Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1998 Volume VII: The Population Explosion

Life in 2010

Curriculum Unit 98.07.03
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Introduction

> "The real work of planet-saving will be small, humble, and humbling, and (insofar as it involves love) pleasing and rewarding. Its jobs will be too many to count, too many to report, too many to be publicly noticed or rewarded, too small to make anyone rich or famous."
>
> Wendell Berry

When we discuss environmental, social and economic problems with our students, the issue of population is seldom explored. This is possibly because any discussion of population must include the controversial or uncomfortable issues of sexuality and contraception, hot topics involving personal rights and religion. We, as teachers, often don't even know what we can and cannot say when discussing these issues. Furthermore, "overpopulation" is such a broad concept, we do not know where to begin when trying to discuss the concept, much less how to present it to young people. Because the subject is politically sensitive and the concept is so broad, few of our students are learning that population is a critical subject over which they have total control of any consequences. Students rarely even know what they mean by "overpopulation."

"Overpopulation" is a relative, not an absolute term. Each student will possess their own opinion regarding what is too much--too much competition, too much stress--both symptoms of overpopulation. Some students will identify their school, home or neighborhood as overpopulated; others will firmly disagree. Because "overpopulation" is such a subjective term, it is recommended teachers request that students complete a survey or open the discussion with an empathy lesson. Feelings associated with overpopulation are personal. Educators should question where students feel crowded and redirect students back to these feelings they have as they complete the activities. Do not assume students' perceptions associated with overpopulation is the same yours, or that they share a concept.

Start with a reasonable working definition of overpopulation by an author in the field: " . . .when there are more people than can live on the earth in comfort, happiness and health and still leave the world a fit place for future generations." For each component of this definition, there are many issues which need to be considered. For example, under the category of "comfort," housing, food, health, and perhaps employment are

a few topics that may be discussed. But the standard by which these items should be judged is subjective. For example, on the issue of housing, the following questions might be asked: What kind of housing? How much space for each person? What is necessary for comfort? Students will all have their own varying responses to all these questions. Their inability to agree on a concept as simple as "comfort" underlies the difficulty presented when trying when teaching the abstract concept of "overpopulation".

It's impossible to come up with a definition of "happiness" that would satisfy everyone in the class, much less the world. One person's definition of happiness might be "to provide adequate shelter, food, and health care for my family," while another's might be "to have two cars, a big house, servants, and a swimming pool." A life without fear associated with crime might be considered happiness for many in urban areas. Ask students to list three things needed in their own definition of happiness. Compare these lists. These is sure to be little agreement.

Consider "leaving the earth a fit place for future generations." What, for example, is "fit?" Does that mean completely pollution free? Do we only concern ourselves, humans, when we consider "a fit earth"? Is the damage cause by pollution, desertification, and deforestation reversible? These are some of the questions that might be asked about the state of the planet.

Students will often associate comfort and happiness with social, economic and environmental standards. To further their understanding of the impacts of overpopulation on each of these issues, examine each individually, first at the student's personal level, then at the city or community level and aggregate this information to provide a national or international perspective on overpopulation and its impact on societies, wealth and incomes and the environment.

Illustrating Overpopulation

Population is the members of one species which occupies a given area. When examining population, any species may be examined--humans, dogs or birds--but that species must be identified. In this unit we examine local human population. We need to also specify the environment, or community. This unit, again, focuses on a specific area, New Haven, and the state of Connecticut.

Population is a numbers game. Three things affect the size of the human population for any given area: births, deaths and people moving in and out of the area. As more people reproduce, more children are born and population size keeps increasing. Demographers use birth rates and death rates to determine population size. They find out population numbers by taking the numbers of births or deaths per 1000 persons in the population at the mid-year of any given year. Then the demographers divide the total number of births or deaths per year by the total population at midyear and multiply the results by 1,000. Population experts also use fertility rates to determine population size. A fertility rate is the number of live births per 1,000 women in the reproductive age group (15 to 44 in the United States and up to 49 years in many other countries). For further projections demographers use the total fertility rate, which is a projection of the average number of children a woman will have during her entire reproductive period. (See YNHTI Curriculum Unit: Human Ecology: How It Relates to Population, by Sherree L. Kassuba, Guide Entry to 80.05.07)

Any study of population must be preceded by an understanding of such concepts as community, environment and carrying capacity. A community contains many different interacting species. Species are identified and

differentiated by their ability to reproduce only within their own species. The individuals belonging to any one community are said to be a population. The environment is the habitat, both natural and man-made, that support the community.

Carrying capacity is a difficult concept to define, much less comprehend. The carrying capacity concept is critical to ecology and states that an environment--by extension, the earth--has a finite amount of resources. Given this finite environment, the growth of many of its members follows an S-shaped curve where growth slows and eventually stops because of environmental limits. Space and resources are finite, particularly non-renewable resources. This can be illustrated by introducing a few algae into a petri dish. At optimum temperature and with adequate food, algae increase their numbers, slowly at first, then more rapidly , until growth eventually slows and then stops, usually because of waste accumulation. The usefulness of the carrying capacity concept, however, is hotly debated by economists and ecologists because while ecologists see finite resources being depleted, economists see technology increasing the earth's store of resources. New irrigation techniques, for example, have made previously arid, useless land into efficient agricultural land.

