

LESSON 1: INTRODUCTION TO FOOD SECURITY

 THE BIGGER PICTURE

Food security is a foreign concept to many Americans. Most believe that chronic hunger and malnutrition happens only to people in developing nations or to the homeless. In reality, 1 in 6 people in America go hungry every day and are not food secure. To some students, food insecurity is a reality, therefore this is a subject that must be approached with great sensitivity and care. Throughout the lesson students will develop and refine their understanding of food security using online resources, videos and class discussion to help guide their thinking. This concept is the introduction to the unit and will be addressed in future lessons associated with the unit, so it is important that the students get a solid understanding of the concept. They are able to compare different countries and analyze what food security issues they have based on the three pillars using global statistics. The lesson ends by introducing students to the UN council meeting that will take place at the end of this unit, and answering questions to prepare for it in the *Building Your Case* worksheet.

 OBJECTIVESWhat students learn

Food security is defined by 3 pillars, and it is influenced by many factors including poverty, geography, society, climate, and politics. 11% of all people worldwide go hungry each day. This is a complex, global problem that needs addressed in *their* lifetime.

What students do

Students create their own definition of food security using knowledge from class discussions. They apply statistics to compare and contrast food security in countries around the world and collaborate with team members to investigate one country with food insecurity.

 TIME

50 minutes - 1 class period

 STANDARDS

- NGSS PE: HS-LS2-1; DCI: LS2.A; SEP: Mathematics and Computational Thinking; CC: Scale, Proportion, and Quantity
- NGSS PE: HS-ESS3-1; DCI: ESS3.A; SEP: Constructing Explanations and Designing Solutions; CC: Cause and Effect
- NGSS PE: HS-ESS3-3; DCI: ESS3.C; SEP: Mathematics and Computational Thinking; CC: Influence of ETS

 PREREQUISITES

Students should have a basic understanding of middle school mathematics - percentages, ratios, and proportional relationships.

 BEFORE CLASS

Gather materials: Optional whiteboard for discussion; index cards numbered 1-10, map of the world; [world hunger map](#); [Food Security Vocabulary PowerPoint](#); 3 Pillars PowerPoint; Building your Case worksheet; Further Background section (below). All of the *Modeling Sustainable Food Systems* resources are on the SEE website: see.systemsbiology.net.

 TEACHER INSTRUCTIONS

You will be using a few online, interactive maps to help students understand the overwhelming number of people who are undernourished and food insecure around the world. The following data comes from the UN's World Food Program using their most recent data from the Food and Agricultural Organization (FAO). Your challenge is to take global statistics and translate it to the number of students. It would be beneficial to read the Further Background section (below) before teaching this.

Hunger statistics that can be used for this activity

- Globally - 795 million hungry people of a population of 7,300 million = 11 %
- USA proportion of undernourished <5%
- North Korea (Democratic People's Republic of Korea) proportion of undernourished = 42%
- South Korea (Republic of Korea) proportion of undernourished <5%
- Dominican Republic proportion of undernourished = 12%
- Haiti proportion of undernourished = 53%

1. Warmup: Show Food Security Vocabulary PowerPoint. Have students hypothesize what they think "food security" means. There is no right or wrong answer at this point. They can write their thoughts in a notebook or share outloud. *Do not give them the correct definition yet!*
2. Before introducing the lesson, pass out an equal number of index cards labeled 1-10, one per student. Extra student(s) can be employed as counters during the activity. If you have more than 10 students, make additional cards numbered 1-10.
3. Display a map of the world on your projector. Give the students the global hunger statistics and have them determine which combination of cards distributed equals 11%. This equates to about 1 in 10 students or 2 in 20 students that go hungry each day. Students with a "1" or "2" raise their hands depending on the number of students in your class.
4. Ask students to predict what the % of undernourished people is in the USA or Canada. Tell them 4% is a high estimate and have them determine which combination of cards distributed that equals 4% (less than 1 in 10 people, ~1 in 20 people).
5. It isn't always about geographic location; countries with certain policies/politics/geography all influence food security. The United States even has problems with hunger. Point out two sets of countries that share common borders such as Haiti and the Dominican Republic, or North and South Korea. You can use any combination of countries of your choosing off of the [FAO's World Hunger Map](#).

