World Population

Note: This activity is intended for advanced and/or upper elementary students.

Student Objectives
The student:
- can explain how population, energy consumption and limited natural resources are connected
- will list renewable and non-renewable energy sources.

Key Words:
fossil fuel
J curve
population
renewable energy

Materials:
- *World Population* video (see Internet Sites section for link)

Time:
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' 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 is currently at 7.3 billion, and is expected to reach 8.5 billion by 2025. 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 320 million people, is growing by more than 2.3 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.

With a current annual growth rate of 1.1%, world population is projected to double in just 63 years. However, this doubling time 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 Iraquis, 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 1996, the United States was responsible for 23% of the world's carbon dioxide emissions, more than any other country. Our per capita emissions are greater than every country except the United Arab Emirates. 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

Note: It is extremely important that after showing the video you lead a discussion that stresses positives--career opportunities, the positive effects of having more people in your school/neighborhood/town/county, and the positive things that can be done by individuals to make our world a better place for everyone. Young students can easily feel helpless by overwhelming negative images, so care must be taken to balance the message and empower them.

1. Show the 6-minute video.
2. Take a few minutes to discuss the video. Remind your students that the **facts** are the historical population data presented and that there are 7.6 billion people on the world at the present time. 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.

3. Ask the students what this video has to do with energy and energy use. Students should understand that every living thing on the planet needs energy to live, and that more people means we have to share the available energy with everyone. Remind your students that in some areas of the world people have less technology and use less energy than people in our country do. Follow with a line of questions--
   - in some areas of the world families don't have refrigerators, but they are starting to be available....should they be able to have one?
   - in some places they don't have televisions, but would like to have one....should they be able to have one?
   - Continue this line of questioning with other items the students take for grated like computers, cell phones, video games, etc.
   - End the list of questions with cars.

   Note: don't be surprised if some students answer 'no' to some of these questions. If that happens, ask them why. They may even have a good answer (i.e. my parents say that too much television is bad for me). Students should ultimately see that they don't have the right to tell other people what they can and cannot do....even if walking may be healthier for them then than riding in a car.
4. Explain to the students that the United States is 5% of the world's population, but we use 25% of the world's resources. Draw two pie charts on the board to show the difference between these two percentages. Ask the students if everyone in the world wants to have and use the technology that we have and enjoy (refrigerators, cars, computers, etc), where is the energy going to come from? *(We would need approximately 5 Earths!)*
5. Steer the discussion into ways we can have enough energy for everyone. Things to include in the discussion are:
   - conservation of resources (if we don't need to use as much then there is more to share with others)
   - recycling (recycling uses less resources than making new)
   - reusing (we live in a very throw-away society!)
   - renewable energy sources (these can be expanded even as our nonrenewable resources are shrinking).
   - thinking of things in a new way–new housing solutions, transportation solutions, food production, etc.
   - new inventions

   During this discussion let the students brainstorm...almost no answer is wrong! If a student suggests harnessing electricity from lightning (or something similar)...respond with something like "What a great new invention.....and it's your generation that will be the ones to invent it!"
   - When a student says something like 'pump more oil' or 'dig up more coal', tell them that at present, we are digging/pumping just about as fast as we can. And, even if we could extract more of these resources faster, they are finite–non-renewable–and not a good solution for the future. We don't know when, but if we keep using these resources as quickly as we are now, someday they will become very scarce and very, very expensive.
6. On the board write 'Renewable Resources' and 'Non-Renewable Resources'. Have the students volunteer to come up and list a resource under one or the other column. Prompt

them as needed until the major resources are listed. (You may want to let them use two colors–one for resources we currently use, and one for the futuristic ideas they brain-stormed.)

