Environmental Science

NAME: _____
DATE: _____

Chapter 9: Human Population as an Environmental Problem

Introduction

"The Earth cannot support a larger population of any species than it can supply food for. Homo sapiens is the one species that might succeed through thought and foresight in making use of the constraint of a lowered birth rate."

Isaac Asimov

The size of the human population affects virtually every environmental condition on the Earth. Today, over 6 billion people inhabit the planet, compared to 1 billion in the nineteenth century. The rate of increase is so dramatic that unless the use of birth control methods increases, the world population will exceed an estimated 10 billion by the year 2000 and 14 billion by the end of the next century. If this rate is allowed to continue, ***the number of people on the planet will double in less than forty years*** and seriously tax or entirely deplete our planet's natural resources. All this will happen during your lifetime, creating problems even more severe for your children's generation.

The continual increase in demand for resources lead inevitably to increased pollution and waste problems. More energy is used, escalating the problems of global warming, acid rain, oil spills, and nuclear waste. More land is required for agriculture, homes, and factories, contributing to deforestation and soil erosion. Political conflicts arising over ownership of resources will lead to more military confrontations between countries. And species will continue to become extinct at an astronomical rate due to loss of habitat. Population growth appears to contribute significantly to the tragedy of environmental degradation.

Some experts describe the bottom line in terms of sustainability. It has been suggested that a society cannot truly be sustainable if it consumes renewable resources faster than they can be replenished. In other words, an overpopulated society clears forests and uses water supplies faster than they have time to renew themselves. Measured in this way, the world is already overpopulated in many areas and we all have a responsibility to support efforts to find viable solutions that impose as little change as possible on cultural and social mores.

As Aldo Leopold stresses in his writings, every condition is interconnected. We cannot solve this one problem of overpopulation by suggesting unnatural solutions, such as mandatory sterilization after having one child, and then expect everything else to work itself out. Perhaps if we can expand our public policy agenda to question our value system, we will make the cultural changes necessary to ensure that there will be fertile land and wilderness left for our children's children.

The challenge is our choice, and the next generation's inheritance.

It is not my intention (and it should not be yours) to pass judgment, but rather to engage people in an active dialogue of what is most valuable in life. When we look at population growth and its consequences we must take responsibility for our own actions and instill these values as we raise the children of the future.

Demographic Facts of Life

Student Activity 4

Concept: The discrepancy between a population's birth and death rates determines rate of growth.

Objectives: Students calculate the rate of natural increase and corresponding doubling times for several countries and discuss differences.

Students examine the impact of world disasters on population growth.

Subjects: Math, biology, demography, environmental science, social studies

Skills: Data collection, analysis and interpretation, math calculations

Materials:

Copies of Student Worksheet
Calculators

Introduction:

Birth and death rates determine the rate of population growth. If the birth and death rates are similar, a population experiences little or no growth. When the birth rate far exceeds the death rate, the population soars. These rates are expressed as the number of births or deaths for every 1,000 people in a given year. For instance, in 1991 the world's birth rate was 27 per 1,000 and the death rate was 9 per 1,000. Using the formulas below, we can determine the world's annual growth rate and the number of years it will take the population to double if the growth rate remains constant.

Percent annual natural increase =
(birth rate – death rate) ÷ 10

$$\frac{27-9}{10} = 1.8\ \%$$

Doubling time (in years) =
70 ÷ rate of increase

$$\frac{70}{1.8} = 39 \text{ years}$$

(Note: 70 is the approximate equivalent of 100 times the natural log of 2.)

Procedure:

Part 1: On the Double

Distribute copies of Student Worksheet 1 and have students complete the table.

Discussion:

1. Why do you think some countries are doubling much more rapidly than others? Why do you think some countries, such as Denmark, have reached zero population growth (z.p.g.)?

2. Which figures differ most greatly between countries, the birth rates or the death rates? How would you explain the wide disparity in birth rates among different countries? Why are the death rates relatively low in many of the countries with high birth rates?

3. If you were a national leader in Kenya, would you be concerned about the rapid population growth? Why or why not? Similarly, if you were a national leader in Denmark, would you be concerned that your country has reached z.p.g.? Why or why not?

4. The population of the United States is actually growing at the rate of 1.2 percent each year, significantly more than its rate of natural increase. Where is the additional population growth coming from?

Demographic Facts of Life

Student Worksheet 1

On the Double

Using the table below, determine the percentage of annual increase and the population doubling times for each country.

$$\text{Percent annual natural increase} = \frac{\text{birth rate} - \text{death rate}}{10}$$

$$\text{Doubling time (in years)} = \frac{70}{\text{rate of increase}}$$

Country	Birth Rate in 1991 (per 1,000 people)	Death Rate in 1991 (per 1,000 people)	Annual Natural Increase	Doubling Time (years)
United States	17	9		
Mexico	29	6		
Japan	10	7		
United Kingdom	14	12		
China	21	7		
India	31	10		
Kenya	46	7		
U.S.S.R. /Russia	18	10		
South Africa	35	8		
Italy	10	9		
Denmark	12	12		

U.S. growth rate w/ immigration = 1.2% Doubling Time = 58 yrs

Part 2: Grim Reaper's Revenge

We are currently adding 95 million people (net growth) to the world each year, or 255,000 people each day. Conveying the importance of such figures to students can be difficult since the numbers are so large they lose their meaning. The table in Student Worksheet 2 makes these numbers more concrete by illustrating that the numbers of people lost in history's major disasters are currently being replaced in a matter of days or weeks.

Have students complete the table in Student Worksheet 2.

Grim Reaper's Revenge

We are currently adding 95 million people (net growth) to the world's population each year. This means we are adding 255,000 people each day. Even the deaths from large-scale disasters have little effect on a population growing so rapidly. Below is a listing of some of the world's worst disasters, along with an approximate death toll. At today's present rate of growth, determine how many days, weeks or months it would take to replace those people lost. Round off to one decimal place.

Some Past Disasters	Approximate # of deaths	Present world population growth replaces this # in what time span?
Bangladeshi cyclone, 1991	200,000	
Total American deaths in all wars	600,000	
Great flood, Hwang Ho River, 1887	900,000	
Total U.S. automobile deaths through 1989	2,600,000	
Indian famine, 1769-70	3,000,000	
All major global disasters as of 1988[1]	6,500,000	
Chinese famine, 1877-78	9,500,000	
Present global famine	5,000,000 to 20,000,000	
Influenza epidemic, 1918	21,000,000	
Global deaths in all wars in the past 500 years	35,000,000	
Bubonic plague, 1347-51	75,000,000	

[1] This includes deaths from all recorded major earthquakes, avalanches, volcanic eruptions, tornadoes, floods, typhoons, fires, explosions, shipwrecks, and railroad and aircraft accidents through 1988.

Casualty figures obtained from the World Almanac *(New York: Newspaper Enterprise Associates, 1988),* Information Please Almanac *(New York:*

Analysis Questions

1. Explain how each of these density-dependent factors affects human populations.
   a. Limited resources:

   b. Disease:

   c. Reproduction:

2. How do density-independent factors affect human populations? Give an example.

3. Do humans engage in interspecific competition? Give an example.

4. Do humans engage in intraspecific competition? Give an example.

5. The current world population is 6.6 billion. Is there a carrying capacity for humans? How will we know when we've reached it?