

World Population

Student Objective

The student:

- will be able to explain what is meant by population growth being referred to as a 'J' curve
- will be able to explain how population, energy consumption and limited natural resources are connected

Key Words:

carrying capacity
fossil fuel
J curve
momentum
population
renewable energy

Materials:

- *World Population* video produced by Population Connection
- Science Journal

Time:

½ to 1 hour

Background Information*

A graph of human population before the agricultural revolution would likely have suggested a wave, reflecting growth in times of plenty and decline in times of want, as graphs of other species and populations continue to look to this day. The graph of recent human population growth is referred to as a **J curve** as it follows the shape of that letter, starting out low and skyrocketing straight up.

World population reached 7 billion people in 2011. At the present rate of growth; nearly 80 million a year, the world adds a New York City every month, a Germany every year and a Europe each decade. The United States, with over 310 million people, is growing by more than 2.5 million people each year. At this rate, we are one of the fastest growing industrialized nations in the world, and we have the third largest population of all nations, preceded only by China and India. At 5% per year, the U.S. also has the highest teen pregnancy rate of any modern industrialized country.

With a current annual growth rate of 1.14%, world population is projected to double in just 61 years. Our doubling times will be realized *if and only if* growth rates remain constant. Today, the world's birth rate is almost three times its death rate. The closer these two rates are, the slower population growth will be.

An area's **carrying capacity** is the number of a given species that area can support without impairing its ability to continue supporting that population. People are only able to live in densely populated areas if enough space elsewhere is left much less densely populated to grow food and produce oxygen.

The impact of any human group on its environment has to do with three equally important factors. The first is the number of people. The second factor encompasses the ways in which we

manufacture goods, design communities, and use technology. The third is the actual amount of resources consumed by each person. Unfortunately, the rate at which industrialized nations consume resources makes their populations effect on the planet vastly greater than that of developing countries. Consider the following examples:

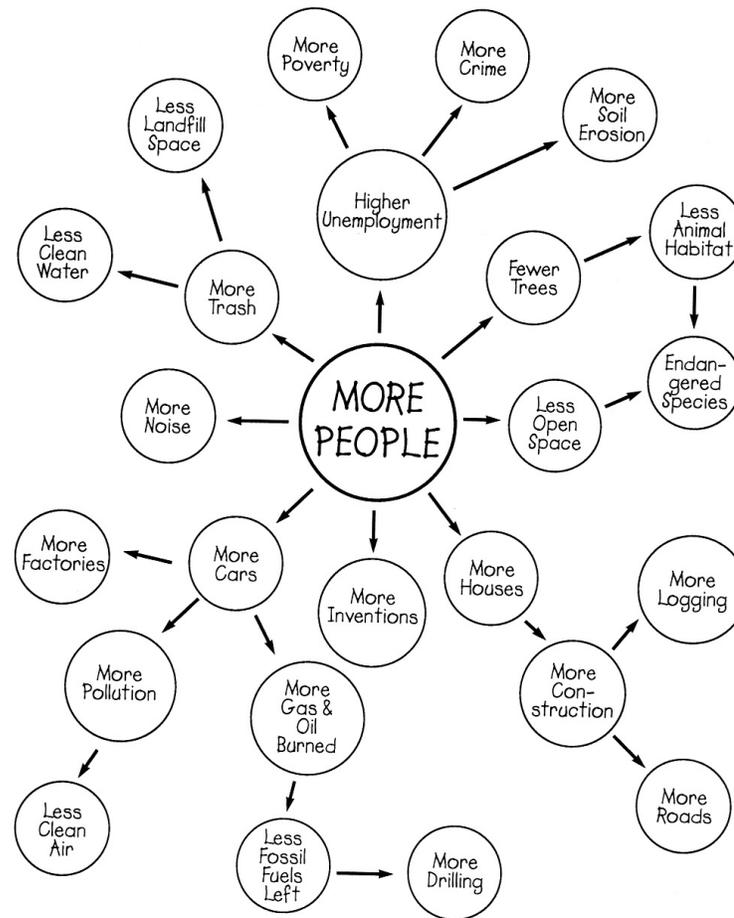
- Energy - Americans constitute less than 5% of the world's population, but are responsible for 26% of the world's annual energy consumption, including 25% of fossil fuels. On average one American consumes as much energy as 2.1 Germans, 6.9 Iraqis, 12.1 Columbians, 28.3 Indians, 127 Haitians, or 395 Ethiopians.
- Natural Resources - Industrialized countries account for only about 20% of global population, yet they consume 86% of the world's aluminum, 81% of its paper, 80% of its iron and steel, and 76% of its timber.
- Land Use - In the last 200 years the United States has lost: 71% of its topsoil, 50% of its wetlands, 90% of its northwestern old-growth forests, and 99% of its tallgrass prairie. We are currently developing rural land at the rate of 9 square miles per day, and paving over 1.3 million acres each year—an area roughly equivalent in size to the state of Delaware.
- Global Warming - In 2011, the United States was responsible for 16% of the world's carbon dioxide emissions, second only to China. Carbon dioxide is the primary greenhouse gas, responsible for 60% of global warming caused by greenhouse gases.
- Water Pollution - In the United States, 40% of all surface waters are unfit for bathing or fishing. Agricultural chemicals, eroded sediment, and animal wastes have fouled over 173,000 miles of waterways. In addition, groundwater reserves are being depleted in many regions, and overall are being used at a rate 25% greater than their replenishment rate.
- Waste - The more we consume, the more waste we produce. By the time a baby born today in the United States reaches the age of 82 years, he or she will have produced nearly 60 tons of garbage. The average resident of New York City generates 4 lbs. of solid waste each day. The average Parisian produces 2.4 lbs., while residents of Manila, Cairo, and Calcutta produce just 1.1 lbs. per day.

