BRITANNICA GLOBAL GEOGRAPHY SYSTEM

Overview

BGGS Overview



BGGS is the Britannica Global Geography System, a modular electronic learning system which combines the latest pedagogical approach to geogra-

phy 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.

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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, nonconsumable 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

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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 signup 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.

BRITANNICA GLOBAL GEOGRAPHY SYSTEM

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GIGI

Geographic Inquiry into Global Issues

Waste Management

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TEACHER'S GUIDE

Regional Case Study Europe



Geographic Inquiry into Global Issues (GIGI)

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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. GeopediaTM, 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	Where do religious differences
	affect resource availability?	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? Japan	Why do the effects of natural hazards vary from place to place?
	(Colombia, United States)	Japan
		(Bangladesh, United States)
Former Soviet	Diversity and	
Union	Nationalism*	Environmental Pollution
	How do nations cope with cultural diversity?	What are the effects of severe environmental pollution?
	Commonwealth of	Aral Sea
	Independent States (Brazil, United States)	(Madagascar, United States)
East Asia	Population Growth*	Political Change
	How is population growth to be managed? China	How does political change affect peoples and places? Hong Kong

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.

(United States)

(South Korea, Taiwan,

Singapore, Canada)

^{*} Under development

Geographic Inquiry into Global Issues (GIGI)

Issues, Leading Questions, and Case Study Locations

Australia/ New Zealand/ Pacific

Global Climate Change

What could happen if global warming occurs? Australia and New Zealand (Developing Countries, U.S. Gulf Coast)

Interdependence*

What are the causes and effects of global interdependence? Australia (Falkland Islands, United States)

North Africa/ Southwest Asia

Oil and Society*

How have oil riches changed nations? Saudi Arabia (Venezuela, Alaska)

Hunger

Why are people hungry? Sudan (India, Canada)

Africa—south of the Sahara

Building New Nations*

How are nation-states built? Nigeria (South Africa, Canada)

Infant and Child Mortality

Why do so many children suffer from poor health? Central Africa (United States)

Latin America

Urban Growth

What are the causes and
effects of rapid
urbanization and urban
growth?
Mexico
(United States)

Development

How does development affect peoples and places? Amazonia (Eastern Europe, U.S. Tennessee Valley)

Europe

Regional Integration*

What are the advantages of and barriers to regional integration? Europe (United States, Mexico, Canada)

Waste Management

Why is waste management both a local and global concern? Western Europe (Japan, United States)

^{*} Under development

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

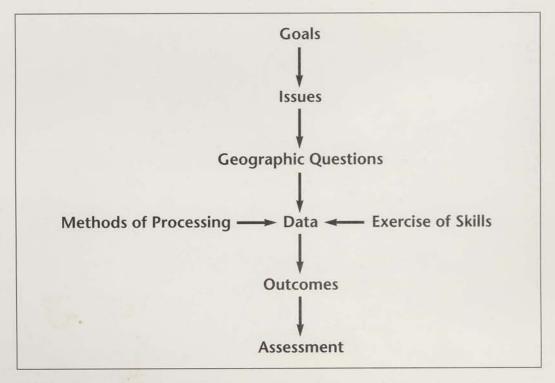


Figure 2 GIGI's model for issues-based geographic inquiry (after Slater 1993).

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

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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

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 openmindedness. 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

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.

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 issuesbased 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, issuesbased 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.
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PREPARING TO TEACH THIS MODULE

Waste Management

Why is waste management both a local and global concern?

The question of how to manage waste is reaching a crisis stage, both locally and globally. At the local scale, some places are literally running out of space to deposit waste products. This is a mounting global issue because the world's population is increasing rapidly and people are consuming more and more resources and, thus, creating more and more waste. Many of our most pressing environmental issues, such as air and water pollution, result from the way people manage the wastes they produce. Innovative ideas are needed to resolve the waste management issue, because many of the traditional methods of dealing with waste are obsolete.

Each of us generates waste but we can also take actions that will help solve the problem of waste management. The module suggests several activities to get your students more aware of the local and personal dimensions of managing waste.

The issue of waste management provides many opportunities for you to make a global connection to your students' personal lives. Throughout the module, emphasize how the issues described for Europe and Japan also pertain to your own community. Invite representatives from your school or community to discuss local waste management methods. Plan a field trip to a local waste-processing facility.

In Lesson 1, students learn what waste management is and identify related environmental problems. The geographic theme of *Human-Environment Interaction* is central to this lesson. To connect this global issue with students' lives, have your students monitor their trash production and challenge your students to change their personal waste management habits.

The interconnectedness of places and peoples around the world (the theme of *Movement*) and the areas that generate the most and the least waste (the theme of *Region*) are addressed in Lesson 2.

Through mapping and graphing activities, students will identify the regions that produce the most waste and give reasons why these regions produce so much waste.

Lessons 3 and 4 provide the primary case study on Europe, with a special focus on the Netherlands. How and where Europeans dispose of their waste, what alternative methods of disposal are being developed, and how waste management connects Europe to other places are important geographic questions examined in this section.

Lesson 5 offers a brief comparative case study of waste management in Japan. Students critique waste management innovations and consider whether their ideas would be appropriate for their own community. Lesson 6 turns students' attention on the United States, with a case study of interstate garbage transport. Students debate the question: Should Utah import California's garbage? Debate can also focus on whether importing trash would be a desirable option in your community.

Finally, Lesson 7 gives some of the "good news" about waste management by documenting innovations in waste management at the local level. The module closes by giving students a chance to discuss the changes they have made in their own waste management habits during the module.

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

- Explain the concept of waste management.
- Identify conditions that affect the amount of waste a country produces.
- Evaluate both old and new methods of waste management.
- Describe how wastes create both local and global problems.
- Identify ways that individuals, communities, and countries may contribute to the reduction of wastes.
- Decide to change personal behavior to help with the problem of waste management.

Number of Days Required to Teach Waste Management

Twelve to fifteen 50-minute class periods

Suggestions for Teacher Reading

- Blumberg, Louis, and Gottlieb, Robert. 1989. War on Waste: Can America Win its Battle with Garbage? Washington, DC: Island Press.
- Bowermaster, Jon, and Steger, Will. 1990. Saving the Earth: A Citizen's Guide to Environmental Action. New York: Knopf.
- Garbage Magazine: The Practical Journal for the Environment. Any issue of this monthly publication will have useful supplementary materials.
- Long, Robert Emmet. 1989. The Problem of Waste Disposal. The Reference Shelf, volume 60, number 5. New York: The H. W. Wilson Company.
- Myers, Norman, editor. 1984. Gaia: An Atlas of Planet Management. New York: Doubleday. Contains many useful thematic maps on environmental issues.
- Newsday. 1989. Rush to Burn: Solving America's Garbage Crisis? Washington, DC: Island Press.
- Pollock, Cynthia. 1987. Mining Urban Wastes: The Potential for Recycling.
 Worldwatch Paper 76. Contact the Worldwatch Institute, 1776
 Massachusetts Ave., NW, Washington, DC 20036, for a complete list of their publications.
- Pringle, Laurence. 1986. Throwing Things Away: From Middens to Resource Recovery. New York: Thomas Y. Crowell.
- United States Department of Energy. The DOE cosponsored the production of a set of materials dealing with the management of nuclear waste. Contact them at the OCRWM Information Center, P.O. Box 44375, Washington DC 20026. Phone: 1-800-225-6972.
- United States Environmental Protection Agency. 1988. Environmental Progress and Challenges: EPA's Update. Washington, DC: USEPA.
- Young, John E. 1991. Discarding the Throwaway Society. Worldwatch Paper 101. Washington, DC: Worldwatch Institute. Contact the Worldwatch Institute, 1776 Massachusetts Ave., NW, Washington, DC 20036, for a complete list of their publications.



What is waste management and why is it a problem?



Time Required

Three or four 50-minute class periods



Materials Needed

Copies of Activity 1 for each group of students Butcher paper Several glasses of water and food coloring for Activity 1



Glossary Words

biodegradable pollution compost precycle

groundwater radioactive waste

heavy metals recycle incinerator scrubber landfill solid waste

leaching toxic hazardous waste

NIMBY waste management

(Not In My Backyard)

pig iron

Procedures

Are we wasting our environment? (pages 4–5)

A. Divide the class into groups of three or four students for this lesson. Have students read the extract on pages 4–5. Ask each group to quickly illustrate on a piece of butcher paper the *main idea* of the extract. Follow-up might involve posting the illustrations, reporting on the main idea, and/or discussion. [The main idea is that an economy acquires raw materials (often damaging the environment) and processes them into products that are used and then discarded. Waste is created in every phase of the cycle: acquisition, processing, and disposal. This essential "input-output model" (raw materials in—waste materials out), with its environmental effects, might be

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.
- Have students keep a list of a week's worth of trash from their own homes. Have them classi-

- fy the trash into categories such as glass, tin, aluminum, paper, organic, or plastic. As the module proceeds, have students add to their list and include ideas for recycling, reducing, and reusing household waste.
- Have students write a personal-action contract committing them to take one step to reduce their personal contribution to the garbage problem. This contract would be in force for the duration of the module, about three weeks. Examples of steps individuals can take include recycling paper, glass, or metals; picking up trash they see on the street; consuming less; or buying products with minimal packaging. (At the end of the module, students will evaluate how well they stuck to this contract.)

illustrated in any number of ways. Tell students that this module is primarily about the part of this model that deals with problems of managing waste.]

Younger students may need help with the vocabulary in the extract. In fact, it is probably best to have younger students read this extract aloud so that you can help them understand it. Have younger students illustrate the input-output model on butcher paper and then have them discuss their illustrations with the class.

B. Have groups explain the meanings of the cartoons in Figures 1 and 2 (pages 5 and 6).

With younger students, you may need to help them understand that ocean pollution can affect the quality of the fish we eat (Figure 1) and municipal, industrial, and agricultural waste can affect the quality of the water we drink (Figure 2). Challenge older students to explain how waste can create environmental hazards.

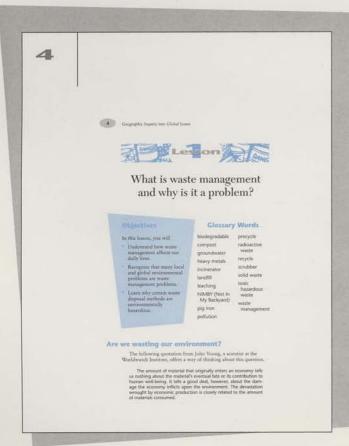
C. Tell the groups that during the course of working on this module they will be doing a poster

project, which they are now going to begin. Give each group a place in the classroom to post its material. To begin the project, give groups five minutes to brainstorm lists (on butcher paper) of specific environmental problems of waste management. For each item on the list, they should write *local* if they think the problem affects their own community; other communities if the problem affects local communities other than their own; and global if they think the problem is widespread over many parts of the world. Tell them they will be asked to add to these lists later.

Older students might be asked to organize these lists according to some meaningful categories, for example, waste management problems of the land (lithosphere), water (hydrosphere), and air (atmosphere). Post the lists in the classroom.

What is waste management? (pages 6-12)

D. Give groups adequate time in class to read this section. Remind students to consult the Glossary as needed. Distribute copies of









What is waste management?



Figure 2 Water quality is affected by all activity



Is This Trash?

Figure 3 What do you consider to be potential trash?

8



B Geographic Impury ests Global Louve



9

7

Waste Management 9

The products we use	The potentially hazardous waste they generate	Safe disposal methods
Plantex	Orkanie compounds and solvents	Recycli when position
Pesticides.	Channe compounds and phosphate compounds.	Use all/unave; store for hazardous wanta collection
Medicines.	Solvents and resistures, heavy metals (moccury and arcs, for example)	Small amounts can go slown drain
Fairts :	Heavy metals, pigments, solvents, and residues	Share, recycle; store for hazardous wants collection
Oil, yasohre, and petroleum products	Oit phenois and other compounds, other heavy metals, petroleum, amenoria, suit acids, and sautilics	Recipite at approved facility, take to fracardour weets collection site
Metals	Heavy missel, fluorides, syarides, acid and alkaline, solvents, cleaners, pigments, abrasives, plating salts, oils, and phenois.	Recycle
Leather	Heavy metals and solvents	Reuse; give away
Testles	Heavy metals, styre, chlorine compounds, and solvents	Result; glor away

Source U.S. Environmental Protection Agency 1988.

Geometric famous o

plans to build an underground repository in Nevada for long-term (thousands of years) storage of high-level radioactive waste from nuclear power plants. But reven if this plan provis to be technically sound, the project has been delayed because of jublic perceptions of risk (Slovic et al. 1991).

Table 2 Hazardous waste management methods, United States, 1983

Management method	Percentage of total watte managed
Land disposi-	67
Discharge Into sewers, mers, streams	22
Separation for recovery of solvents	4
Burning in industrial boilers	.4
Others	18
Total	100

Given time, nature can cleanse intel of many pollunants. But with too much water and too little time, nature will be overwhelmed, had passed to be a support of the control of the control of the control of the cleaning capacity of the natured system. Where this happens, the environment becomes degraded, be example, a until amount of possoons themicals dumped into a large twier will be diluted in the large volume of water. Thus it will one degrade the river's basic water quality. But that same amount of possoon dumped into a very small extrama might sectionly degrade the water's quality, smallerly, where only a little took material is dumped onto the ground, the soil may be able to absorb it without becoming contaminants. Into a larger amount may contaminants that a larger amount may contaminants that a larger amount may contaminant that is a larger amount may contaminant that of a larger drawn from well as due to be contaminant of the size of the contaminant of the contaminant of the contaminant of the contaminant of the size of the contaminant of the contaminan

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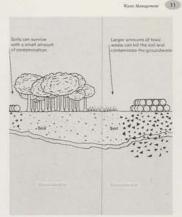


Figure 4 Soils can filter only small amounts of poison (left panel) before passing it on in the groundwater (right panel)

You should now be better able to understand why Young said that "the garbage crisis... has generated political heat in common the around the world" (1994), page 6). Why do you think NMMSY (Noe In My Backyard) is a slogan often identified with this political least? Figure 5 on page 12 may help you consider this question.

12

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(12) Geography Jopeny

Figure 5 Why is this an example of a potential NIMBY situation?

Why is waste management a greater problem today than it was in the past?



People in the nineteenth or tury threw garbage from house backets directly into the street, spreading diseas causing gents. 13

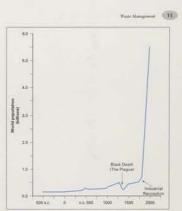


Figure 6 Estimated human population, 500 a.c. to the present.

Human population has grown tremendously since the Industria Revolution (Figure 6 above). This fact may be taken as an indicato of the increasing scale of the waste management problem—the nonpeople, the more waste. But population is not the whole story. Consumption is another important parts of the equation, No only there more people today than in the past, but individuals today consume much note than the wild in the bast.

- Activity 1 to each group. This contains material to help guide analysis of the figures and tables in this section. See *Key for Activity* 1.
- E. After completing Activity 1, discuss Figure 5 on page 12. Ask students whether there are any NIMBY issues in your community, and have them debate the pros and cons of locating waste-disposal facilities in neighborhoods.

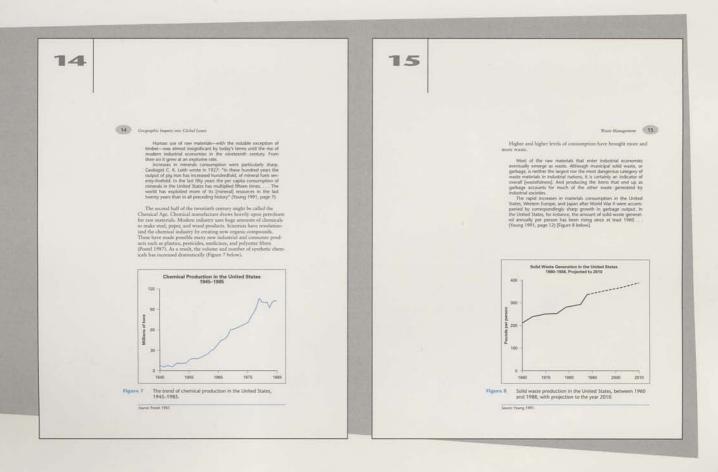
Why is waste management a greater problem today than it was in the past? (pages 12–15)

F. After students have read this section, ask them to describe the meanings of Figures 6, 7, and 8 (pages 13–15) and then explain their importance to the problem of waste management. [Increasing population leads to increasing waste generation, especially in wealthier societies like the United States.] Various figures could be assigned to the groups or individuals might be asked to write a paragraph on each figure.

G. Give the groups time to modify and repost their lists of the environmental problems of waste management (from Procedure C).

For Further Inquiry

- Have students bring waste to school. Sort it to get representative items and place it in a large aquarium. Layer alternatively with soil to simulate a sanitary landfill. Changes can be noted over a period of weeks. *Important:* Do not use animal products of any kind, since they may harbor bacteria.
- Make a compost pile outside the school building to use the school's nonmeat food waste.
- Have students conduct a study of the school's waste management system, their classroom, or their communities, using the input-output idea given in this lesson.