One critical fact about carrying capacity that students need to understand is that human choices influence the earth's carrying capacity. Their decisions determine the earth's future. While each students may find it difficult to comprehend that they can affect the whole earth's future, it is imperative the realize their impact. If students indicate they each want two children, the replacement rate, world population would grow to 7.7 billion in 2050 and would level off around 8.4 billion by 2150. Future population size is very sensitive to future levels of average fertility, however. If the average couple had a level of fertility that was one tenth of a child less than replacement rate, population would peak at 7.8 billion in 2050, but would drop to 5.6 billion in 2150. For example, if there are 20 students in the classroom, and each student (10 couples) wants 2 children, an additional 20 children projected, the former scenario prevails; population levels at about 8.4 billion. If, however, the total future children the class elects to have drops by one tenth (2), the latter scenario prevails, and population levels at 5.6 billion. Your 20 students can actually contribute to a future population which can be reduced by more than 2 billion!.

Global overpopulation is a vast, overwhelming concept. Our population is growing at 1.6%. At this rate, given current our current population, humans would number 11 billion by 2025. The earth currently has 5.7 billion people. A billion is an unfathomable number . A billion is 1,000 million or 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 x 10 (109) Students should imagine 2 football field side by side. That area is 100 meters by 100 meters. If you stacked all the people in New Haven on each square meter, you would have a billion or so people. A billion equals four times the 1990 population of the United States.

When introducing the concept of overpopulation, students, should consider these facts: The United States is the third most populous country in the world following China and India. The U.S. population, currently more than 265 million, is growing by about 2.5 million people each year, making the United States one of the world's fastest-growing industrialized nations. In 1994, there were about 3.95 million births and 2.29 million deaths in the United States, resulting in a net natural increase of nearly 1.7 million more people. Sixty percent of pregnancies and 40 percent of births in the United States are unintended. The Census Bureau projects that in the year 2000, the U.S. population will exceed 275 million, more than double the 1940 population. By 2050, the nation's population is projected to increase by nearly 130 million people -- the equivalent of adding another four states the size of California.

Students cannot begin to understand the numbers associated with overpopulation and its implications until they personalize the "population" concept. Only after student's understand and can empathize with personal

and community space and resource limitations, can they extend these concepts and begin to appreciate and comprehend global stresses due to overpopulation.

Activities

A. Overpopulation Obviously Stunts Growth

(*note: start project first week of unit; 8 week discovery)

Objective: Students will measure effects of overpopulation in plants

Materials:

3 identical seed starter flats
soil
1 packet sunflower seeds
water
light source

Procedure:

1. Fill seed starter flats with soil. Take care to use the same amount of soil (control.)
2. Label each flat: A, B, C
3. In flat A plant one seed in each subdivision (6 to 8 subdivision flats are ideal).
4. In flat B plant two seeds in each subdivision.
5. In flat C plant five seeds in each subdivision.
6. Prepare a chart to measure growth in each flat for eight weeks.
7. Students propose how much growth they expect from each flat (Flat A will yield 1/2 the height flat in flat B within a month, for example).
8. Water, using the same amount, twice weekly.
9. Record plant growth in mm.

Extension: plant will not continue to grow in starter kit. It will die because its demands exceed the carrying capacity of the starter kit. Transplant a few plants from flat A and contrast their growth with those left in the flats.

B. In Your Face: Overpopulation at home, school, play

Objective: Students will record and describe how they are affected by overpopulation at home, school and in their community. They will organize their findings to discover where they feel the effects of overpopulation and for which resources they find most valuable and competitive.

Procedure: Students will keep a log/diary for three days (including one weekend) in which they record any activities which were negatively affected by others in any way. Brainstorm a substantial list with the class which includes examples such as: they had to wait for the bathroom; they couldn't watch TV because Dad was watching; they got stuck in traffic; they couldn't hear their radio because the car next to theirs was too loud; they had to take an undesirable school lunch because first choice was gone. Daily they will record their activities which were affected by others in a format which illustrates where they are most impacted by others.

Example:

Create master list on display board in which all students share how others "ruin their day". Ask students to decide if there is one area in their life that is more "overcrowded". Students compare their findings. Students decide if over population is an issue in their life. List the situations in which they wished there were fewer people. List when they wished there were more people. Compare these lists.

C. How much space do I need anyway?

Objective: Students will identify all the space and resources they need in a day.

(Save this information for final project)

Procedure: Students will estimate how much space and resources they need. (For a more scientific sample, have students record data for one or two weeks and average the data) This lesson requires previous knowledge of area, calculating area.

At home: Using a yardstick or tape measure, have students measure and record how much living space is in their home. Then have them divide this number of square feet (meters) by the number of residents in the home to calculate their own living space: _____

At school: Students can interview the principal or other professional to discover how many square feet (yards) their school is, and how many students attend their school. By dividing the number of students into the square feet (yards), they will discover their individual space requirement: _____

Commuting/play/travel: Students should estimate how much "free space" they need for activities. It is a fun investment to buy one or two foot/athletic odometers that each student can wear to get a class average of miles spent walking to school, or participating in activities. Students who play sports should include the size of fields required to support their sport. After data is gathered, aggregate the "commuting/recreation" space, divide by total in class and use an average of space for this project: _____

Food: Students should create a blank menu to record all the food they eat in one week. Then estimate how much land is required to provide that food. Remember dairy and meat require almost an acre of land to support livestock. Estimate food space: _____

*note: The Millennium Institute calculates that each person requires approximately 30,000 square feet (.26 hectares) of farmland just to produce enough food and fiber or survival.

