concluded that by using modern agricultural methods, the Third World could support more than 30 billion people (Mann 1993, pages 48–50).

Putting Earth's population into perspective

You, your family, your friends, and the rest of the more than 5,420,000,000 (five billion, four hundred twenty million) people on our planet are stranded here. Think of Earth as a small speck of rock in space. It is flying at 77,000 miles per hour around a nuclear fusion reactor we call the Sun. Everything that we use is available to us from Earth's environment. Earth's resources must be shared by nearly 5.5 billion human beings. Every year another 90 to 100 million people are added to the planet's total population, and they need and want a share of these resources too.

Earth has not always had so many people. Two thousand years ago, there were far fewer people on this planet than there are today. In fact, it is estimated that, in the year A.D. 1, there were only about 250 million people on Earth (Table 1 below). That's about the number of people in the United States today. No one knows exactly how many people there were in the past. No census or other accurate count was taken. But it is not essential to know exactly how many people there were. The estimates are believed to be fairly accurate and indicate the overall trend in population growth.

How fast is Earth's population growing?

Table 1   Estimate of Earth's population growth, from A.D. 1 to 2000

Year	Population (billions)
1	0.3
1000	0.3
1300	0.4
1500	0.5
1600	0.5
1700	0.6
1800	0.9
1900	1.6
2000	6.2

Note: Figure for 2000 is an estimate.

Sources: Jordan and Rowntree 1990; Population Reference Bureau 1992.

1. During the period covered by Table 1, in what century has population growth been the fastest?

2. How many people are predicted to be on the planet in the year 2000?

3. How many more than the current population is that?

4. What problems might be caused by the population size estimated for 2000?

How much is a billion?

The number of people now on Earth is so large that it is hard to comprehend how many people this really is. Just how large a number is five billion, four hundred twenty million?

If we think in terms of inches instead of people, 5,420,000,000 inches is equal to 85,543 miles. The circumference of Earth is about 24,910 miles. So, a rope 5,420,000,000 inches long would wrap around the world almost three and one-half times. Or, think in terms of sheets of paper. A stack of 5,420,000,000 sheets of paper would be nearly 335 miles tall! Or, think in terms of time: 5,420,000,000 minutes would be the same as sitting in class for 10,312 years without taking a break! So, while we may not be able to fully comprehend how many people 5,420,000,000 really is, we can see it is a huge number.

Table 2 on the next page shows how long it took Earth's population to double. The table includes a prediction of when there will be 8 billion people. The table shows how the doubling time of human population is changing.

A billion sheets of paper.

Table 2   Doubling of Earth's population from A.D. 1 to 2020

Historical highlight	Year	Population (billions)
Han Dynasty, China	1	0.25
Charles I of England beheaded	1650	0.50
Industrial Revolution	1830	1.00
Great Depression	1930	2.00
Vietnam War ends	1975	4.00
People born in 1980 turn 40	2020	8.00

Note: Figure for 2020 is an estimate.

Sources: Jordan and Rowntree 1990; Population Reference Bureau 1992.

5. How many years did it take for the population of Earth to double from 0.25 billion to 0.50 billion?

6. If you calculate the number of years for the population to double each time, what trend do you notice?

What do population growth rates mean?

Why is Earth's population growing? Very simply, population growth occurs when the total number of births exceeds the total number of deaths. Population growth is usually measured as a rate of increase per year, expressed as a percentage.

Earth's current rate of population increase is just under 2 percent (1.7%) per year. At a rate of 2 percent growth per year, the population of Earth in 100 years would be more than 40 billion (Table 3 on the following page). Imagine what it would be like if there were eight times more people competing for food, water, housing, clothing, energy, transportation, education, and parking spaces!

The rate of population growth in the United States is under 1 percent per year. India is growing at 2 percent per year; Haiti is growing nearly 3 percent per year. And some countries (e.g., Kenya and Iraq) are growing at almost 4 percent per year (Population Reference Bureau 1992). What do these growth rates mean? Is a rate of 2 percent, 3 percent, or even 4 percent so high that it is undesirable?

Table 3   Percentage annual increase and 100-year growth

Percentage annual increase	Percentage increase for 100 years	Total world population in 100 years (current population 5,420,000,000)
1	272	14,742,400,000
2	739	40,053,800,000
3	2098	113,711,600,000
4	5469	296,419,800,000

7. If the population of the world were to grow at only 1 percent per year, how many people would there be on the planet in 100 years?

8. That would be an increase of how many times more than the current population?

The streets of Tokyo's Ginza district are typical of highly populated urban areas.

Population growth rates and doubling time

Another way to understand the impact of population growth rates is to look at the time it will take a population to double at the current rate of growth. This is important because it can be assumed that when a population doubles, the demand for things like food, shelter, clothing, health care, education, and jobs will also double.

Doubling time can be estimated from this simple formula:

Doubling time = 70 ÷ Percentage annual population growth

Let's look at two examples of doubling time. The percentage annual growth rate of India is 2 percent. If that rate stays constant, India's population will double in only 35 years (70 ÷ 2). Compare that to Russia, which has a population growth rate of 0.2 percent. At that rate, Russia's population will take about 350 years to double (70 ÷ 0.2).

9. What problems might countries with short doubling times face because their populations are growing so fast?

10. Do countries with low population growth rates have advantages over those with high rates of growth? Think of an example to support your answer.

Lesson 2

How and why does population growth vary from place to place?

Objectives

In this lesson, you will

- Map rates of population growth in different places.

- Speculate on the implications of different rates of population growth.

Glossary Words

population growth

What are the regional differences in population growth?

It is clear that global population is growing rapidly and that some places have faster growth rates than others. This raises two geographical questions:

- What are the regional differences in growth rates?
- What causes these differences?

Table 4 on page 12 provides data for selected countries in several regions. Although these data help answer the first question, a map showing the data from Table 4 would be even more helpful. Geographers often use maps to help analyze global issues. Maps

show whether there is a locational pattern to problems such as the rate of population growth. Think about how you would map the data in Table 4.

Table 4   Population growth for selected countries

Country	1992 estimated population (millions)	Percentage annual natural population increase*	Years for population to double at current rate of increase
Algeria	26.0	2.4	28
Argentina	33.1	1.2	56
Australia	17.8	0.8	83
Bangladesh	111.4	2.4	29
Brazil	150.8	1.9	37
Canada	27.4	0.8	89
China	1,165.8	1.3	53
Colombia	34.3	2.0	35
Egypt	55.7	2.4	28
India	882.6	2.0	34
Indonesia	184.5	1.7	40
Iran	59.7	3.3	21
Italy	58.0	0.1	1,386
Japan	124.4	0.3	217
Kazakhstan	16.9	1.4	50
Kenya	26.2	3.7	19
Mexico	87.7	2.3	30
Nigeria	90.1	3.0	23
Russia	149.3	0.2	301
Saudi Arabia	16.1	3.5	20
South Africa	41.7	2.6	26
Spain	38.6	0.2	433
Sudan	26.5	3.1	22
Sweden	8.7	0.3	210
Thailand	56.3	1.4	48
United Kingdom	57.8	0.3	257
United States	255.6	0.8	89
Zaire	37.9	3.1	22

*Note: Natural population increase accounts only for births and deaths, and not immigration.

Source: Population Reference Bureau 1992.

1. Which places have slow population growth?

2. Which places have the fastest population growth?

3. Why do you think the rates of population increase are not the same everywhere?

The following comment was made in 1990 by Robert G. Mugabe, president of the Republic of Zimbabwe, about rapid population growth:

> In Africa today, we have the most rapid population growth rate ever recorded for a continent. The present rate of about 2.95 percent is expected to rise to 3.13 percent during the 1995–2000 period (Mugabe 1990, page 7).

4. Is a rate of 3.13 percent really high? Support your answer.

5. Should the people of Africa be concerned? Why or why not?

Why do the differences between places exist?

