

INGREDIENTS OF THE FOOD SYSTEM

LESSON PLAN

Overview

Estimated lesson time: 120 minutes

Before this module, we recommend students become familiar with the vocabulary definitions for this module. Refer to vocabulary builders for suggested activities.

- 15 min Introduction**
Brainstorm and discussion
Students will reflect on the roles and meanings of food in their lives. They will also share their prior knowledge about the food system, including stages along the supply chain, the people involved and the relationships with health, justice and the environment.
- 20 min The food system**
Supply chain activity and lecture
Students will be given partially completed diagrams depicting the supply chains of several common foods. In groups, they will attempt to fill in the missing stages. The lecture that follows will introduce food systems, stages in the supply chain and the people involved.
- 30 min Food, health, justice and the environment**
Lecture and discussion with graphic organizers
The lecture will cover relationships between food, health, justice, animal welfare, and the natural and built environments. Students will take notes on graphic organizers. Alternatives to the dominant, industrialized U.S. food system will be briefly introduced.
- 35 min Visualizing the food system**
Group poster design and presentation
In groups, students will create posters depicting their vision of the food system, then present their work. Students will refer to their graphic organizers from the preceding lecture.
- 10 min Systems thinking**
Lecture and discussion
The lecture will cover the value of systems thinking.
- 10 min Reflection**
Think-pair-share
Students will respond to quotes about the food system.

Essential questions

Essential questions¹ point to the big ideas of a module. They can be discussed, written on the board and posed on essays and exams.

- Why study the food system?
- How is food connected to health, justice and the environment?
- What is the value of systems thinking?
- What is my role in the food system? How do I affect, and how am I affected by, the food system?

Learning objectives

Students will be able to:

- Reflect on their own relationship with food;
- Illustrate the food supply chain from field to plate;
- Describe the relationships between food, public health, social justice, and the natural and human environments.

Materials

Educators must provide:

- Poster paper
- Drawing materials

Available on the *Teaching the Food System* website:

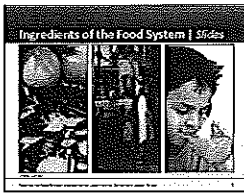
- Background reading, intended to brief educators on the concepts covered in this module but also suitable as a reading assignment for students
- Slides
- Student handouts:
 - *Food supply chain: Washington apple*
 - *Food supply chain: U.S. broiler chicken*
 - *Graphic organizer: food, health and justice*
 - *Graphic organizer: food and the environment*

15 min Introduction

Brainstorm and discussion

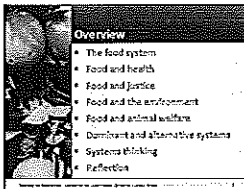
Students will reflect on the roles and meanings of food in their lives. They will also share their prior knowledge about the food system, including stages along the supply chain, the people involved and the relationships with health, justice and the environment.

Note: Instructions to the educator are written in italics; talking points to students are written in plain font. Talking points are not intended to be delivered verbatim—we expect educators will adapt them to best suit their audiences.



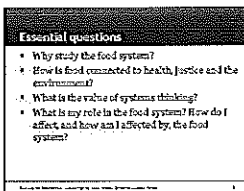
Title slide

- In this lesson, you will:
 - Reflect on the roles food plays in your lives;
 - Learn the steps involved in bringing food from farm fields to consumers' plates;
 - Explore the relationships between food, health, justice and the environment and depict them on posters and graphic organizers.



Overview

- *Briefly indicate some of the topics that will be covered.*



Essential questions

- These questions point to the big ideas of this module.
- *Give students a few moments to read the essential questions. Notify them that they may be used after the lesson as exam or essay questions.*

Roles and meanings of food

- Food holds many meanings and serves many roles. Why is food important to you? What does it provide you? What meanings does it hold for you? What roles might it serve for other people, and what meaning might it hold for them? *List student responses on the board.*
- At its most basic level, food is a source of nourishment, without which we would cease to function.
- On a global scale, nations depend on food for political stability.²
- Among the one in six people worldwide who lack adequate access to food,³ it may be viewed as a rare and precious commodity. Others who enjoy access to an abundant food supply may take it for granted; in many parts of the world, consumers and food industries discard it in great quantities.⁴
- Beyond its biological roles, food has deep social meaning; it can serve as a mark of culture, values or taste, a gathering point among communities or a chance to reinforce relationships.^{5,6}

- On a personal level, food and emotion are closely tied.⁷ Food may provide temporary relief from anxiety, depression, loneliness and boredom.⁷ Feelings of joy and other positive emotions may inspire healthier, more pleasurable eating experiences.⁷
- These examples illustrate just a few of the ways that food is an integral part of human lives. We all experience food, if for no other reason than because we all consume it. Our relationship with food, however, extends far beyond the act of eating.