*Used with the permission of Population Connection: <http://www.populationconnection.org>

Procedure

1. Show the 6-minute video.
2. Allow 5 - 10 minutes for the students to complete their Science Journal.
3. Take a few minutes to discuss the video. Remind your students that historical population data and that there are 6.1 billion people on the world at the present time are **facts**. The predictions of human population in the future as well as its effects are **issues**. As with all issues, there are many different valid opinions.
4. You may wish to show the video a second time and stop it in places to discuss what is happening. The Companion Text can give you some ideas.
5. Have the class develop a concept map:
 - Write the words '*More People*' in the middle of the board.
 - Tell the students that you want them to think of what might be the environmental, economic or social impacts of there being more people. (An example would be

“more people might mean more cars on the road”. Next to more people draw an arrow and add ‘more cars’) See example below.



- Tell students that there are no right or wrong answers, but they may be asked to explain their proposed connections. Cause and effect relationships can be positive, negative or neutral.
 - Invite students to come up to the board a few at a time to add to the word web. If all the concepts seem to be negative, guide the students to see at least a few positive effects (more inventions, career opportunities, friends, parks, etc)
6. After all of the students have had a chance to contribute, lead a discussion. Ask the students “Why did I show you this video at the start of our unit about energy? What does world population have to do with energy?” Let the discussion follow the direction the students are most interested in; however, try to strike a balance by making sure positive effects (more jobs, great career potential, opportunities for new inventions, etc) are mentioned also.

Key Words & Definitions

- **carrying capacity** - the number of a given species that an area can support without

- impairing its ability to continue supporting that population
- **fossil fuel** - a nonrenewable energy source created from the remains of plants that lived millions of years ago
- **‘J’ curve** - the shape that population growth appears on a graph, starting out low and shooting straight up near the end
- **momentum**- the fact that even in countries when population stabilizes with the average being two children per woman, it can take 60 - 70 years for population numbers to stabilize. Stabilization will only occur when the percentage of elderly equal the percentage in child-bearing age
- **population** - the whole number of people or inhabitants occupying a country, region or area
- **renewable energy** - abundant fuel sources that are replenished.

Related Research

1. Population Circle - An action activity where students simulate the population of the world from AD 1500 to 2000, helping students to realize that most of our growth occurred in the past 200 years. This activity can be found on the Population Connection website at: <http://www.populationeducation.org/content/population-circle>

Related Reading

- *A Quick Trip to 7 Billion* (poster) by Population Connection (2011)
On one side of the wall chart is a timeline of historical events, inventions and social movements that have affected birth and death rates over the past 200 years. The other side of the wall chart shows the challenges we face as a growing global family—from meeting our basic human needs to the delicate balance of natural ecosystems.