It is evident from Table 4 on page 12 that rates of population growth are very different from place to place. Geographers want to know why. Based on what you already know about population growth, speculate about the cause or causes of the place-to-place differences you have observed. Speculation (*hypothesizing* or guessing) is the heart of geographic inquiry. Making a reasonable guess about the cause of geographic patterns is the first step to finding an answer.

Lesson 3

What is overpopulation and how is it distributed?

Objectives

In this lesson, you will

- Develop working definitions for *overpopulation* and for *resource*.

- Map and identify the correlation between relative wealth and rate of population growth.

Glossary Words

gross national product (GNP)

overpopulation

per capita

population density

resource

standard of living

How can you tell if a place is overpopulated?

Read what several people have said about population growth.

Egypt appears headed for crisis. Its population leaps by one million every nine months, upping both drinking water and food demands. . . . It rarely ever rains, and the country's 55 million people depend almost entirely on the waters of the Nile—none of which originate within the nation's boundaries. . . . Ethiopia's development plans could reduce the Blue Nile's flow . . . bringing drastic consequences downstream. . . . "The next war in our region will be over the waters of the Nile, not politics," says Egypt's minister of state for foreign affairs (Postel 1989, pages 14–15).

Nearly one-half of the world's population—some 2 billion people—depend on wood for fuel to cook and to heat their homes. The FAO [United Nations Food and Agriculture Organization] estimated that close to 100 million people are already unable to satisfy their minimum needs. A further 1 billion are in a "deficit situation" where they can meet their needs only by depleting wood resources. . . . According to FAO's projections, as population increases, as forests become more scarce, half of the people in the developing world will lack a sustainable supply of fuelwood by the year 2000 (Zero Population Growth 1989).

At its current growth rate, the Philippines' population [66 million] will double in 25 years. The country's agricultural production is not likely to double in the foreseeable future; indeed, it may even decline. . . . In 1990, there were almost 2 million more Filipino mouths to feed than in 1989 (Ehrlich and Ehrlich 1990, page 75).

These quotations all hint that overpopulation is a special kind of relationship between people and resources. What is the relationship between the wealth of a country and overpopulation? What are some examples of resources? Are all resources of equal importance? Where do resources come from? Review the definition of *resource* in the glossary to help yourself think about these questions.

What is standard of living and how is it measured?

Standard of living is a term referring to the relative wealth of a person or a group of people. Many measures can help indicate the standard of living of a population.

"UNICEF [United Nations Children's Fund] reports that in Nigeria, between 120,000 and 150,000 children die each year of malnutrition" (Brown 1989, page 35). What standard of living does widespread hunger and malnutrition suggest? What other factors would be indicators of a country's standard of living?

One measure of wealth is per capita Gross National Product (per capita GNP). It is measured in monetary value, such as U.S. dollars. This measure represents the estimated value of all wealth a country has produced in a given year, divided by its total population. Because per capita GNP is only an average, it does not mean that each person has that much money to spend. Rather, it indicates the country's overall wealth. It suggests the probability that a country is overpopulated. What is the probable relationship between per capita GNP and overpopulation?

Are standard of living and population growth related?

Both per capita GNP and percentage of annual natural population increase are provided on Table 5 below for selected countries. The phrase *natural population increase* refers to births and deaths, not immigration.

Table 5   Population characteristics for selected countries

Country	1992 estimated population (millions)	Percentage annual natural population increase
Algeria	26.0	2.4
Argentina	33.1	1.2
Australia	17.8	0.8
Bangladesh	111.4	2.4
Brazil	150.8	1.9
Canada	27.4	0.8
China	1,165.8	1.3
Colombia	34.3	2.0
Egypt	55.7	2.4
India	882.6	2.0
Indonesia	184.5	1.7
Iran	59.7	3.3
Italy	58.0	0.1
Japan	124.4	0.3
Kazakhstan	16.9	1.4
Kenya	26.2	3.7
Mexico	87.7	2.3
Nigeria	90.1	3.0
Russia	149.3	0.2
Saudi Arabia	16.1	3.5
South Africa	41.7	2.6
Spain	38.6	0.2
Sudan	26.5	3.1
Sweden	8.7	0.3
Thailand	56.3	1.4
United Kingdom	57.8	0.3
United States	255.6	0.8
Zaire	37.9	3.1

continued

Note: N.A. means data not available.

Table 5   *(continued)*

Country	Population density (pop/sq mile)	Per capita GNP, 1990 (U.S. $)	Percentage of population rural
Algeria	28	2,060	50
Argentina	31	2,370	14
Australia	6	17,080	15
Bangladesh	2,004	200	86
Brazil	46	2,680	26
Canada	7	20,450	22
China	315	370	74
Colombia	78	1,240	32
Egypt	144	600	55
India	695	350	74
Indonesia	249	560	69
Iran	94	2,450	46
Italy	499	16,850	28
Japan	865	25,430	23
Kazakhstan	16	N.A.	42
Kenya	116	370	78
Mexico	115	2,490	29
Nigeria	253	370	84
Russia	23	N.A.	26
Saudia Arabia	19	N.A.	23
South Africa	88	2,520	44
Spain	198	10,920	9
Sudan	27	N.A.	80
Sweden	50	23,860	17
Thailand	284	1,420	82
United Kingdom	611	16,070	10
United States	71	21,700	25
Zaire	42	230	60

Source: Population Reference Bureau 1992.

1. What relationship do you see between the distribution of standard of living and population growth in Table 5?

2. Is population growing faster in wealthier or in poorer countries? Speculate about why you think this is the case.

3. Could rapid population increase be used to predict standard of living? Why or why not?

4. Is overpopulation more likely to occur in places with fast or slow population growth? Give examples that defend your answer.

5. What is the relationship between the "Percentage annual natural population increase" and "Percentage of population rural" columns in Table 5? How might you explain this relationship?

Lesson 4

How poor is Bangladesh?

Objectives

In this lesson, you will

- Investigate the present level of poverty in Bangladesh.

- Find out how a rapidly growing population helps perpetuate and accelerate poverty in Bangladesh.

- Discover whether Bangladesh has always been poor.

Glossary Words

gross national product (GNP)

life expectancy

per capita

resource

standard of living

What is the extent of poverty in Bangladesh today?

Several measures of the relative wealth of Bangladesh are provided on the next few pages. Each table gives information on a different measure of standard of living.

Are there enough basic resources?

General indicators in Table 6 on the next page suggest whether there are enough basic resources available in Bangladesh. Data for India in the table provide a comparison to another country in South Asia. To compare conditions in Bangladesh to those in a country with high per capita GNP, data for the United States are given.

Table 6   General indicators of standard of living

	Bangladesh	India	United States
Per capita GNP (U.S. $)	$200	$350	$21,700
Life expectancy (years)	54	58	75
Calories consumed (per person per day)	1,804	2,126	3,682

Notes: Per capita GNP is for 1990; calories consumed data are for 1985.

Sources: World Bank 1988; Food and Agriculture Organization 1985; Population Reference Bureau 1992.

1. Using the measure of per capita GNP, how much lower is the standard of living in Bangladesh than in India or the United States?

2. Life expectancy is very short in Bangladesh. What could this indicate?

3. What fraction of the daily calories consumed by a person in the United States does a person in Bangladesh consume?

4. Do you think basic resources are relatively scarce in Bangladesh? Why do you think as you do?

Are things getting worse?

Because food is an essential resource, the level of food production in a country is a valuable measure of standard of living. This is especially true for poor countries that depend heavily on local farms to feed their people. In Bangladesh the population is growing very fast.

Every day many more people want and need food. In order to keep up with demand, farmers must be able to produce more food each year. Table 7 below summarizes what has actually happened in recent years.

Table 7   Change of agricultural production in Bangladesh

Dates	Change
1976–1980	Decrease 0.6%
1981–1985	Decrease 0.6%
1986–1989	Decrease 2.3%

Source: Department of International Economic and Social Affairs 1990.
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5. Has agricultural production kept up with population growth? How do you know?

6. Is the amount of food per person increasing or decreasing in Bangladesh? How can you tell?

7. If current trends continue, what is the outlook with regard to hunger in Bangladesh?

What is housing like in a poor country such as Bangladesh?

