Unit 5
Human Population Dynamics

Background

Introduction

Human population dynamics is a field that tracks factors related to changes in population such as fertility rate and life expectancy. Predicting population changes is important because these demographic trends impact economic, social, and environmental systems. An increase in human population can impact the quality of natural resources like biodiversity, air, land, and water.

Essential Questions

What are the trends in human population growth? How fast is the population growing? Has it always grown at this rate and how can we predict the population in the future?

Are the populations of different countries growing at different rates?

What do factors like human population density, movement, and composition mean for the sustainability of the planet?

What is meant by the Earth's carrying capacity?

Content

Unit 5 looks at the interconnecting variables that influence population trends across the globe and how the various factors impact the environment. Obviously, rising populations put increasing demands on natural resources such as land, water, and energy supplies. However, the intensity of consumption and the technologies involved also must be considered. Changes in population size, age, and distribution affect issues ranging from food security to climate change. Population variables interact with consumption patterns, technologies, and political and economic structures to influence environmental change. This interaction helps explain why environmental conditions can deteriorate even as the growth of population slows.

Carrying capacity is considered to be the population that the Earth can support on a continuing basis. Carrying capacity depends on much more than food production; it also involves subjective measures like quality of life. This is why the term "ecological footprint" is important as humans consider their impact on the planet's resources and ecosystems. This unit introduces the concept of demographic convergence and identifies factors such as pandemics, political instability, wars, and poor climate and land resources that disrupt the economies of countries moving from developing to developed status.

The unit 5 video introduces three different demographers who explore such issues as the interaction of death rate, life expectancy, and immigration in determining population dynamics for an area, specifically in the United States.

Background

They discuss ecological and economic carrying capacity and the relationship between population growth and consumption rates, in particular the special impacts of megacities and even larger metacities as the population becomes more urban.

Learning Goals

During this session you will have an opportunity to build understandings of the following.

a. Knowledge

   i. For much, perhaps most, of human history, demographic patterns were fairly stable; the human population grew slowly and age structures, birth rates, and death rates changed very little, but these trends are no longer considered stable.

   ii. World population growth has been and will continue to be unevenly distributed across the globe.

   iii. Infant and child mortality rates decline as a result of improved nutrition, public health interventions related to water and sanitation, and medical advances, such as the use of vaccines and antibiotics.

   iv. America's relatively high rate of population growth, natural resource consumption, and pollution, in combination create one of the largest environmental impacts of any country at present.

b. Skills

   i. Demographers use mathematics to determine human population dynamics and trends and summarize data in charts and graphs for the public.

   ii. The more forces that are identified that affect human population dynamics, the more difficult it becomes to predict demographic changes.

c. Dispositions

   i. To understand human population trends, one has to appreciate how social, political, economic, and cultural factors can shape events.

   ii. Providing information about population, health, and the environment empowers people around the world to use the information to advance the well-being of current and future generations.

   iii. Countries can carefully select and protect surface area to contribute to environmental sustainability.

Key Concepts

Birth rate
Overpopulation
Carrying capacity
Death rate
Infant mortality rate
Population density
Population distribution
Ecological footprint
Resource consumption
Population growth
Demographic transition
Demographic dividend
Dependency ratio
Demographic Convergence
Global demographics
Land use patterns
Resource consumption
Human quality of life
Indicators
Population trends

FACILITATOR: These concepts correspond roughly to the sections of the unit. There are a number of other concepts that could be included. It is best to start with the author's major ideas and then ask for input from the study group for other concepts they would include.

Background

Misconceptions about Human Population

There are many different kinds of misconceptions related to understanding human population issues, some of which result from lack of clarity about terms. Whenever the term "human population growth" is used, misunderstandings arise. Population growth is defined as the limiting of population increase to the number of live births needed to replace the existing population. However, focus on "population growth" can be perceived to be a need to control human reproduction rights and use of the word "control" sets off a red flag, especially for countries based on democratic principles.

There can also be a lack of clarity when people use the term rate of population growth or decline. People need to be aware that the rate of human population growth can decline, while the absolute number of people on Earth can continue to increase. Also important to recognize is that areas experiencing rapid population growth are also often areas where the majority of Earth's remaining biodiversity can be found.

Another misconception about population growth occurs when people assume that developing countries must go through the same processes, steps, or trends that developed countries have gone through. "Leapfrogging," a concept that developing countries can adopt modern systems without going through all the intermediary steps, is an important process when thinking about global development and population issues.

The idea that population problems of developing countries are not a problem for the United States is a misconception. The scale of human activities is now so large that humans are appreciably affecting the climate and ecosystems in the U.S. and the world. The total impact of people on the environment is proportional to the number of people and the average impact of each person. If we are to reduce the total impact of people on the global environment, we must address both factors.