Water: Have student keep track of all the water they use in one day. They should consult energy and usage guides on appliances to see how much water these items use. In Water, Water Everywhere, toilet and shower usage are estimated at 12 and 30 gallons respectively. Average American water consumption is estimated at 193 gallons per day. Use student's or Water, Water estimates here: _____

Garbage: Students should measure their household trash daily, using a tape measure and calculating volume: _____ and weight _____.You should also keep trash in the classroom for one week. What is the total for trash at school? _____

Record your data for individual use in the first column. Multiply individual use by the total number of students in the class for class use. Use town census numbers to estimate resources used by the town. New Haven population (1990): 130,474 (Use http://www.census.gov/main/www/srchtool.html for local census information)

	Current Individual Use	Class Use	Town Use
Home			
School			
Commute/play			
Food			
Water			
Trash			

Do students consider these numbers to be high?

Multiply "Current Individual Use" by 6 billion to discover how much space/resources are needed by people in the world this year. World population is currently growing by over 80 million people each year, and is projected to exceed six billion people in 1998.

D. Space, No problem

Objective : Students will decide if there is enough space on the planet for its population to live comfortably, using a scaled model of available living space.

Procedure: Some growth advocates argue that the world is not overpopulated because its entire population could fit in Jacksonville, Florida. (At one square foot per person.) Draw or tape a three by three foot square on the playground or classroom floor, and place 9 students in it. Consider whether the lifestyle needs of those students can be met in that space. Discuss what other needs those students have beyond room to stand. How large a "footprint" do they need at school, including desk and study space, playground space, bathroom space, lunchroom space, library space, etc.

Population and the Environment

When discussing overpopulation, its impact on the environment is the most discussed issue. While there is little debate that human population increase erodes the environment, there is a fierce debate on the impact of human numbers alone. Again, human choices affect the environment as much as sheer numbers. The debate about just how much human numbers affect the environment has long historical roots. Thomas Malthus, whose "Essay on the Principal of Population" was first published in 1798, began a debate which continues 200 years later. Malthus warned the human race was doomed because the Earth's finite resources could not support unlimited geometric population increases. Contemporary biologist Paul Ehrlich proposes population growth must be halted to avoid worldwide ecological disaster in his best seller The Population Bomb.

Since 1950, the world's population has doubled, and its economic output has increased almost fivefold. In that time, world water use, and demands for grain, firewood, beef and mutton have tripled, and fossil fuel use has nearly quadrupled. If human population is successfully limited to 12 billion, the problem of meeting human needs isn't solved. At current yields, over 3 billion hectares of arable land would be required to feed 12 billion people, and while there are 3.3 billion hectares of potentially arable land available on Earth, the economic and ecological cost of bringing it all into production is prohibitive. An effort to bring 3 billion hectares under cultivation implies an enormous loss of habitat for many entire species and for the critically important wild varieties of human food species.

There is substantial evidence of environmental destruction here in the United States. Depletion of soil, water, and fuel at a much faster rate than any of these can be replenished suggests that the carrying capacity of the United States already has been exceeded The disappearance of natural capital is continuing at a great rate and is compromising future food production. Iowa has lost 50 percent of its topsoil since the advent of farming in the nineteenth century. The drawdown of U.S. aquifers is also proceeding quickly and, so far, has led to abandonment of over 300,000 formerly irrigated acres in Arizona alone. Seventy-five percent of irrigation is threatened in Nebraska. Good air, land, water, and energy are the nuts and bolts of carrying capacity. The Carrying Capacity Network states (1991) the United States is "currently losing topsoil 18 times faster than it is being replaced; or that groundwater,...much of which we stored during the Ice Age and is nonrenewable, is currently being pumped out of the ground 25 percent faster than it is being replenished."

Close to home, here in Connecticut and along the Long Island Sound Basin, the effects of too many humans demanding too many water resources is apparent. Long Island Sound is located in the middle of one of the most densely populated regions in the United States. More than 8 million people live in the Long Island Sound Watershed. Every one of Long Island Sound's many environmental problems, from sewage and toxic chemicals to overfishing and habitat destruction, stems from its location smack dab in the middle of the most densely populated regions in the world. The Sound is a cesspool, drainage ditch, trash can, playground and food source to the millions of people who live and play in the region. For years, signs of the Sound's decline have been visible: the disappearance of dolphins, collapse of the flounder population, closure of more than on-half of its 120,000 acres of clam and oyster beds. (For a more detailed analysis of the effects of overpopulation on Long Island Sound see YHNTI Volume VII, 1997: New Haven: Your Coastal Community)

Despite this historic debate and profound evidence of man's destruction of finite natural resources, recent surveys show that Americans are less concerned about population than they were 25 years ago, and they are not connecting environmental degradation to population growth. A recent Gallup Poll showed that 78% of Americans considered themselves environmentalists and 71 % favored strong environmental protection, even

at the expense of economic growth. It seems likely that Americans are not connecting population growth to environmental problems. Too often educators may present environmental problems without examining overpopulation as an underlying cause. These two issues--overpopulation and environmental degradation--must be linked more in education and in the media.