Along with food, shelter is also a basic resource. Tables 8 and 9 on pages 22 and 23 give data on the number of people per household and on the types of construction used for houses in Bangladesh.

Table 8   Population of households in Bangladesh

Number of occupants in home	Percentage of households	Percentage of population
1–2	10.6	4.4
3–4	24.3	16.3
5–7	39.8	40.8
8 or more	23.3	38.5

Note: About 70 percent of the homes have only one or two rooms.

Source: Bangladesh Bureau of Statistics 1986.

8. What percentage of the households have five or more people living in them?

9. What percentage of the population lives in houses that have five or more people living in them?

Figure 1 on page 23 is a plan of a typical house in Bangladesh. Note the overall size and that it consists of only one room. Imagine if you lived in this house with five, six, or more other people.

Extended families live and work together in Bangladesh.

Figure 1   Diagram of a typical house in Bangladesh.

Source: Johnson 1982.

To learn more about what housing is like in Bangladesh, see Table 9 below.

Table 9   Materials used for home construction in Bangladesh (thousands of homes)

Walls	Straw/bamboo	Roof Tiles	Metal/wood	Cement
Straw/bamboo	6,720	73	2,576	—
Mud/adobe	1,933	214	809	—
Metal/wood	95	29	1,593	—
Cement/brick	19	3	269	416

How to read Table 9: The numbers tell you how many houses (remember to multiply by 1,000) are made of certain wall and roof materials. The rows across show how many homes have each kind of wall material. The columns show the number of homes having each kind of roof. The combination of types of roof and walls is shown by the numbers where the rows and columns meet. For example, there are 19,000 homes with walls made of cement or brick and roofs made of straw or bamboo. There are only 3,000 homes that have cement/brick walls and tile roofs.

Source: Bangladesh Bureau of Statistics 1986.

10. Of what materials are most houses in Bangladesh made?

11. Why do you think these materials are used so widely?

12. Which of all these types of homes do you think would be the safest to live in? Why?

13. Why do you think so few people live in homes made out of safer construction materials?

After looking at these various measures, do you have a clearer picture of the standard of living in Bangladesh? How will a rapidly growing population affect the standard of living in the future?

Has Bangladesh always been poor?

In 1866, a historian wrote this about Bangladesh:

> Six centuries ago the Moroccan explorer Ibn Battuta, whose travels took him to Persia, China, Sumatra, and Timbuktu, reported: "This is a country of great extent, and one in which rice is extremely abundant. Indeed, I have seen no region of the Earth where provisions are so plentiful" (Yule 1866 cited in Boyce 1987, page 3).

Another traveler wrote this about Bengal (sometimes spelled Bengale), an earlier name for the area we now call Bangladesh:

> The French traveler Bernier, who visited Bengal around 1660, recorded similar impressions: ". . . Bengale . . . produces rice in such abundance that it supplies not only the neighboring but remote states. . . . Bengale abounds likewise in sugar. . . . The three or four sorts of vegetables which, together with rice and butter, form the chief food of the common people, are purchased for the merest trifle, and for a single *roupie* [the unit of currency] twenty or more good fowls may be bought. Geese and ducks are proportionately cheap. There are also goats and sheep in abundance. . . . Fish of every species, whether fresh or salt, is of the same profusion. In a word, Bengale abounds with every necessary of life" (Bernier 1914 cited in Boyce 1987, pages 3–4).

Contrast these impressions from earlier travelers to this modern description of Bangladesh:

Bangladesh and the neighboring Indian state of West Bengal are home to some of the world's poorest people. Yet the region was once legendary for its wealth and agricultural abundance. Although its farmland is among the most fertile in the world, its rice yields are today among the lowest. Nowhere on Earth is the contrast between the lushness of the landscape and the poverty of the vast majority of the people more striking. Nowhere is the gap between what is possible and what exists more poignant (Boyce 1987, page v).

Lesson 5

How do high population densities affect land availability?

Objectives

In this lesson, you will

- Explore the impact of population density on the availability of land.

- Compare arithmetic and agricultural population density and evaluate which is the better indicator of density in Bangladesh.

Glossary Words

agricultural population density

arable land

arithmetic population density

carrying capacity

population density

population growth

resource

How crowded is Bangladesh becoming?

Bangladesh is a small country, only about the size of Wisconsin. Yet its population is nearly half as large as the population of the United States. Imagine if one-half of all Americans lived in Wisconsin! It would be a very crowded place. Imagine further what life would be like if all those people crowded into Wisconsin were as poor as the people of Bangladesh.

What if the rate of population growth was so fast that the current population would double in just 29 years? That would mean that a very poor population—nearly the size of the entire United States today—would be crowded into an area the size of Wisconsin.

We have already seen that most people in Bangladesh live in rural rather than urban areas (Table 5 on pages 16 and 17). But because Bangladesh is small and crowded, there is a shortage of land for the people. There is only a fixed amount of land in Bangladesh. Thus, as population increases, there is less land available per person.

Population density is a measure used to indicate how crowded a place is. It is the average number of people per unit area of land, usually expressed as number of people per square mile or square kilometer. How much more densely populated do you think Bangladesh is than the United States?

What are the differences in population density between Bangladesh and the United States?

In Lesson 3, you saw in Table 5 that the population density of Bangladesh was 2,004 people per square mile. For the United States, the population density shown was 71 people per square mile.

1. How does the population density of Bangladesh compare to the density of the United States?

2. How do you think the people of Bangladesh view land? How does this view compare to that of people in the United States?

3. How does high population density make life in Bangladesh different than life in the United States?

Is the population density the same everywhere in Bangladesh?

The population density figures mentioned above are averages for the entire country of Bangladesh or the United States. That means that all land, regardless of what it is like, was figured into the calculation. When looking at such data, can we predict that every square

mile in Bangladesh would have had 2,004 people living on it in 1992? Or would some land be more densely settled than other land (Figure 2 on page 29)?

4. How would you describe the distribution of population in Figure 2?

5. What do you think caused this pattern of settlement?

6. What do you think most of the land is used for?

7. Do you think that the most densely populated land is the best land for growing crops? Why or why not? What problems could this pattern of settlement cause?

Rural Bangladeshis still use traditional agricultural methods.

BANGLADESH POPULATION DENSITY 1984

| 0 | | | 100 mi |
| 0 | | | 100km |

Key

Persons per square mile

< 300	800-1,000
300-600	1,000-2,000
600-800	> 2,000

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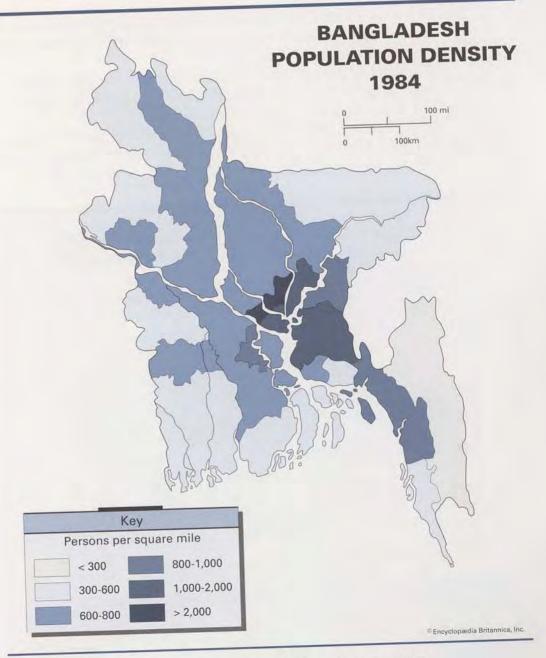
Figure 2   Distribution of population in Bangladesh, 1984.

Source: Encyclopædia Britannica World Data Annual 1984.

Is all of the land equally valuable?

In 1992 the population of Bangladesh was about 111 million people, or about 2,004 people per square mile. There are 640 acres in one square mile. That means that there were more than three people for every acre of land. An acre is about the size of the playing

area of a football field. In other words, there is only about one-third of a football field of land for each person. From this land, food must be grown for Bangladesh's people.