Field to plate

- Food takes a complex journey from its origins on on farm fields, ranches, rivers, oceans and other sources to consumers' plates. What activities are involved around food? Who are the people directly and indirectly involved in these activities? *List responses on the board.*
- The activities in the journey from **field to plate**, including the people and resources involved at each stage, are called the **food system** or **supply chain**.

Health, justice and the environment

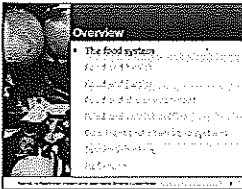
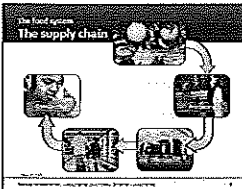
- How is food connected to health, social justice and the environment? Consider the parts of the environment that are important to our food supply. *List student responses on the board.*
- These related ideas—food, its roles and meanings, the people and activities involved in it, and its relationships with the public's health, social justice and the environment—fall under the study of the food system. What do you think might be the value of studying the food system?

20 min The food system**Supply chain activity and lecture**

Students will be given partially completed diagrams depicting the supply chains of several common foods. In groups, they will attempt to fill in the missing stages. The lecture that follows will introduce food systems, stages in the supply chain and the people involved.

Supply chain activity

- Divide students into groups of three or four. Provide each group with one of the two Food supply chain handouts (the U.S. broiler chicken handout is the more challenging of the two). Completed versions of these handouts are depicted in the slides.
- What happens to an apple before it arrives on our plates? What about a broiler chicken (a chicken raised for its meat)?
- Students will discuss in groups, then depict the supply chains of their assigned foods on their handouts. The first and final steps of the supply chain are given. Instruct students to use as many boxes and arrows as they deem necessary to connect the first and final steps. Students are not expected to know all the steps at this time.
- When groups have finished working, ask several groups to present their results to the class.

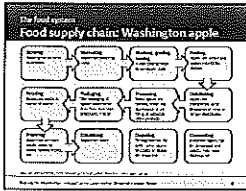
Lecture**Overview: The food system****The supply chain**

- Major stages along the food supply chain include:
 - Production, which includes growing crops and raising animals on land and in water;
 - Processing, which is the transformation of foods and raw ingredients into products for consumers,⁹⁻¹⁰ using techniques such as heating, cooling, mixing and packaging;
 - Distribution, which involves transporting and storing food and food ingredients;
 - Retail, or selling food;
 - Consumption, or eating;
- Various forms of waste—such as spoiled and uneaten food, and human and animal bodily wastes—are generated from these activities. These wastes can be discarded or recycled back to the land to help produce more food.



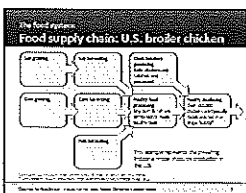
People in the food system

- Who are the people involved at each stage of the supply chain?
- From field to plate, food passes through the hands of producers (including farmers, ranchers and fishermen), processors, transporters, warehouse operators, retailers, consumers and waste handlers.
- All of us, regardless of occupation, are connected to food because we all consume it.



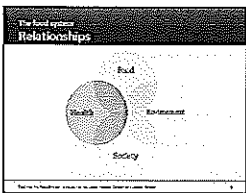
Food supply chain: Washington apple

- Guide students through each of the steps along the supply chain of an apple.¹ Skip over details where appropriate.
- Compare this supply chain to the one generated by students.



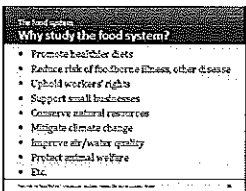
Food supply chain: U.S. broiler chicken (2 slides)

- Guide students through each of the steps along the supply chain of a U.S. broiler chicken.² Skip over details where appropriate.
- Compare this supply chain to the one generated by students.