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TEACHER INSTRUCTIONS CONTINUED

- Continue having students determine which combination of cards distributed equals the % undernourished in those countries.
- Display the high resolution UN World Hunger Map (<http://www.wfp.org/content/hunger-map-2015>) and ask if students see any patterns. Hypothesize a few reasons these patterns may exist. At this point, many issues/ideas should begin to surface (political system, geography, state of the country's economy, infrastructure, climate, etc).
- Discussion: there are a number of things that keep people from having enough food. What are some things that prevent them from getting enough food? When students start listing ideas, link them to the categories of "food availability", "food access", and "food use" *but don't yet reveal the definition of food security.*
- Show the 3 Pillars PowerPoint ask the students to brainstorm (in pairs) the factor inhibiting food supply demonstrated on each slide.
- Ask the students to revisit their definitions of food security following slide 8. Is there anything they want to change or add? Proceed to slide 9, which outlines the main questions we need to think about when evaluating food security, and then review the 3 pillars of food security and the World Summit of 1996 definition with the class on slides 10 and 11.
 - Food availability: sufficient quantities of food available on a consistent basis
 - Food access: having sufficient resources to obtain appropriate foods for a nutritious diet
 - Food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation
- Start a discussion: of the countries we looked at, do you think these countries are missing all of these pillars? Can you be food secure and only have 2 pillars? Students should recognize that, even if a country is missing one pillar, it would still be considered food insecure.
- Lead a class discussion to **come up with a class definition of food security**, and then compare that to the definition from the World Food Summit (3 Pillars PowerPoint, Slide 11). Lead the class into the idea that food security is not just an American issue, but worldwide, and is not just about growing more food or eliminating poverty.
- Formative assessment: Open the Food Security Vocabulary PowerPoint. Is the answer to food security simply growing more food? Justify your answer. Students will revisit their answers in Lesson 3.
- Hand out the Building your Case student document and complete questions for Lesson 1. Split students up into up to 3 groups to represent 3 different countries - North Korea, Namibia, and Haiti. If you have less than 25 students, split up students into 2 groups and choose 2 countries. Within those country groups, students should split up into smaller groups of 3-4 to complete the Building Your Case questions each day. To save time, Lesson 1 questions (country research) can be assigned as homework.

BUILDING YOUR CASE ACTIVITY

Students now recognize that many countries around the world, including the United States, suffer from food insecurity. You and your students will be using the *Building your Case* student and teacher documents at the end of each lesson in this curriculum series. This activity will guide students through the process of investigating a food insecure country and creating a proposal to aid the UN in solving the crisis in that country. Each lesson will introduce more information to students pertaining to the global food crisis and sustainable food production. After learning new material in each lesson, students will apply it to questions in the *Building your Case* worksheet.

MATH EXTENSION ACTIVITY

This optional extension activity (~15 minutes) gives students the opportunity to practice calculating percentages and growth rates and recognize the implications of population growth on food security. This activity should follow step 11 in the teacher instructions.

- Remind students that currently 11% of the global population is undernourished.
- Open link to Figure 1 from Resources and select "world" from the dropdown menu. Either explain the graph or allow students to gather information from the key and figure summary.
- Using the figure, have students determine the percent growth of the Earth's population from today to 2050.
- Using this % increase and current hunger trends, how many hungry humans will there be in 2050?

Example Calculation:

- Current global population: 7300 million
- Projected global population in 2050: 9500 million
- What is the percent increase in population?
- $(9500 - 7300)/7300 * 100 = 30\%$ increase

Example Calculation

- Current % hungry people globally: 11%
- Projected global population in 2050: 9500 million
- Number of hungry people: $9500 * 0.11 = 1045$ million (approximately 3x USA population)

- Is this an exaggerated or conservative value? Explain.

FURTHER BACKGROUND

Food security is a complex sustainable development issue, linked to health through malnutrition, but also to sustainable economic development, environment, and trade. There is a great deal of debate around food security with some arguing that:

- There is enough food in the world to feed everyone adequately; the problem is distribution.
- Future food needs can - or cannot - be met by current levels of production.
- National food security is paramount - or no longer necessary because of global trade.
- Economic Globalization may, or may not, lead to the persistence of food insecurity and poverty in rural communities.
- Increasing food production to meet future population demands may or may not lead to increased negative environmental impacts.
- Climate change may or may not make agricultural production more difficult
- Issues such as whether households get enough food, how it is distributed within the household and whether that food fulfills the nutrition needs of all members of the household show that food security is clearly linked to health.