Too often environmental issues are presented in a vacuum, without further examination of underlying causes--primarily, too many people. Educators are not the only ones to fail to present this correlation. It seems linking population to the environment is unpopular. The media also does not want to approach the moral or religious implications of managing population. News articles were downloaded from Lexis-Nexis, the world's largest database of full-text news stories (using the connector "endangered w/2 species") and searched only stories in which the search terms "endangered" and "population" appeared within two words of each other. Just over 10% of a Lexis-Nexis sample of environmental news stories link human population growth to the environmental problems it affects. Even more significantly, only one story in a sample of 150 presents the view that limiting population growth might be a solution to environmental problems.

In the last 200 years, the United States has lost 50 percent of its wetlands, 90 percent of its old-growth forests, and 99 percent of its tall grass prairie. Every day, an estimated nine square miles of U.S. rural land is lost to development. These are dire statistics which are seldom attributed to environmental pressures associated with overpopulation. This fact is not addressed in the media. It must be addressed by educators or our students may be deprived of parks and playgrounds, wildlife and wilderness, rivers and beaches, rose gardens and silence.

Activities

A. Your Community E.Q.R.

Objective: Students use a rating system to indicate the environmental quality of their community. The class will develop an Environmental Quality Rating (E.Q.R.)

Procedure: Divide students into groups of two or three. Each group will investigate one form of pollution: water, air, land, noise, littering (surface), manufacturing. Study local pollution through observation and research. Each team will list all the sources of pollution within their area of specialty. Students should research different types of pollution in their area and include the specific types of substances that cause the pollution. For example, air pollution may contain chemicals may contain lead, carbon monoxide, sulfur dioxide, and smoke. From that list students will compile an E.Q.R. score. The teams will then share and aggregate their data to get a community E.Q.R. score. This score will give students some idea of the pollution problems their community faces.

Start with 100 points. Using the following criteria, record scores for the aggregate community E.Q.R :

Subtract the following points to calculate E.Q.R. If your community has: Air Pollution

mild -2
moderate -4
severe -6

Noise Pollution

mild -2
moderate -4
severe -6

Water pollution

mild -2
moderate -4
severe -6

*subtract one additional point for every occurrence of a beach closing due to water pollution

Surface pollution

mild -2
moderate -4
severe -6

Manufacturing

mild -2
moderate -4
severe -6

If their community has a score of 100 on their E.Q.R., their community has no pollution. A score between 90 and 99 indicates mild pollution. A score between 80 and 89 indicates a moderate problem,. A score between 70 and 79 indicates an extensive problem. A score below 70 indicates their local pollution problem is severe.

What does the final E.Q.R. indicate about pollution in your community? Are these problems expected to improve or worsen? If the population in your community increases 10%, how ill it affect these conditions? If it increases 25% If it doubles?

B. A Pretty Picture

Objective: Students will identify resources they find valuable, design a collage which represents these resources and understand how important the loss of these resources are to them.

Procedure: Each student creates a collage of all natural resources they appreciate and/or use...animals, trees, water, sunsets, for example. Each student is creating a patch for a classroom quilt of individual collages. The teacher should attach the pieces with wide, clear tape (such as packing tape). Once completed, discuss all the different resources they enjoy. After the discussion, rip the collage to elicit student response at the loss of their work and these resources. How would they feel if overpopulation took away some of their favorite resource? Remind them that natural resources will disappear if population growth continues unabated.

C. Garbage Costs

Start a large classroom trashbin and create "dollars" for students to use when they deposit trash. Create a price list for disposing classroom garbage. See if students can minimize garbage, thereby saving dollars to be used toward prizes.

Population and Social Stresses

"The Tragedy of the Commons," written by Garrett Hardin 20 years ago serves as a simple, yet excellent illustration which explains some of the social stresses due to competition evident today. Competition due to overcrowding exacerbates conflict, in a neighborhood, state country or region. One person's gain is another's loss. Given one pie--be it finite natural resources or available full-time jobs--adding additional consumers must be at the expense of others.

Students should read and voice their opinions on this classic piece, "The Tragedy...": The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.

1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly + 1.

2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decisionmaking herdsman is only a fraction of - 1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another.... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy.

Each man is locked into a system that compels him to increase his herd without limit -- in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

The Tragedy of the Commons is so applicable to our students here in the United States, particularly because of welfare and other social institutions, as well as the support of the extended family. Citizens are cared for by the Commons, and if "irresponsible breeding" occurs, children are often cared for by family or by the state. But as population numbers increase and pressures on the social system are escaberated, can we be assured of government assistance? Already, many state and federal programs are refusing to support families who cannot sustain themselves. In Connecticut, a family is provided with 18 months of welfare assistance.