Relationships

- The stages along the supply chain do not occur in a vacuum.
- They depend upon parts of the natural environment, such as soil, freshwater and countless organisms.
- People and organizations, including businesses, policymakers, nonprofits and ordinary citizens, influence the supply chain.
- In turn, the activities taking place along the supply chain affect, both positively and negatively, human health, society and the natural environment.
- The study of the food system encompasses all of these interrelated parts.



Why study the food system?

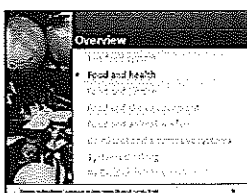
- Through understanding—and working with—the food system, health advocates, researchers, policymakers, business owners and otherwise engaged citizens can foster positive changes, such as:
 - Promoting healthier diets;
 - Reducing the risk of foodborne illness and other diseases;
 - Upholding workers' rights;
 - Supporting small businesses;
 - Conserving natural resources;
 - Mitigating climate change;
 - Improving air and water quality;
 - Protecting animal welfare.
- Compare this list to the one generated by students during the introduction.

30 min Food, health, justice and the environment
Lecture and discussion with graphic organizers

The lecture will cover relationships between food, health, justice, animal welfare, and the natural and built environments. Students will take notes on graphic organizers. Alternatives to the dominant, industrialized U.S. food system will be briefly introduced.

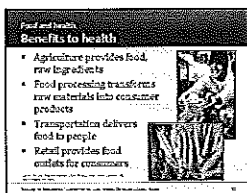
- Provide each student with a copy of the handouts, *Graphic organizer: food, health and justice* and *Graphic organizer: food and the environment*.
- During the following lecture, students will listen for the information they will need to complete their graphic organizers.

Food and health



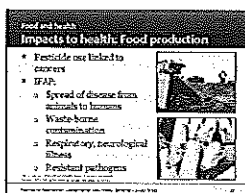
Overview: Food and health

- What do you think are some of the ways the food system can affect health?
- Refer to the list that was generated during the brainstorm.



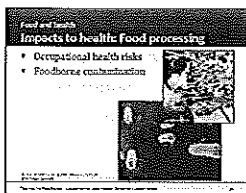
Benefits to health

- The food system is essential to health for the obvious reason that we depend on a safe and adequate food supply to survive.
- Globally, agriculture—the production of food and goods through growing crops and raising animals—provides the vast majority of the raw foods and ingredients that form the basis of our food supply.¹¹
- Food processing—the practices used to transform raw plant and animal materials into products for consumers⁸⁻¹⁰ —can extend the availability of certain foods and reduce the risk of foodborne illness.^{9,12-15}
- To deliver food to hungry consumers, it must be transported. Densely populated cities, in particular, may not be able to feed themselves without relying on food produced on remote farmland.¹⁶
- Finally, food outlets, such as supermarkets, schools and farmers’ markets, may provide consumers with access to a wide variety of food choices.



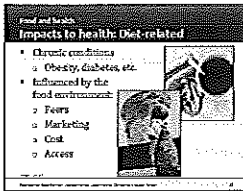
Impacts to health: Food production

- Each stage of the food system, from field to plate, can produce activities that are detrimental to health, such as:
- The use of chemical **pesticides**, a practice common in the industrial model of agriculture in the United States, poses health risks (including various cancers) to farm workers and consumers.¹⁷⁻¹⁹
- The prevailing approach to raising animals for meat, eggs and dairy is called **industrial food animal production (IFAP)**.²⁰
 - Potential health harms associated with IFAP include the spread of disease from animals to humans, a risk that is increased by crowding many animals into **concentrated animal feeding operations (CAFOs)**.²⁰
 - Animal waste, known to harbor **pathogens** (disease-causing organisms) and harmful chemicals, may contaminate air, water, soil and the food supply.²⁰
 - Gases and other airborne materials arising from stored animal waste can cause respiratory and neurological illnesses in IFAP workers and nearby communities.²⁰
 - The routine use of antibiotics, primarily to promote animals' growth,²⁰ can foster the generation of antibiotic-resistant pathogens, which can cause human infections that are difficult or impossible to treat.²⁰⁻²⁷