Another popular misconception is that the world's worst population problem is found in developing countries. The United States has a high per capita resource consumption. Some estimates say a person in the United States has 30 times or more impact on world resources than does a person in an underdeveloped nation.

The notion that all growth is good is a misconception. Steady growth of towns and cities has often been the goal to which communities aspire. If a town's population is growing, the town is said to be "healthy" or "vibrant," and if the population is not growing the town is said to be "stagnant." However, something that is not growing could alternately be viewed as "stable" and good.

Getting Ready (45 minutes)

Assessing Prior Knowledge, Questions, and Related Experiences

FACILITATOR: Distribute index cards to the study group. On the first card, participants should indicate something they know about population dynamics. On the second, they should write one question they have about population dynamics. And on the third card, they should describe a direct experience that they have had that relates to population dynamics. For example an individual might write:

For the human population to become stable, individuals can think about replacing themselves; hence a couple can have two children during their lifetime.

What is an effective way that one country can assist another in helping it manage its natural resources?

Cities have more problems than rural areas related to large populations—poor air quality, water rationing, and congested traffic.

Getting Ready

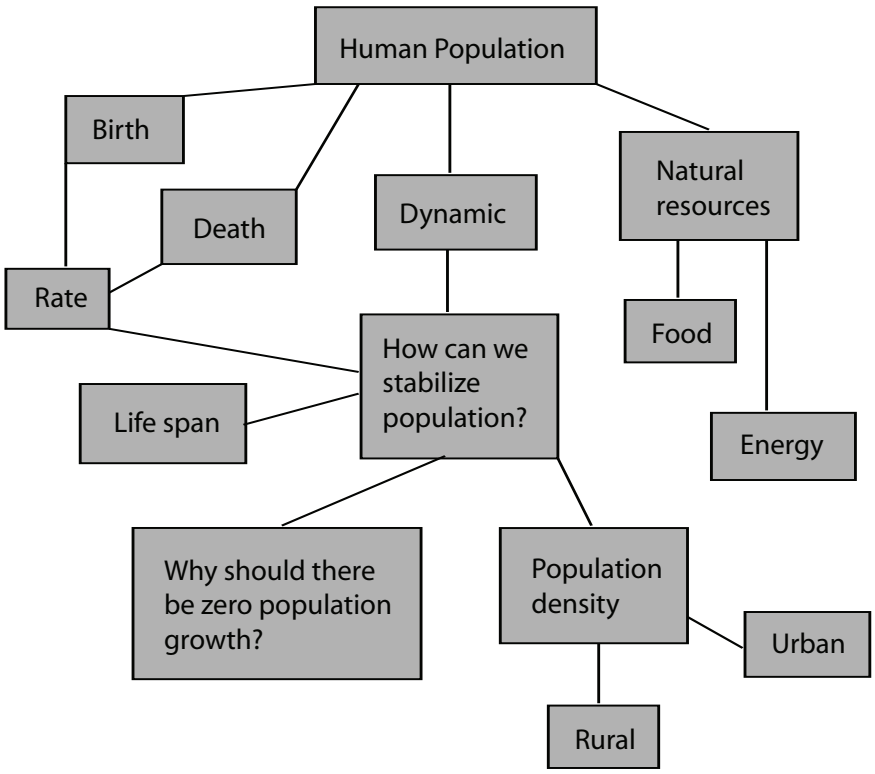


Figure 5.1 An example of a study groups' idea collection, with major subjects identified and the addition of the major focus ideas of the video. This activity links individual pre-existing knowledge with that of other members of the group and the unit content.

Activity Two: Current Events & Editorial Cartoons

Participants will share an article that they have found that relates to the week's topic. All members of the group will share their headlines for the articles. The leader should ask a few people to summarize their articles and ask for comments from others with related articles. As the group discusses the articles, a participant should record key concepts and make a list. (Participants may choose to bring in a cartoon or an editorial related to the week's topic instead of an article.)

Activity Three: Changes in Human Population

Part 1. Exponential Growth

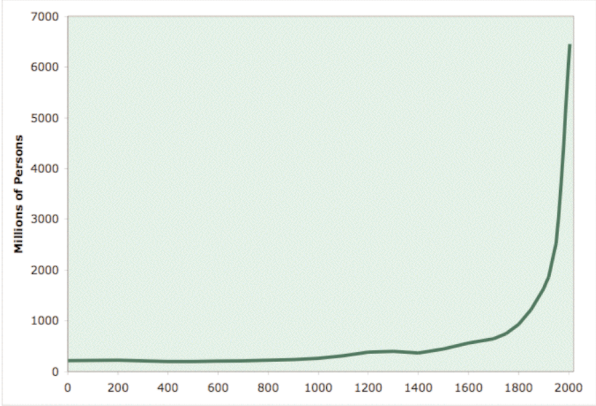
FACILITATOR: Bring copies of the table and graphs in Activity Three. Have the participants read the table on the history of human population growth based on 2002 data.