It is sad to say but true: if each human family were dependent only on its own resources and if overbreeding brought its own "punishment" -- then there would be no public interest in controlling the breeding of families. But our society is deeply committed to the welfare state, and is therefore confronted with another aspect of the tragedy of the commons.

One way to understand the stress increasing human numbers place on social and economic institutions is through the formula, H = R/P. This means that human condition (H) is determined by available resources (R), divided by population (P). Simply put, the more people who require a slice of any particular pie, the smaller the piece each one receives. Should resources decline or population increase, the human condition must fall. Here, in the United States, we have both--resource depletion and population increase.

This tragedy has consequences: competition for services and conflict. There are already excessive demands on public services in the United States: on education and health care, for example, two current hotly debated issues. Our healthcare debate is centered on growing demand for a finite service: who will pay for the increasing number of uninsured? There is increasing ethnic conflict in the United States as a growing population competes for finite services that must be paid for at the expense of others. There is, for example, growing hostility in the US toward legal immigration. Consider laws passed in California in 1986 which restricts access to social services and education. Citing concerns about job losses, higher taxes and demands on services, both state and federal lawmakers have passed punitive legislation targeting immigrants.

There is a social carrying capacity. People want tolerable work-to-home commuting conditions, favorable conditions for childrearing, and safe neighborhoods. Where population size detracts from the capacity to provide these amenities, overpopulation exists.

There is a strong correlation between population growth and declines in social well-being in the United States. According to the1996 Index of Social Health published by Fordham University, the social health of America stands at its lowest point in the twenty-five years since the study began. The Index of Social Health monitors sixteen factors to measure the quality of life in America: infant mortality, children in poverty, teen suicide,

drug abuse, unemployment, average weekly earnings, poverty among those over 65, homicides, food stamp coverage, access to affordable housing and the gap between rich and poor. Overall, since Fordham began to monitor these issues, America's social health has declined from an indicator scale of 74 in 1970 to 37 in 1994 - a drop of 50 percent.

Stresses on our social carrying capacity alarm many. Clinton adviser Michael Mandelbaum has said, "We have a foreign policy today in the shape of a doughnut--lots of peripheral interests but nothing at the center. The environment, I will argue, is part of a terrifying array of problems that will define a new threat to our security. This is an alarmist view shared by many. Futuristic doomsday prophesies are not reserved for the environmentalists.

Thomas Fraser Homer-Dixon, who is the head of the Peace and Conflict Studies Program at the University of Toronto, integrates the two fields--military-conflict studies and the study of the physical environment. In "On the Threshold: Environmental Changes as Causes of Acute Conflict" he predicts future wars and civil violence will often arise from scarcities of resources such as water, cropland, forests, and fish. "Think of a stretch limo in the potholed streets of New York City, where homeless beggars live. Inside the limo are the air-conditioned post-industrial regions of North America, Europe, the emerging Pacific Rim, and a few other isolated places, with their trade summitry and computer-information highways. Outside is the rest of mankind, going in a completely different direction."

Activities

A. Social Problem Scrapbook

Objective: Students will identify social problems in their neighborhood, community, town or city.

Procedure: Students can list many social ills, either witnessed in their neighborhood, or seen on the news. Brainstorm a list of problems which may include arrests, number of children living below the poverty level Ask two students to serve as "illustrators" at a white board or chalkboard. Ask the class to name all the social concerns they can think of - poverty, homelessness, hunger, drug abuse, crime, disease, etc. Ask the illustrators to list all of these. Start a large scrapbook/display where students, each day, search the newspaper for crimes committed in their neighborhood, town, city, or a nearby city. Then ask the class to identify the correlation, if any, of these social concerns and population size and growth. If the class determines that any of these issues are not related to population, ask them to detail the cause.

B. Correlating Population and Social Stresses in Connecticut

Objective: Students will create a scattergram using city population data in Connecticut and social indication data. They will graph their data and conclude that the most populated areas scored poorly using several social indicators.

Procedure: Using Connecticut's Children: A Cause For Hope (The Connecticut Association for Human Services, Hartford; sample data tables provided in Appendix), and data from the census bureau, students rate Connecticut towns and cities by population, and rate by regional indicators: child death rate, infant mortality rate, and juvenile violent arrest crime rate. Students conclude and confirm population correlates with social stress indicators. Another source of data is on the internet: the census home page (www.census.gov) Choose ACCESS TOOLS. Next choose 1990 CENSUS LOOKUP. Then choose either STF3A (for socio economic data) or STF1A (for detailed population and housing data). Choose a state. Submit. Also see the State of Connecticut home page (www.state.ct.us) Choose AGENCIES, then DEPARTMENT OF ECONOMIC AND COMMUNITY

DEVELOPMENT, then RESEARCH, then CEIS, then INCOME.

Students should plot population of Connecticut's towns and cities on the X axis, and plot one social indicator on the Y axis. Students may form teams to plot each of the social indicators, or the teacher may use transparencies placed upon one another to show correlation of population and each of the social stress indicators.

(Alternative resource) In Connecticut, students can examine data from Connecticut Magazine in its "Rating of the towns" November 1996 issue. On page 53, students will find data from which they can build bar charts to show relative crime rates, economies and education assessments. They will discover Connecticut's largest cities have the highest crime rates and their schools are rated poorest. How might population contribute to these statistics?