Although this demonstrates that land is scarce, there is another problem. To get at the problem, think about this question: Is all of the land in Bangladesh suitable for agriculture?

Bangladesh is a land of low elevation that is dominated by great rivers (Figure 3 below). The three major rivers are the Brahmaputra, the Ganges, and the Meghna. Many other rivers flow through

RIVERS OF BANGLADESH

Brahmaputra
Purnabhaba
Tista
Rangpur
Jamuna
Jamuna
Kangsa
Old Brahmaputra
Baulai
Surma
Sylhet
Karatoya
Kalni
Kusiyara
Siragānj
Bhagirathi
Dhaleswari
Lakhya
Meghna
Ganges
Padma
Dhaka
Gumti
Garai
Arial Khan
Meghna
Hooghly
Pusur
Bishkhali
Buriswar
Tetulia
Chittagong
Matamuhari
Sangu

0   100 mi
0   100 km

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Figure 3   Rivers of Bangladesh.

Bangladesh. Do you think that the rivers occupy very much of the space in Bangladesh?

The total area of Bangladesh is about 144,000 square kilometers. But some of this land cannot be farmed because rivers occupy th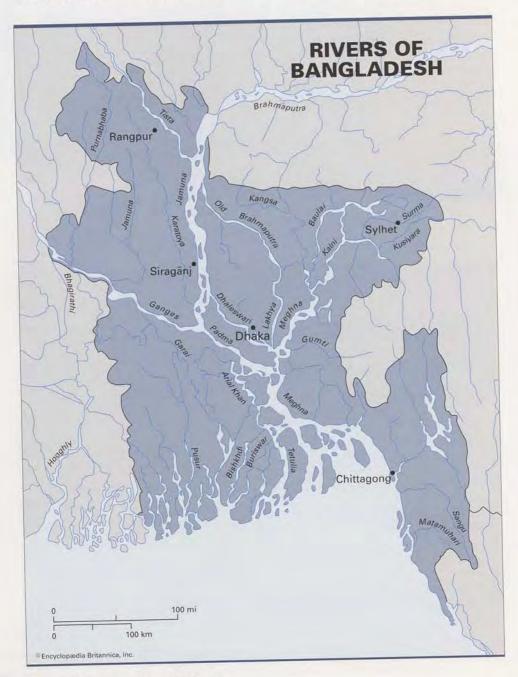e land. Parts of the remaining land are covered by forests. When all of the land that cannot be farmed is subtracted from the total, the actual land available for farming is only about 119,625 square kilometers, a reduction of about 8.5 percent. Land that is actually suited to raising crops is called arable land. This is the land available for agricultural production.

Earlier, density was computed by dividing the population by the total area, including land covered by rivers or forests that cannot be used to grow food. This measure of population density is known as arithmetic density. Since people cannot settle and use areas occupied by rivers, it can be misleading to include these lands in calculations of population density.

Another way to calculate population density is to divide the population by the area of arable land. Population density computed this way is known as agricultural density. Compare the two measures below:

Arithmetic Density = Population ÷ Total Land Area

Agricultural Density = Population ÷ Arable Land Area

Population of Bangladesh (1992) = 111,400,000

Total Land Area = 144,000 square kilometers or 55,589 square miles

Arable Land Area = 119,625 square kilometers or 50,872 square miles

8. Compute Bangladesh's arithmetic and agricultural densities. Which measure is a better indicator of how well the people of Bangladesh can feed themselves? Why?

Are land resources adequate?

A farm size in Bangladesh of at least two hectares (1 hectare = 2.47 acres) allows a family to meet many of its food needs. A farm this size also allows the family to grow some crops for sale in order to earn money. This is important because without money a family is unable to buy needed goods and services that cannot be produced on

the farm. Included in this category might be health care and medicine, tools, construction materials, fuel, and food items not locally produced.

Table 10 below shows the distribution of farm sizes in Bangladesh. The categories in the table are different in terms of relative wealth. The *Landless* are the poorest—they own no land. *Subsistence farmers* are those who are just able to meet their needs from the farm. *Below subsistence* means that basic needs are not being met. On the other hand, *Surplus farmers* are able to produce more than they need. They can sell their surplus.

Table 10   Farm size in Bangladesh, 1977

Category	Area owned	Percentage of all farm families	Percentage of land area
Landless	none	32.8	0.0
Below subsistence farmers	less than 1 hectare	44.9	25.1
Subsistence farmers	1–2 hectares	12.7	24.2
Surplus farmers	2–4 hectares	6.9	31.3
Big farmers	over 4 hectares	1.8	19.3

Source: Johnson 1982.

9. What is the relationship between land ownership and relative wealth in Bangladesh?

10. What is the smallest farm size that allows a family to meet its basic needs and allow for surpluses?

11. What percentage of the farm families live *below* this subsistence level? What percentage of the total land do they control?

12. What percentage of all farm families are in the wealthier categories of surplus and big farmers? What percentage of the total land do they control?

13. Do you think the land is evenly distributed among the people in Bangladesh? Why do you think as you do?

14. Could the current patterns of land distribution contribute to keeping poor people from improving their lives? Why or why not?

What impact is the rapid rate of population growth having on the availability of land?

Remember, at least two hectares are needed to meet the basic requirements of a farm family in Bangladesh. Less than 10 percent of the farm families in Bangladesh have farms that meet this minimum size (Table 10 on the previous page). Although farms are already small, a growing population is causing farms to become even smaller. Population is beginning to exceed the land's carrying capacity. The carrying capacity is the number of people that can be supported by an area's resources. Even if a family has an adequate piece of land now, there may soon be problems if too many people have to earn a living from that same land.

In Bangladesh, the law strictly controls transfer of land from one generation to the next. Each child inherits a portion of the family farm. According to the law, each son is entitled to two shares of the farm and each daughter is entitled to one share.

After only a few generations the family's farm can become too small and fragmented to meet the needs of the residents. They often sell the land and move away. Sometimes they have borrowed money that they cannot pay back, and the land is taken to cover the debt. Many people in Bangladesh lose their land every year. Without land, the people are forced to take jobs to earn wages. Because there are so many workers and so few jobs, the wages are very low. Many people cannot find enough work. Because so many people own little or no land and cannot find adequate jobs, basic resources such as food and housing are scarce. As a result, malnutrition is a serious problem for the children of Bangladesh.

Lesson 6

How does Bangladesh's high population density increase the hazard from floods?

Objectives

In this lesson, you will

- Assess some major natural hazards of Bangladesh.

- Explain how high population densities increase the number of people at risk from natural hazards.

Glossary Words

chars

cyclone

drainage basin

monsoon

natural hazard

population density

typhoon

Because Bangladesh is so crowded, there is no land to spare. As a result, people live on land subject to serious natural hazards. The worst hazards are floods along the many rivers and coastal floods next to the Bay of Bengal. These occur when the ocean is driven by powerful storms known as *tropical cyclones* (what we call hurricanes). One such cyclone struck Bangladesh in April 1991, killing over 200,000 people.

Why do cyclones in Bangladesh kill so many people?

One reason is described in this quotation from a newspaper article published not long after the 1991 cyclone.

[The 1991 cyclone] is said to have been the worst for 10 years, or it may have been 20 or 30. . . . The figure for the dead is a

guess, and may be less but is probably more. One aid worker said that it could be half a million. What can be said with certainty is the cyclone was not unexpected. Since 1857, [Bangladesh] has been hit by some 50 major cyclones and far more lesser ones. . . .

One reason for the high death tolls is [that] many of the dead lived on islands in the Bay of Bengal: not really islands at all, they are banks of silt [called *chars*] composed from deposits brought down by the rivers. As soon as they are formed, they are taken over by farmers who grow rice in the rich soil. Assuming they heard the warnings—a big if, as not everyone has a radio—the farmers and their families could leave. . . . [But] waves 20 feet high driven by 145 mph winds swept away whole island communities (*The Economist* 1991, page 29).