Getting Ready

THE HISTORY OF HUMAN POPULATION GROWTH

Years Elapsed	Year	Human Population
10,000	1 A.D.	170 Million
1,800	1800	1 Billion
130	1930	2 Billion
30	1960	3 Billion
15	1975	4 Billion
12	1987	5 Billion
12	1996	6 Billion

1. Point out trends, especially how many years elapsed between the milestones in human population growth.
2. Discuss milestones in human civilization, including the agricultural and industrial revolutions. Did these have dramatic effects on world population?
3. Project population size into the future. Specify years and the expected population.
4. Discuss the graph of human population growth below. Describe the pattern or shape of the graph. Compare and contrast variables that influence the pattern. Why are line graphs suited for showing population growth? What two factors need to be depicted? What do the numbers across the bottom— the x axis—represent?



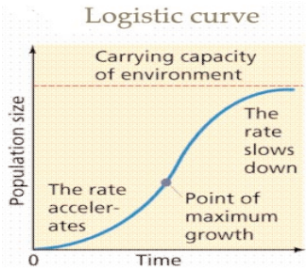
Exponential growth, or j curve growth patterns, can be viewed as unrestricted growth. Why is this true for humans or is this actually true for humans in the long run? What role has technology played in the human population curve?

Getting Ready

Part 2. Population Dynamics

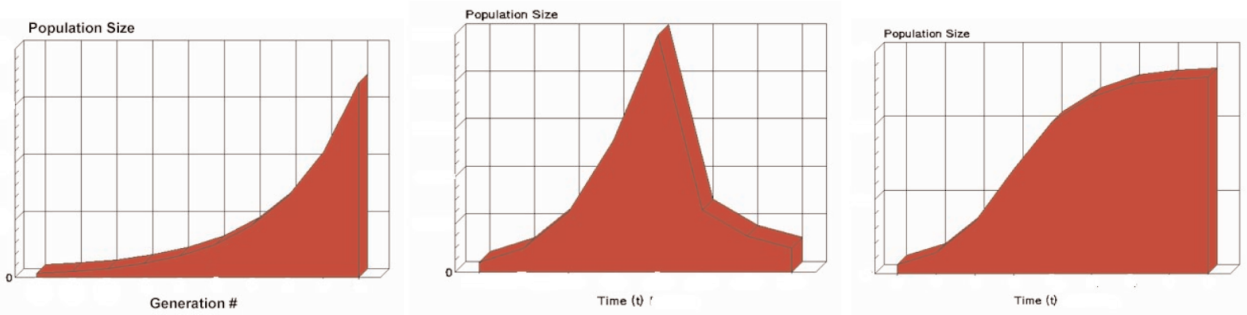
Background

In population ecology, a population is a group of individuals of the same species living in the same geographic area. Populations are said to undergo three distinct phases of their life cycle: growth, stability, and decline. The study of factors that affect growth, stability, and decline of populations is called population dynamics. Nearly all populations tend to grow exponentially as long as there are resources available. Stability is usually the longest phase of a population's life cycle. Decline is the decrease in the number of individuals in a population. The Logistic curve (also



known as an S-curve) shows the effect of a limiting factor (which can be the carrying capacity of the environment).

The logistic curve is frequently used to model biological growth patterns where there is an initial exponential



growth period followed by a leveling off as more of the population is infected or as the food supply or some other factor limits further growth.

Scientists studied the Kaibab Plateau of northern Arizona between the years of 1907 and 1939. In 1907 the deer population was unusually low with only 4,000 head. The carrying capacity was 30,000 at this time, so a massive campaign was waged against the natural enemies of the deer. Between the years of 1907 and 1923, the natural predators of deer (mountain lions, wolves and coyotes) were eliminated by hunters in order to increase the deer population. The deer population increased rapidly to 100,000 by 1924, but then died off rapidly to a mere 10,000 by 1939. Because of severe overgrazing by excessive populations of deer, the carrying capacity of this region was reduced to approximately 10,000 in 1939, and the deer population was reduced accordingly.

Discussion

Examine the three graphs above and discuss which best fits the Kaibab Plateau scenario.

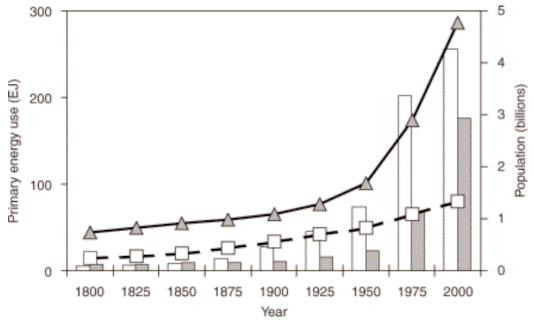
Could this happen to the human population?

