Human populations through time

Focus questions	How can we meet the demands for food of a growing population? How might humans increase the earth's carrying capacity?
Learning target	Students begin to develop a sense for the earth's carrying capacity and how humans have impacted it.
Vocabulary	Carrying capacity

LS2.A: Interdependent Relationships in Ecosystems

Performance expectation HS-LS2-1	Classroom connection: Students begin to identify and describe the components in the given mathematical and/or computational representations (e.g., trends, averages, histograms, graphs, spreadsheets) that support current explanations of factors that affect carrying capacities of ecosystems at different scales. The components include: i. The population changes gathered from historical data.

Science and engineering practices

Using Mathematics and Computational Thinking	Classroom connection: Students begin to use given mathematical and/or computational representations (e.g., trends, averages, histograms, graphs, spreadsheets) of ecosystem factors to identify changes over time in the numbers of humans in countries of different sizes.

Disciplinary core ideas

LS2.A: Interdependent Relationships in Ecosystems	Classroom connection: Ecosystems have carrying capacities. Students begin to use mathematics and computational thinking to determine how humans have impacted carrying capacity.

Cross-cutting concepts

Scale, Proportion, and Quantity	Classroom connection: Students begin to analyze and use the given mathematical and/or computational representations: i. To identify the interdependence of factors (both living and nonliving) and resulting effect on carrying capacity; and ii. As evidence to support the explanation and identify the factors that have the largest effect on the carrying capacity of an ecosystem for a given population.

NOURISH THE FUTURE

Phenomenon

1. Begin the unit by asking students "How can we meet the demands of a growing population?" Gather information from them about what those demands are.
2. Show students the video at:
   worldpopulationhistory.org/map/2050/%20mercator/1/0/25/
3. Have students brainstorm questions individually for 30 seconds to one minute after the video is over, then share their questions within small groups (3-4 students) for two or three minutes. Have groups share their questions one-by-one until all questions are shared. Keep note of the questions, as they will guide the rest of this unit. Possible questions:
   - What impacts human population growth?
   - How many people are added in a minute?
   - How many people are added in our state?
   - How many people are added in the United States?
   - Where are all of these people?
   - What is the rank of countries by population?
   - Why are some countries growing faster than others?
   - What are the effects of this growth?
   - What effects do the growth of human populations have on ecosystems?
   - Do we have enough food?
   - Can we grow enough food?
   - When did we grow so large as a human population?

   If no one brings up food or food production, add your own questions: Do we have enough food to feed everyone? Where are the people and where is the food? How can we feed over 9.5 billion people in 2050, and what happens along the way?

   To begin investigating these questions, organize them into categories that students can investigate.

   To invesitgate the impacts on population growth, use the student sheet with these additional questions.

See these resources for additional information:
- ourworldindata.org/world-population-growth
- worldpopulationhistory.org/map/2050/mercator/1/0/25/
- theworldcounts.com/counters/shocking_environmental_facts_and_statistics/world_population_clock_live

Use Lesson 1: Population Growth to begin to address some of the student questions.

Student handout

Essential questions: What causes a population to grow in nature?
Are the same factors at work in human populations?

1. List the factors that cause populations in nature to grow.

Possible answers: Birth rate/death rate of a population, life span, abundant food, plentiful water, space to expand/find shelter, lack of predators, disease

2. What factors from above also apply to human populations?

Possible answers: Birth rate/death rate of a population, life span, abundant food, plentiful water, space to expand/find shelter, lack of predators, disease

3. What additional factors impact human population growth?

Possible answers: Access to natural resources to build shelters, create conveniences (industrialization); money/poverty; education; access to health care/family planning; religion; infant/child mortality; life expectancy; social/cultural norms (expectations of family size, women in workforce, children needed to work, etc.)

4. What are the factors that affect both populations in humans and populations in nature?
   Create a Venn diagram or other infographic to illustrate this.

5. Choose one of the above factors to research. What effect does it have on the growth of human populations (increases or decreases)? Provide specific evidence to back up your claim.
   Be prepared to explain your reasoning to others.