Why does waste generation vary from place to place?



Time Required

One or two 50-minute class periods



Materials Needed

Copies of Activities 2 and 3 for each pair of students Transparency of Overhead 1 Mini-Atlas maps 1 and 2



Glossary Words

energy use municipal waste waste generation

Getting Started

- Ask the class to vote on whether they agree or disagree with the following statement: All countries generate the same amount of waste. Students will most likely disagree with the statement. Have the class brainstorm a list of reasons why some countries generate more waste than others.
- If you want to carry this further, ask students to rank the list by importance. The point is to set the stage for a closer look at spatial variation and the cause. Motivated students may want to explore the list on their own to search for explanations.

Procedures

What parts of the world generate the most waste? (pages 16–18)

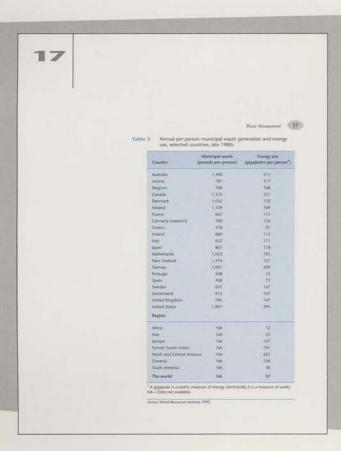
A. Tell students to look at the "Municipal waste" column in Table 3 (page 17) showing how much municipal waste is generated in a variety of countries. Have students answer Questions 1–4 on page 18.

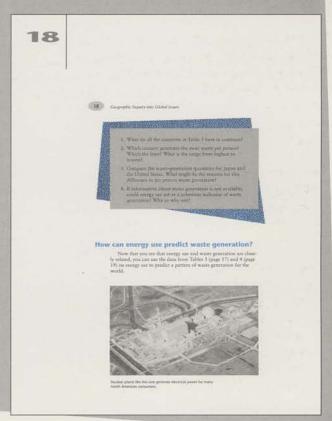


Questions and Answers for page 18

- 1. What do all the countries in Table 3 have in common?
 - This is a tough question for younger students, but they might guess correctly that these countries are all relatively wealthy and industrialized (developed). They can examine this issue by collecting GNP per capita data for these places and comparing them to other countries not listed. They can also look at the right-hand column of Table 3 and compare the countries to world regions or the world total to see that they use more energy than other places. Students may want to know why developing countries are excluded. The answer is that the data are not available.
- 2. Which country generates the most waste per person? Which the least? What is the range from highest to lowest?
 - The amount of waste ranges from 1,901 pounds per person in the United States to 508 in Portugal (range of 1,393). Note that the table only lists selected countries, but these differences are representative of developed countries.

continued



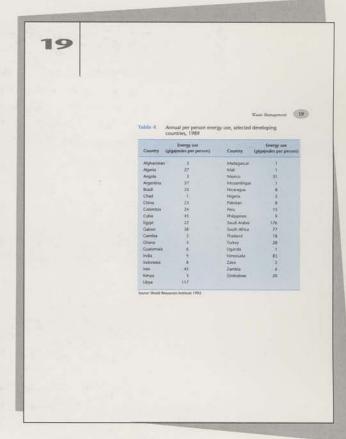


- 3. Compare the waste-generation quantities for Japan and the United States. What might be the reasons for this difference in per person waste generation?
 - Students should see that countries like Japan and the United States, both industrial leaders,
 produce greatly different amounts of waste per person. It would be natural for students to
 wonder why that is the case; let them wonder. This question leads into the next section,
 linking energy consumption to waste generation.
- 4. If information about waste generation is not available, could energy use act as a substitute indicator of waste generation? Why or why not?
 - Yes, because the pattern of energy consumption is similar to the waste-generation
 quantities. Countries with high waste generation also have relatively higher energy use
 (e.g., the United States has the second-highest; Portugal has the lowest). A simple exercise
 would be to have students rank-order each column separately and see how many countries
 are in the same rank for both waste generation and energy use.

How can energy use predict waste generation? (pages 18–19)

B. Use Activity 2 to have students work in pairs to create a scatter diagram, plotting data from Table 3. (This provides a good link to math; in fact you may wish to team-teach this with a math teacher.) Have students examine the diagram to discover a direct relationship between waste and energy used. [Increased energy use leads to more waste generated.] There is a mathematical way to calculate the slope and intercept of a line that would fit the data, but that procedure is beyond the scope of this exercise. The *Key for Activity 2* includes this "line of best fit."

If this exercise is beyond the abilities of your students, you can use **Overhead 1**. A map shows the data from Table 3 in an easy display. Students can see that high energy users are also large waste generators. They will also readily see the regional clustering. Overhead 1 can also be used for more analysis by older students.



- Although energy use is shown here as a surrogate for waste generation, your class discussions should include other measures such as urbanization and GNP. Have students use Mini-Atlas maps 1 and 2. [The point is that the countries with high percentages of urban populations and high incomes also tend to have higher waste generation. This discussion sets the stage for Lesson 3.]
- C. Have pairs of students use Activity 3 to plot energy data from Tables 3 and 4 (pages 17 and 19). They will see patterns of energy use worldwide. Have students compare these patterns to the waste generation/energy use plotted in Activity 2. [Comparison of Activity 2 to Activity 3 reveals similar patterns between energy use and waste generation.] Explain to students that scientists may use energy data as a proxy for waste generation because of the lack of data on waste generation for developing countries. This is a common strategy for explaining phenomena when direct data are not available. For example, in social science research, it is not possible to directly measure community awareness about political issues, but scientists could infer awareness by using
- indirect data, such as the number of people in the community who subscribe to a political magazine. Have students use colors to create a key for Activity 3. [The Key for Activity 3 is called a choropleth (or area-value) map of selected countries. It shows that developing countries generate the least amount of waste, with the exception of oil-producing countries such as Saudi Arabia and Venezuela.]
 - For younger students, you may want to provide the legend breakpoints found in the *Key for Activity 3*. Older students can be challenged to create their own legend or even to create several maps with different breakpoints.
- D. To provide a bridge to Lesson 3, inform the class that they will now start their inquiry into how waste is managed. The case studies are all set in developed countries—Western Europe, Japan, and the United States. By this point, students should understand that more-developed countries produce more waste than less-developed countries. They should see the need for developed countries to come up with environmentally sound ways of managing waste.



How do Europeans manage waste?



Time Required

Two 50-minute class periods



Materials Needed

Copies of Activity 4 for all students Mini-Atlas map 3



Glossary Words

toxic hazardous waste urbanization waste management (page 21). Then, ask how these data might help them to link changes in Europe over the past 50 years to the need for a waste management plan. You might prompt them to recall relationships between waste generation, urbanization, national income per person, and energy use discussed in Lesson 2. [Students may say that many factors contribute to a growing waste management problem in Europe: as a more-developed region, it is highly industrialized and urban, and it has a high standard of living, which means it has high levels of consumption.]

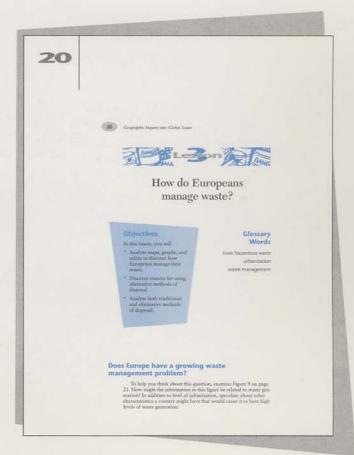
Getting Started

- Have students list the ways their community deals with waste. Put this list on the chalkboard, to remain there until this lesson ends. The list can be used to compare your community to countries in Europe.
- If possible, obtain and show an informational video from a local recycling group or waste management company.

Procedures

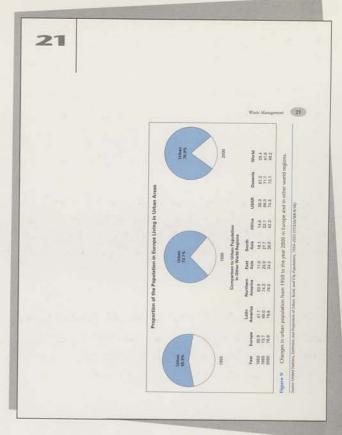
Does Europe have a growing waste management problem? (pages 20–21)

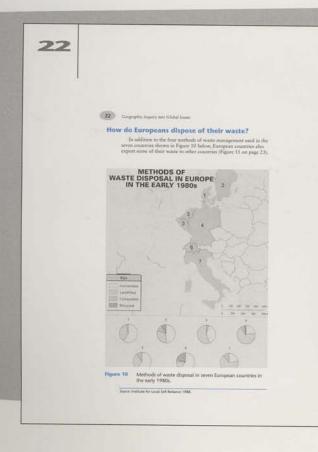
A. Tell students that they will now focus on Europe in order to find out how the waste management issue affects a particular region. First, ask them to describe the data in Figure 9

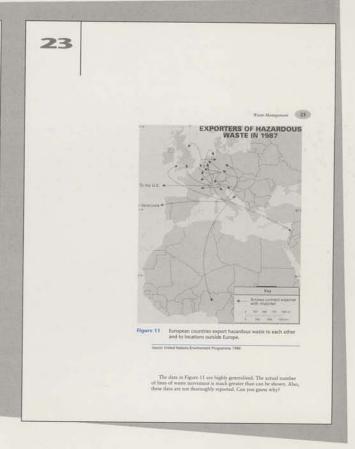


How do Europeans dispose of their waste? (pages 22–24)

- B. Put students into groups and distribute copies of Activity 4 and Mini-Atlas map 3 of Europe to use in interpreting Figure 10 on page 22. Because the size and landforms of some countries influence their waste management choices, the mini-atlas map can help students see why some small nations are reluctant to use scarce land for landfills. Similarly, very mountainous countries may have little suitable space for landfills, and very flat, low-lying countries (e.g., the Netherlands) cannot use landfills because the water table is too near the surface. (See the Key for Activity 4.)
- C. Now have groups turn to Figure 11 on page 23, which gives data on international transfers of hazardous wastes. Have groups respond to Questions 1–5 on page 24.





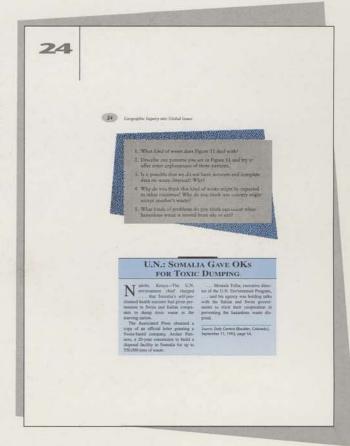


Questions and Answers for page 24

- 1. What kind of waste does Figure 11 deal with?
 - Figure 11 is concerned only with hazardous waste.
- 2. Describe any patterns you see in Figure 11 and try to offer some explanations for those patterns.
 - European countries export hazardous waste to other countries. Sea disposal is also used.
 Some countries, such as Switzerland, clearly export a lot of waste. Other countries, such as Italy, both import and export waste. (Now that Germany is unified, the transfer of waste to the former East Germany from West Germany would not be considered an international transfer.)
- 3. Is it possible that we do not have accurate and complete data on waste disposal? Why?
 - It is probable that data on waste disposal are inaccurate and incomplete because data
 collection is expensive and may miss many small firms that produce waste. Also, illegal
 disposal is bound to occur, and this would not be reported.

continued

D. The pattern of rich countries exporting their waste to poor countries is particularly trouble-some, since the poor countries probably do not have the special technology for safe waste disposal. Discuss the news story about proposed toxic waste dumping in Somalia. Ask why the United Nations might be interested in stopping this proposal. To link this to the next lesson, note that European countries have to try to come up with creative solutions to their waste problems.



- 4. Why do you think this kind of waste might be exported to other countries? Why do you think one country might accept another's waste?
 - Hazardous waste might be exported to other countries for several reasons: (1) safe
 hazardous waste disposal requires special technology that may not be available in every
 country; (2) some countries may have more liberal laws about waste disposal than others;
 (3) some poor countries—such as in Africa—might import hazardous waste to get money
 for development projects.
- 5. What kinds of problems do you think can occur when hazardous waste is moved from site to site?
 - The transportation of hazardous waste may cause many problems. For example, if the waste is spilled because of an accident, it could endanger the health of whole communities.



What problems does waste management pose for Europe?



Time Required

Two or three 50-minute class periods



Materials Needed

Mini-Atlas map 4



Glossary Words

compost

dioxin

groundwater

incinerator

landfill

leaching

PCBs (polychlorinated biphenyls)

polders

pollution

recycle

solid waste

waste management

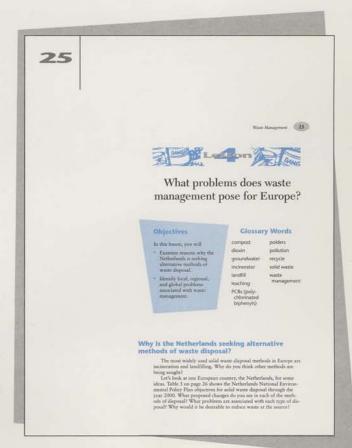
Getting Started

Ask students to spend five minutes drawing a cartoon that shows their community facing a crisis of where to put its waste. Collect the sketches and create a wall display.

Procedures

Why is the Netherlands seeking alternative methods of waste disposal? (pages 25–27)

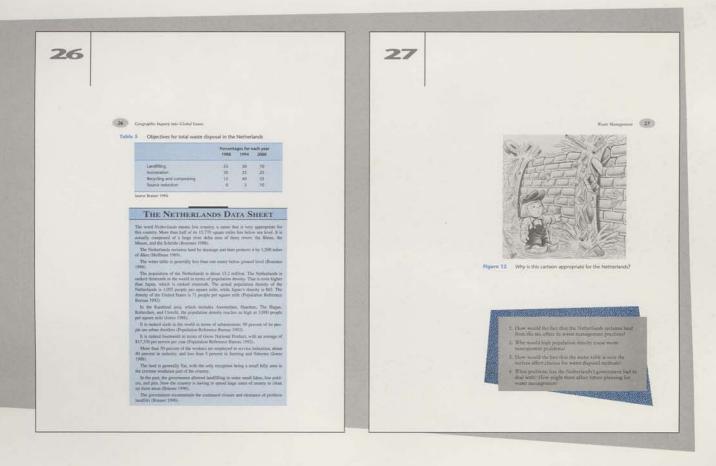
A. Tell students that they will be reading about the Netherlands in order to learn more about waste management. Have students locate the Netherlands on a map. Have students look again at Figure 10 on page 22. Ask what methods of waste disposal are used most in the Netherlands. [Landfilling accounts for more than 50 percent.]



Have students brainstorm reasons why the Dutch are seeking alternative methods of waste disposal today. Allow students to share their ideas. [Students may note that landfills take a lot of space and would not be a long-term solution in a small country.]

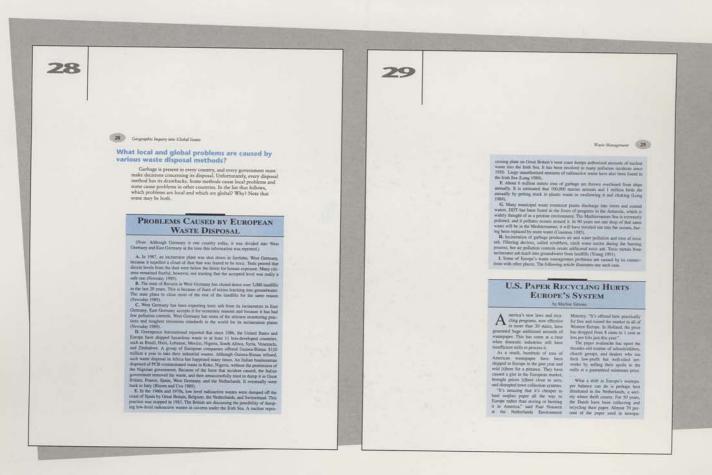
- B. Using the in-text questions on page 25, have students interpret Table 5 on page 26. The table shows The Netherlands National Environmental Policy Plan objectives for solid waste disposal through the year 2000. Ask students to write one sentence for each disposal category in order to demonstrate understanding of the data. An example would be: "The Netherlands plans to reduce landfilling from 55 percent of total disposal in 1988 to only 10 percent in 2000." Establish the fact that the Netherlands plans to reduce landfilling and incineration, while increasing recycling and source reduction. Source reduction (precycling)
- means that less waste is produced because less material is used. For example, by eliminating cardboard packaging, cardboard boxes no longer become waste.
- C. Have students analyze Figure 12 on page 27, which underscores the fact that the Netherlands has a lot of dikes to reclaim land from the sea. Also, it suggests that a "flood" of waste could overwhelm this small country.

Divide students into cooperative learning groups. Assign each member of a group to answer one of the four questions on page 27. Each group should have Mini-Atlas map 4, which shows elevation in the Netherlands and the location of all its major cities. This shows how flat the country is and helps students see how dense its population is. Students will also need to read "The Netherlands Data Sheet" on page 26. Then have students swap their answers within each group.