How is human population growth more complicated than simple geometric progressions? Look at the shapes of the three graphs above. Which one best describes the deer scenario?

Getting Ready

Part 3. Population and Energy Resource

Discuss possible ecological scenarios that might result in the population and time relationships illustrated in each of the three graphs.



Discuss the energy, population, and time graph below. Consider how energy resources will impact human population growth over time. Notice the changing relationship in energy use between industrialized and developing countries.

In this graph you can see growth in world population (shown as lines and referring to the scale on the right-hand axis) and primary energy use (shown as bars and referring to the scale on the left-hand axis), industrialized (open squares and bars) versus developing (closed triangles and bars) countries, 1800–2000.

1. Describe the trends in energy use and population growth in both developed and undeveloped countries between 1800 and 2000.
2. Describe the relationship between developed and undeveloped countries up to 1950.
3. What happens between 1975 and 2000 in terms of the relative size of the open (industrialized countries' energy use) and closed (developing countries' energy use) bars?
4. Do you think this will continue? What could happen if more countries increase their energy use?
5. Discuss alternatives to continuation of these trends. How can these trends be changed? What would the outcomes be?

Video (45 minutes)

Activity Four: Watch the Video

As you watch the video, think about the following focus questions:

1. What is the value of census information?
2. What kinds of problems do social demographers help solve?
3. Why focus on U.S. population dynamics in particular?
4. Why is there disagreement about the carrying capacity of the Earth?
5. What assumptions are used to determine sustainability?
6. How does an increasing global market influence sustainability of the planet?

Video

7. How does technology relate to sustainability of the planet?
8. What is meant by market based solutions to sustainability?
9. As demographers, what do Martha Farnsworth Riche and Deborah Balk have in common? How does their work differ? What are each of their specializations? As a demographer, how does David Bloom's focus differ from Farnsworth Riche's and Balk's?
10. What are the trends as a region moves from pre-industrial to industrial characteristics or from rural dominated populations to urban concentration?

Activity Five: Discuss the Video

Discuss the following questions about the video.

1. How do death rate, life expectancy, and immigration and emigration figure into determining population dynamics for an area?
2. What is the impact of megacities on the environment?
3. What is meant by the ecological and economic capacity of an area?
4. How are population growth and consumption rates related?
5. What is meant by carrying capacity? Do you think the Earth has reached its carrying capacity? Why are there so many differing opinions about this?

Going Further (60 minutes)

Activity Six: Spatial Demographics Activity

The goal of this activity is to compare specific environmental and natural resource conditions and population growth in a variety of countries.

In the Unit 5 video on human population dynamics, Deborah Balk, who studies spatial demographics, talks about how environmental conditions and population growth interact, specifically focusing on population and geographical characteristics. For example, the video claims that throughout the world, population density is associated with coastal environments. The research objective is to study environmental characteristics associated with population characteristics.

Going Further

The online Interactive Lab: Demographics gives the population characteristics for seven specific countries. In this activity participants will relate the population characteristics from the Lab with the general environmental and natural resource characteristics of those countries.

Population and Growth Data from Online Interactive Lab

Country	Population	Population Growth/year
China	1.3 B	.6%
Egypt	78 M	2%
India	1.1 B	1.5%
Italy	58 M	.35%
Mexico	106 M	1.41%
Nigeria	129 M	2.46%
USA	296M	.92%

Materials

One set of fact sheets for each participant, listing the environmental and natural resources for the 7 countries featured in the Interactive Lab

A computer and Internet access in order to run the Demographics Lab

Procedure

1. As a group, run the online Interactive Lab: Demographics for each country using the pre-set criteria for population growth in each country for 45–90 and 180 year increments.
2. Describe and summarize what the population characteristics are for each country. Consider the population graph and population by age group graphs and describe the characteristics.
3. Examine the environmental and natural resource fact sheets provided from the World Factbook.
4. Discuss these questions:

   How does climate relate to population growth?

   What is likely to be the effect of population trends on natural resources in each country?

   What geographical characteristics are related to the growth trends and population characteristics?

   How will population growth influence current environmental concerns?

   What is the future for land use in these countries?

Further Investigation and Discussion

Modify the parameters for birth and death rate for each country and relate the changes in growth and age distribution to natural resource information.

Consider the developed countries (USA & Italy) and developing countries (Egypt & Nigeria). How do the natural resource and population characteristics compare?

Compare the relatively stable population countries (USA & China) to the fastest increasing population countries (Egypt & Nigeria). How do the natural resource and population characteristics compare?

Going Further

China

Natural Resource Fact Sheets adapted from United States Central Intelligence Agency, The World Factbook 2007, Washington, DC; retrieved: 6-7-07 from:

https://www.cia.gov/library/publications/the-world-factbook/index.html.

