ScienceNews
EDUCATOR GUIDE

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December 17, 2022 & December 31, 2022

Human Population Hits a Milestone

SOCIETY FOR SCIENCE

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Human Population Hits a Milestone

About this Guide

The world population has reached 8 billion people, according to the United Nations. In this Guide, students will learn about how the human population has grown over time and how it is projected to grow in the future, then analyze a graph of world population data. In a quick activity, students will think about how a growing human population might impact various industries and how changes at the national or international level might help those industries support a larger population.

This Guide includes:

Article-based Comprehension Q&A — Students will answer questions about the *Science News* article "The world population has now reached 8 billion," which explores trends in human population growth. A version of the article, "Human population hits a milestone," appears in the December 17, 2022 & December 31, 2022 issue of *Science News*. Related standards include NGSS-DCI: HS-ESS3; MS-ESS3.

> **Student Comprehension Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

Cross-curricular Discussion Q&A — Students will explore a graphic representation of trends in the size of the global human population and analyze the importance and implications of projected data. Learning Outcomes: Reading and interpreting graphs. Related standards include NGSS-DCI: HS-ESS3; MS-ESS3.

> **Student Discussion Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

Science Bite Activity — In this quick activity, students will brainstorm the effects of population growth on industries such as agriculture and medicine, then will work collaboratively to come up with changes at the national or international level that will help those industries support the growing population. Related standards include NGSS-DCI: HS-ESS3; MS-ESS3.

> **Student Activity Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

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Article-based Comprehension, Q&A

Directions for teachers: Ask students to read the online *Science News* article "The world population has now reached 8 billion," which explores trends in human population growth. A version of the article, "Human population hits a milestone," appears in the December 17, 2022 & December 31, 2022 issue of *Science News*.

1. How many people were estimated to live on Earth as of November 15, 2022, according to the United Nations?

Eight billion people.

2. How might the global population change over time according to U.N. projections?

The United Nations projections show that the global population will continue to grow, but the rate of growth will slow.

3. When will the global population peak, and what number will it peak at?

The global population is projected to peak at around 10.4 billion people in the 2080s.

4. How is the new peak estimate different from the previous estimate? Why do you think the estimate changed?

The new estimate of 10.4 billion people is about 0.8 billion fewer people than the previous estimate of 11.2 billion people. The estimate probably changed because the rate of population growth has changed since 2017.

5. Does global population growth mean that every country and region will see their populations grow? Explain.

No. Some countries will find that their populations grow while others will experience decreases in population size based on a variety of factors. According to the United Nations, the populations of 61 countries and regions are predicted to decline by 1 percent or more between 2022 and 2050.

6. What does United Nations official Maria-Francesca Spatolisano say about the effects of population growth on the environment? Who does she say is largely responsible for managing those effects?

Population growth puts more stress on the environment and natural resources. Developed countries that consume the most resources are most responsible for offsetting that stress.

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Student Comprehension Worksheet

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Cross-curricular Discussion, Q&A

Directions for teachers:
Ask students to read the *Science News* article "The world population has now reached 8 billion" and answer the following questions. A version of the article, "Human population hits a milestone," appears in the December 17, 2022 & December 31, 2022 issue of *Science News*.

Note that should you want to include additional questions and information about computer simulations in this discussion, check out the "Defining simulations" section of the lesson plan "The significance of simulations."

Want to make it a virtual lesson? Post the online *Science News* article to your virtual classroom. Discuss the article and questions with your class on your virtual platform.

Population on a global scale
1. What does the graph included in the story show, according to the graph title? What is measured on the y-axis and x-axis? What are the units of measure and what increments are represented by each mark on the axes?

The graph shows the estimated global population from 1950–2100. The global population is measured in billions on the y-axis, and time is measured in years on the x-axis. As you move up the y-axis, the population increases in increments of 2 billion. On the x-axis, time is represented in increments of 10 years.

2. What do the colors of graphed lines represent? How was each line obtained, and why were the various lines included in the graph, according to the article? Choose a point on the line and describe the data it represents. Don't forget to include appropriate units.

The dark gray line represents the observed global population from 1950 through 2021. These data are obtained from global population information gathered from previous years. The light gray lines represent global population projections. The projections are made by computer simulations and rely on many factors. The red line, which represents the median projection, is shown to summarize the different global population projections. From the graph, it appears that in 2000 there was a global population of about 6.1 billion people.

3. Use the graph to calculate the average rate of change per year from 2000 to 2020. Use the graph to calculate the median projected rate of change per year from 2060 to 2080.

From 2000 to 2020, the change is about 1.8 billion, or 0.09 billion per year. From 2060 to 2080, the median projected rate of change is about 0.4 billion, or 0.02 billion per year.

4. How would you describe the general trend in data that you see on the graph? How does the rate of change differ from observed to projected values?

There is a general upward trend in the global population until about 2080. The slope of the red line from 2022 to 2100 is not as steep as the line from 1950 to 2022, indicating that the growth rate might slow over time.

