

Our Exploding Population

6th grade Pre-Sly Park Experience Activity

Content Standards:

- NGSS
MS-ESS3-3 Earth and Human Activity
Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4 Earth and Human Activity
Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Objectives:

- Become aware of the rapidly rising human population.
- Understand the relationship between population growth and (a) the availability of food and other resources and (b) the generation of waste and pollution.
- Be able to suggest mechanisms by which such problems as food shortages and environmental problems related to the population growth can be monitored and minimized.

Background Info for Teachers:

If possible, go online to www.worldmeters/info/world population/#pastfuture.

At the dawn of the Age of Agriculture, after approximately 50,000 years of Homo Sapien history, world population stood at 5 million. A slow and gradual growth pattern lasted until the Age of Industry, at which point population growth accelerated rapidly, a pattern that continues to this day. Major landmarks are outlined below.

DATE	POPULATION
8000 BC	5 million
1 AD	250 million
1000 AD	250 million
1500 AD	500 million
1800 AD	1 billion
1927 AD	2 billion
1960 AD	3 billion
1974 AD	4 billion
1987 AD	5 billion
1999 AD	6 billion
2011 AD	7 billion
2025 AD	8 billion

2050 AD	9.5 billion
2075 AD	10.5 billion
2100 AD	>11 billion

Note the interval between successive billions. It took the whole of human history up until 1800 AD to reach a billion; 127 years for the next billion; only 12 years for the increase from 6 to 7 billion. The population of China, India and the USA is now bigger than the population of the earth was as recently as 1960. Such increases have put a strain on the earth's food supply (as well as other resources) while generating huge levels of waste and pollution. This has led to increased competition for resources and indeed consequent hostilities across the globe as people fight for an ever smaller slice of the pie. A pie, in fact, which is unequally divided between different regions of the world. While food production has increased, it has not matched the population growth. A major component of the food supply, fish stocks, have probably reached their maximum sustainable production - with some stocks having already collapsed. We are in danger of exceeding the earth's carrying capacity (the number of people the Earth is capable of supporting). Consequently, there is an urgent need to monitor and minimize the impact of this growth on the environment.

Materials:

- A clearly marked area approximately 1 meter x 2 meters. A rope can be used to enclose a corresponding circular area to make this more representative of the Earth.
- 30 small blocks/coins, etc. to represent available food or other resources. In the case of food, each cube or coin represents a daily meal for the population. More coins will be needed to represent waste/pollution if the extension activity is completed.

Procedures:

Anticipatory Set

Earth's population grew very slowly for the first 50,000 years of Homo Sapien's existence up until the dawn of the industrial revolution. As a general rule, the population did not put an undue strain on our natural resources or systems. Since about 1800 AD the Earth's population has increased dramatically, to the extent that we might be approaching or even exceeding the carrying capacity of our planet.

Time

Approximately 45-60 minutes. Another 15 minutes for the extension activity. Additional time can be used to discuss monitoring techniques and ways to minimize impacts.

Each student represents 500 million (0.5 billion people).

Discuss environmental problems until a student mentions humans or population growth. Then explain how you are going to show how population growth is a problem. Proceed through each date outlined in the background information. Until 1500 AD there will be nobody in the rectangle or circle designated to represent the Earth because the population is below 500 million. Then, as numbers increase, have the students move into this area (and stand still!) until the area is insufficient to contain the population: carrying capacity has been exceeded. This simulation is very dramatic. Adjust the rectangle or circle size if you find it is too large or small

Students return to their seats. After a discussion, proceed to the second part of the simulation. This will show the effect of population growth on available food (or indeed other resources). Proceed through the dates in the background information section, as done in the initial activity. As students go into the rectangle or circle, give them 3 blocks/coins or other items, each one of which represents a daily meal. Start with thirty items. As population increases above 5 billion (10 students each representing 0.5 billion) the food runs out (3 meals per person per day). As the population continues to increase, students will either have to reduce their own food intake (by giving away blocks/coins/other items) to create a more equitable distribution of food or, if they choose not to do so, additional students joining the rectangle or circle will starve. Arguments may break out mirroring real life situations involving resource scarcity. Providing one cube or coin or other items to additional students beyond the 5 billion is indicative of an increase in the food supply (due to improved yields/ technological developments/more area being turned over to agriculture, etc.) Instead of starving the additional students are merely malnourished! Have students return to seats and discuss the above, including ways of correcting or minimizing the impact or a resource shortage.

Extensions and Evaluations:

- Go through the same simulation but this time representing waste or pollution. Each student is given 3 cubes/coins/other items to represent their share of waste or pollution. Students will understand that increasing the population will also increase resource use, waste or pollution. As the population increases beyond, for example, 7 billion, give extra cubes/coins/other items to the students joining the rectangle or circle. These represent the inability of the environment to cope with the extra waste or pollution generated and indeed perhaps the breakdown of the earth's natural systems.
- Have a Town Hall meeting to deal with the above problems
- Check for understanding of the above concepts by oral or written questioning.