Location:	Eastern Asia, bordering the East China Sea, Korea Bay, Yellow Sea, and South China Sea, between North Korea and Vietnam
Geographic coordinates:	35 00 N, 105 00 E
Area—comparative:	slightly smaller than the US
Coastline:	14,500 km
Climate:	extremely diverse; tropical in south to subarctic in north
Terrain:	mostly mountains, high plateaus, deserts in west; plains, deltas, and hills in east
Natural resources:	coal, iron ore, petroleum, natural gas, mercury, tin, tungsten, antimony, manganese, molybdenum, vanadium, magnetite, aluminum, lead, zinc, uranium, hydropower potential (world's largest)
Land use:	*arable land:* 14.86% *permanent crops:* 1.27% *other:* 83.87% (2005)
Irrigated land:	545,960 sq km (2003)
Environment —current issues:	air pollution (greenhouse gases, sulfur dioxide particulates) from reliance on coal produces acid rain; water shortages, particularly in the north; water pollution from untreated wastes; deforestation; estimated loss of one-fifth of agricultural land since 1949 to soil erosion and economic development; desertification; trade in endangered species
Geography—note:	world's fourth largest country (after Russia, Canada, and U.S.); Mount Everest on the border with Nepal is the world's tallest peak

Going Further

Egypt

Location: Northern Africa, bordering the Mediterranean Sea, between Libya and the Gaza Strip, and the Red Sea north of Sudan, and includes the Asian Sinai Peninsula

Geographic coordinates: 27 00 N, 30 00 E

Area—comparative: slightly more than three times the size of New Mexico

Coastline: 2,450 km

Climate: desert; hot, dry summers with moderate winters

Terrain: vast desert plateau interrupted by Nile valley and delta

Natural resources: petroleum, natural gas, iron ore, phosphates, manganese, limestone, gypsum, talc, asbestos, lead, zinc

Land use: *arable land:* 2.92% *permanent crops:* 0.5% *other:* 96.58% (2005)

Irrigated land: 34,220 sq km (2003)

Environment—current issues: agricultural land being lost to urbanization and windblown sands; increasing soil salination below Aswan High Dam; desertification; oil pollution threatening coral reefs, beaches, and marine habitats; other water pollution from agricultural pesticides, raw sewage, and industrial effluents; very limited natural fresh water resources away from the Nile, which is the only perennial water source; rapid growth in population overstraining the Nile and natural resources

Geography—note: controls Sinai Peninsula, only land bridge between Africa and remainder of Eastern Hemisphere; controls Suez Canal, a sea link between Indian Ocean and Mediterranean Sea; size, and juxtaposition to Israel, establish its major role in Middle Eastern geopolitics; dependence on upstream neighbors; dominance of Nile basin issues; prone to influxes of refugees

Going Further

India

Location:	Southern Asia, bordering the Arabian Sea and the Bay of Bengal, between Burma and Pakistan
Geographic coordinates:	20 00 N, 77 00 E
Area—comparative:	slightly more than one-third the size of the U.S.
Coastline:	7,000 km
Climate:	varies from tropical monsoon in south to temperate in north
Terrain:	upland plain (Deccan Plateau) in south, flat to rolling plain along the Ganges, deserts in west, Himalayas in north
Natural resources:	coal (fourth-largest reserves in the world), iron ore, manganese, mica, bauxite, titanium ore, chromite, natural gas, diamonds, petroleum, limestone, arable land
Land use:	*arable land:* 48.83% *permanent crops:* 2.8% *other:* 48.37% (2005)
Irrigated land:	558,080 sq km (2003)
Environment —current issues:	deforestation; soil erosion; overgrazing; desertification; air pollution from industrial effluents and vehicle emissions; water pollution from raw sewage and runoff of agricultural pesticides; tap water is not potable throughout the country; huge and growing population is overstraining natural resources
Geography—note:	dominates South Asian subcontinent; near important Indian Ocean trade routes; Kanchenjunga, third tallest mountain in the world, lies on the border with Nepal

Going Further

Italy

Location:	Southern Europe, a peninsula extending into the central Mediterranean Sea, northeast of Tunisia
Geographic coordinates:	42 50 N, 12 50 E
Area—comparative:	slightly larger than Arizona
Coastline:	7,600 km
Climate:	predominantly Mediterranean; Alpine in far north; hot, dry in south
Terrain:	mostly rugged and mountainous; some plains, coastal lowlands
Natural resources:	coal, mercury, zinc, potash, marble, barite, asbestos, pumice, fluorspar, feldspar, pyrite (sulfur), natural gas and crude oil reserves, fish, arable land
Land use:	*arable land:* 26.41% *permanent crops:* 9.09% *other:* 64.5% (2005)
Irrigated land:	27,500 sq km (2003)
Environment —current issues:	air pollution from industrial emissions such as sulfur dioxide; coastal and inland rivers polluted from industrial and agricultural effluents; acid rain damaging lakes; inadequate industrial waste treatment and disposal facilities
Geography—note:	strategic location dominating central Mediterranean as well as southern sea and air approaches to Western Europe