C. Civility's Decline

Objective: Students decide if overpopulation contributes to rudeness in their community.

Procedure: Read "No, please, after you", by David Taylor in Forbes, September 22, 1977 p.36. How might students compare Los Angeles with their own city? What conflicts do they encounter while walking or in a car because of city congestion. Are people they encounter daily pleasant? Has overpopulation in their area already affected their way-of-life? Write a persuasive letter to the editor of their local newspaper asking community citizens to be more civil.

Population and Economic Woes

The Rockefeller Commission in 1972, citing considerations such as energy and mineral resources, water supply, agricultural land supply, outdoor recreation resources, and environmental pollution, concluded that "Neither the health of our economy nor the welfare of individual businesses depends on continued population growth. In fact, the average person will be markedly better off in terms of traditional economic values if population growth slows down than if it resumes the pace of growth experienced in the recent past." The Commission closed with the recommendation "that the nation welcome and plan for a stabilized population."

Our standard of living has barely risen. In many households, two earners are needed where one formerly sufficed. Home ownership and a college education are unaffordable for many Americans. Public parks and recreational areas are deteriorating from overuse. The very poor are often "discouraged" workers, uncounted in unemployment statistics. Education, health-care, garbage-disposal, correctional, water, and highway costs have become more burdensome, while education, housing, social-service, and welfare monies are spread mere thinly. The number of poor grows constantly. More children (and a larger proportion) than before live in poverty. Homelessness appears chronic.

The costs of accommodating more people in the same amount of space and with the same amount of natural resources are escalating in our free market economy. Given limited resources, we have a fixed supply of many commodities, such as land for dumping and clean water. Costs must go up if we add more people and this will also add to the burdens of the poor. Poverty has also risen significantly in the United States in the past 20 years. Over 35 million Americans now live in poverty, including over one fifth of all US children. According to the Population Reference Bureau, there is still as strong correlation between family size and poverty. While

barely five percent of families with no children live in poverty, over 25 percent of families with three children live in poverty. Over 35 percent of all US families with four children live in poverty, while well over half of all families with five or more children live in poverty.

Not only do increased human numbers contribute to poverty because of the H = R/P, but is also affects jobs and income. The latter half of this century has seen tremendous increases in productivity and economic growth, due largely to increased mechanization and improved technology. The result of this development, however, has been a decrease in agriculture and manufacturing jobs, even as more and more workers enter the job market due to population growth. Furthermore, with the globalization of information technology, more U.S. jobs are going overseas to depressed labor markets. Jobs (R) will continue to be lost to overseas markets if our standard of living keeps wages high. Some of these job losses have been offset by increased service jobs, but often at lower wages. (R) have not increased in ratio to population (P). The result is lower wages and greater unemployment, or declining economic security (H).

Our income is dropping because of intense competition fostered by population growth. On the flip side of the economic coin, costs are escalating as well because of enhanced demand on the environment. Open land and clean water (R) are becoming scarce, again deteriorating the human condition. Garbage disposal is a hot topic. Many of us realize the supply of dumping locations is severely limited when we have to dispose of the remains of some household project or make an attempt to clean and dispose of basement "collections". In just a few years, dumping fees in U.S. cities have skyrocketed, from $5 or $10 a ton to an average of over $150. Attorney General Bleumenthal, of the state of Connecticut, is pursuing a law suit against New York because of excessive Long Island Garbage polluting Connecticut's shores.

The rising cost of water in areas that are not naturally arid makes the same point. Even if the quantity of water is sufficient, purity tends to suffer when population density grows. It costs money to keep clean or clean up. A 1992 Wall Street Journal account (Poor Pay, 1992) states that "Boston water and sewer bills have risen 39% in the past two years as the costs of cleaning up Boston Harbor have been phased into rates." In 1991, the average household paid $500 a year in water and sewer bills, and "water shutoffs as a result of nonpayment of water bills...tripled."

Activities

A. Job Search

Objective: Students compete for jobs and observe the best, most well paying jobs are the hardest to get--competition is fierce. Upon completion, students are assigned "careers" with established salaries, which will be used for the final project.

Materials:

- Index cards (2 per student)
- Bowls/containers to hold index cards
- Newspaper job listings (New York Times is ideal)
- Career brochures

Procedure: Set up a mock job fair in the classroom.

1. List jobs from local newspapers or career brochures, with description, requirements and salary on the board or on a handout. Make sure jobs vary in salary, requirements and education.
2. Divide the jobs into three categories by salary or educational requirements. For example, category 1 may include: Vice President (of a Corporate Division) Lawyer, Administrator; category 2 might include: Sales Professional, Software Engineer, Accountant or Teacher; category 3 might include Maintenance Worker, Customer Service Worker, Bus Driver or Clerk.
3. Create job qualification cards: copy each job listing from category 1 on an index card; copy each job listing from category 2 on two index cards; copy each job listing from category 3 on three index cards.
4. Have each student write the one title and description of the job they want most.
5. You should have at least two index cards for each student. Add job titles and descriptions if necessary. Maintain only one copy of each category 1 job).
6. Shuffle and pass out two cards to each student.
7. In turns, have each student write their name on the back of the card and place it in the labeled bowls or containers around the room.
8. After students have placed their qualifications card, assign one "personnel manager" who will retrieve one card from each job bowl/listing.
9. This is a permanent job listing for each student for the remainder of the unit. If a student is selected for two jobs, they get to select the one they wish to keep. If a student is not selected for any of the jobs, that student will be unemployed.
10. Students can research their job description and other requirements in The Young Person's Occupational Handbook (JIST Works, Indianapolis, IN, 1996)
11. Lead a discussion: How happy are the students with their selections? Which jobs were the hardest to get? Why?