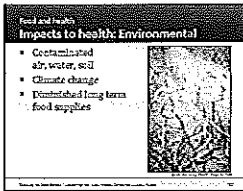
Impacts to health: Food processing

- Slaughtering animals and meat processing can present additional risks to workers' health and the safety of the food supply.
- Injuries in the food processing industry as a whole are among the highest in any job category.²⁸
- The scale of the current food processing industry contributes to foodborne illness outbreaks; as processing plants become larger, they handle greater volumes of products—sometimes from many different sources—and distribute them over a broader geographic area.²⁸ This practice increases the risk of widespread exposure to contaminated products.²⁸
- The conditions under which food is transported, stored and prepared can also contribute to foodborne illness.^{29,30}



Impacts to health: Diet-related

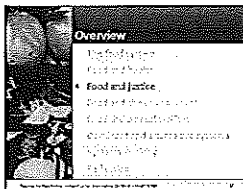
- Food and diet are major determinants of health.
- Rates of obesity³¹ and diabetes³² have risen to epidemic proportions in the United States. Heart disease, obesity, diabetes and other related conditions are among the leading causes of death.³³⁻³⁵
- In general, Americans eat too many **nutrient-poor** foods made with **refined grains**, added fats and added sugars; and too few **nutrient-dense** foods like fruits and vegetables.^{36,37}
- These dietary patterns are not solely determined by individual will. External factors may play a considerable role; these include the influence of family and peers, food advertising, the cost of food and physical access to food stores—all part of what has been called the **food environment**.³⁸



Impacts to health: Environmental

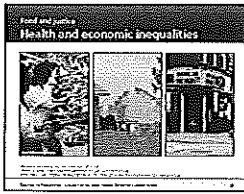
- Many of the health harms and benefits of the food system are the indirect result of its effect on the environment.
- Some of the health harms described above result from contaminated air, water and soil.
- Climate change, for example, is generally viewed as a major threat to **public health, equity, food security, freshwater supplies and ecosystems**.³⁹⁻⁴³
- Impacts to the environment that diminish the long-term viability of the food supply have downstream effects on nutrition.

Food and justice



Overview: Food and justice

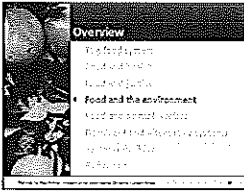
- The harms and benefits of the food system are not equally shared.^{31,44}
- What do you think are some of the health and economic inequalities in the food system?
- *Refer to the list that was generated during the brainstorm.*



Health and economic inequalities

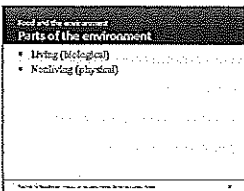
- Certain segments of the population, particularly low-income, minority and immigrant communities, bear a heavier burden of health risks associated with food production and processing.^{18,45-51}
 - *1st photo:* Workers in U.S. meat and poultry processing plants often suffer health risks, poor working conditions and labor violations.⁵²⁻⁵⁴ These jobs are often held by migrant workers who are willing to accept low wages and poor working conditions.^{28,55}
 - *2nd photo:* Rural residents living near IFAP facilities and places where concentrated manure is sprayed (pictured) may be forced to cope with odors, respiratory health harms and other nuisances.
- Some communities may have less access to healthy food stores in their neighborhoods, potentially putting the residents at greater risk for diet-related diseases.^{56,57} The price of some foods may also be a barrier to adopting healthier diets among lower-income families.⁵⁸⁻⁶⁰
 - *3rd photo:* Corner stores (pictured) generally sell fewer nutritious foods and offer them at relatively high prices.⁶¹⁻⁶³
- These and other disparities illustrate the significance of equity, or fairness, in the food system—sometimes called food justice.⁶⁴

Food and the environment



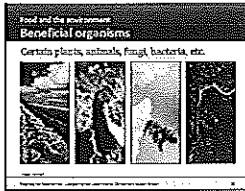
Overview: Food and the environment

- What do you think are some of the ways the food system can affect, or be affected by, the environment?
- *Refer to the list that was generated during the brainstorm.*



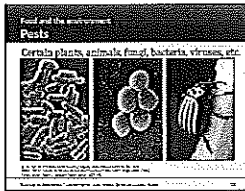
Parts of the environment

- The term *environment* refers to the living (biological) and nonliving (physical) components of our surroundings. We frequently use it to refer to natural and human environments, such as farms, rivers, oceans, forests and the organisms that inhabit these places.
- The term ecosystem is also sometimes used to refer to the organisms living in a place, their physical environment and all of the interactions within.⁶⁵