Going Further

Mexico

Location:	Middle America, bordering the Caribbean Sea and the Gulf of Mexico, between Belize and the U.S. and bordering the North Pacific Ocean, between Guatemala and the U.S.
Geographic coordinates:	23 00 N, 102 00 W
Area—comparative:	slightly less than three times the size of Texas
Coastline:	9,330 km
Climate:	varies from tropical to desert
Terrain:	high, rugged mountains; low coastal plains; high plateaus; desert
Natural resources:	petroleum, silver, copper, gold, lead, zinc, natural gas, timber
Land use:	*arable land:* 12.66% *permanent crops:* 1.28% *other:* 86.06% (2005)
Irrigated land:	63,200 sq km (2003)
Environment —current issues:	scarcity of hazardous waste disposal facilities; rural to urban migration; natural fresh water resources scarce and polluted in north, inaccessible and poor quality in center and extreme southeast; raw sewage and industrial effluents polluting rivers in urban areas; deforestation; widespread erosion; desertification; deteriorating agricultural lands; serious air and water pollution in the national capital and urban centers along U.S.-Mexico border; land subsidence in Valley of Mexico caused by groundwater depletion note: the government considers the lack of clean water and deforestation national security issues
Geography—note:	strategic location on southern border of U.S.; corn (maize), one of the world's major grain crops, is thought to have originated in Mexico

Going Further

Nigeria

Location:	Western Africa, bordering the Gulf of Guinea, between Benin and Cameroon
Geographic coordinates:	10 00 N, 8 00 E
Area—comparative:	slightly more than twice the size of California
Coastline:	853 km
Climate:	varies; equatorial in south, tropical in center, arid in north
Terrain:	southern lowlands merge into central hills and plateaus; mountains in southeast, plains in north
Natural resources:	natural gas, petroleum, tin, iron ore, coal, limestone, niobium, lead, zinc, arable land
Land use:	*arable land:* 33.02% *permanent crops:* 3.14% *other:* 63.84% (2005)
Irrigated land:	2,820 sq km (2003)
Environment —current issues:	soil degradation; rapid deforestation; urban air and water pollution; desertification; oil pollution—water, air, and soil; has suffered serious damage from oil spills; loss of arable land; rapid urbanization
Geography—note:	the Niger enters the country in the northwest and flows southward through tropical rain forests and swamps to its delta in the Gulf of Guinea

Going Further

United States of America

Location: North America, bordering both the North Atlantic Ocean and the North Pacific Ocean, between Canada and Mexico

Geographic coordinates: 38 00 N, 97 00 W

Area—comparative: about half the size of Russia; about three-tenths the size of Africa; about half the size of South America (or slightly larger than Brazil); slightly larger than China; more than twice the size of the European Union

Coastline: 19,924 km

Climate: mostly temperate, but tropical in Hawaii and Florida, arctic in Alaska, semiarid in the great plains west of the Mississippi River, and arid in the Great Basin of the southwest; low winter temperatures in the northwest are ameliorated occasionally in January and February by warm chinook winds from the eastern slopes of the Rocky Mountains

Terrain: vast central plain, mountains in west, hills and low mountains in east; rugged mountains and broad river valleys in Alaska; rugged, volcanic topography in Hawaii

Natural resources: coal, copper, lead, molybdenum, phosphates, uranium, bauxite, gold, iron, mercury, nickel, potash, silver, tungsten, zinc, petroleum, natural gas, timber

Land use: *arable land:* 18.01% *permanent crops:* 0.21% *other:* 81.78% (2005)

Irrigated land: 223,850 sq km (2003)

Environment —current issues: air pollution resulting in acid rain in both the U.S. and Canada; the U.S. is the largest single emitter of carbon dioxide from the burning of fossil fuels; water pollution from runoff of pesticides and fertilizers; limited natural fresh water resources in much of the western part of the country require careful management; desertification

Geography—note: world's third-largest country by size (after Russia and Canada) and by population (after China and India); Mt. McKinley is highest point in North America and Death Valley the lowest point on the continent

Going Further

Activity Seven: Return to Essential Questions

The facilitator should draw the attention of the participants back to the essential questions posed in the Background Section of this unit guide. Discuss how the participants' ideas may have changed in regard to the questions. Discuss the most logical and complete answers to the questions.

Activity Eight: Discuss Classroom Supplementary Activities

If the participants in the study group are teachers, the facilitator should draw the participants' attention to supplementary classroom activities located at the end of this guide. Discuss how teachers would implement these activities in their classrooms and how they would relate them to the topics in this unit.