Agriculture remains the largest employment sector in most developing countries and international agriculture agreements are crucial to a country's food security. Some critics argue that trade liberalization may reduce a country's food security by reducing agricultural employment levels. Concern about this has led a group of World Trade Organization (WTO) member states to recommend that current negotiations on agricultural agreements allow developing countries to re-evaluate and raise tariffs on key products to protect national food security and employment. They argue that WTO agreements, by pushing for the liberalization of crucial markets, are threatening the food security of whole communities.

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RESOURCES

- SEE website: see.systemsbiology.net
 - Food Security Vocabulary PowerPoint
 - 3 Pillars PowerPoint
 - Building your Case Worksheet
- FAO's World Hunger Map: <http://www.fao.org/hunger/en/>
- UN World Hunger Map: <http://www.wfp.org/content/hunger-map-2015>
- Source of Statistics: UN's World Food Program (<http://www.wfp.org/>)
- Figure 1: UN Department of Economic and Social Affairs (<https://esa.un.org/unpd/wpp/Graphs/Probabilistic/POP/TOT/>)
- Reliable websites students can use to research their country information:
 1. <https://www.cia.gov/library/publications/the-world-factbook/>
 2. <http://data.worldbank.org/country>
 3. <http://data.un.org/CountryProfile.aspx>
 4. <http://wits.worldbank.org/CountrySnapshot/en/NAM/textview>
 5. <http://www.fao.org/faostat/en/#country/93>
 6. <http://www.fao.org/faostat/en/#country/116>
 7. <http://www.fao.org/faostat/en/#country/147>

FOOD SECURITY MODULE ICON KEY



Infer global patterns and trends in food insecurity using geography



Apply math and statistics to quantify relationships and population parameters



Examine relationships between geography, climate, and politics and food security



Collaborate with peers through group activities and class discussions



Synthesize information from online resources to propose solutions



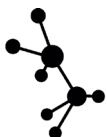
Examine and analyze case studies through video clips to inspire innovation



Present and defend opinions and/or findings to an audience



Propose a plan for creating and evaluating a food production system



Use systems thinking to infer effects of perturbations within a system



Design and construct a model to demonstrate systems biology concepts



Compile information from text to make inferences and draw conclusions



Evaluate the impact of decisions and solutions on global processes and societies



Apply cost-benefit analyses and business strategies to sustainably support the economy

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BUILDING YOUR CASE

Globally, one in nine people in the world today (795 million) are undernourished. The vast majority of the world's hungry people live in developing countries, where 12.9% of the population is undernourished. Throughout this lesson, you will be the voice for one of these countries, where they so desperately need a solution to the food crisis. You will be preparing a proposal for the United Nations (UN) that clearly describes your country's plan to eradicate food insecurity, and will present it to the UN council at the end of this unit. You will answer the following questions after learning more information in each lesson. This will help you build your case.

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You and your group are representatives of the following country _____

Fellow country representatives _____

With your smaller team of country representatives, collect background information about your country:

1. Annual rainfall _____
2. Current population size _____
3. Land area _____
4. Population density (people per square kilometer) _____
5. Population growth rate _____
6. Exports (price and main materials) _____
7. Imports (price and main materials) _____
8. Per capita income _____
9. Political issues _____
10. Cultural and/or religious notes _____
11. Main transportation and any difficulties _____
12. Land use _____
13. Water resources and use for agriculture _____
14. Fertilizers (use, import/export) _____
15. Current environmental issues _____
16. Staple food crop and dietary preferences _____
17. Primary crop production _____
18. Primary type of farming _____
19. Land area dedicated to growing crops (compared to other land use) _____
20. Biomes _____
21. Climate _____
22. Other notes: _____

LESSON 2: CRITICALLY EVALUATING FOOD PRODUCTION TECHNIQUES

1. You just investigated various strategies for growing food. Based on your country's demographics and needs, which growing technique would you choose? Justify your answer. Questions to consider: does the system rely on resources that are limited? How does the system deliver food to people?
2. Where and how will the system be used? Are their limited resources such as water or adequate healthy soils? Explain your answer.

LESSON 3: WHO CARES? STAKEHOLDERS!

1. Which stakeholder are you representing? _____
2. As a stakeholder, you care about the outcome of the decision to solve the food security crisis in your country as it will affect you in a number of ways. Do you believe we can simply grow more food to solve this issue in your country? Explain.
3. After meeting with the other stakeholders in your country, were you able to come to a consensus about whether or not simply growing more food would solve the crisis in your country? If so, how did you come to that conclusion? If not, what were some of the points of disagreement?