Questions and Answers for page 27

- 1. How would the fact that the Netherlands reclaims land from the sea affect its waste management practices?
 - To reclaim land from the sea and then use it for landfilling would be much too costly as well as hazardous to freshwater sources.
- 2. Why would high population density cause waste management problems?
 - With so many people in such a small country, there is a nearly complete absence of unused land suitable for landfills.
- 3. How would the fact that the water table is near the surface affect choices for waste disposal methods?
 - Landfilling leads quickly to pollution of fresh water where the groundwater table is so near the surface.
- 4. What problems has the Netherlands's government had to deal with? How might these affect future planning for waste management?
 - All of the factors listed in answers 1–3 make it increasingly difficult to find land suitable for landfilling. It is clear that the Netherlands must find alternatives to landfilling.



What local and global problems are caused by various waste disposal methods? (pages 28–30)

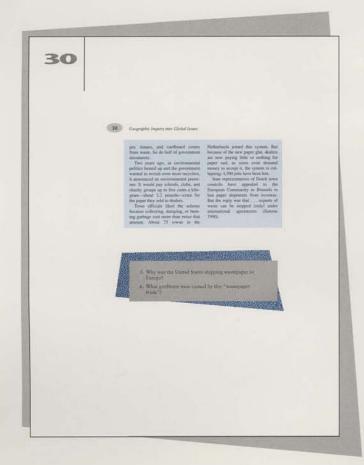
D. Have the small groups read "Problems Caused by European Waste Disposal" (pages 28-29). Have them discuss and reach group consensus on which are local problems and which are global problems and why. (They might use this occasion to add items to the posters they started in Lesson 1.) Their responses might include the following, which are keyed to the lettered passages in the reading: [Incinerators (passages A, C, and H) that expel toxic plumes into the atmosphere can create health hazards for both the local area as well as over much larger areas, but this depends on many factors, such as wind strength and the height of smokestacks. Atmospheric pollution has greater potential for more global effects than does soil and groundwater pollution.

Toxics from landfills (passage B) that leach into groundwater can create extremely

hazardous local conditions when this groundwater is relied upon for the water supply. Groundwater also feeds streams that can carry the toxics quite far beyond the local area. Similar problems occur when waste is dumped into streams or coastal areas (passage G).

Sea dumping of radioactive and other toxic materials (passages E and F) can have potentially global effects, because the oceans are interconnected. Exporting waste to other countries (passage D) also makes a local problem a global problem.]

E. After reading passage I, the article called "U.S. Paper Recycling Hurts Europe's System" (pages 29–30), groups can answer Questions 5 and 6 on page 30. Discuss with them how efforts to help the environment in one region can affect other regions.



Questions and Answers for page 30

- 5. Why was the United States shipping wastepaper to Europe?
 - The United States was shipping wastepaper to Europe because the United States had an
 oversupply of it. New laws and recycling programs in the United States created more
 wastepaper than could be handled by existing U.S. paper mills. With this oversupply, the
 price for wastepaper was lower in the United States than in Europe (even though the price
 in Europe was very low), and the price difference was enough to cover the costs of
 shipping to Europe.
- 6. What problems were caused by this "wastepaper trade"?
 - The glut of paper on the European market lowered the price so much that traditional groups who saved paper to raise funds, such as football clubs, could no longer get their accustomed price for paper, so local governments had to step in to subsidize them. And in the Netherlands, a government program to encourage more recycling was curtailed because paper dealers would not accept the wastepaper; as a result, many jobs in the wastepaper recycling business were lost.

For Further Inquiry

- Have students write a paragraph about this lesson, following these instructions: After reflecting on past activities concerning waste disposal, and after class discussion of the waste disposal problems in the Netherlands, write a paragraph answering the question "Why are people seeking alternatives to landfilling?" Use the Netherlands as a case study in
- your paragraph. Support your ideas with facts from the list on pages 28–29 and the Mini-Atlas maps provided. In your conclusion, draw connections to other countries that share silarities with the Netherlands.
- Ask students to begin reading the newspapers for articles dealing with waste management in the United States and abroad. Create a bulletin board display with the articles.



How does Japan manage waste?



Time Required

One 50-minute class period



Materials Needed

Mini-Atlas maps 5 and 6



Glossary Words

incinerator

landfill

recycle

waste management

Getting Started

- Ask students to quickly give single words that come to mind when they think of Japan.
 Record the words on the board. The purpose of this word-association exercise is to have students verbalize their perceptions of Japan.
- One thing to point out if students don't mention it is how densely populated Japan is. Have students look at Mini-Atlas maps 5 and 6. Ask students to consider why a dense population would require a country to come up with innovative ways to manage its waste. (For comparison, mention that Japan's population density is 858 people per square mile; the Netherlands has 1,164 people per square mile, and the United States averages 73 people per square mile.) Students may also note the dense concentration of industry in Japan, which also requires creative waste management techniques.

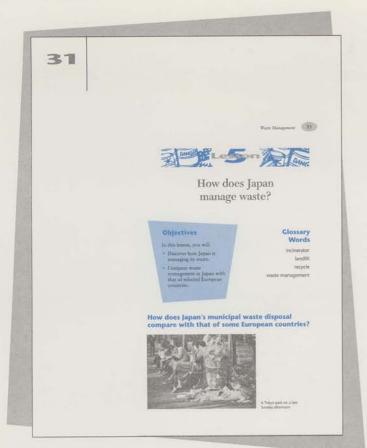
Procedures

How does Japan's municipal waste disposal compare with that of some European countries? (pages 31–32)

A. The first part of this lesson ties Europe to Japan, permitting some comparison of the strategies used to deal with waste. Have students review Table 6 on page 32 and write one or two statements comparing Japan with these European countries. [Some things students might note are that Japan has a low percentage of landfill and the highest percentage of incineration. This is just the opposite pattern of Italy. Sweden is far ahead of Japan in terms of recovering energy during incineration.]

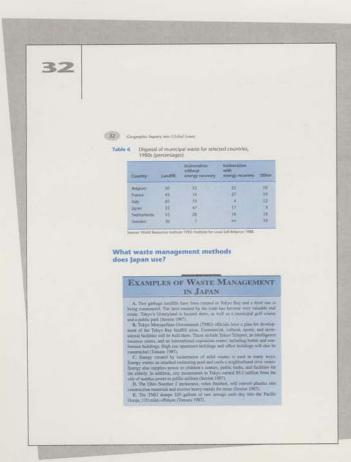
What waste management methods does Japan use? (pages 32–33)

B. Divide students into groups of three or four. Have each group read the "Examples of Waste Management in Japan" (pages 32-33). Have the groups make a list of pros and cons of the methods listed. Groups may then write a oneparagraph critique of these methods, saying how these Japanese innovations in waste management could be applied to their own community. (It is also a fair reply to note that some of the Japanese ideas would be impractical for other places.) [Advantages-]apan is innovative when it comes to waste management. They have developed technologies to convert waste and landfills into usable materials or facilities (points A, B, C, D, and L); they have established successful recycling programs (points F and G); and they raise awareness about the importance of waste management (points H, I, J, and K).



Disadvantages—These solutions are not without some problems and criticisms. Ecology groups have protested government policy on incineration because of air pollution problems (Tomaru 1987). Japan compensates around 100,000 people for health problems related to air pollution from incinerators (Sexton 1987). Ecology groups also protest Tokyo Bay landfilling, fearing water pollution. Point E, the dumping of raw sewage into the ocean, demonstrates the reason for that concern.]

C. Have the groups discuss the question on page 33 ("Do you think Japan has a waste management problem?"). Discuss this in the context of Japan as a small, industrialized, island nation with a very high population density. Use Mini-Atlas maps 5 and 6 to help students with this inquiry.





D. The next lesson deals with the United States. You might ask students to discuss how U. S. waste management problems compare with Japan and Europe. Have students seek a consensus whether the innovations listed in this lesson could or should be used in the United States. Have students add any new ideas for waste management to the posters started in Lesson 1.

For Further Inquiry

- Some Japanese programs are being used as pilot projects in selected U.S. cities. Students could investigate these projects and see if their own communities have plans to use them.
- Arrange a class field trip to a local waste-processing facility, such as an incinerator, a recycling plant, or a landfill.
- Invite a representative from a waste management company to make a presentation to your class about the methods they use.



Should Utah import California's garbage?



Time Required

Two 50-minute class periods



Materials Needed

None



Glossary Words

heavy metals landfill pollution radioactive waste solid waste

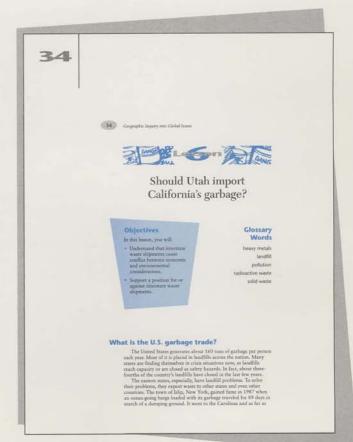
Getting Started

Tell students to pretend that they each have a *huge* trash can at home, while a neighbor has only a very small one. Would you allow your neighbor to dump some garbage into your can? What if you were offered money? Tell them that this scenario has some relevance in the United States today, because some states are running out of room for their garbage and are looking for other states in which to dispose of it.

Procedures

What is the U.S. garbage trade? (pages 34–35)

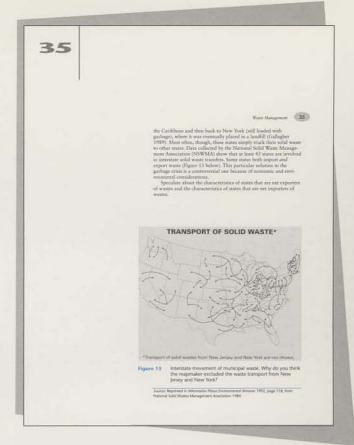
A. Have students read the text and examine Figure 13 on page 35. Note that waste is moved from state to state in the United States much as it is moved from country to country in Europe, as was shown in Figure 11 on page



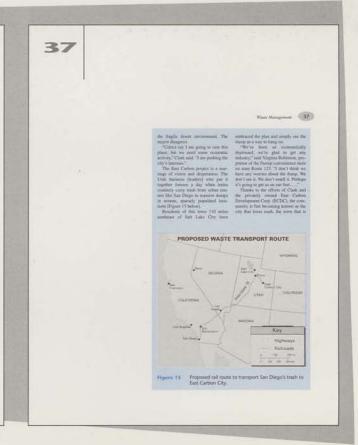
23. Have students identify which states import waste and which export waste (note that several do both). Focus in on your own state. Ask students why New York and New Jersey were not included on the map and have them consider what the map would look like if those two states' garbage trade was included. [New York and New Jersey were omitted from Figure 13 because adding in arrows to show their trade would add too much information, rendering the entire map unreadable. This is a simple way to highlight the point that mapmakers must always be selective in what information they show.]

Is "the town that loves trash" making a good decision by importing garbage? (pages 36–42)

B. "The Town That Loves Trash" (pages 36–40) and the two articles that follow it (pages 40-42), describe the plans of a town in Utah (East Carbon City) to import trash from California and other places. It explains why these plans









Geographic Impury erro Global Issues

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tive for urban asses.
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From boom to bus

According to Store Creature, ECDC's president, the company now sumpleys 22 people at the fast Carbon lossfull. Exercisely, the hopes to boost dar. Highes to 60 or 70 workers. Even the company's attention with now account of the damp will not come close to Hilling the mappleyment.

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nts for each roy of water disposed of the dump.

"I don't like the idea of each a his dump being forced on us. I don't thus they informed us properly.

Doubling city budget

Clark socied that the 30-cents a time for is inherboled to take by 50 cents mercy 10 years, for the most fosdecodes. So list, sponding by BCOC, has pumped about \$25 million into the local economy, said Creames.

Built for 20 to 40 years of suspects, the 2,400-acre landfill eventuality will occupied by Toelli value, 40 feet show the damer flow Each will hold up to 6.3 million cable yards of waste. While cook lenders count that most sowrapeople strongly built the landfill, not everyone in its larve sold the land of everyone in its larve sold the land of everyone in the landfill.

Distription
An opposition group called Citizens
An opposition group called Citizens
Assumes New (CAN) experience a significant position of the constitution by
Holff, a CAN founder who cittentizes was for a living, skyr be surreas about possible pullmost from dast and heavy metals.

A logal battle lameched by CAN is clear the damp as the has been assumentable. While some appearents have specific universalistic concerns, much of the oppositions stress from discreast of ECDC and city leaders. Some critics complain that the damp is less flour two miles from the intent \$500000. Others say they disket.

wen's homes. Others say they didn't miles how large the project would be imong them is Olen Heorie, a retired integ recclassic who owne to fine

Sarbage imperialism

Reliciting trads from mahade the community "in the greatest lake we would think about," said Cardy King of the Secret Clab's Unit chapter. "We amply a lack of impressibility and a

According to Brad Aoget, the Greenpeace inguistables a tooks compagner for the Southwest, smiles after water to used areas in that of a garbage experiation. Low-passing communities consumently are

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The Unit Legislature's relatively lax antitude roward would wome will recoverage California cities to see morely by objecting their mark in East Carbon, where roles not less distrigues and diagonal foca are changed. Ming cod.

San Deeps Supervision Iteras-Bilbray and other county officials say se's cheaper to open new leadfills locally than to send trash to other states. The problem is the unaccessful search for a new damp in North [San Diego] County.

Each time a new sits is proposed

40



Geographic Impury into Global James

years of landing studies and fending off lawsuits, the county is no closer to a new dump thus when a standal critics say.

To the measurement the North County region's only during may had only of good to specificate market and state official are decembered unit measurement and state official are decembered by a state of the state of t

A recent proposal in reorganize Se Diego County's trash system in go cities more comot has been rejecte by several communication. Some a cargoring other openies, tacheding or hard. Whatever tappens in California, during can only improve in Basi Carton, Clark said. According to Torrowy Grant, a basefuld conch, and prideoce oversueler as East Carton-High School, things almody are turn-

mg arcent.

Normally, few of East Carbon's high whool gradiants continue their aducation. Last year, thorks to a scholarship program set up by ECOC 17 of 29 gradiants revolved in coding content of the content of the

or vocational peograms, Graer said.
"They've done a list for the salloot,"
he said with a solemn nod. "They've
done a list for a lox of people."

Solver The Sun Diego Union Tolhams, June 6, 1993

MAYOR'S AIM: DIG OUT REVIVAL

Emmet Piene

E art Carbon City, Undo-The residents of this ween-us, dying mining town are secured to hard times, but nothing has divided them more deeply than the consumar recovery plan embraced by Mayor Paul Clark.

Mayor Paul Clark.

Clark a criter three; is set outspecies become of the 2-600-acer dump that has opened at the city's western edge. Stemping through Roothern California on bedalf of the privarily owned Eacliff, Clark has noticed East Carbon as the city that warm to become the Wint's garding receptable. Demaction say the facility will

the inntill as economic survival forcity that is becoming a ghost town. "We're as old town built durin World War II for the annuag of end. Cheir and. "The reducty has slower in the point where... there is bushed

ly or employment for the young."
So committed its Clark that he recovery involved in Carthus (California) to field East Carbo Development Corp. (ECDC) official my to won North (San Diego) County cities sweet from San Diego County.

Despite the promise of economrevival, a group of local resider called Catients Awareness No. 41

Waste Managemen



(CAN) hauched a vigorous campaign to close the damp sees offer the project received all necessary permits in 1990 and 1991; Clark recalled. Last year, council summers who thought they had a project that every-

Last year, council numbers draught they had a project that evce wanted authority found it achies besieged by proteuros, it wast.

eminion. Some emics viewed to record solver to the ultimate companrum.
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"If got megh," the reason such "A couple of council people had some tharata. I never tiid." Elemently landfill supporters raland and cords their feelings known at council senters, Clark used.

For all the fast over the landfill, Fast Carbon will offers a peaceful, enhanced litters to, he said.

Clark, who returnd from the job as a mindised manager with U.S. Stock in 1964, grees up to the nearly construnity of Spring Canyon, a news that find with the local cost inclure. He and his wife Mary, have two soms hiting in fine Carbons. If they all hand handful has speccrashed, If they all shand handful has speccrashed.

Source The East Diogo (1986) February June 6, 1993.

TOWN WAS SHAFTED, SHE CLAIMS

E au Carbon City, Utah-Mannaly, mild manaters Physika Johnson (Figure)

frebrand, but she sook to die role prickly when this remote mining town became from its new of the notion's



Figure 16 Phyllis Johnson leads opposition to ECOC's pl import trash:

Jakon: The San Diego Union Tubure: Plantagraph by Layne Mi

- are controversial and presents both sides of the issue. There are several ways in which you might use this material; here are two suggestions:
- Hold a class debate: "Resolved: East Carbon City, Utah, should import waste from California." To do this, divide the class into groups of two or three to read and discuss the material in class. Assign half the groups to support the resolution and half to oppose it. Bring the two sets of groups together to plan the debate and to choose their spokespersons. Perhaps each side could have three debaters and each debater could focus on one particular issue.
- Stage a mock hearing of the Utah Supreme Court: Citizens Awareness Now (CAN) has filed a suit asking the Court to order a referendum vote of East Carbon City residents to close down ECDC. Have students play the roles of people mentioned in the readings and make up other names as needed. Assign some students as Supreme Court judges, some as supporters of ECDC, and some as members of CAN. After all sides have been heard, have the Court discuss and then vote whether or not to order a referendum vote.