Between Sessions

Next Week's Topic Overview

Read Unit 6 before the next session. In Unit 6, the emphasis is on risk, exposure, and health issues. Sub-topics will include exposure to environmental hazards, risk tradeoffs, and risk perception.

Read for Next Session

Read the Unit 6 Professional Development Guide background section. Consider the essential questions as you read the text. The misconceptions section will give you some insight into what misunderstandings people may have about risk and exposure. Consider discussing the topic with your friends or students and discussing common misconceptions.

Current Events

Bring in a current event article or cartoon related to risk, exposure, and health issues.

Supplementary Classroom Activity 1

Analyzing Population Growth Rates

Learning Objectives

Students will be able to:

- identify factors that influence birth and death rates in human population growth rates
- describe relationships between birth and death rates and how they both affect human population growth rates
- explain factors that affect population growth rates in addition to birth and death rates

Part 1. World Birth and Death Rates

The natural increase of a population depends on the number of births and deaths. If the number of births is greater than the number of deaths at any given point in time, there will be a natural increase in the number of people. Typically, the growth rate of a population is given in terms of the birth rate (number of births per 1000 people per year) and death rate (number of deaths per 1000 people per year).

Use the information below or have students research birth and death rates for different countries of their choice. Compare and contrast birth and death rates and speculate and research on why the rates differ. Students can report on what they've learned about each country. The group can explore which countries are similar and which are strikingly different from the United States. For example, why do some countries have double the death rate of other countries? Which countries have better health services, better sanitation, and better nutrition?

1. Mark all of the countries listed below on a map of the world.
2. Group countries by continent, compare average birth and death rates, and discuss possible causes for the differences.
3. Group countries by north or south of the equator, compare average birth and death rates, and discuss possible causes for the differences.
4. Group the countries according to developed and undeveloped, compare average birth and death rates, and discuss possible causes for the differences.
5. Compare the birth and death rates of individual countries.
   a. Order the birth rates from lowest to highest.
   b. Order the death rates from lowest to highest.
   c. Compare lists.
   d. Compare other countries to the United States.

Supplementary Classroom Activity 1

BIRTH AND DEATH RATES BY SELECTED COUNTRY

Source: United States Census International Programs Center, 1992

Country/region	Birth rate	Death rate
Afghanistan	41.0	17.4
Argentina	18.2	7.6
Australia	12.7	7.3
Austria	9.6	9.7
Belarus	9.9	14.0
Belgium	10.6	10.1
Bhutan	35.3	13.7
Bolivia	26.4	8.1
Botswana	28.0	26.3
Brazil	18.1	9.3
Cameroon	35.7	12.1
Canada	11.1	7.5
Chile	16.5	5.6
China	15.9	6.8
Colombia	22.0	5.7
Denmark	11.7	10.8
Egypt	24.4	7.6
France	11.9	9.0
French Guiana	21.7	4.8
Gabon	27.2	17.6
Gaza Strip	41.9	4.1
Germany	9.0	10.4
Ghana	28.1	10.3
Guinea	39.5	17.2
Guinea-Bissau	39.0	15.1
Guyana	17.9	9.3
Haiti	31.4	14.9
Honduras	31.2	5.7
Hungary	9.3	13.1
India	23.8	8.6
Indonesia	21.9	6.3
Iran	17.5	5.4
Iraq	34.2	6.0
Ireland	14.6	8.0
Israel	18.9	6.2
Italy	8.9	10.1
Japan	10.0	8.5
Jordan	24.6	2.6
Kazakhstan	17.8	10.7
Kenya	27.6	14.7
Korea, North	18.0	7.0
Korea, South	14.6	6.0
Kuwait	21.8	2.5
Liberia	46.0	16.1
Mexico	22.4	5.0
Moldova	13.8	12.6
Nepal	32.9	10.0
Niger	50.0	22.3
Nigeria	39.2	14.1
Norway	12.4	9.8
Peru	23.4	5.7
Philippines	26.9	6.0
Poland	10.3	10.0
Portugal	11.5	10.2
Russia	9.7	13.9
Saudi Arabia	37.3	5.9
Slovakia	10.1	9.2
Slovenia	9.3	10.1
Solomon Islands	33.3	4.2
Somalia	46.8	18.0
South Africa	20.6	18.9
Spain	9.3	9.2
Sri Lanka	16.4	6.5
Sudan	37.2	9.8
Suriname	20.0	5.7
Swaziland	39.6	23.3
Sweden	9.8	10.6
Switzerland	9.8	8.8
Syria	30.1	5.1
Taiwan	14.2	6.1
Tajikistan	33.0	8.5
Tanzania	39.1	13.0
Thailand	16.4	7.6
Togo	36.1	11.3
Tonga	24.1	5.6
Tunisia	16.8	5.0
Turkey	18.0	6.0
Turkmenistan	28.3	8.9
Tuvalu	21.4	7.5
Uganda	47.2	17.5
Ukraine	9.6	16.4
United Kingdom	11.3	10.3
United States	14.1	8.7
Uruguay	17.3	9.0
Uzbekistan	26.1	8.0
Vanuatu	24.8	8.3
Venezuela	20.2	4.9
Vietnam	20.9	6.1
Virgin Islands	15.9	5.6
West Bank	34.9	4.3
Yemen	43.3	9.3
Zambia	41.0	21.9
Zimbabwe	24.6	24.1