B. Debate

Divide the class into two. From Taking Sides, Issue 19, assign each group to either argument, "yes' or "no", in "Should Pollution Be Put to the Market Test?" Have students prepare arguments for court, in which an administrator or parent is judge.

C. Budgets (home project)

At home with parents, have students develop a listing of household expenses. Refer to the assigned "occupations" to see if they could afford their present lifestyle on the assigned occupation. Propose that their electric, water, sewer and their other utility bills increase 25% because of increased demands due to an increase in the town or city's population. How would that affect their budget? Have students write a narrative how their budget would be affected and explain how they would pay for these increases.

Their Future: The Year 2010

Paul and Anne Ehrlich noted in The Stork and the Plow, "Earth can support a larger population of cooperative, far-sighted, vegetarian pacifist saints than competitive, myopic, meat-eating, war-making typical human beings. All else being equal, Earth can hold more people if they have relatively equal access to the requisites of a decent life than if the few are able to monopolize resources and the many must largely do without. The problems of population, social and economic inequity, and environmental deterioration are thus completely intertwined."

Will our students be "cooperative, vegetarian pacifists" or are they more concerned with their own welfare? Most students in their early teens are somewhat self-absorbed and competitive--with good reason; our society encourages and rewards competition. In this final project, however, students will confront a future with environmental and societal costs associated with population growth. People will be taxed on how much the government thinks they contribute to air pollution. For example, if they work in manufacturing, they will be taxed for the dirt, smoke and chemicals from the which pollutes the air. Many people commute to work, causing air pollution, water pollution, and sometimes noise pollution. Commuters will be taxed tremendously. These are additional considerations for students as they plan their future in an increasingly populated world.

Activities

A. Planning your Future (one week)

Objective: Students will plan their future in the year 2010. As this unit is prepared for eighth grade students, most will be 25 or 26 years old. They will attempt to balance a budget, with and without environmental expenses and taxes. They will include family costs and consider family planning expenses and issues. They will decide if family planning is important to them and their group. They will deduct future "creature comforts" are dependent on group efforts.

Materials:

*Occupation Card assigned (Divide salary by 12 for monthly income)
*Home Listings/Real Estate Section of Newspaper
* Household bills: Fixed: utilities, water, sewage and trash removal Variable: food, taxes, car payments, insurance/medical (collect monthly bills from four different households -remove identification)
*Spreadsheet
*Calculators
*Index (situation) cards

* Connecticut Magazine's "Rating of the Towns", November 1996, p.53 or Connecticut census data obtained when analyzing social stresses

Procedure:

1. Create "Situation Cards". Copy each (and create your own) on index cards

"There's too many people retiring. Deduct 20% of your income for additional social security."
"We now have a national health plan. Your contribution is 10% of your income. Deduct 10% from your pay"
"You commute 20 miles to work. Pay a 5% commuters tax. Deduct it from your income."
"Water pollution in your area is so bad you have to pay a private company to install a special water purification system. The cost is $6,000. You have two years to pay. Create a payment plan and add this cost to expenses."
"Welfare will end for all this month. Your salary goes up 5% because you will pay less taxes. However, because there is no where to go for help, crime is rising. You get robbed of a TV, VCR and $500 in cash. Add the 5% to your salary, but add a one-time expense of $500.00"
"There is an air pollution alert. No one is allowed out of the house for two days. You lose two days' pay. Deduct 10% from your monthly income."
"Social Security benefits will be decreased 50%. Your parent cannot make ends meet. They need to move in with you. Add $150 each month to your expenses to cover the additional costs of caring for them."
"You drive a Lexus which gets 22 miles per gallon. The government has introduced a penalty tax for cars that get less than 30 miles per gallon. You pay $20.00 for each gallon under the 30 gallon threshhold each month. Add this tax to your expenses.
"With so many pressures on social services, income tax is 50%. Deduct 1/2 your monthly income."
"With crime rising, the need for additional police requires additional property task. Add $150.00 to your expenses if you own a home"

*students should refer to figures gathered in "How Much Space Do I Need Anyway" to calculate the following:

"Your house/apartment is too big. Pay an excessive consumption tax of $7.00 for each square foot of personal living space over 120 square feet each month. Add this to your monthly expenses."
"You use too much water. You are allocated 150 gallons of water per day. You will pay a supplemental water bill of $.25 per gallon per day for each day you go over the 150 gallon limit. Multiply how much water you use each day; subtract 150 gallons. Multiply this difference by the excess fee of $.25 and multiply by 30 for a monthly estimate of this expense. Add it to your monthly expense column.
"There is no room at the land fill to take you town's trash. You have to pay a premium service to take your garbage away. It costs $5.00 per pound to haul your trash away now. Will you recycle? Start a compost? Plan how to minimize garbage and estimate how much trash you will generate. Deduct this cost from your monthly budget."