1. Why didn't people leave before the storm hit?

2. What can you conclude from the fact that people who heard the warnings risked their lives to stay on the small, hazardous silt islands (chars) in the Bay of Bengal?

3. What does the fact that people were willing to occupy these chars tell you about land scarcity in Bangladesh?

What causes floods in Bangladesh?

Flooding in Bangladesh has two sources. First, water from snowmelt in the Himalaya Mountains and intense rains during the wet season combine to create annual floods along the country's many rivers. Second, tropical storms (called *typhoons* or *cyclones*) that begin in the Indian Ocean drive huge waves inland from the Bay of Bengal. Together with the country's dense population, the flat land of Bangladesh increases the hazard from both types of flooding.

Typhoons in the Indian Ocean often push a wall of seawater into Bangladesh, as did the 1991 cyclone. When these very powerful storms directly hit Bangladesh's low-lying coast, high winds drive ocean water onto the shore. These floods are sometimes called *storm surges.* In a storm surge, the sea level may rise many feet above the normal high tide line and flood several miles inland (Muller and Oberlander 1987). Such storm surges have devastated Bangladesh frequently. Besides the 1991 cyclone, a cyclone killed about 300,000 Bangladeshis in 1970. In addition to the enormous death toll, millions of people are left homeless.

But serious floods occur throughout Bangladesh, not just along the seashore. Recall from Figure 3 (page 30) that Bangladesh is dominated by large rivers that originate in the Himalaya Mountains. By

the time these rivers reach Bangladesh, they have formed vast flood-plains. These are flat, broad valleys filled with the sediments deposited by the rivers. When in flood, the rivers overflow onto these flood-plains. These floods cause many deaths among the people who live on the floodplains. But they also benefit the land by bringing nutrients that improve soil fertility. As a result, most of Bangladesh's land is suitable for a wide variety of crops (Figure 4 below).

BANGLADESH LAND USE

Key
- Wheat/Barley
- Cotton
- Forest
- Tea
- Jute
- Rice
- Grazing
- Coconuts
- Unused Land
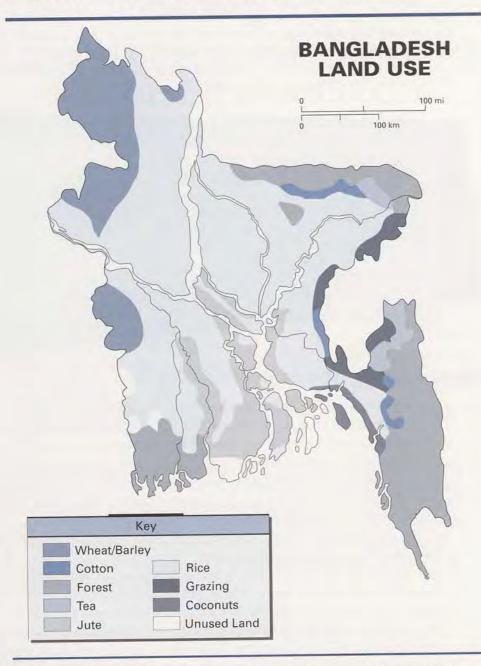
Figure 4   Land uses in Bangladesh. The area shown above is part of the delta system of the Brahmaputra, the Ganges, and the Meghna rivers. This, the world's largest delta, forms most of Bangladesh.

Source: Fisher 1992.

To better understand the causes of flooding in Bangladesh, it helps to examine the average distribution of rainfall (Figure 5 below). Precipitation falls in a seasonal pattern known as the monsoon. There are two monsoon seasons in Bangladesh, wet and dry.

BANGLADESH MEAN ANNUAL RAINFALL

Key

- < 60 inches
- 60-79 inches
- 80-99 inches
- 100-120 inches
- > 120 inches
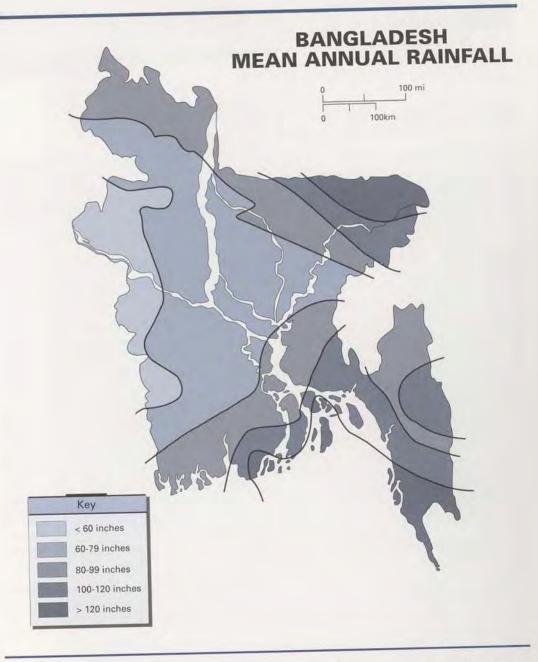
Figure 5   Distribution of mean annual rainfall amounts in Bangladesh. Notice that even the driest area receives up to 60 inches of rain. How much precipitation does your community receive each year?

Source: Johnson 1982.

4. Is Bangladesh a moist place overall, or does it have dry areas like the United States does?

5. Can you determine from Figure 5 when the wet and dry monsoon seasons occur in Bangladesh? What kind of data would help answer that question?

Table 11   Mean monthly temperature and precipitation, Comilla, Bangladesh

Month	Mean temperature (°F)	Mean precipitation (inches)
January	66	0.32
February	70	1.22
March	79	3.01
April	82	5.85
May	83	12.39
June	83	18.28
July	82	16.42
August	82	17.18
September	83	11.35
October	81	6.72
November	74	1.29
December	67	0.30
Total rainfall for year		94.33

Note: Comilla is a town in southeastern Bangladesh. These mean temperature figures are calculated from the average between the monthly mean maximum temperature and the monthly mean minimum temperature.
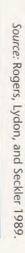
Source: Rashid 1977.

The wet monsoon begins in March, maximizes in the summer, and extends into October. During the winter months, the region is relatively dry. But the rivers flowing through Bangladesh carry more than just the rain that falls within Bangladesh. Heavy rains extend from the coastal delta inland up to the Himalaya Mountains. Each spring, snowmelt also flows from the mountains.

Combined, this water fills and overflows the river banks, causing regular annual flooding. Figure 6 on the next page shows the size of the drainage basins for the river systems that flow into and through Bangladesh. (A drainage basin is an area of land from which all runoff and sediment flows into a stream or river.)
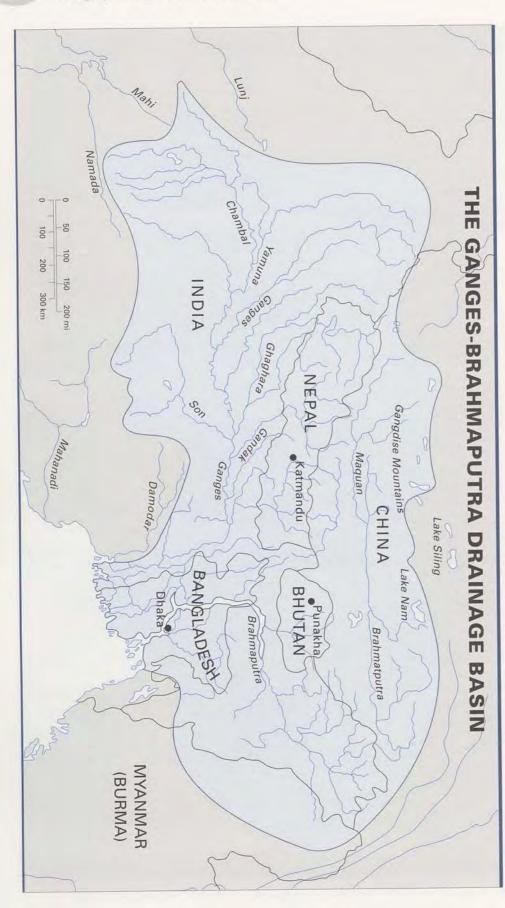
Villagers return to face the devastation caused by the 1991 cyclone that struck the coast of Bangladesh.