- Renewable Resources - solar, wind, hydropower (dams and tidal), geothermal, biomass (wood, corn, etc), waste material (methane from garbage dumps), food, water, oxygen
- Non-Renewable Resources - oil (includes gas and diesel), coal, nuclear fuel, natural gas, minerals

Key Words and Definitions

- **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
- **population** – the whole number of people or inhabitants occupying a country, region or area
- **renewable energy** – bundant fuel sources that can be replenished

Further Research

1. Do the activity *Timber!* from Population Connection, **https://populationeducation.org/sites/default/files/timber.pdf** which contrasts arithmetic growth with geometric growth and relates it to supply and demand.
2. Currently in the U.S. the number of motor vehicles per 1000 inhabitants is 910 (this includes children and infants!). In China the number is 154, similar to our national rate in the early 1900s when motor vehicle use was fairly rare. As China modernizes, more of its citizens are planning to purchase a vehicle. How will the Earth supply enough energy for all the cars? Have students research in groups the new cars being produced that use less fossil fuels (electric/gasoline hybrids, plug-in electric vehicles, hydrogen fuel cell vehicles) with each group reporting on one of the new technologies. The groups should then present their findings to the class using visuals (posters, slide shows, manufacturers brochures, etc). Included in their presentations should be the vehicles range (miles before refueling), price and what areas of the country the vehicle is available. The class can then 'vote' on their favorite car/new technology.
3. What can young students do to make a difference in our very large world? Watch a few of the videos on Lynne Cherry's website Young Voices for the Planet, **https://www.youngvoicesfortheplanet.com/youth-climate-videos/**. Have the students discuss the videos and brainstorm ways that they can make a difference, either as a class or individually. Pick a project and begin working on it!

Related Reading

- ***Earth's Growing Population*** by Catherine Chambers (Heinemann-Raintree, 2009) This book takes an important world-wide issue and makes it easy to read, understandable

and engaging. Each section also includes teacher ideas, writing prompts, discussion starters and community service project ideas.

- ***The Earth's Resources: Renewable and Non-Renewable*** by Rebecca Harman (Heinemann, 2005)
  This book includes information on renewable and non-renewable resources and suggestions on how we can use fewer nonrenewable resources--using photos, diagrams and relatable facts and figures.

Internet sites

https://vimeo.com/130468614

World Population video with 'dots' to show population growth in millions from 1CE to present.

http://worldpopulationhistory.org/map/1/mercator/1/0/25/

Interactive website lets you explore different times in history as they related to the themes of Food & Agriculture, Health, People & Society, Environment, and Science & Technology.

https://www.census.gov/popclock/

US Census Bureau, population clock

http://www.populationconnection.org/poped/

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

http://www.prb.org/

Population Reference Bureau, worldwide data and current population issues

World Population

Florida NGSS Standards & Related Subject Common Core

			.1	.2	.3	.4	.5	.6	.7	.8
Grade 4										
Earth Structures	**Big Idea 6**	**SC.4.E.6**			X			X		
Interdependence	**Big Idea 17**	**SC.4.L.17**		X		X				
Language Arts Standards	**Third Grade:** LAFS.3.SL.1.1 **Fourth Grade:** LAFS.4.SL.1.1 **Fifth Grade**: LAFS.5.SL.1.1									

Third Grade Benchmarks

Language Arts–Standards for Speaking and Listening

- LAFS.3.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

Fourth Grade Benchmarks

Science--Big Idea 6: Earth Structures

- SC.4.E.6.3 - Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.
- SC.4.E.6.6 - Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy).

Science–Big Idea 17: Interdependence

- SC.4.L.17.2 - Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.
- SC.4.L.17.4 - Recognize ways plants and animals, including humans, can impact the environment.

Language Arts–Standards for Speaking and Listening

- LAFS.4.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

Fifth Grade Benchmarks

Language Arts–Standards for Speaking and Listening

- LAFS.5.SL.1.1 - Engage effectively in a range of collaborative discussions with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

National Next Generation Science Standards

Third Grade Standards

Note: Related Common Core Language Arts Standards are listed in the Florida section above.

Fourth Grade Standards

Earth and Human Activity

- 4-ESS3-1 - Obtain and combine information to describe that energy and fuels are derived from natural resources and their use affect the environment.

Note: Related Common Core Language Arts Standards are listed in the Florida section above.

Fifth Grade Standards

Note: Related Common Core Language Arts Standards are listed in the Florida section above.