Supplementary Classroom Activity 1

Part 2 Birth and Death Rate Demonstration

This demonstration illustrates different human population growth rates for different countries. Bring to the study group several clear containers at least 1 quart in capacity. Label the containers to represent individual countries. Fill the containers with colored water. Have several same size cups available for students.

The objective is to add or take away water from each container in direct proportion to the actual birth and death rates. Use the table below to determine how much water is put in or taken out for each generation. This is the ratio between birth and death. For example, for Afghanistan, one student can add one cup of water to represent the birth rate of forty one. Another student can remove approximately half a cup of water representing the death rate of seventeen. These two students can keep doing this each time representing a generation. The class can observe and record what happens over time.

If new countries are added to the list below, students can calculate what size measuring cup and amounts of water will be added and removed. For every amount of water added to represent the birth rate, water representing the death rate must be removed. Students should continue until a trend is clear or one or the other containers is getting ready to overflow. Several countries can be done at the same time to compare outcomes.

	Birth Rate	Death Rate	Birth to Death Ratio
Afghanistan	41/1000	17/1000	41 to 17
China	16/1000	7/1000	16 to 7
Germany	9/1000	10/1000	9 to 10
India	24/1000	9/1000	24 to 9
Pakistan	30/1000	9/1000	30 to 9
Uganda	47/1000	18/1000	47 to 18
United States	14/1000	9/1000	14 to 9

Ask students to discuss the following questions:

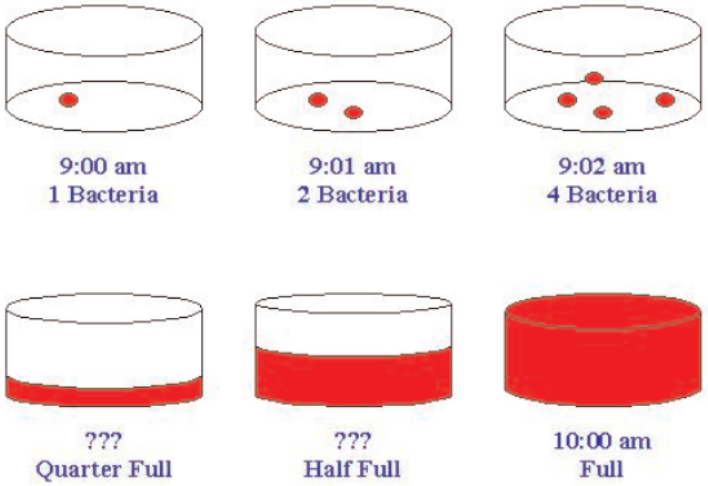
1. What circumstances might result in a high birth rate for a population? A low birth rate?
2. What circumstances might result in a high death rate for a population? A low death rate?
3. If both birth rates and death rates are declining worldwide, why is the world's population still increasing?
4. There are many factors that contribute to birth rates and death rates. Fertility rates and life expectancy are just two examples. Fertility rate is the average number of children born to women in a given population. How might the fertility rate affect the birth rate? How might it ultimately affect the population growth rate? How does life expectancy affect the death rate? How might it ultimately affect the population growth rate?
5. Can you think of any other factors that might affect the growth rate of a country?

Supplementary Classroom Activity 2

Impact of a Growing Population

The activity explores the mathematical and environmental aspects of population growth.

1. A scientist places one bacteria in a Petri dish at 9:00 a.m. Assume each bacteria is one cubic centimeter. The bacteria can reproduce at a rate that doubles its population every minute. The scientist observes that the container is completely full at 10:00 a.m.



   a. Estimate when the container was half full. Quarter full.

   b. What is the volume of the container?

   c. What volume will the bacteria population occupy at 10:02 am?

   d. In what ways is this example similar to human population growth?

   e. In what ways is this example different from human population growth?

2. What are the limiting factors in an environment that will control the growth of most populations of organisms?

3. What areas of the world are most populated? Why do you think these areas have so many people?

4. How does population size affect the resources used by a country? How does population size affect other environmental conditions? Are there other factors besides population size that can have an impact on resource consumption and environmental conditions in a country?

Notes