THE GANGES-BRAHMAPUTRA DRAINAGE BASIN

The Ganges-Brahmaputra drainage basin.   **Figure 6**

6. Which is larger, the area of the drainage basin or the area of Bangladesh? How might this contribute to flooding?

7. How much of the country of Bangladesh do you think is subject to flooding? Why do you think so?

How serious is the flooding?

Figure 7 below shows the percentages of land in Bangladesh having different degrees of flooding. *Low land* refers to areas that remain underwater for more than six months a year. *Medium land* normally remains underwater for less than six months. *High land* normally does not go underwater any time of the year. Even these areas may sometimes have floods, but the water does not exceed knee-depth even during the wettest months.

Land Classification According to Normal Flood Depths in Bangladesh

38.8%   24.8%

■ Low land

■ Medium land

□ High land

36.4%
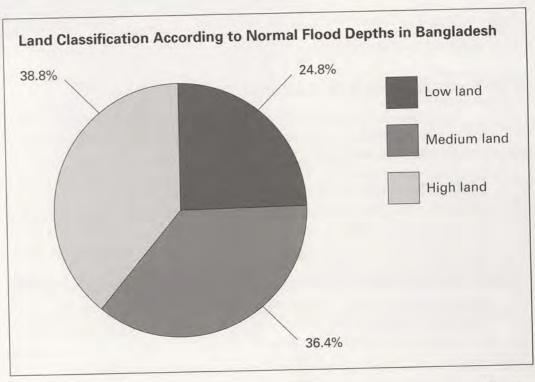
Figure 7   Percentages of land area in Bangladesh classified according to normal flood depths.

Source: Boyce 1987.

You have seen that several factors contribute to frequent flooding in Bangladesh. Now consider where the floods occur.

8. What percentage of the area of Bangladesh floods each year?

9. How much of the country experiences deep flooding?

10. Do you think that flooding is a way of life for many people in Bangladesh? Why?

11. Do you think there are any benefits from flooding? If so, what are they?

12. What problems do you think floods cause the people of Bangladesh?

13. How do you think the people of Bangladesh have adapted to regular flooding?

What problems are caused by flooding?

In Bangladesh, people suffer from many flood problems. In 1991, for instance, floods caused severe food shortages. Not only did the people lose their supplies of food in the flood, but a quarter of the year's crop was also lost. This meant that food was in short supply until another crop could be planted and harvested. What food was available was often spoiled. Water was contaminated, which spread sickness rapidly. Also, flooding greatly slowed the economy, and jobs were lost. Bridges, roads, railroads, and flood control structures were also damaged or completely destroyed.

High densities of people and shortages of land force large numbers of people to live in areas where dangerous natural hazards are common. Flooding also destroys resources. This, in turn, contributes to increased poverty in Bangladesh.

Lesson 7

How has population growth destroyed Haiti's resources?

Objectives

In this lesson, you will

- Identify the causes of population and resource problems in Haiti and compare the Haitian case to Bangladesh.

- Recognize that destruction of a country's resource base can occur in extreme cases of population growth.

Glossary Words

agricultural population density

arable land

arithmetic population density

gross national product (GNP)

life expectancy

overpopulation

per capita

population growth

standard of living

What resources have been destroyed on Haiti?

Read these quotations from a book by the geographer Bonham Richardson:

The fundamental ecological problem in Haiti is its soil erosion. Too many people for too little arable land has pushed Haitian cultivation onto ever-steeper hillsides, creating an all-too-familiar vicious circle in which the land's capacity to produce is continuously undermined by the necessity to cultivate marginal slopes.

Topsoil erosion on a Haitian hillside.

During periods of drought—whose effects are intensified by a lack of protective vegetation—parts of southwestern Haiti appear barren and bleak; the topsoil has long since washed away, leaving sun-bleached bedrock where subtropical forests once stood (Richardson 1992, page 13).

1. What has caused soil erosion on Haiti?

2. The author refers to a "vicious circle." Draw a circular diagram showing the causes of Haiti's soil erosion problem.

3. Why do you think Haitians find it necessary to cultivate marginal (steep) slopes?

4. Why can severe soil erosion destroy a country's resource base?

5. What evidence in the quote tells you that Haiti hasn't always had a soil erosion problem?

The historical background of Haiti's contemporary ecological dilemma is typically Caribbean. The aboriginal peoples of the region farmed and fished and modified the island landscapes relatively little. Then centuries of European exploitation (mainly by France in Haiti's case) were marked by massive environmental change. West African slaves, laboring under European supervision, stripped the natural vegetation from Caribbean islands and planted tropical staple crops—mainly sugar cane—in its place. . . . Massive local soil erosion followed. Introduced overpopulation exerted additional stresses on island environments during the slavery era and beyond (Richardson 1992, page 14).

6. Why did European colonists on Haiti plant crops instead of leaving the natural vegetation?

7. The author refers to "introduced overpopulation." What does he mean by this? Why would this have taken place?

8. Why do you think overpopulation would have persisted since the end of slavery on Haiti?

How has resource destruction affected Haiti's people?

Geographers West and Augelli had this to say:

There is no more arresting theme on the Haitian landscape than the hopeless [imbalance] of its people, land, and resources, and the grinding human poverty that ensues from this. The mountain lands that make up almost 70 percent of the national territory's 10,714 square miles [about the size of Maryland] are eroded, the lowlands often suffer from inadequate rainfall, minerals are virtually nonexistent, the forests have largely been cut down, and fishing makes only a minor contribution to the food supply of the nation.

On this weak resource base live over 6 million people. Densities are high almost everywhere, for people have had to spread over mountains and plains, wet areas and dry ones, regardless of conditions (West and Augelli 1989, page 160).

Although only about 30 percent of Haiti is arable, about 50 percent of the land is actually under cultivation (Goodwin 1992). Recall from Lesson 5 that population densities can be expressed as either arithmetic (based on total land area) or agricultural (based on land area available for agriculture). The agricultural densities of the Caribbean islands are the highest in the Western Hemisphere (Table 12 below).

Table 12   Population data for Haiti and the United States

	Haiti	United States
Population,1992 (millions)	6.4	255.6
Arithmetic density (population per square mile)	597	71
Agricultural density (population per square mile of cultivated land)	1,816	350
Annual population growth rate (percentage)	2.9	0.8
Birth rate (per 1,000 population)	45	16
Death rate (per 1,000 population)	16	9
Infant mortality rate (per 1,000 live births)	106	9
Fertility rate (average number of children born to a woman during her lifetime)	6	2
Life expectancy at birth (years for males/females)	53/56	72/79
Annual per capita GNP, 1990 (U.S. $)	370	21,700
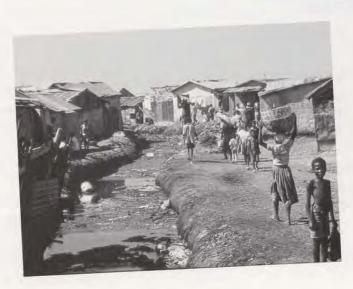
Sources: Population Reference Bureau 1992; West and Augelli 1989.

9. What evidence can you find in Table 12 to show that the standard of living in Haiti is very low?

10. What evidence can you find to explain why the fertility rate in Haiti is so much higher than in the United States? *Hint:* Look at infant mortality rates in Table 12.

Haiti is a country of some unfortunate extremes. Among all the countries in the Western Hemisphere, Haiti has the lowest GNP per capita, the lowest life expectancies, the highest infant mortality rate, and the highest fertility and birth rates (Table 12 on the previous page). Only about one-third of the people have clean running water, and diseases related to poor sanitation (such as tuberculosis, malaria, and parasitic worms) are out of control. But despite very high mortality rates, Haiti's population will double in less than 30 years if present growth rates continue (West and Augelli 1989).