Internet Sites

<http://www.populationconnection.org>

Population Connection site contains current population events and actions, teacher resources, and internet publications

<http://www.census.gov/popclock/>

US Census Bureau, population clock

<http://www.prb.org/>

Population Reference Bureau, worldwide data and current population issues

https://www.ted.com/talks/kevin_kelly_tells_technology_s_epic_story#t-248436

Ted Talk with Kevin Kelly on the history and impact of technology throughout human history.

<http://worldpopulationhistory.org/>

Population Connection’s interactive time line. Explore population, food/agriculture, health, environment and science and technology.

World Population

1 A.D.	The world population in 1 A.D. is about 170 million. Agriculture has advanced to the point where farmed land is producing 50 times more food than unformed land. As a result, large permanent settlements are developing in places where the climate is good and land is fertile, often along river banks and near deltas. These early settlements of people were much smaller and spread out than present day cities.
Roman Empire	At this time the Romans control a highly developed empire. At one point Rome has an estimated million residents, but by 476 the Roman empire will splinter and fall. By then, there are an estimated 190 million people worldwide.
India's Golden Age	Under the Gupta Dynasty (320-335 A.D.), India takes a prominent role in world culture, science and the arts that lasts well into the 5 th century. Population starts its upward surge in Asia.
Mayan Empire	Around 550 A.D., the Mayan Empire was flourishing in Central America. Its epicenter was their most famous city, Chichen Itza.
Islam	A new religion, Islam, develops in the Middle East. Religious fervor and increased trade contribute to Islamic expansion.
Vikings	Both the Vikings and the Anasazi cliff-dwellers in the Southwestern region of the Americas reach their cultural peak now. The dots in Central and South America represent the Incas, Aztecs, Mayans, and Toltecs.
Crusades	Wars between Moslem and Christian armies in southeast Europe and the Middle East went on for 200 years. By 110 world population had grown to 320 million
Mongols in China	First war, then disease, cuts China's population in half, as indicated by the disappearance of dots.
Plague	The Bubonic Plague travels from Asia to the Middle East and finally arrives in Europe. It spreads most quickly there because that is where population density and crowding are the highest, which are the conditions under which contagion is most dangerous. In a period of

five years, one-fifth of the world's population, 75 million people, are lost to the disease. This is the only point during the film where population growth is negative—it drops by 10 million between 1300 and 1400, from 360 to 350 million. But as you can see, the dots disappear and reappear almost immediately. It took only 20 years to return to pre-plague population levels.

New World	The great boat migration to the New World begins soon after Christopher Columbus stumbles upon North America. The New World potato dramatically expands European food production and, as a result, its population.	
Colonial America	In the Americas, Old World diseases cause widespread death amongst native residents, delaying population expansion until the 18 th Century.	
Industrial Revolution	The 18 th and 19 th Centuries bring advances in food production, water supply, sanitation, transportation, and disease control. These advances enable people to live longer, and population, as a result, reaches 1 billion in 1830.	
1930	Two billion	(Icons representing the World Wars, Modern Medicine, and the Information Age appear quickly during these segments)
1960	Three billion	
1975	Four billion	
1987	Five billion	
1999	Six billion	
2030	About 8.2 billion, only a few years from now. The largely unpopulated areas show environments that can't currently support a large human population, like the deserts of Africa and Australia, or the fragile tundra of Canada.	

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World Population

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Grade 7														
Earth Structures	# 6	SC.7.E.6						X						
Interdependence	# 17	SC.4.L.17			X									
Social Studies Standards	Sixth Grade: SS.6.G.3.2													
Language Arts Standards	Sixth Grade: LAFS.6.SL.1.1 Seventh Grade: LAFS.7.SL.1.1 Eighth Grade: LAFS.8.SL.1.1													

Sixth Grade Benchmarks

Language Arts–Standards for Speaking & Listening

- LAFS.6.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 6 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

Social Studies–Geography

- SS.6.G.3.2 - Analyze the impact of human populations on the ancient world’s ecosystems.

Seventh Grade Benchmarks

Science–Big Idea 6: Earth Structures

- SC.7.E.6.6 - Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

Science–Big Idea 17: Interdependence

- SC.7.L.17.3 - Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.

Language Arts–Standards for Speaking & Listening

- LAFS.7.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

Eighth Grade Benchmarks

Language Arts–Standards for Speaking & Listening

- LAFS.8.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