C. Close the lesson by relating the question about importing trash to your own community. Ask students whether they would like to have ECDC in their town. Have students explain their opinions. You may want to have them write paragraphs stating their views, using their reasons as support. An alternative would be to have students list reasons for and against the importation of garbage, to demonstrate their understanding of both sides of the issue.

This may be a good time to bring up the NIMBY issue again (Not In My Backyard). If people are opposed to having waste management facilities in their own town, what would be a fair way to decide where such places should be located?

For Further Inquiry

- Have students investigate whether or not their state exports or imports garbage: why, where it goes and/or comes from, what types, modes of transport, etc.
- The Student DataBook mentioned that the United States produces 160 tons of garbage per person per year (this works out to almost 1,000 pounds per person per day!). Have students look back over their list (started in Lesson 1) of their households' waste and estimate whether they are contributing more or less than the U.S. average. It is almost certain (we hope!) that a household's waste would come nowhere near this figure. This provides an opportunity to examine the data closer: Ask students what kinds of waste must be included in this figure (e.g., industrial waste and the weight of wastewater in sewage).
- For older students, emphasize the point about how all maps must be selective in what information they show by having students bring in maps from newspapers or magazines and critique what choices the mapmakers made.



Is there good news in waste management?



Time Required

One 50-minute class period



Materials Needed

None



Glossary Words

compost

landfill

recycle

solid waste

waste management

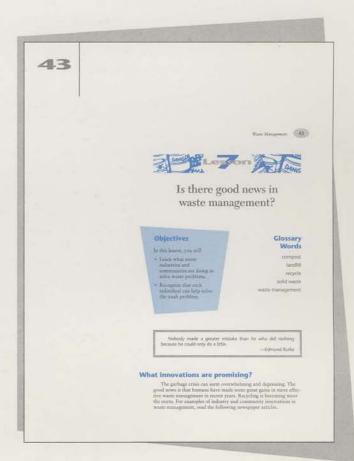
Getting Started

Environmental problems can seem overwhelming to students and it is important to leave them with a hopeful, rather than a hopeless, feeling. We cannot, however, depend on industries to solve all of our problems. Waste management is an area in which every human can make a difference—even school-age students. Have students discuss the meaning of Edmund Burke's quote on page 43. (Draw attention to the fact that Burke said this in the 18th century, which helps explain the usage of "he"—although we would consider this a sexist referent today, it is not implied that only men can take meaningful actions.)

Procedures

What innovations are promising? (pages 43–47)

A. Have students study Table 7 and the news clips (on plastics recycling, on landfills, and on composting) on pages 44–47. You might use a cooperative learning format by assigning the four sections to four different groups. Structure a debate with the resolution that



PLASTICS RECYCLING: INDUSTRY BUYS IN



Warte Management (45)

Table 7 A selection of successful industrial waste reduction programs

Company/location	Products.	Stratogy and effect
Astra/Sweden	Pharmecruticals	improved in-plant recycling and substitution of water has solvents; cut host; weaths by half.
Booders Chemical/U.S.	Reson, authorives	Altered imining and other operating procedures; cut organic chemicals in waste water by 93%; studge shipout costs reduced by \$49,000/year.
Cleo Wrap/U.S.	Cift wrigi paper	Substitution of water-bissed for solvent-based rek-sertually allemnated hazardous vasite, saving \$25,000/year.
Duphar/The Netherlands	Pesticides	Now manufacturing process cut look, waste per unit of one chemical prockured from 44 pounds to a half-yound.
Ou Port/Colordia	Pesticides	New equipment to recover chemical used in making materials valued at \$50,000 annually; wants discharger were cut by 95%.
Dia Pront/Verreztable	Patriti, finishes	New solvent receivery unit. eliminated disposal of solver watter, saving \$200,000/yea
Ploneer Metal/U.S.	Destroplated metal	New treatment system design cut water use by 96% and studge production by 20%, erosal net awings of \$52,500, investment paid back in three years.
IMALS:	Varieus.	Company wolls, 12-year pollution prevention effect has halved wester generation yielding total savings of \$100 million.





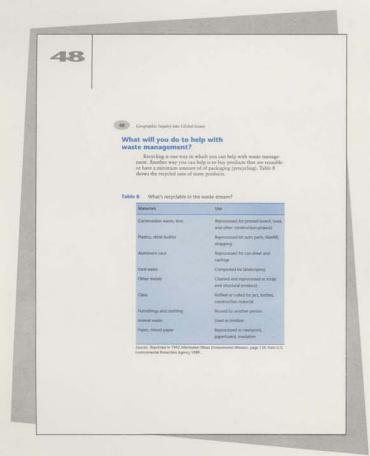
"Technology will solve all the major problems of waste management," or simply hold a class discussion on Question 1 on page 47. Encourage students to use any of the materials in this module to argue their positions. They might also wish to refer to the posters they have been making.

What will you do to help with waste management? (page 48)

B. Have students examine Table 8 on page 48 and identify which items can be recycled easily in their community. Survey the class to find out if their households recycle those items. For things that cannot be recycled easily, ask students what they would have to do to recycle them. Ask students for opinions about what they think can be done to make recycling easier and more popular.

Ask students what else they personally can do besides recycling to reduce their waste generation. They might say that they can precycle, which means to buy products that are reusable or come with a minimum amount of packaging. They can also consume less. If the class is interested, they can encourage their school and community to start recycling programs and to consume less.

C. Close the module by reviewing the contracts that students designed in the first lesson. Have students evaluate themselves on their success at keeping to their contracts. Discuss the changes they had to make to their behavior and the difficulties posed by making such changes. Ask students to think about what they can continue to do to reduce their own contribution to the waste problem (Question 2 on page 47).



Extension Activities and Resources

1. Related GIGI Modules

- The module *Urban Growth* has data concerning the problems of waste management in rapidly growing cities in developing countries. The primary case study is set in Mexico.
- The module Global Climate Change explores the related problem of how inefficient use of resources (specifically, fossil fuels) can create other global problems. Environmental Pollution provides an example of how agricultural waste products can contaminate water resources.
- Two issues raised in this module are discussed at greater length in three other modules. The question of increasing populations is addressed in *Population Growth* and the way nations interact and depend on each other via trade is examined in *Interdependence* and *Global Economy*.

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 videos "The Garbage Explosion" and "Soil: A Natural Habitat" discuss the issues explored in this module.

4. Additional Activities

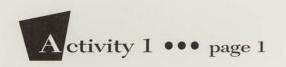
- To further promote students' skills in civic participation, have students start recycling programs in their schools or neighborhoods.
- Encourage your students to join the school's environmental club. If your school does not have such a club, perhaps students would be interested in starting one.
- Have students conduct an opinion poll (among other students and/or parents) about what people think is the biggest waste management problem. The question for the opinion poll could be "What do you think is the most important cause of the

nation's garbage problem?" Suggest that students provide a list of possible answers for this question, which can include any of the following (National Solid Waste Management Association 1990):

- Lack of safe places/ways to dispose of waste
- Lack of recycling programs
- Excessive packaging
- Plastics
- Too much garbage generated
- Lack of public concern or awareness
- Inappropriate disposal methods
- Lack of proper planning or regulation
- Overpopulation
- Other reason (please specify)
- Don't know or no opinion

5. Writing

- Investigate the waste management problems in the community and write proposals to local government officials suggesting steps that could be taken locally to deal with the problem.
- Have students write science fiction stories or children's stories dealing with the trash issue, and share these with elementary schools.



GIGI

Waste Management

Lesson 1

Guide for Selected Activities and Tables

Each of the following activities relates to figures and tables in Lesson 1.

F1	3	1	71
Figure	3	(page	1)

Recyclable
Reusable
Organic (meaning that they can decompose)
Potentially hazardous—needs safe disposal (Table 1 may help with this)
Throw it away (can't be recycled or reused)
Not a waste product
Other
Which items would <i>not</i> have existed 100 years ago?

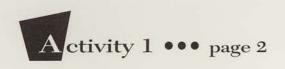
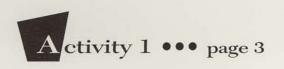
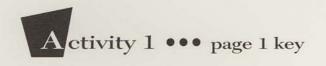


	Table 1 (page 9)		
	Make two lists to show how each product in the table's first column is disposed of by (a) your household and (b) your school.		
	a. Household	b. School	
	Where do these waste products go? In household or school gets rid of them?	other words, where are they taken after your	
5.	How do these methods of handling hazardous waste compare with the safe disposal methods in Table 1?		
	Table 2 (page 10)		
	Make a list of the environmental probl specific management methods in the ta	ems that might result from <i>each</i> of the four ble.	
	Land disposal		
	Discharge into sewers, rivers, stream	ns	



Burnin	g in industrial boilers
- III	Figure 4 (page 11)
the vol	imple demonstration to show how the concentration of a solution is related to tume of water. Place the same number of drops of food coloring into two—one full of water, the other only half full. How does this experiment explain occass shown in the figure?
ground	a list of as many items as you can think of that can contaminate the soil or the water. Contamination may result from the item being applied to the ground, d on purpose, or accidentally spilled.



Guide for Selected Activities and Tables

Figure 3 (page 7)

Important: Note that the list below is for suggestion only. Many organic items or potentially hazardous items are also recyclable. Students may wish to put either of these in more than one category.

1.	Identify the items on this list according to the following categories:		
	Recyclable		
	[newspapers, tires, cardboard boxes, pop cans, magazines (some		
	_places only), glass bottles, plastic milk jugs, paper]		
	Reusable		
	[wrecked cars (parts), plastic bags, furniture, automotive supplies,		
	cleaning solvents, batteries, blankets, factory equipment]		
	Organic		
	[noodles, bananas, bread, potato peels]		
	Potentially hazardous		
	[photography chemicals, hospital wastes, paint remover, industrial wastes,		
	wood preservatives, medicines, furniture spray, pesticides, paint, toilet cleaners]		
	Throw it away		
	[cigarette butts, cereal boxes, makeup, fluorescent light bulbs]		
	Not a waste product		
	[All items, once used, may be considered waste, but this category was included		
	in case students were undecided about some things]		
	Other		
	[As above, included in case students were uncertain about anything]		
	Which items would not have existed 100 years ago?		
	[Many of these items were invented during this century, including cars and mos		

of the chemical products listed under "potentially hazardous"]

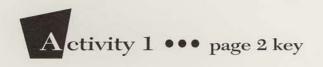


Table 1 (page 9)

3–5. Make two lists to show how each product in the table's first column is disposed of by (a) your household and (b) your school. Where do these waste products go? In other words, where are they taken after your household or school gets rid of them? How do these methods of handling hazardous waste compare with the safe disposal methods in Table 1?

[3–5. Answers will vary. Unless your community has an easily available hazardous-waste disposal facility, it is likely that most households simply throw all these products away. Invite the person who handles waste-disposal procedures for your school to come to class and explain what your school does.]

Table 2 (page 10)

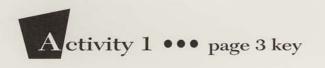
6. Make a list of the environmental problems that might result from *each* of the four specific management methods in the table.

Land disposal

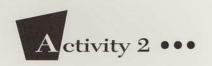
[Uses up land that could be used for other purposes; landfills have a limited capacity; toxics can leach into groundwater; landfills prevent wastes from decomposing; etc.]

Discharge into sewers, rivers, streams

[Toxics can pollute rivers and threaten ecosystems; drinking water made unpotable; recreational uses eliminated; etc.]



	Not everything is recoverable, but of all the treatments shown, this best capitalize		
	on the recyclability of the wastes.]		
	Burning in industrial boilers		
	[Releases pollutants and heat into the atmosphere.]		
	Figure 4 (page 11)		
	Try a simple demonstration to show how the concentration of a solution is related to the volume of water. Place the same number of drops of food coloring into two glasses—one full of water, the other only half full. How does this experiment explain the process shown in the figure?		
	[From the figure, students should understand that water will dissolve and leach ou		
	toxics and carry them into the soil and the groundwater. In the demonstration,		
	the brighter color of the half-full glass shows the stronger solution of coloring.		
	Explain that the dissolving of toxics works the same way: As the amount of water		
	decreases, the amount of toxics relative to the water increases.]		
•	Make a list of as many items as you can think of that can contaminate the soil or the groundwater. Contamination may result from the item being applied to the ground, dumped on purpose, or accidentally spilled.		
	[Answers will vary. Encourage groups to compete by seeing who can make		
	the longest list.]		

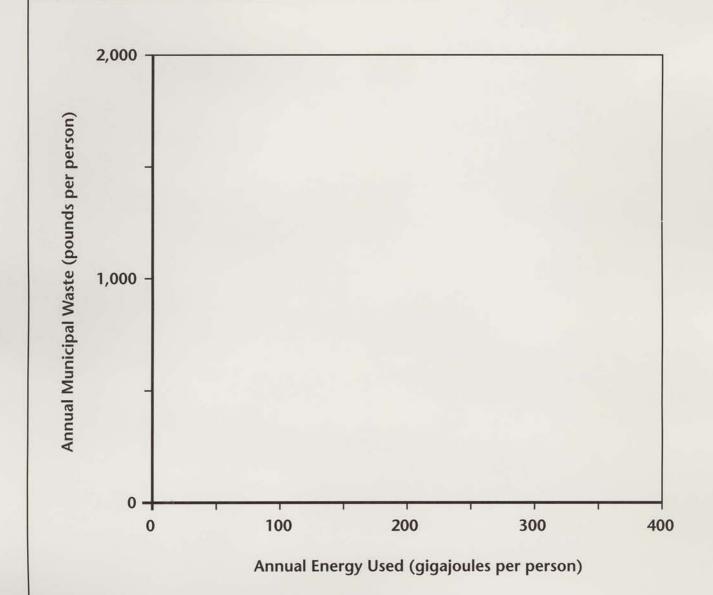


GIGI

Waste Management

Lesson 2

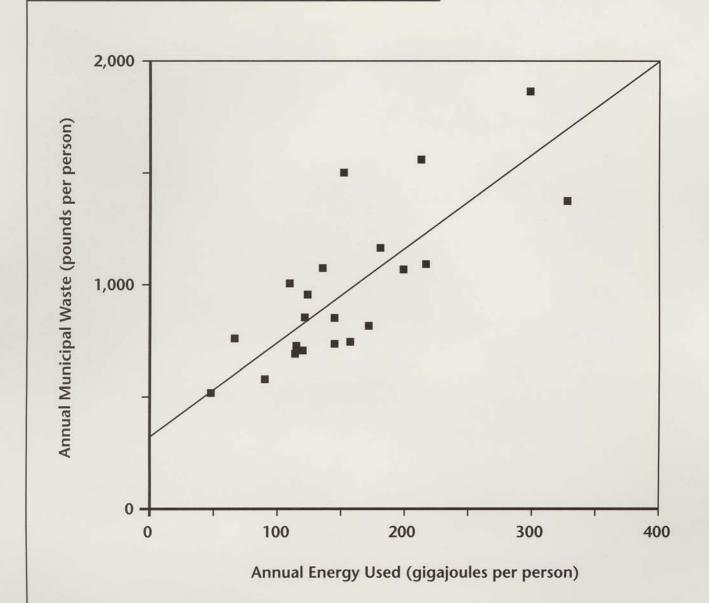
A Comparison of Waste Generated and Energy Used



Directions: Use Table 3 in your text to create a scatter diagram, plotting the municipal waste and energy use for each country in the table. You will need to estimate the points, since the values are so precise. Then, draw a straight line through the group of points where you think a line best fits the cluster of points.