Haiti is also among the least urbanized countries in the Western Hemisphere. Only about 29 percent of its population lives in urban areas. But recently there has been a large rural-to-urban migration in Haiti. As people have poured into the cities, they have run into new problems. Inadequate housing in the cities has led to the creation of huge shantytowns. Urban unemployment rates are close to 50 percent, meaning half the people have no work (West and Augelli 1989).

11. How are the population and resource problems in Haiti similar to those in Bangladesh?

12. How are Haiti's problems different from those in Bangladesh?

13. Why do you think rural Haitians would want to move to the cities, even if there are no jobs there?

14. Do you think Haitians would leave Haiti if they could? Why or why not? Where can they go?

Slums of Haiti.

UNIT 8 Lesson

Do the problems of Bangladesh and Haiti have global implications?

Objective

In this lesson, you will

- Evaluate the global nature of the issue of population growth and resource availability.

Glossary Words

global community

population growth

resource

Do these problems occur only in Bangladesh and Haiti?

We have seen that Bangladesh and Haiti are both poor and crowded places with rapidly growing populations. Because poverty is severe, both the absolute numbers of people and the rate of population growth are problems. Many other countries in the world face similar problems. In extreme cases, such as in Haiti, poor countries are sinking further into poverty and destroying their environmental resource bases at the same time. It is possible that this problem will become increasingly severe in your lifetime.

Is this only a problem for the poorer countries such as Bangladesh and Haiti? Or does it have implications for everyone who lives on the planet?

What are the prospects for the global community?

The world has 157 billionaires, and perhaps 2 million millionaires, but 100 million people around the globe are homeless, living on sidewalks, in garbage dumps, and under bridges. The concerns of the rich contrast violently with those of the poor. Americans spend $5 billion each year on special diets to lower their calorie consumption, while the world's poorest 400 million people are so undernourished they are likely to suffer stunted growth, mental retardation, or death (Durning 1990, page 22).

Conditions of poverty, which seem to be related to many other problems, are widespread. Table 13 below gives the number and percentage of people in several regions of the world who live in absolute poverty. The phrase *absolute poverty* was defined in 1978 by Robert McNamara, then president of the World Bank, as the following:

"A condition of life so limited by malnutrition, illiteracy, disease, squalid surroundings, high infant mortality, and low life expectancy as to be beneath any reasonable definition of human decency (quoted in Durning 1990, page 24)."

Table 13   People estimated to be living in absolute poverty, 1989

Region	Number of people	Percentage of region's population
Asia (East, South, and Southeast)	675,000,000	25
Africa—South of the Sahara	325,000,000	62
Latin America	150,000,000	35
North Africa and Southwest Asia	75,000,000	28
Total	1,225,000,000	23

Source: Durning 1990.

Over 1.2 billion members of the global community—nearly one out of every four people—fell into the category of absolute poverty in 1989. Every year there are more and more people living in poverty on the planet.

Is this only a problem for the poor, or is it a problem for everyone? Table 14 provides a look at global availability of grain, which is the most basic item of diet worldwide.

Table 14   World grain production, 1950–1980, with projections for 1990–2000

| Year | World grain production (millions of metric tons) | | Per person (pounds) | |
	Total world production	Percentage change	Production per person	Percentage change
1950	631	N.A.	542	N.A.
1960	847	+34	613	+13
1970	1,103	+30	653	+6
1980	1,442	+31	710	+9
1990	1,688	+17	699	-2
2000*	1,846	+9	653	-7

Notes: N.A. = data not available
* = estimated

Source: Brown 1989. Reprinted by permission of The Worldwatch Institute.

1. Has world production of grain increased or decreased each decade?

2. By how many times did production increase between 1950 and 1990?

3. In which year was there the most grain per person?

4. Is the trend today toward having more or less grain per person?

5. If population continues to grow faster than increases in grain production, what will be the outcome of widespread food shortages?

Children of Bangladesh.

Is food the only resource that will become more scarce if population continues to grow at a rapid pace?

Think back to the things that are resources in your own life. What will happen to the availability of resources such as energy, housing, transportation, and space for recreation if population continues to increase at the current rates? The increase in population may result in resource shortages for *all* people on Earth. Also, more people may lead to more waste and more pollution. That, too, can be a serious problem for all people.

There are two parts to the population-resource problems of the world: population and resources. Should solutions to the problem focus on both parts?

As for resources, if more can be made available, then the problem of resource scarcity and overpopulation might cease to exist. Could new technology create more resources?

As for population, the current level of resources would be adequate if there were fewer people. But the only way to reduce the number of people is to decrease birth rates. Could this be done?

Today, there is no generally agreed-upon approach for solving the pressure of population growth on resource availability. These problems are not yet even fully understood. Understanding the problems and deciding on a course of action will be a major challenge for *your* generation.

What do you think the most serious problems are? What do you think should be done?

Glossary

Agricultural population density The number of people per unit of arable land.

Arable land The part of the total territory that is usable for agriculture, typically excluding such areas as marshes, steep mountains, and forests.

Arithmetic population density The number of people per unit of land, for example, persons per square mile or per square kilometer.

Carrying capacity The size of a population that can be supported by an area's resources. The global carrying capacity refers to the number of people that Earth can provide for at a given time. Carrying capacity may also be defined at regional and local scales.

Chars Banks of silt deposits brought down by river current.

Cyclone A general term for any center of low atmospheric pressure, usually associated with stormy weather.

Doubling time The number of years for a population to double, if the rate of increasing population stays the same during the doubling-time period.

Drainage basin An area of land from which all runoff and sediment flows into a stream or river.

Global community A perspective that sees Earth's inhabitants as one interdependent community.

Gross National Product (GNP) The economic value of all goods and services produced by a country for a specified period of time, usually a year.

Life expectancy The average number of years that people are likely to live.

Monsoon A climate type dominated by seasonal winds. In summer, moist air blows from ocean toward continent, bringing heavy rains. In winter, winds blow from continent toward ocean and climate is dry.

Natural hazard A natural event such as a flood, volcano, or earthquake that carries risks to human life and property.

Overpopulation The number of people in an area exceeds the availability of one or more essential resources to support them.

Per capita Amount per person. For example, per capita income for a country is calculated by taking the sum of income for all people in that country and dividing by the number of people in the country.

Population density See **arithmetic population density.**

Population growth Increase in population that occurs when the total number of births exceeds the total number of deaths. It is usually shown as a percentage.

Resource Physical elements of the world that people believe to be of value or use in meeting their needs. Examples include food, materials, minerals, land, clean air and water, open space, and things that are hard to measure in dollar value such as scenery and parks.

Standard of living The relative wealth of a person or group of people.

Typhoon A severe tropical storm of the Eastern Hemisphere, characterized by
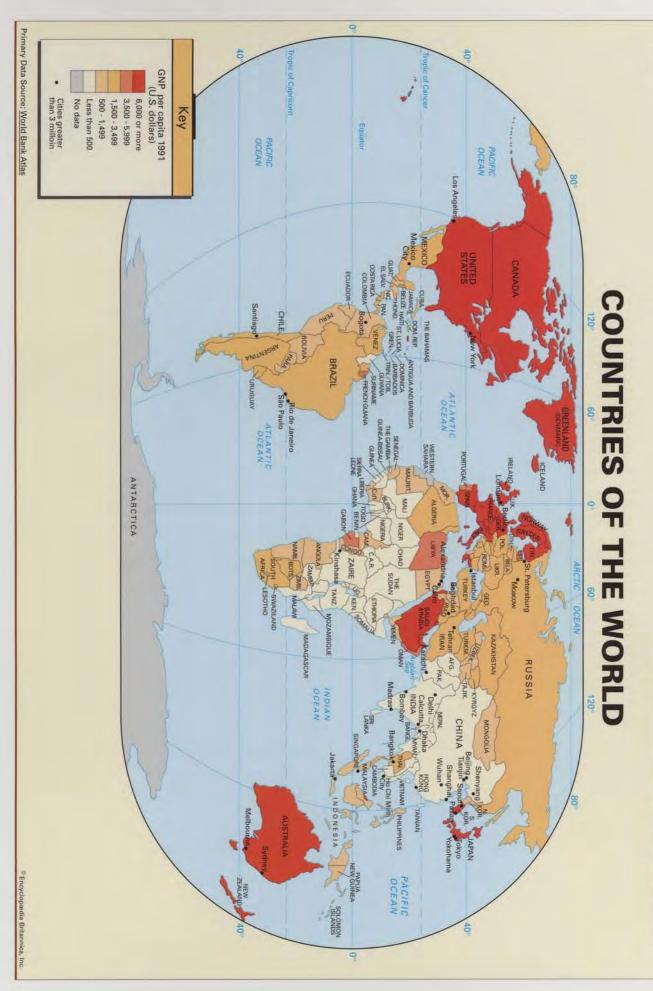
masses of air rapidly circulating around the low-pressure center. Winds exceed 75 miles per hour (120 km) and are usually accompanied by heavy, intense rains.