Extension: Think about different mathematical functions you know and use one in your description of the overall trend.

The overall shape of the graph looks like a natural logarithmic function.

5. Why do you think the graph is included in the article?

The graph is an easy way to show a reader the global population trend over time. It consolidates data collected by the United Nations into an easy-to-understand picture, as well as supports the claim that the world population has reached 8 billion and may peak around 10.4 billion in the 2080s.

Processing projections

1. How do you think the United Nations calculated the observed global population?

The United Nations likely collected data on the number of people in different regions and countries, estimating to fill certain data gaps as needed, and adding it all up to find the sum.

2. What factors do you think went into creating the computer simulated population projections? Brainstorm a list.

Some factors that were gathered for regions and countries were likely: life expectancy (perhaps influenced by several factors such as disease prevalence, poverty level, education rate, income), current population growth rate (probably determined by death rate and birth rate, and perhaps fertility rate), projected immigration and emigration rates, etc.

3. What happens to the range of the samples of projections as the dates go further into the future? Give specific data points to support your answer.

The range of population projections increases. In 2050, the projected population ranges from about 9.2 billion to about 10.1 billion, a difference of 0.9 billion. In 2100, the projected population ranges from about 8.5 billion to about 12.2 billion, a difference of about 3.7 billion.

4. How would you expect the uncertainty of the projections to change as the dates extend further into the future?

Predicted data becomes more uncertain as future years get further away from the current year. Each population projection builds on a predicted, uncertain value in the previous year.

5. Why do you think the United Nations found it worthwhile to project the global population? Why might it be beneficial to include many of the projections on the graph?

The global population projections can help inform future decisions about global issues. Including many projections in the graph sets out different possible scenarios to consider and emphasizes to the reader that there is uncertainty in the projected data.

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Student Discussion Worksheet

Directions: Read the *Science News* article "The world population has now reached 8 billion" and answer the following questions as directed by your teacher. A version of the article, "Human population hits a milestone," appears in the December 17, 2022 & December 31, 2022 issue of *Science News*.

Population on a global scale

1. What does the graph included in the story show, according to the graph title? What is measured on the y-axis and x-axis? What are the units of measure and what increments are represented by each mark on the axes?

2. What do the colors of graphed lines represent? How was each line obtained and why were the various lines included in the graph, according to the article? Choose a point on the line and describe the data it represents. Don't forget to include appropriate units.

3. Use the graph to calculate the average rate of change per year from 2000 to 2020. Use the graph to calculate the median projected rate of change per year from 2060 to 2080.

4. How would you describe the general trend in data that you see on the graph? How does the rate of change differ from observed to projected values?

Extension: Think about different mathematical functions you know and use one in your description of the overall trend.

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Processing projections

1. How do you think the United Nations calculated the observed global population?

2. What factors do you think went into creating the computer simulated population projections? Brainstorm a list.

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5. Why do you think the United Nations found it worthwhile to project the global population? Why might it be beneficial to include many of the projections on the graph?

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Science Bite Activity: Preparing for Population Growth

Directions for teachers: This quick activity asks students to think about the possible effects of population growth, as reported by the United Nations and covered in the *Science News* article "The world population has now reached 8 billion." Students will then choose different industries and think about how population growth would impact the industry and how the industry might impact future population growth. They will consider changes at the national or international level that might support the growing population.

Consider coordinating with other science teachers to teach this interdisciplinary lesson, which lends itself to combining students from biology, earth science and environmental science classes. You could even collaborate with teachers outside of the sciences, such as in economics or history.

Thinking across disciplines

1. Brainstorm a list of ways that a growing human population can affect society and the planet. Think about both positive and negative effects. Which groups of people and industries (for example, agriculture or medicine) do you think will be most affected by population growth and why?

Student answers will vary.

2. Choose one industry to focus on and write a few sentences to summarize how population growth will affect the industry. Could the choices made within the industry also impact population growth? Explain.

Student answers will vary.

Collaborating across industries

1. Working with a classmate who focused on a different industry in the previous question, come up with a change that might be implemented on a national or international level that might help the industries support the needs of the growing population. Explain how your recommendations would impact each industry and people more broadly.

Student answers will vary.

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Student Activity Worksheet: Preparing for Population Growth

Directions: Read the *Science News* article "The world population has now reached 8 billion" and work with a classmates to answer the questions below. A version of the article, "Human population hits a milestone," appears in the December 17, 2022 & December 31, 2022 issue of *Science News*.

Thinking across disciplines

1. Brainstorm a list of ways that a growing human population can affect society and the planet. Think about both positive and negative effects. Which groups of people and industries (for example, agriculture or medicine) do you think will be most affected by population growth and why?

2. Choose one industry to focus on and write a few sentences to summarize how population growth will affect the industry. Could the choices made within the industry also impact population growth? Explain.

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1. Working with a classmate who focused on a different industry in the previous question, come up with a change that might be implemented on a national or international level that might help the industries support the needs of the growing population. Explain how your recommendations would impact each industry and people more broadly.

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