GIGI Waste Management Lesson 2

A Comparison of Waste Generated and Energy Used



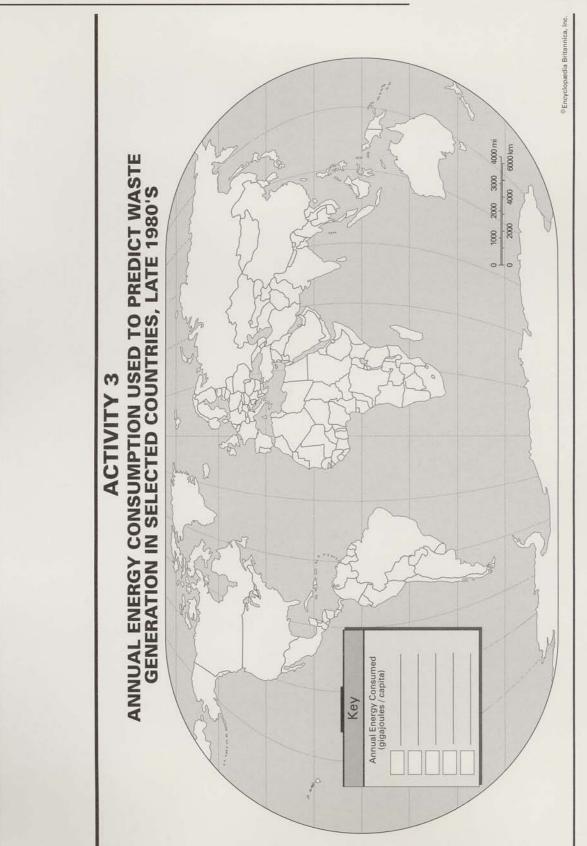
Line of best fit: y = 288.89 + 4.2917x

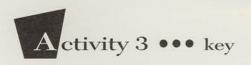
Regression value: 0.630

Annual Energy Consumption Used to Predict Waste Generation in Selected Countries, Late 1980s

GIGI Waste Management

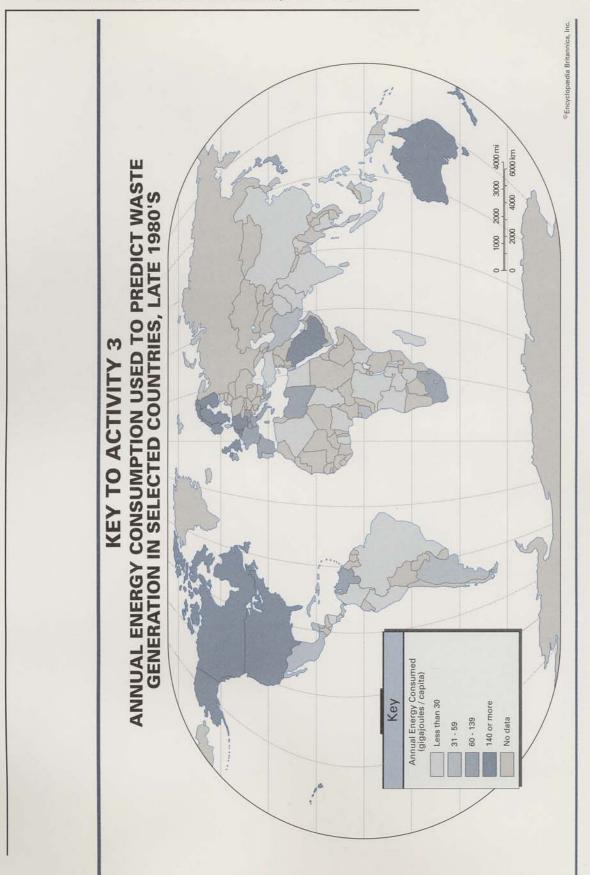
Lesson 2





Annual Energy Consumption Used to Predict Waste Generation in Selected Countries, Late 1980s

Waste Management Lesson 2



GIGI

Waste Management

Lesson 3

Guide for Figure 10

Directions: Use with Mini-Atlas map 3 (physical-political map of Europe) to help interpret Figure 10 on page 22.

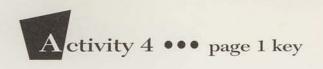
1. Describe the four waste management methods in Figure 10. Use a dictionary or the Glossary if you need help.

	Method	Description
	Incineration	
	Landfills	
	Composting	
	Recycling	
2.	Describe any patterns you	can see in the data for Figure 10.
3.	Which country relies most	on recycling? Why?
4.	Why do you think Switzer	land does so little landfilling?
	-	



What other method of waste disposal should have been added to Figure 10? (See Figure 11 on page 23 for a clue.)		
_		

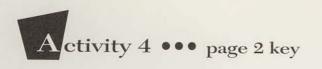
Activity 4 ••• page 2



Guide for Figure 10

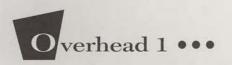
1. Describe the four waste management methods in Figure 10. Use a dictionary or the Glossary if you need help.

Method	Description
Incineration	[The process by which wastes are burned. This, how-
	ever, expels toxic fumes into the atmosphere and
	can create health hazards for both the local areas
	and much larger areas.]
Landfills	[a place in which garbage is interspersed with layers
	of soil to produce an area that can be reused as a
	parking lot, park, or for some other useful purpose]
Composting	[the process by which decayed organic matter from
	waste is later used for fertilizing and conditioning
	land]
Recycling	[the process by which materials are separated from
	waste and converted into useful products, such as
	bottles]
	ou can see in the data for Figure 10.
Landfills and incineral	tion are the major methods of waste disposal.]
20000	Environ to 1 Colombia Control
3. Which country relies mo	
[Switzerland, probably	because it has a well-organized system.]
-X -X/ - X - X - X - X	72
	zerland does so little landfilling?
_[It is a small mountain	ous land with very little area suitable for landfills.]



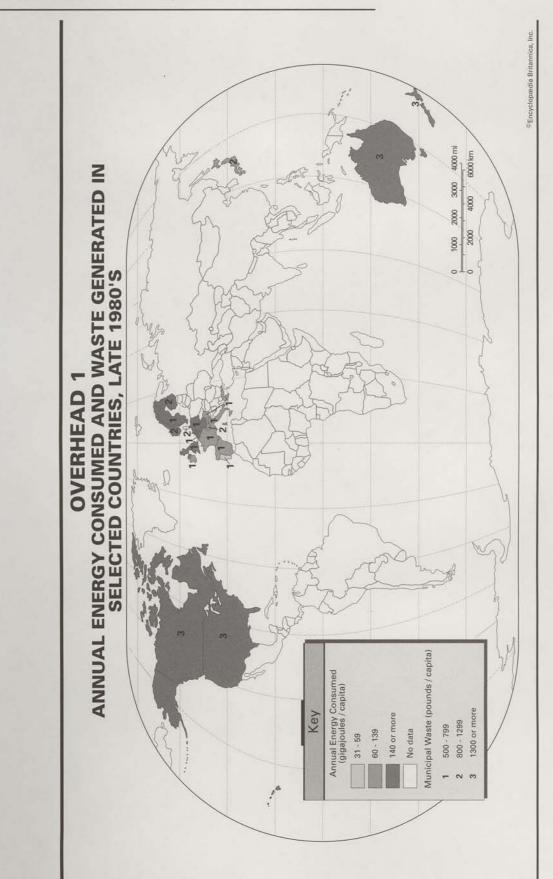
Waste Management Lesson 3

5.	Why do you think Germany and Italy do the most landfilling? [These are large European countries, so they have more land suitable for this use
	_than most of the smaller countries.]
6.	What other method of waste disposal should have been added to Figure 10? [Exporting is another method of disposing of waste.]



Annual Energy Consumed and Waste Generated in Selected Countries, Late 1980s

Waste Management Lesson 2



BRITANNICA GLOBAL GEOGRAPHY SYSTEM

GIGI

Geographic Inquiry into Global Issues

Waste Management

Program Developers

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

Regional Case Study Europe



Geographic Inquiry into Global Issues (GIGI)

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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

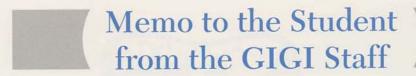
Salt Lake City, UT

Monroe, WI

Racine, WI

Cheyenne, WY

Worland, WY



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!

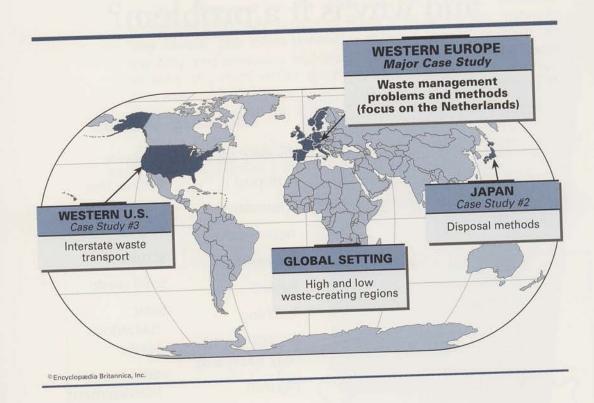


Waste Management

Why is waste management both a local and global concern?

- How is waste management an environmental issue?
- How are you a part of the problem of waste management?
- How can you be a part of the solution to the problem of wastes?
- Do you think the United States is a "throwaway society"? Why or why not?

Everyone everywhere generates waste. This module examines waste management because many of our most difficult global environmental problems result from the waste we create. In this module you will study the global nature of waste management and conduct a major case study of waste management in Europe. Then, for comparison, you will examine waste management issues in Japan and the United States.



Questions You Will Consider in This Module

- What is waste management?
- Why is waste management both a local and a global problem?
- Why do some countries generate more waste than others?
- What are some old and new ways of disposing of waste?
- How can a region or country reduce the amount of waste it produces?
- How can individuals and communities reduce wastes?



What is waste management and why is it a problem?

Objectives

In this lesson, you will

- Understand how waste management affects our daily lives.
- Recognize that many local and global environmental problems are waste management problems.
- Learn why certain waste disposal methods are environmentally hazardous.

Glossary Words

biodegradable
compost
groundwater
heavy metals
incinerator
landfill
leaching
NIMBY (Not In
My Backyard)
pig iron
pollution

radioactive
waste
recycle
scrubber
solid waste
toxic
hazardous
waste
waste
management

Are we wasting our environment?

The following quotation from John Young, a scientist at the Worldwatch Institute, offers a way of thinking about this question.

The amount of material that originally enters an economy tells us nothing about the material's eventual fate or its contribution to human well-being. It tells a good deal, however, about the damage the economy inflicts upon the environment. The devastation wrought by economic production is closely related to the amount of materials consumed.

Extracting and processing raw materials—minerals, wood, and so on—are among the most destructive of human activities. Logging usually ruins forest ecosystems, and transforming trees into paper and other wood products involves several highly polluting processes. Mining regularly obliterates whatever ecosystems or human settlements [that] sit atop ore deposits. Making metals from ores takes great quantities of energy and produces large amounts of pollution and waste. Unfortunately, much of the damage from producing raw materials occurs in remote areas, so most people know little about it.

The other end of the cycle is more familiar. Industrial economies eventually excrete as waste most of the raw materials they devour. This refuse presents a massive disposal problem. As the dirty and expensive legacies of careless dumping have come to light, the most visible symptom of profligate materials consumption—the "garbage crisis"—has generated political heat in communities around the world (Young 1991, pages 5–6).

What environmental messages can you find in the cartoons below and on page 6 (Figures 1 and 2)?

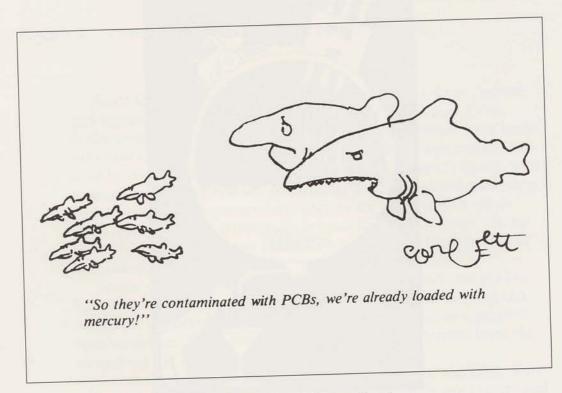


Figure 1 Consequences of pollution for seafood.

What is waste management?

Almost anything can be considered waste (Figure 3 on page 7), and almost every form of human activity makes waste. Waste management is how we deal with the wastes we create. All kinds of human systems produce many types of waste that need different forms of management. Rural and urban households use different ways of disposing of their garbage, sewage, trash, and junk. Typically, rural families have their own separate systems, but urban households depend upon city governments to manage their waste. Farms produce chemical wastes from fertilizers, pesticides, and herbicides. Factories need waste management practices suited to the wide variety of waste products from industry. Even schools need waste management systems. How does your school manage its wastes? What happens to the contents of the wastebaskets and pencil sharpeners?



Figure 2 Water quality is affected by all activities.

Source: Mikkelsen 1981.

Is This Trash?

plastic bags newspapers cleaning solvents cigarette butts batteries cereal boxes bread noodles make-up wrecked cars pop cans photography chemicals magazines furniture pesticides tires glass bottles hospital wastes blankets automotive supplies plastic milk jugs paint remover paper industrial wastes potato peels fluorescent light bulbs bananas wood preservatives paint medicines toilet cleaners furniture spray factory equipment cardboard boxes

Figure 3 What do you consider to be potential trash?

Some kinds of waste cause more problems than others. Animal and vegetable material is biodegradable. This means that it can decompose by natural processes into harmless (and sometimes useful) substances. Small amounts of food and vegetable waste can be managed by composting. This is a method of using decayed organic waste to produce fertilizer and soil conditioner for farming and gardening. Large amounts of organic waste, such as are generated by whole Large amounts of organic waste, such as are generated by whole towns and cities, can biodegrade in landfills. At these large "dump sites," layers of solid waste (some of which are not biodegradable) are covered with layers of soil.

Sometimes incinerators, which are special furnaces, are used to burn household, municipal, and industrial waste. But burning can add to air pollution. To prevent this, incinerators can be equipped with scrubbers. These are devices for removing pollutants from the air coming out of the smokestack.

air coming out of the smokestack.

Another waste management method is reusing or recycling. This reduces the amount of waste by separating materials from waste and changing them into useful products. Precycling (or source reduction) is the term used for reducing or eliminating the amount of material that finds its way to waste. About \$1 of every \$10 spent in the

United States on food and drink pays for packaging that becomes waste (Pollock 1987). Thus, it is clear that waste management could be simplified if the amount of materials used for packaging could be reduced.

Some waste is highly poisonous. The used—but still radioactive—fuel rods from nuclear power plants remain toxic (poisonous) for thousands of years. Obviously, the management of nuclear waste is a very large, complex, and long-term problem. But by no means is it the largest problem. There are many other kinds of hazardous waste. Many industries use and produce toxic materials such as heavy metals (for example, lead and mercury), petroleum, chlorine, ammonia, cyanide, and acid (Table 1 on page 9).



Garbage trucks unload while bulldozer piles waste at Southern California Landfill.

 Table 1
 Safe disposal of potentially hazardous solid waste

The products we use	The potentially hazardous waste they generate	Recycle when possible Use all/share; store for hazardous waste collection	
Plastics	Chlorine compounds and solvents		
Pesticides	Chlorine compounds and phosphate compounds		
Medicines	Solvents and residues, heavy metals (mercury and zinc, for example)	Small amounts can go down drain	
Paints	Heavy metals, pigments, solvents, and residues	Share, recycle; store for hazardous waste collection	
Oil, gasoline, and petroleum products	Oil, phenols and other compounds, other heavy metals, petroleum, ammonia, salt acids, and caustics	Recycle at approved facility; take to hazardous waste collection site	
Metals	Heavy metals, fluorides, cyanides, acid and alkaline, solvents, cleaners, pigments, abrasives, plating salts, oils, and phenols	es, Recycle	
Leather	Heavy metals and solvents	Reuse; give away	
Textiles	Heavy metals, dyes, chlorine compounds, and solvents	Reuse; give away	

Source: U.S. Environmental Protection Agency 1988.

Households, towns, and industries have several ways to manage solid and liquid hazardous waste (Table 2 on page 10). Where regulation and enforcement is absent, hazardous materials are often simply dumped onto the ground or into streams, lakes, and oceans. Despite the environmental dangers, dumping is probably the most widespread method of waste disposal in the world. Where regulation is strict, such as for the U.S. nuclear power and weapons industries, radioactive waste is usually managed safely. The U.S. government

plans to build an underground repository in Nevada for long-term (thousands of years) storage of high-level radioactive waste from nuclear power plants. But even if this plan proves to be technically sound, the project has been delayed because of public perceptions of risk (Slovic et al. 1991).

Table 2 Hazardous waste management methods, United States, 1983

Management method	Percentage of tota waste managed
I dimoral	67
Land disposal	22
Discharge into sewers, rivers, streams	4
Separation for recovery of solvents	4
Burning in industrial boilers	3
Others	
Total	100

Source: Postel 1987.

Given time, nature can cleanse itself of many pollutants. But with too much waste and too little time, nature will be overwhelmed. Inadequate waste management leads to environmental problems because the amount and concentration of waste materials exceed the cleansing capacity of the natural system. When this happens, the environment becomes degraded. For example, a small amount of poisonous chemicals dumped into a large river will be diluted in the large volume of water. Thus it will not degrade the river's basic water quality. But that same amount of poison dumped into a very small stream might seriously degrade the water's quality. Similarly, where only a little toxic material is dumped onto the ground, the soil may be able to absorb it without becoming contaminated. But a larger amount may contaminate the soil and even the groundwater when it is leached through the soil and into the groundwater (Figure 4 on page 11). Crops grown in contaminated soil and drinking water drawn from wells dug into contaminated groundwater can present serious health problems.