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Map 1

Geographic Inquiry into Global Issues

POPULATION AND RESOURCES

COUNTRIES OF THE WORLD

Key

GNP per capita 1991
(U.S. dollars)

- 6,000 or more
- 3,500 - 5,999
- 1,500 - 3,499
- 500 - 1,499
- Less than 500
- No data

• Cities greater than 3 million

PACIFIC OCEAN
ATLANTIC OCEAN
ARCTIC OCEAN
INDIAN OCEAN

Tropic of Cancer
Equator
Tropic of Capricorn

ANTARCTICA

UNITED STATES
CANADA
GREENLAND (DENMARK)
MEXICO
Los Angeles
New York
Mexico City
GUAT.
EL SALV.
BELIZE
HOND.
NIC.
COSTA RICA
PAN.
COLOMBIA
VENEZ.
ECUADOR
PERU
BRAZIL
BOLIVIA
PARA.
CHILE
ARGENTINA
URUGUAY
Santiago
São Paulo
Rio de Janeiro
Bogotá
CUBA
JAMAICA
HAITI
DOM. REP.
THE BAHAMAS
ST. LUCIA
GREN.
DOMINICA
BARBADOS
TRIN. / TOB.
ANTIGUA AND BARBUDA
GUYANA
SURINAME
FRENCH GUIANA

ICELAND
IRELAND
U.K.
PORTUGAL
SPAIN
FRANCE
NORWAY
SWEDEN
FIN.
London
Paris
GER.
POL.
ROM.
UKR.
BELA.
GEO.
St. Petersburg
Moscow
RUSSIA
KAZAKHSTAN
MONGOLIA
CHINA
Beijing
Tianjin
Shenyang
Shanghai
Wuhan
HONG KONG
TAIWAN
N. KOR.
S. KOR.
JAPAN
Tokyo
Yokohama
Seoul
Pusan
Osaka

WESTERN SAHARA
MOR.
ALGERIA
LIBYA
EGYPT
Cairo
Alexandria
MAURIT.
MALI
NIGER
CHAD
THE SUDAN
SENEGAL
THE GAMBIA
GUINEA-BISSAU
GUINEA
SIERRA LEONE
LIBERIA
GHANA
BURK.
NIGERIA
CAM.
C.A.R.
GABON
CONGO
ZAIRE
Kinshasa
ANGOLA
NAMIBIA
BOTS.
SOUTH AFRICA
ZAMBIA
ZIMB.
MOZAMBIQUE
MALAWI
TANZ.
MADAGASCAR
SWAZILAND
LESOTHO
ETHIOPIA
SOMALIA
KEN.
UG.
TOGO
BENIN
Istanbul
TURKEY
SAUDI ARABIA
YEMEN
OMAN
Baghdad
Iraq
IRAN
Tehran
TURKM.
UZBEK.
TAJIK.
AFG.
KYRGYZ.
PAK.
INDIA
Delhi
Calcutta
Bombay
Madras
NEPAL
BANGL.
Dhaka
SRI LANKA
MYAN.
THAI.
Bangkok
CAMBODIA
VIETNAM
Ho Chi Minh City
MALAYSIA
SINGAPORE
PHILIPPINES
INDONESIA
Jakarta
PAPUA NEW GUINEA
SOLOMON ISLANDS
AUSTRALIA
Melbourne
Sydney
NEW ZEALAND
Karachi
Arabian Sea

Map 2

PHYSICAL FEATURES
OF BANGLADESH

NEPAL

Brahmaputra

Jamuna

Old Brahmaputra

BANGLADESH

Ganges

INDIA

INDIA

Meghna

Madhumati

Padma

Meghna

CHITTAGONG
HILLS

Karnaphuli
Reservoir

SANDWIP
ISLAND

Karnaphuli Dam

DAKHIN
SHAHBAZPUR
ISLAND

SOUTH
HATIA
ISLAND

G A N G E S   D E L T A

S U N D A R B A N S

Mount
Mowdok
1053 m ▲

Matamuri

Bay of Bengal

MYANMAR
(BURMA)

KEY

Elevation

metres		feet
2000		6560
1000		3281
500		1640
200		656

0	25	50 mi
0	25 50	75 km

Map 3

CITIES OF BANGLADESH

NEPAL

Thakurgaon

Saidpur

Dinajpur

Rangpur

Gaibandha

Brahmaputra

Jaipur Hat

Bogra

Jamaipur

Sunamganj

Mohanganj

Sylhet

Naogaon

Mymensingh

Gouripur

Old Brahmaputra

Nawabganj

Jamuna

Ganges

Siraganj

Kishorganj

Moulvi Bazar

Rajshahi

Tangail

Habiganj

Ishurdi

Bhairab Bazar

Pabna

Narsinghdi

Brahmanbaria

INDIA

Kushtia

Dhaka

Agartala

Chuadanga

Faridpur

Padma

Comilla

Magura

Meghna

CHITTAGONG HILLS

Mahespur

Chandpur

Hajiganj

Karnaphuli Reservoir

Madhumati

Madaripur

Lakshmipur

Jessore

Kalia

Gopalganj

Chaumuhani

Rangamati

INDIA

Khulna

Noakhali

Meghna

Satkhira

Bagerhat

Barisal

Bhola

SANDWIP ISLAND

Karnaphuli Dam

Calcutta

Chalna Port

Pirojpur

DAKHIN SHAHBAZPUR ISLAND

Kaptai

G A N G E S

D E L T A

SOUTH HATIA ISLAND

Chittagong

Barguna

S U N D A R B A N S

Matamuhari

Cox's Bazar

MYANMAR (BURMA)

KEY

⊙ Capital city

• Other cities

— International boundaries

Bay of Bengal

0	25	50 mi
0	25	50	75 km

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Map 4

PHYSICAL FEATURES OF HAITI

KEY

International boundaries

⊙ Capitals

• Major cities

Elevation

metres	feet
2000	6560
1000	3281
500	1640
200	656

CUBA

ATLANTIC OCEAN

GREAT INAGUA ISLAND

TORTUGA

Windward Passage

Port-de-Paix

Jean-Rabel

Môle

Saint-Nicolas

Saint-Louis du Nord

Cap-Haïtien

Limbé

Fort Liberté

Ouanaminthe

Saint-Michel de l'Atalaye

Hinche

CENTRAL PLATEAU

NOIRES MTS.

Gonaïves

Desdunes

Saint-Marc

Verrettes

Lascahobas

Mirebalais

Gulf of Gonâve

LA GONÂVE ISLAND

GRAND CAYEMITE

Jérémie

MASSIF DE LA HOTTE

Macaya Peak 2347

Anse-d'Hainault

Miragoâne

Les Cayes

VACHE ISLAND

Gravois Point

NAVASSA ISLAND (U.S.)

Jamaica Channel

Grand Goâve

Léogâne

Port-au-Prince

Pétionville

Mount La Selle 2674

Jacmel

DOMINICAN REPUBLIC

Santo Domingo

Lake Saumâtre

Lake Enriquillo

BEATA ISLAND

Cape Beata

CARIBBEAN SEA

50 mi

50 km

0