2. Organize students into groups of four or five.

3. Each student will create a "Budget Spreadsheet"

In the upper left-hand column of each student's spreadsheet, label "Income"
In the upper right-hand corner, label "Expenses" (Costs)
In the Income column, students post their monthly income earned on their "Occupation Cards".

4. Calculate adjusted gross income: Multiply monthly income by 25% for a 25% flat tax.

Deduct this 25% from net income (salary). The remaining 75% income will start student budget calculations. Post this gross income below the monthly income earned on their "Occupation Cards".

5. Total fixed monthly expenses: utilities, water, sewage and trash removal. Post these fixed expenses in the first section under expenses on their worksheet.

8. Students should subtract their fixed household bills (expenses) from their income.

9. From previous activity, "How Much Space Do I Need Anyway", students should estimate their food budget. They might want to complete this piece at home with their parents for a realistic food expense. Add this to expense column on worksheet.

10. Using Connecticut Magazine's rating of the towns, students select a town in which to live. Using the average home value, calculate a monthly mortgage at 9%. Add property tax or using the local real estate listing, select a rental property.

11. Deduct rent or mortgage, food and taxes from the income column.

12. What remains is disposable income.

13. Pass out "Situation Cards" . Students calculate their environmental adjustments to income.

14.For each child the student plans to have, itemize childcare expenses (provided by a parent or teacher), or deduct $260.00 per month.

15. Each group should total their balance. The group with the highest balance survives. Even if one individual in the group maintains a large balance, their survival is dependent upon group survival. Remind students of the "Tragedy of the Commons".

16. Students prepare an oral report with illustrations: they will describe their home, their family, and their way-of-life given their disposable income.

Worksheet Example (Given a $40,000 annual salary)

Monthly

Income	Expenses
$3,333	
- 25% income tax	
Adjusted Gross $2,600	

Fixed Expenses:

Utilities Water Sewage Removal Trash removal

TOTAL

Adjusted Income:

Food

Rent/Mortgage

Real Estate Taxes

Automobile

Insurance

TOTAL

Adjusted Income:

Environmental Costs: _ (specify costs)

TOTAL

Adjusted Income:

Childcare Expenses:

Itemize or x $260.00 per child

TOTAL
Adjusted TOTAL Disposable Income:

Glossary of Population Terms

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birth rate: the number of births per 1,000 population in a given year. Not to be confused with growth rate. birth control: practices employed by couples that permit sexual intercourse with reduced likelihood of conception. The term is often used synonymously with such terms as contraception, fertility control, and family planning. death rate: the number of deaths per 1,000 population in a given year demography: (Greek, demos [people] + graph [study]) the scientific study of human populations, including their composition, distribution, growth, other demographic and socioeconomic characteristics and the causes and consequences of changes in these factors. family planning: the effort of couples to regulate the number and spacing of births. Family planning usually connotes the use of birth control to avoid pregnancy, but also includes efforts to induce pregnancy. fertility rate: the number of live births per 1,000 women ages 15-44 years in a given year.

fertility: the actual reproductive performance of an individual, a group, or a population.

growth rate: the rate at which a population is increasing (or decreasing) in a given year due to natural increase and net migration, expressed as a percentage of the base population. infant mortality rate: the number of deaths to infants under one year of age per 1,000 live births in a given year life expectancy: the average number of additional years a person would live if current mortality trends were to continue. Most commonly cited as life expectancy at birth. migration: the movement of people across a specified boundary for the purpose of establishing a new permanent residence.

natural increase (or decrease): the surplus (or deficit) or births over deaths in a population in a given period.

population density: population per unit of land area; for example, persons per square mile or persons per square kilometer of arable land. population distribution: the patterns of settlement and dispersal of a population

population increase: the total population increase resulting form the interaction of births, deaths, and migration in a population in a given period of time.

population projection: computation of future changes in population numbers, given assumptions about future trends in the rates of fertility, mortality, and migration. rate of (natural) increase: the rate at which population is increasing (or decreasing) in a given year due to a surplus (or deficit) of births over deaths, expressed as a percentage. This rate does not include immigration or emigration replacement-level fertility: the level of fertility at which a cohort of women on the average are having only enough daughters to replace themselves in the population. By definition, replacement level is equal to a net reproduction rate of 1.0. The total fertility rate is also used to indicate replacement-level fertility. In the United States and other industrialized countries, a TFR of 2.1 is considered to be replacement level. stress: a measure of the level of concern/pain caused by not being able to meet basic human needs; may contribute to concern/pain to some not able to supply wants. urban: in the United States, "incorporated and unincorporated places of 2,500 or more inhabitants, plus the urbanized zones around the cities of 50,000 or more inhabitants." (Bureau of Census) urbanization: growth in the proportion of a population living in urban areas. vital

statistics: demographic data on births, deaths, fetal deaths, marriages and divorces.

zero population growth: a population in equilibrium, with a growth rate of zero, achieved when births plus immigration equal deaths plus emigration.

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