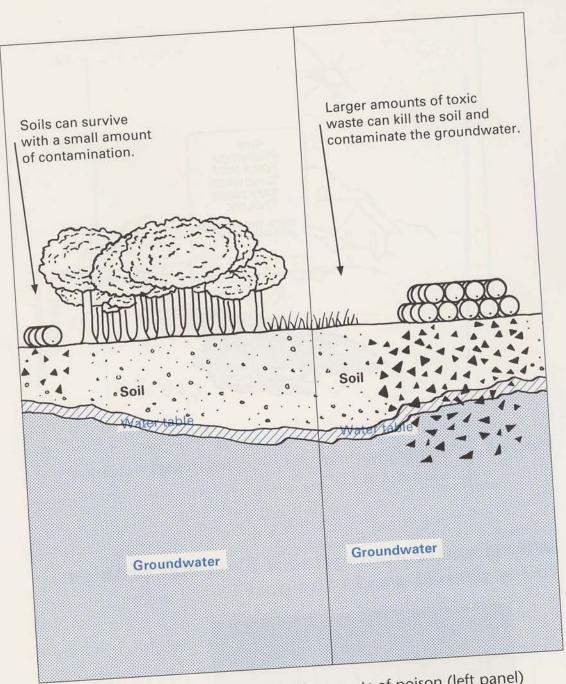


Figure 4 Soils can filter only small amounts of poison (left panel) before passing it on in the groundwater (right panel).

You should now be better able to understand why Young said that "the garbage crisis . . . has generated political heat in communities around the world" (1991, page 6). Why do you think NIMBY (Not In My Backyard) is a slogan often identified with this political heat? Figure 5 on page 12 may help you consider this question.



Figure 5 Why is this an example of a potential NIMBY situation?

Source: Dave Harbaugh.

Why is waste management a greater problem today than it was in the past?



People in the nineteenth century threw garbage from house buckets directly into the street, spreading disease-causing germs.

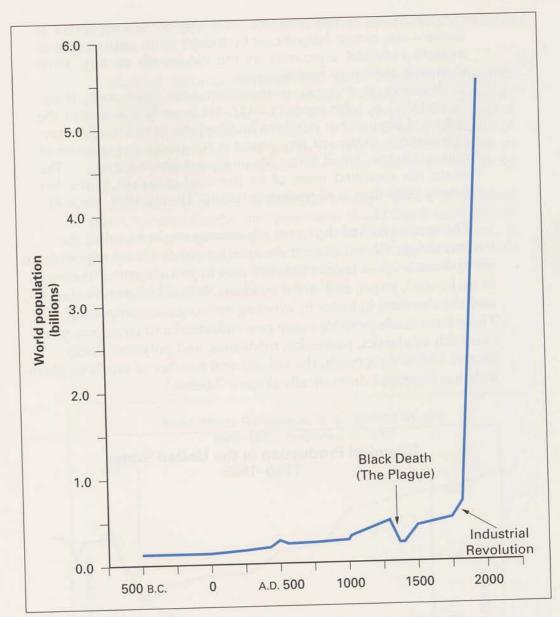


Figure 6 Estimated human population, 500 B.C. to the present.

Sources: U.S. Bureau of the Census; Population Reference Bureau 1992.

Human population has grown tremendously since the Industrial Revolution (Figure 6 above). This fact may be taken as an indicator of the increasing scale of the waste management problem—the more people, the more waste. But population is not the whole story. Consumption is another important part of the equation. Not only are there more people today than in the past, but individuals today consume much more than they did in the past.

Human use of raw materials—with the notable exception of timber—was almost insignificant by today's terms until the rise of modern industrial economies in the nineteenth century. From then on it grew at an explosive rate.

Increases in minerals consumption were particularly sharp. Geologist C. K. Leith wrote in 1927: "In these hundred years the output of pig iron has increased hundredfold, of mineral fuels seventy-fivefold. In the last fifty years the per capita consumption of minerals in the United States has multiplied fifteen times. . . . The world has exploited more of its [mineral] resources in the last twenty years than in all preceding history" (Young 1991, page 7).

The second half of the twentieth century might be called the Chemical Age. Chemical manufacture draws heavily upon petroleum for raw materials. Modern industry uses huge amounts of chemicals to make steel, paper, and wood products. Scientists have revolutionized the chemical industry by creating new organic compounds. These have made possible many new industrial and consumer products such as plastics, pesticides, medicines, and polyester fibers (Postel 1987). As a result, the volume and number of synthetic chemicals has increased dramatically (Figure 7 below).

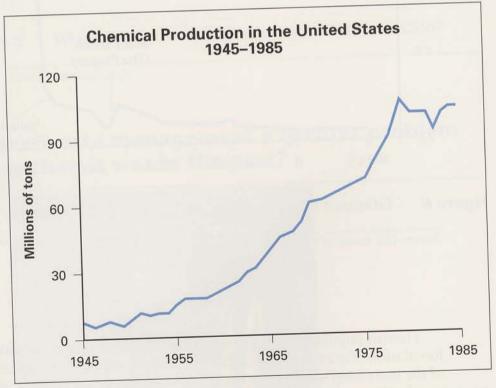


Figure 7 The trend of chemical production in the United States, 1945–1985.

Higher and higher levels of consumption have brought more and more waste.

Most of the raw materials that enter industrial economies eventually emerge as waste. Although municipal solid waste, or garbage, is neither the largest nor the most dangerous category of waste materials in industrial nations, it is certainly an indicator of overall [wastefulness]. And producing the items that end up as garbage accounts for much of the other waste generated by industrial societies.

The rapid increases in materials consumption in the United States, Western Europe, and Japan after World War II were accompanied by correspondingly sharp growth in garbage output. In the United States, for instance, the amount of solid waste generated annually per person has been rising since at least 1960. . . (Young 1991, page 12) [Figure 8 below].

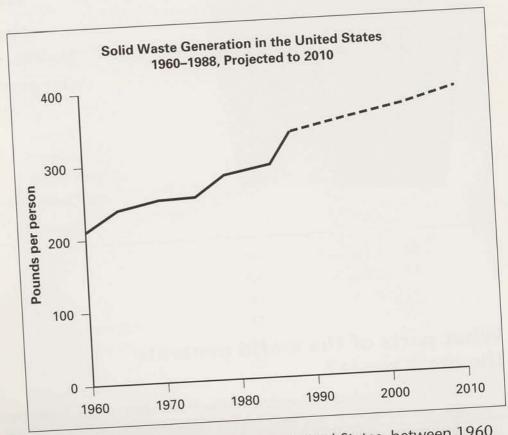


Figure 8 Solid waste production in the United States, between 1960 and 1988, with projection to the year 2010.



Why does waste generation vary from place to place?

Objectives

In this lesson, you will

- Discover the patterns of waste generation per person around the world.
- Examine reasons why some countries generate more waste per person than others.

Glossary Words

energy use municipal waste waste generation

What parts of the world generate the most waste?

Some people generate much more waste than others. Some people use things over and over while others may just buy new things and throw away slightly used ones. For this reason, the United States, one of the richest countries in the world, has been called a "throwaway society." Do the data in Table 3 on page 17 support this statement?

Table 3 Annual per person municipal waste generation and energy use, selected countries, late 1980s

Sametra (1	Municipal waste pounds per person)	Energy use (gigajoules per person*)	
Country		211	
Australia	1,498	117	
Austria	781	168	
Belgium	768	321	
Canada	1,375	130	
Denmark	1,032	169	
Finland	1,109	115	
France	667	156	
Germany (western)	700	91	
Greece	570	112	
Ireland	684	111	
Italy	662	118	
Japan	867	195	
Netherlands	1,023	151	
New Zealand	1,474	209	
Norway	1,041	53	
Portugal	508	73	
Spain	708	147	
Sweden	697	107	
Switzerland	933	147	
United Kingdom	785	295	
United States	1,901	275	
Region		12	
	NA		
Africa	NA	23	
Asia	NA	127	
Europe	n NA	191	
Former Soviet Unio	America NA	207	
North and Central	NA	158	
Oceania	NA	30	
South America The world	NA	(technically it is a measure	

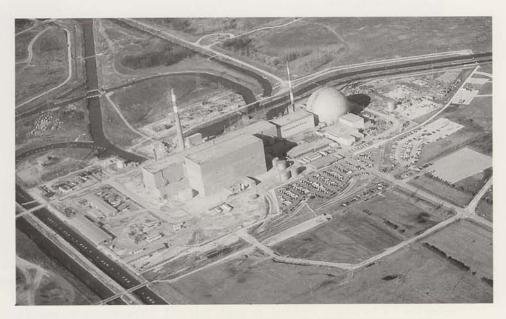
^{*} A gigajoule is a metric measure of energy (technically it is a measure of work). NA = Data not available.

Source: World Resources Institute 1992.

- 1. What do all the countries in Table 3 have in common?
- 2. Which country generates the most waste per person? Which the least? What is the range from highest to lowest?
- 3. Compare the waste-generation quantities for Japan and the United States. What might be the reasons for this difference in per person waste generation?
- 4. If information about waste generation is not available, could energy use act as a substitute indicator of waste generation? Why or why not?

How can energy use predict waste generation?

Now that you see that energy use and waste generation are closely related, you can use the data from Tables 3 (page 17) and 4 (page 19) on energy use to predict a pattern of waste generation for the world.



Nuclear plants like this one generate electrical power for many North American consumers.

Table 4 Annual per person energy use, selected developing countries, 1989

Source: World Resources Institute 1992.



How do Europeans manage waste?

Objectives

In this lesson, you will

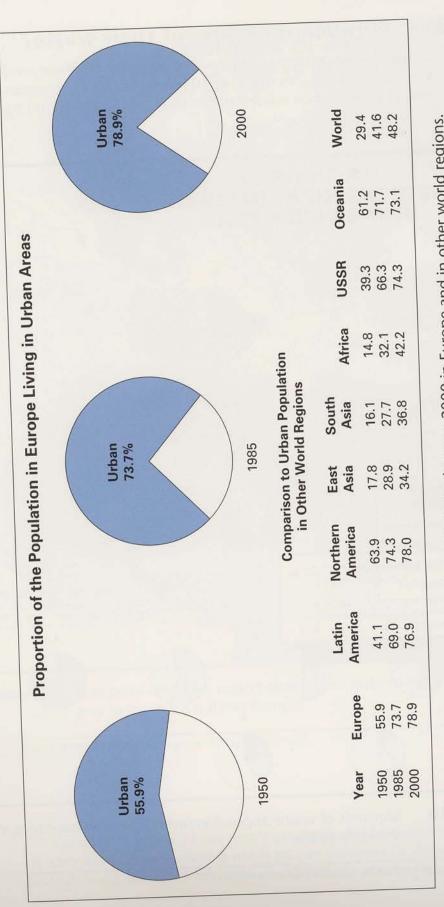
- Analyze maps, graphs, and tables to discover how Europeans manage their waste.
- Discover reasons for using alternative methods of disposal.
- Analyze both traditional and alternative methods of disposal.

Glossary Words

toxic hazardous waste urbanization waste management

Does Europe have a growing waste management problem?

To help you think about this question, examine Figure 9 on page 21. How might the information in this figure be related to waste generation? In addition to level of urbanization, speculate about other characteristics a country might have that would cause it to have high levels of waste generation.



Changes in urban population from 1950 to the year 2000 in Europe and in other world regions. Figure 9

Source: United Nations, Estimates and Projections of Urban, Rural, and City Populations, 1950–2025 (ST/ESA/SER.R/58).

How do Europeans dispose of their waste?

In addition to the four methods of waste management used in the seven countries shown in Figure 10 below, European countries also export some of their waste to other countries (Figure 11 on page 23).

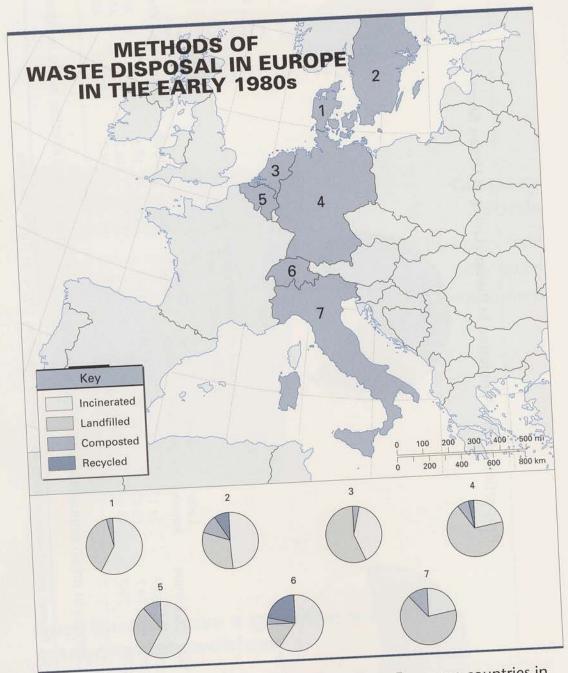


Figure 10 Methods of waste disposal in seven European countries in the early 1980s.

Source: Institute for Local Self-Reliance 1988.



Figure 11 European countries export hazardous waste to each other and to locations outside Europe.

Source: United Nations Environment Programme 1989.

The data in Figure 11 are highly generalized. The actual number of lines of waste movement is much greater than can be shown. Also, these data are not thoroughly reported. Can you guess why?

- 1. What kind of waste does Figure 11 deal with?
- 2. Describe any patterns you see in Figure 11 and try to offer some explanations of those patterns.
- 3. Is it possible that we do not have accurate and complete data on waste disposal? Why?
- 4. Why do you think this kind of waste might be exported to other countries? Why do you think one country might accept another's waste?
- 5. What kinds of problems do you think can occur when hazardous waste is moved from site to site?

U.N.: SOMALIA GAVE OKS FOR TOXIC DUMPING

airobi, Kenya—The U.N. environment chief charged that Somalia's self-proclaimed health minister had given permission to Swiss and Italian companies to dump toxic waste in the starving nation.

The Associated Press obtained a copy of an official letter granting a Swiss-based company, Archer Partners, a 20-year concession to build a disposal facility in Somalia for up to 550,000 tons of waste.

... Mostafa Tolba, executive director of the U.N. Environment Program, ... said his agency was holding talks with the Italian and Swiss governments to elicit their cooperation in preventing the hazardous waste disposal.

Source: Daily Camera (Boulder, Colorado), September 11, 1992, page 5A.



What problems does waste management pose for Europe?

Objectives

In this lesson, you will

- Examine reasons why the Netherlands is seeking alternative methods of waste disposal.
- Identify local, regional, and global problems associated with waste management.

Glossary Words

compost polders

dioxin pollution

groundwater recycle

incinerator solid waste

landfill wast

leaching

PCBs (polychlorinated biphenyls) waste management

Why is the Netherlands seeking alternative methods of waste disposal?

The most widely used solid waste disposal methods in Europe are incineration and landfilling. Why do you think other methods are

being sought?

Let's look at one European country, the Netherlands, for some ideas. Table 5 on page 26 shows the Netherlands National Environmental Policy Plan objectives for solid waste disposal through the year 2000. What proposed changes do you see in each of the methods of disposal? What problems are associated with each type of disposal? Why would it be desirable to reduce waste at the source?

Table 5 Objectives for total waste disposal in the Netherlands

	Percentages for each year		
	1988	1994	2000
Landfilling	55	30	10
Incineration	30	25	25
Recycling and composting	15	40	55
Source reduction	0	5	10

Source: Brasser 1990.

THE NETHERLANDS DATA SHEET

The word *Netherlands* means low country, a name that is very appropriate for this country. More than half of its 15,770 square miles lies below sea level. It is actually composed of a large river delta area of three rivers: the Rhine, the Meuse, and the Schelde (Bonomo 1988).

The Netherlands reclaims land by drainage and then protects it by 1,500 miles of dikes (Hoffman 1989).

The water table is generally less than one meter below ground level (Bonomo 1988).

The population of the Netherlands is about 15.2 million. The Netherlands is ranked thirteenth in the world in terms of population density. That is even higher than Japan, which is ranked sixteenth. The actual population density of the Netherlands is 1,055 people per square mile, while Japan's density is 865. The density of the United States is 71 people per square mile (Population Reference Bureau 1992).

In the Randstad area, which includes Amsterdam, Haarlem, The Hague, Rotterdam, and Utrecht, the population density reaches as high as 3,000 people per square mile (Jones 1988).

It is ranked sixth in the world in terms of urbanization: 89 percent of its people are urban dwellers (Population Reference Bureau 1992).

It is ranked fourteenth in terms of Gross National Product, with an average of \$17,330 per person per year (Population Reference Bureau 1992).

More than 50 percent of the workers are employed in service industries, about 40 percent in industry, and less than 5 percent in farming and fisheries (Jones 1988).

The land is generally flat, with the only exception being a small hilly area in the extreme southeast part of the country.

In the past, the government allowed landfilling in some small lakes, low polders, and pits. Now the country is having to spend large sums of money to clean up these areas (Brasser 1990).

The government recommends the continued closure and clearance of problem landfills (Brasser 1990).



Figure 12 Why is this cartoon appropriate for the Netherlands?

- 1. How would the fact that the Netherlands reclaims land from the sea affect its waste management practices?
- 2. Why would high population density cause waste management problems?
- 3. How would the fact that the water table is near the surface affect choices for waste disposal methods?
- 4. What problems has the Netherlands's government had to deal with? How might these affect future planning for waste management?

What local and global problems are caused by various waste disposal methods?

Garbage is present in every country, and every government must make decisions concerning its disposal. Unfortunately, every disposal method has its drawbacks. Some methods cause local problems and some cause problems in other countries. In the list that follows, which problems are local and which are global? Why? Note that some may be both.

PROBLEMS CAUSED BY EUROPEAN WASTE DISPOSAL

(Note: Although Germany is one country today, it was divided into West Germany and East Germany at the time this information was reported.)

A. In 1987, an incinerator plant was shut down in Iserlohn, West Germany, because it expelled a cloud of dust that was feared to be toxic. Tests proved that dioxin levels from the dust were below the limits for human exposure. Many citizens remained fearful, however, not trusting that the accepted level was really a safe one (*Newsday* 1989).

B. The state of Bavaria in West Germany has closed down over 3,000 landfills in the last 20 years. This is because of fears of toxins leaching into groundwater. The state plans to close most of the rest of the landfills for the same reason (*Newsday* 1989).

C. West Germany has been exporting toxic ash from its incinerators to East Germany. East Germany accepts it for economic reasons and because it has had few pollution controls. West Germany has some of the strictest monitoring practices and toughest emissions standards in the world for its incineration plants (Newsday 1989).

D. Greenpeace International reported that since 1986, the United States and Europe have shipped hazardous waste to at least 11 less-developed countries, such as Brazil, Haiti, Lebanon, Mexico, Nigeria, South Africa, Syria, Venezuela, and Zimbabwe. A group of European companies offered Guinea-Bissau \$120 million a year to take their industrial wastes. Although Guinea-Bissau refused, such waste disposal in Africa has happened many times. An Italian businessman disposed of PCB-contaminated waste in Koko, Nigeria, without the permission of the Nigerian government. Because of the furor that incident caused, the Italian government removed the waste, and then unsuccessfully tried to dump it in Great Britain, France, Spain, West Germany, and the Netherlands. It eventually went back to Italy (Bloom and Uva 1989).

E. In the 1960s and 1970s, low level radioactive wastes were dumped off the coast of Spain by Great Britain, Belgium, the Netherlands, and Switzerland. This practice was stopped in 1983. The British are discussing the possibility of dumping low-level radioactive wastes in caverns under the Irish Sea. A nuclear repro-

cessing plant on Great Britain's west coast dumps authorized amounts of nuclear waste into the Irish Sea. It has been involved in many pollution incidents since 1950. Large unauthorized amounts of radioactive waste have also been found in the Irish Sea (Long 1989).

F. About 6 million metric tons of garbage are thrown overboard from ships annually. It is estimated that 100,000 marine animals and 1 million birds die annually by getting stuck in plastic waste or swallowing it and choking (Long 1989).

G. Many municipal waste treatment plants discharge into rivers and coastal waters. DDT has been found in the livers of penguins in the Antarctic, which is widely thought of as a pristine environment. The Mediterranean Sea is extremely polluted, and it pollutes oceans around it. In 90 years not one drop of that same water will be in the Mediterranean; it will have traveled out into the oceans, having been replaced by more water (Cousteau 1985).

H. Incineration of garbage produces air and water pollution and tons of toxic ash. Filtering devices, called scrubbers, catch some toxins during the burning process, but air pollution controls create additional toxic ash. Toxic metals from incinerator ash leach into groundwater from landfills (Young 1991).

I. Some of Europe's waste management problems are caused by its connections with other places. The following article illustrates one such case.

U.S. PAPER RECYCLING HURTS EUROPE'S SYSTEM

by Marlise Simons

merica's new laws and recycling programs, now effective in more than 20 states, have generated huge additional mounds of wastepaper. This has come at a time when domestic industries still have insufficient mills to process it.

As a result, hundreds of tons of American wastepaper have been shipped to Europe in the past year and sold [t]here for a pittance. They have caused a glut in the European market, brought prices [t]here close to zero, and disrupted town collection systems.

"It's amazing that it's cheaper to haul surplus paper all the way to Europe rather than storing or burning it in America," said Paul Nouwen at the Netherlands Environment Ministry. "It's offered here practically for free and ruined the market in all of Western Europe. In Holland, the price has dropped from 8 cents to 1 cent or less per kilo just this year."

The paper avalanche has upset the decades-old routine of schoolchildren, church groups, and dealers who ran their low-profit but well-oiled networks by selling their spoils in the mills at a guaranteed minimum price.

What a shift in Europe's wastepaper balance can do is perhaps best illustrated in the Netherlands, a society where thrift counts. For 50 years, the Dutch have been collecting and recycling their paper. Almost 70 percent of the paper used in newspa-

per, tissues, and cardboard comes from waste. So do half of government documents.

Two years ago, as environmental politics heated up and the government wanted to recruit even more recyclers, it announced an environmental premium: It would pay schools, clubs, and charity groups up to five cents a kilogram—about 2.2 pounds—extra for the paper they sold to dealers.

Town officials liked the scheme because collecting, dumping, or burning garbage cost more than twice that amount. About 75 towns in the Netherlands joined this system. But because of the new paper glut, dealers are now paying little or nothing for paper and, as some even demand money to accept it, the system is collapsing; 4,500 jobs have been lost.

Irate representatives of Dutch town councils have appealed to the European Community in Brussels to ban paper shipments from overseas. But the reply was that . . . exports of waste can be stopped [only] under international agreements (Simons 1990).

- 5. Why was the United States shipping wastepaper to Europe?
- 6. What problems were caused by this "wastepaper trade"?



How does Japan manage waste?

Objectives

In this lesson, you will

- Discover how Japan is managing its waste.
- Compare waste management in Japan with that of selected European countries.

Glossary Words

incinerator landfill recycle waste management

How does Japan's municipal waste disposal compare with that of some European countries?



A Tokyo park on a late Sunday afternoon.

Table 6 Disposal of municipal waste for selected countries, 1980s (percentages)

Country	Landfill	Incineration without energy recovery	Incineration with energy recovery	Other
Belgium	30	35	25	10
France	45	14	27	14
Italy	65	19	4	12
Japan	33	47	17	3
Netherlands	55	20	10	15
Sweden	30	7	44	19

Sources: World Resources Institute 1992; Institute for Local Self-Reliance 1988.

What waste management methods does Japan use?

EXAMPLES OF WASTE MANAGEMENT IN JAPAN

A. Two garbage landfills have been created in Tokyo Bay and a third one is being constructed. The land created by the trash has become very valuable real estate. Tokyo's Disneyland is located there, as well as a municipal golf course and a public park (Sexton 1987).

B. Tokyo Metropolitan Government (TMG) officials have a plan for development of the Tokyo Bay landfill areas. Commercial, cultural, sports, and recreational facilities will be built there. These include Tokyo Teleport, an intelligence business center, and an international exposition center, including hotels and conference buildings. High rise apartment buildings and office buildings will also be constructed (Tomaru 1987).

C. Energy created by incineration of solid wastes is used in many ways. Energy warms an attached swimming pool and cools a neighborhood civic center. Energy also supplies power to children's centers, public baths, and facilities for the elderly. In addition, city incinerators in Tokyo earned \$9.2 million from the sale of surplus power to public utilities (Sexton 1987).

D. The Ohto Number 2 incinerator, when finished, will convert plastics into construction materials and recover heavy metals for reuse (Sexton 1987).

E. The TMG dumps 520 gallons of raw sewage each day into the Pacific Ocean, 110 miles offshore (Tomaru 1987).

F. In Tokyo, households are required to separate their trash into burnable garbage and burnable plastics and other toxic materials (Sexton 1987).

G. Japan's voluntary recycling programs account for about 50 percent of its

paper, glass, and aluminum being recycled.

H. Children learn early about the waste problems of Japan in their social studies classes in school. Their studies take them on field trips to incinerators and landfills (Sexton 1987).

I. The Bureau of Public Cleansing sponsors a "Town Beautification

Campaign" each May.

J. October is designated as "The Month for All of Us to Think About Wastes Together." This includes receptions for the public at incinerating plants, Old Books Fairs, and Seminars on Wastes (Sexton 1987).

K. Environmentally approved products are marked by a logo called an Ecomark, making it easier for consumers to identify them (Bowermaster and

Steger 1990).

L. Japan has built a \$65 million facility in Machida in central Japan. This facility converts 100,000 tons of garbage into valuable materials, fertilizers, fuel gases, and recycled metals (Nellan 1989).

Do you think Japan has a waste management problem? Why or why not?



Should Utah import California's garbage?

Objectives

In this lesson, you will

- Understand that interstate waste shipments cause conflict between economic and environmental considerations.
- Support a position for or against interstate waste shipments.

Glossary Words

heavy metals
landfill
pollution
radioactive waste
solid waste

What is the U.S. garbage trade?

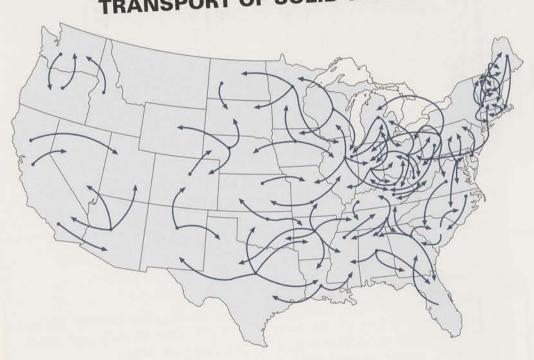
The United States generates about 160 tons of garbage per person each year. Most of it is placed in landfills across the nation. Many states are finding themselves in crisis situations now, as landfills reach capacity or are closed as safety hazards. In fact, about three-fourths of the country's landfills have closed in the last few years.

The eastern states, especially, have landfill problems. To solve their problems, they export waste to other states and even other countries. The town of Islip, New York, gained fame in 1987 when an ocean-going barge loaded with its garbage traveled for 89 days in search of a dumping ground. It went to the Carolinas and as far as

the Caribbean and then back to New York (still loaded with garbage), where it was eventually placed in a landfill (Gallagher 1989). Most often, though, these states simply truck their solid waste to other states. Data collected by the National Solid Waste Management Association (NSWMA) show that at least 43 states are involved in interstate solid waste transfers. Some states both import and export waste (Figure 13 below). This particular solution to the garbage crisis is a controversial one because of economic and environmental considerations.

Speculate about the characteristics of states that are net exporters of wastes and the characteristics of states that are net importers of wastes.

TRANSPORT OF SOLID WASTE*



*Transport of solid wastes from New Jersey and New York are not shown.

Figure 13 Interstate movement of municipal waste. Why do you think the mapmaker excluded the waste transport from New Jersey and New York?

Is "the town that loves trash" making a good decision by importing garbage?

See what you think after you read several June 1993 newspaper articles about one town in Utah.

THE TOWN THAT LOVES TRASH

by Emmet Pierce

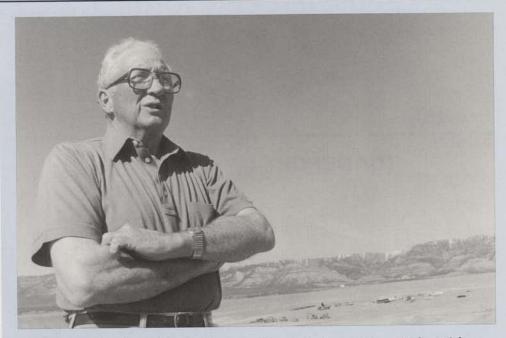


Figure 14 Paul Clark, Mayor of East Carbon City, Utah, with ECDC landfill in background.

Source: The San Diego Union-Tribune. Photograph by Layne Miller.

ast Carbon City, Utah—The quiet stillness of the warm desert air was broken as a rattling road grader scraped its way across the floor of the massive trash-disposal pit.

Mayor Paul Clark [Figure 14 above] grinned broadly as he surveyed the scene from atop an earthen dike that surrounded the 80-acre cavity. Workers below thought they merely

were making room for more garbage between layers of earth and plastic, but Clark knew better.

With each ton of refuse they packed into the dump they were adding money to his impoverished city's coffers.

Skeptics maintain that in their zeal to bring new industry to this beatendown coal town, East Carbon's leaders have overlooked possible threats to the fragile desert environment. The mayor disagrees.

"Critics say I am going to ruin this place, but we need some economic activity," Clark said. "I am pushing the city's interests."

The East Carbon project is a marriage of vision and desperation. The Utah business [leaders] who put it together foresee a day when trains routinely carry trash from urban centers like San Diego to massive dumps in remote, sparsely populated locations [Figure 15 below].

Residents of this town 110 miles southeast of Salt Lake City have embraced the plan and simply see the dump as a way to hang on.

"We've been so economically depressed, we're glad to get any industry," said Virginia Robinson, proprietor of the Fastop convenience store on state Route 123. "I don't think we have any worries about the dump. We don't see it. We don't smell it. Perhaps it's going to get us on our feet...."

Thanks to the efforts of Clark and the privately owned East Carbon Development Corp. (ECDC), the community is fast becoming known as the city that loves trash, the town that is

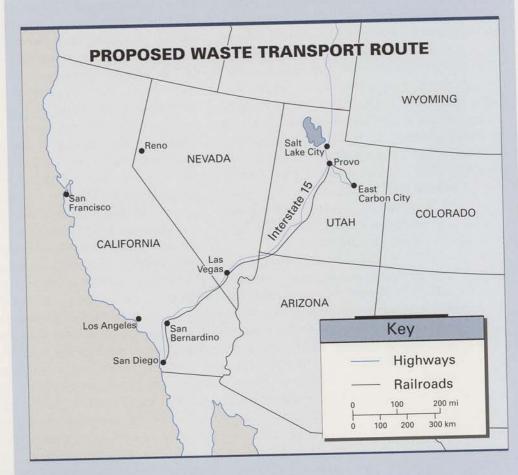


Figure 15 Proposed rail route to transport San Diego's trash to East Carbon City.

eager to become a regional dumping ground.

Escondido, Carlsbad, and Oceanside [cities near San Diego, California] have formed a joint-powers authority to explore the feasibility of abandoning the county program to form their own trash system. One of the alternatives they are considering is a proposal to contract for rail-haul service with ECDC.

Metropolitan areas that are running out of landfill space—such as San Diego and Los Angeles counties—are being urged to use trains to send their garbage hundreds of miles away to eastern Utah.

"We can take virtually everything except for hazardous [and] radioactive waste," said Douglas Foxley, chairman of the board that governs ECDC. "We've done a lot of contaminated soil business. We are as aggressive as heck. We're hungry. Our primary focus is the intermountain area and California, [but] we are aggressively seeking contracts nationwide."

Since last September, tons of solid waste and contaminated soil have been brought into the high-desert community along rail lines that originally were built to haul coal....

Ten cities in northern Utah were the first to sign a trash disposal contract with [ECDC] and they now send 400 tons of trash daily. With contracts to haul contaminated soil for entities such as [the California Department of Transportation], [the city of] San Francisco, and San Diego's Metropolitan Transit Development Board, ECDC is the only waste-by-rail company operating in California, officials say....

As public opposition and increasing government regulation make it more

difficult to expand or open landfills, rail haul may become a choice alternative for urban areas. . . .

The national future of solid waste rail-haul is promising, said Thomas White, a spokesman for the American Association of Railroads. Trains are hauling trash from Seattle to rural Oregon, from New Jersey to Virginia, from New York to Illinois and Georgia....

From boom to bust

According to Steve Creamer, ECDC's president, the company now employs 22 people at the East Carbon landfill. Eventually he hopes to boost that figure to 60 or 70 workers. Even the company's strongest boosters acknowledge that the dump will not come close to filling the employment gap left by the coal industry.

East Carbon was a boom town when coal was king and soldiers returning from World War II came in search of work. The boom turned to bust in the mid-1980s. Today there aren't enough jobs to provide livelihoods for the city's 1,200 residents.

It's hard to imagine a community poorer than East Carbon. Nearly every street has boarded-up homes and yards overgrown by weeds and desert flora. Roads and sidewalks are crumbling. Many of the small modest houses that were built for miners a half-century ago as been a topic of debate since 1989 when ECDC began soliciting industrial revenue bonds from Carbon County to help finance the landfill. All required local, state and federal permits were received in 1990 and 1991.

ECDC is required to pay the city 50

cents for each ton of waste disposed of at the dump. . . .

"I don't like the idea of such a big dump being forced on us. I don't think they informed us properly. . . ."

Doubling city budget

Clark noted that the 50-cents-a-ton fee is scheduled to rise by 50 cents every 10 years, for the next four decades. So far, spending by ECDC has pumped about \$25 million into the local economy, said Creamer.

Built for 30 to 40 years of capacity, the 2,400-acre landfill eventually will consist of 29 "cells" rising 40 feet above the desert floor. Each will hold up to 6.3 million cubic yards of waste.

While civic leaders insist that most townspeople strongly back the land-fill, not everyone is in love with the idea of becoming the West's Dumpster.

An opposition group called Citizens Awareness Now (CAN) represents a significant portion of the community. Bo Huff, a CAN founder who customizes cars for a living, says he worries about possible pollution from dust and heavy metals.

"It's going to ruin our community," he said. "To me there is no doubt."

A legal battle launched by CAN to close the dump so far has been unsuccessful. While some opponents have specific environmental concerns, much of the opposition stems from distrust of ECDC and city leaders.

Some critics complain that the dump is less than two miles from the town's homes. Others say they didn't realize how large the project would be. Among them is Glen Henrie, a retired mining mechanic who came to East Carbon a half-century ago.

"I like this desert country," he said.

Garbage imperialism

Soliciting trash from outside the community "is the craziest idea we could think about," said Cindy King of the Sierra Club's Utah chapter. "It's simply a lack of responsibility and a lack of caring."

According to Brad Angel, the Greenpeace organization's toxics campaigner for the Southwest, sending urban waste to rural areas "is kind of a garbage imperialism. Lowincome communities consistently are targeted."

King worries that, despite ECDC's precautions, the landfill will leak, polluting the groundwater that runs beneath it. While the dump is permitted to accept only non-hazardous waste, some trash that is considered hazardous in California falls within Utah's non-hazardous standards, she noted.

The Utah Legislature's relatively lax attitude toward solid waste will encourage California cities to save money by shipping their trash to East Carbon, where rules are less stringent and disposal fees are cheaper, King said....

San Diego Supervisor Brian Bilbray and other county officials say it's cheaper to open new landfills locally than to send trash to other states. The problem is the unsuccessful search for a new dump in North [San Diego] County.

Each time a new site is proposed, angry citizens' groups oppose it. After

years of funding studies and fending off lawsuits, the county is no closer to a new dump than when it started, critics say.

In the meantime, the North County region's only dump may run out of space this summer and state officials are threatening to rescind an expansion permit. Upon closure, the county may send the 2,000 to 3,000 tons of trash North County produces each day to a dump in East County. Garbage bills for North County residents will soar.

A recent proposal to reorganize San Diego County's trash system to give cities more control has been rejected by several communities. Some are exploring other options, including rail haul....

Whatever happens in California, things can only improve in East Carbon, Clark said. According to Tommy Grant, a baseball coach and guidance counselor at East Carbon High School, things already are turning around.

Normally, few of East Carbon's high school graduates continue their education. Last year, thanks to a scholarship program set up by ECDC, 17 of 29 graduates enrolled in college or vocational programs, Grant said.

"They've done a lot for the school," he said with a solemn nod. "They've done a lot for a lot of people."

Source: The San Diego Union-Tribune, June 6, 1993.

MAYOR'S AIM: DIG OUT REVIVAL

by Emmet Pierce

ast Carbon City, Utah—The residents of this worn-out, dying mining town are accustomed to hard times, but nothing has divided them more deeply than the economic recovery plan embraced by Mayor Paul Clark.

Clark, a retired miner, is an outspoken booster of the 2,400-acre dump that has opened at the city's western edge. Stumping through Southern California on behalf of the privately owned facility, Clark has touted East Carbon as the city that wants to become the West's garbage receptacle.

Detractors say the facility will endanger the environment. Clark sees

the landfill as economic survival for a city that is becoming a ghost town.

"We're an old town built during World War II for the mining of coal," Clark said. "The industry has slowed to the point where . . . there is basically no employment for the young."

So committed is Clark that he recently traveled to Carlsbad [California] to help East Carbon Development Corp. (ECDC) officials try to woo North [San Diego] County cities away from San Diego County's trash-disposal system.

Despite the promise of economic revival, a group of local residents called Citizens Awareness Now (CAN) launched a vigorous campaign to close the dump even after the project received all necessary permits in 1990 and 1991, Clark recalled.

Last year, council members who thought they had a project that everyone wanted suddenly found themselves besieged by protesters, Clark said.

At one point the 67-year-old mayor found himself taking the brunt of the criticism. Some critics viewed the retired miner as the ultimate company man.

"It got tough," the mayor said. "A couple of council people had some threats. I never did."

Eventually landfill supporters rallied and made their feelings known at council sessions, Clark said.

For all the fuss over the landfill, East Carbon still offers a peaceful, unhurried lifestyle, he said. . . .

Clark, who retired from his job as a midlevel manager with U.S. Steel in 1984, grew up in the nearby community of Spring Canyon, a town that died with the local coal industry. He and his wife, Mary, have two sons living in East Carbon.

If the rail-haul landfill is successful, perhaps they will stay, he said.

Source: The San Diego Union-Tribune, June 6, 1993.

TOWN WAS SHAFTED, SHE CLAIMS

by Emmet Pierce

E ast Carbon City, Utah—Matronly, mild-mannered Phyllis Johnson [Figure 16 below] didn't set out to be a political

firebrand, but she took to the role quickly when this remote mining town became host to one of the nation's largest dumps.



Figure 16 Phyllis Johnson leads opposition to ECDC's plan to import trash.

Source: The San Diego Union-Tribune. Photograph by Layne Miller.

A longtime resident who "trusted our local officials to do the right thing," Johnson, 53, is a leader of dissidents, waging what some view as a hopeless battle against savvy business and civic leaders.

Although opponents depict it as a collection of malcontents and outside agitators, Citizens Awareness Now (CAN) consists of average citizens who would rather have a pristine environment than the promises of prosperity, Johnson insists.

But it's hard for some to understand how people who have lived all their lives in the shadow of the coal industry could be upset about a state-of-theart landfill at the edge of town.

"[Neighbors] keep saying, 'Well, you're coal miners. So how could you possibly be environmentalists?" Johnson said. "Instead of arguing, we say we're grassroots, we're people and we're fighting what we see as an environmentally unfriendly thing."

According to Johnson, landfill opponents didn't realize the project's full scope until it was too late to stop it.

"They said, 'We've got an ash dump for you.' That is how they referred to it until after it was permitted. All of a sudden, it got to be solid waste and raw garbage. Then they bid on Boston Harbor sewage sludge. The people said, 'Wait, that is not what you told us. That is not what we agreed to.'"

In a last-ditch attempt to close it, the group filed a suit seeking a referendum vote; it is pending before the Utah Supreme Court....

Town meetings on landfill issues used to attract dozens of protesters but now visible support has waned. The landfill company recently agreed to contribute money to keep East Carbon High School open.

Johnson agrees with the mayor that her town could use an economic boost but insists that most residents aren't desperate enough to trade away a clean environment.

"We are not groveling," Johnson said. ". . . We've always been poor. We've always been in the boom-bust cycle of coal mining, and we've always survived without garbage."

Source: The San Diego Union-Tribune, June 6, 1993.



Is there good news in waste management?

Objectives

In this lesson, you will

- Learn what some industries and communities are doing to solve waste problems.
- Recognize that each individual can help solve the trash problem.

Glossary Words

compost landfill recycle solid waste waste management

Nobody made a greater mistake than he who did nothing because he could only do a little.

—Edmund Burke

What innovations are promising?

The garbage crisis can seem overwhelming and depressing. The good news is that humans have made some great gains in more effective waste management in recent years. Recycling is becoming more the norm. For examples of industry and community innovations in waste management, read the following newspaper articles.

PLASTICS RECYCLING: INDUSTRY BUYS IN

Alarmed by anti-plastic sentiment and community bans, companies are getting the recycling religion.

by Tom Arrandale

ould you drink Coke or Pepsi from a bottle made from recycled plastic? Soft drink bottlers and plastic manaufacturers are gambling that you will—that millions of consumers will be willing to take that drink as a way to help protect the environment.

The U.S. Food and Drug Administration has approved the plastic decontamination processes of the two soft drink bottling giants, setting the stage for what could turn into a critical test of whether the nation's plastic industry can hold onto its \$150 billion-a-year business by encouraging recycling programs.

Plastics are made from oil and natural gas, those irreplaceable fossil commodities. But with oil prices falling once more, the plastics recycling campaign is driven by political, more than economic, motives. "All by itself, you wouldn't see very much plastics recycling [now]," says Wayne Pearson, a retired DuPont chemist who now directs the industry-backed Plastics Recycling Foundation.

Next to aluminum cans, plastics rank as the most intrinsically valuable waste material that modern society generates. But through energy short-Middle East wars, and ages Americans have continued to throw away virtually all of the bottles, food wrappers, toys, tools, appliances, automobile parts, and countless other products that the nation makes from plastic. Roughly a third of plastic products, primarily in the form of packaging, are used and discarded within a few months after they are manufactured.

Japan and European countries burn plastic wastes in waste-to-energy incinerators: Swedes call plastic wastes "white coal." Plastics can be broken back down into raw materials for refining into fuel and other petroleum products, and most forms of plastic can be recycled into new products. Nevertheless, Americans last year recycled just 1 percent of their plastic wastes, primarily from soft drink containers returned in states with bottle deposit laws.

Measured by weight, plastics account for just 7.3 percent of the country's solid waste stream. But a study commissioned by the plastics industry itself calculates that plastics probably compose close to 20 percent of the nation's garbage volume. Environmentalists see throwaway plastic goods as chief culprits in the nation's solid waste problems.

Last November, the McDonald's chain bowed to growing anti-plastics sentiment and efforts by a number of communities to outlaw fast-food coffee cups, hamburger "clamshells" and similar throw-away plastic products by announcing that it would stop selling food in polystyrene containers. To head off more bans, major oil companies joined with DuPont, Dow Chemical, Procter & Gamble and other giant chemical and consumer product corporations in 1988 to form the Council for Solid Waste Solutions, a well-financed lobbying operation that has embraced a goal of recycling 25 percent of all plastic bottles by mid-decade.

 Table 7
 A selection of successful industrial waste reduction programs

Company/location	Products	Strategy and effect
Astra/Sweden	Pharmaceuticals	Improved in-plant recycling and substitution of water for solvents; cut toxic wastes by half.
Borden Chemical/U.S.	Resins, adhesives	Altered rinsing and other operating procedures; cut organic chemicals in waste water by 93%; sludge disposal costs reduced by \$49,000/year.
Cleo Wrap/U.S.	Gift wrap paper	Substitution of water-based for solvent-based ink virtually eliminated hazardous waste, saving \$35,000/year.
Duphar/The Netherlands	Pesticides	New manufacturing process cut toxic waste per unit of one chemical produced from 44 pounds to a half-pound.
Du Pont/Colombia	Pesticides	New equipment to recover chemical used in making materials valued at \$50,000 annually; waste discharges were cut by 95%.
Du Pont/Venezuela	Paints, finishes	New solvent recovery unit eliminated disposal of solvent wastes, saving \$200,000/year
Pioneer Metal/U.S.	Electroplated metal	New treatment system design cut water use by 96% and sludge production by 20%; annual net savings of \$52,500; investment paid back in three years.
3M/U.S.	Various	Company-wide, 12-year pollution prevention effort has halved waste generation, yielding total savings of \$300 million.

Source: Postel 1987.

COUNTY TASK FORCE EYES WAYS TO DRASTICALLY CUT WASTE HEADED TO LANDFILL

by Marcus Montoya

R epresentatives from all over Boulder County, Colorado, waded through solid waste Wednesday night.

The County's Solid Waste Task Force heard and discussed ideas on how to get the county to the lofty goal of keeping 50 percent of the waste from reaching the landfill by the year 2000.

That will be tough considering that right now only about 16 percent of it is being recovered.

So the task force targeted portions of the "waste stream" headed to the landfill and came up with ways to increase recycling, reusing, and composting.

Curbside and drop-off recycling: Currently 2 percent to 3 percent of total waste is saved from the landfill by these programs. The plan is to increase curbside and drop-off recycling to 5 percent each. That would be accomplished through education and possibly by offering recycling programs for more than just the "traditional recyclable." These could include junk mail, oddball plastics, textiles, rubber, and lumber.

Commercial recycling: This area is barely touched, officials said, and thus offers plenty of room for improvement. Currently, 9 percent of all waste is recovered from businesses. Officials would like to see that

double by the year 2000. Larger companies with good programs can sell their recyclables and effectively recycle for free. More effort probably will be put toward finding cost-effective ways for smaller businesses to recycle consistently.

Composting may Greenwaste: hold the most promise for making money for the county. Probably the most intriguing proposal presented Wednesday is to have several composting sites in the county or a large county compost site. The start-up costs run more than \$500,000 and annual operating costs can run from \$278,000 to \$1.6 million. Income estimates, however, run \$1 million plus. The goal is to increase the amount of greenwaste saved from the landfill from the 2 percent it is today to 12 percent by 2000.

Construction and destruction: Estimates are that about 100 cubic yards of waste are generated with the building of each house. And with between 1,500 and 1,700 new homes expected before 2000, that translates to about 86 tons of waste every day. Subcontractors could reduce this by selling for profit materials they now throw away.

Decisions on specific plans of action are expected at future meetings.

Source: Montoya 1993, page B-1.

"MIRACLE CURE" FOR GARBAGE GLUT: 70 PERCENT OF DES MOINES REFUSE WINDS UP AS COMPOST

How Des Moines composts trash

Residents separate plastic bottles from rest of garbage and put plastics in yellow bags.

Trash is collected curbside and hauled to a composting facility, where yellow bags are separated from rest of bags.

The rest of the garbage bags go through a mechanical separation process that filters out metal cans, which are recycled, and bulky items that cannot be composted.

The leftover garbage, including newsprint, plastic bags, food scraps and others go through a grinder, which chops it into smaller pieces to speed up composting.

Another machine mixes the garbage with sewage sludge, and then the stuff is laid out in windrows about 4 feet high and up to 250 feet long.

A spindly machine turns the windrows to keep the piles aerated, which is vital to the health of the microorganisms that do the work of composting.

Six to 12 weeks later, the process ends when the compost goes through a screen to remove most of the plastic and any remaining large items.

The composted waste then is offered to Iowa farmers and city governments for application as a mulch covering.

Source: Denver Post, August 4, 1991, page

- 1. Do you believe there is enough good news about waste management to support an optimistic view? Why or why not?
- 2. What can you do to help with waste management? What will you do?

What will you do to help with waste management?

Recycling is one way in which you can help with waste management. Another way you can help is to buy products that are reusable or have a minimum amount of of packaging (precycling). Table 8 shows the recycled uses of some products.

Table 8 What's recyclable in the waste stream?

Materials	Use	
Construction waste, tires	Reprocessed for pressed board, road, and other construction projects	
Plastics, drink bottles	Reprocessed for auto parts, fiberfill, strapping	
Aluminum cans	Reprocessed for can sheet and castings	
Yard waste	Composted for landscaping	
Other metals	Cleaned and reprocessed as scrap and structural products	
Glass	Refilled or culled for jars, bottles, construction material	
Furnishings and clothing	Reused by another person	
Animal waste	Used as fertilizer	
Paper, mixed paper	Reprocessed as newsprint, paperboard, insulation	

Sources: Reprinted in 1992 Information Please Environmental Almanac, page 124, from U.S. Environmental Protection Agency 1989.

Glossary

- Biodegradable Able to be broken down into naturally occurring compounds.
- Compost Decayed organic waste used for fertilizing and conditioning the land.
- Dioxin Highly toxic chemicals used in some herbicides and in other industrial applications.
- Energy use The amount of power humans use to accomplish their purposes. This includes power from all sources—hydroelectric, nuclear, solar, fossil fuel, and animals.
- Groundwater Water below the surface contained in aquifers, or water-bearing rocks. The upper level of the groundwater is called the water table.
- Heavy metals Metals such as lead and mercury that can be highly poisonous to humans.
- Incinerator A furnace for burning waste.
- Landfill A method of waste disposal in which layers of garbage are alternated with layers of soil. Over time the garbage biodegrades.
- Leaching The removal of water-soluble minerals and chemicals from soil or waste by water moving through the soil or waste.
- Municipal waste The portion of the total discarded solid and liquid materials that comes from settlements, such as villages, towns, and cities, but not from industries.
- NIMBY (Not In My Backyard) Slogan representing the idea that certain land uses, such as landfills, although necessary, are not welcome in one's own neighborhood.
- PCBs (polychlorinated biphenyls)

 Extremely toxic and stable chemical compounds produced in the manufacture of many industrial products.

- Pig iron Crude iron cast in blocks.
- Polders Land in the Netherlands reclaimed from the sea by using dikes (levees) to keep seawater out and ditches and pumps to drain water.
- Pollution Any unwanted change, either physical, chemical, or biological, in the air, water, or land; something that is harmful to the life, health, or activities of living things.
- Precycle To reduce or eliminate materials in manufactured products that would otherwise become waste; also called source reduction.
- Radioactive waste Waste material from nuclear power plants or from the production of nuclear fuel or weapons.
- Recycle Separating usable materials from waste and converting those materials into useful products.
- Scrubber A device for removing polluting dust particles from the airstream of an incinerator's smokestack.
- Solid waste Garbage, including household waste, street litter, commercial refuse, abandoned automobiles, and ashes.
- Toxic hazardous waste Waste requiring special disposal techniques, particularly the waste from nuclear materials and dangerous chemicals.
- Urbanization The increase in the percentage of a population that lives in urban areas.
- Waste generation The process of creating unwanted solid or liquid substances in the course of using or converting materials.
- Waste management How we deal with the waste (trash, garbage, sewage, etc.) we create.

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