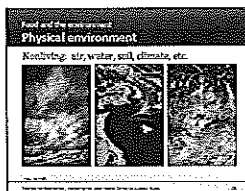
Beneficial organisms

- Living organisms play essential roles in providing our food supply.
- We directly depend on domesticated animals and crop plants for food.
- Countless wild organisms play supporting roles in farming, ranching and other forms of food production.
- Certain birds, insects, fungi and bacteria, for example, perform essential functions such as pollination, controlling pests or providing crops with the necessary nutrients for growth.
- Greater **biodiversity**—the genetic diversity among these domesticated and wild organisms—promotes a more abundant and stable food supply.^{17,66,67}



Pests

- Not all organisms are beneficial from a human perspective. The term *pest* refers to any organism that threatens human interests.⁶⁸ The definition for what is considered a pest is subjective.⁶⁸
- In agriculture, common pests include certain plants (weeds), insects, fungi, bacteria and other organisms that can kill crops or interfere with their growth. Ironically, the technological solutions designed to control agricultural pests, including certain insecticides and herbicides, sometimes cause health and environmental harms.^{17,69}
- Certain bacteria, viruses and other pathogens can also infect animals or contaminate food, potentially posing dangers to human health. The science of protecting the food supply from viral, bacterial and other forms of contamination is called **food safety**.



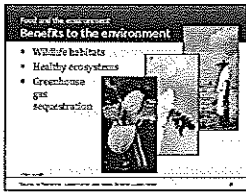
Physical environment

- Nonliving parts of the environment include air, water and **climate**, all critical to food production.
- Most of our food supply depends on soil and the organisms living within it.¹¹
- **Climate**—the overall weather conditions over a long period of time—is a major factor in determining the type and quantity of foods that can be produced in a region.



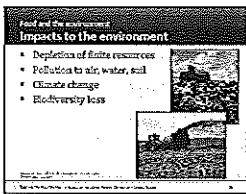
Built environment

- Not every part of the environment is “natural.” Human-made surroundings, sometimes called the **built environment**, include homes, schools, stores, neighborhoods, cities, and the roads and railways that connect them.
- The built environment has a strong effect on what people eat. The type and distribution of food stores in a community are often associated with the diets of residents and their health.⁷⁰ People who live in areas with limited access to healthy food tend to have poorer diets, and they suffer more from obesity and diabetes.⁷¹⁻⁷³
- Buses and other means of transportation can play an important role in improving access to healthy food outlets.⁷⁴⁻⁷⁶



Benefits to the environment

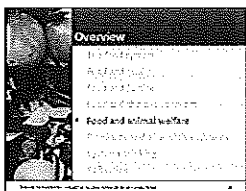
- Living and nonliving parts of the environment are affected, both positively and negatively, by the activities along the food chain.
- Well-managed agriculture, for example, can provide habitats for wildlife,⁷⁷ sequester **greenhouse gas** emissions that contribute to climate change⁷⁸ and foster healthy ecosystems.



Impacts to the environment

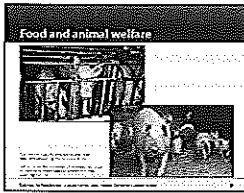
- Both living and nonliving parts of the environment are affected, both positively and negatively, by the activities that take place along the food chain.
- Food production, for example, can degrade finite natural resources^{11,79-81} and negatively impact biodiversity, climate and water quality.^{17,82-84}
- Various forms of waste are generated during food production, processing, distribution, retail and preparation.^{4,85,86}
- All of these stages require energy use,^{87,88} particularly at the household level.⁸⁹
- Depending on the source, energy use can contribute to climate change, fossil fuel depletion, poor air quality and other harms.⁸⁸
- Many of these environmental harms also negatively impact human health.
- Practices in the food system can also have beneficial effects on the natural environment. Well-managed agriculture, for example, can provide habitats for wildlife⁷⁷ and sequester greenhouse gas emissions that contribute to climate change.⁷⁸

Food and animal welfare



Overview: Food and animal welfare

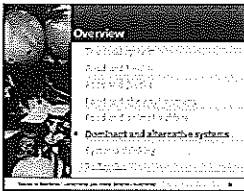
- What do you think are some of the ways that animals are affected by the ways they are raised food?



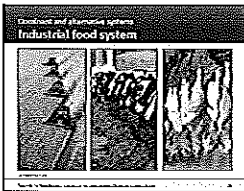
Food and animal welfare

- Depending on how they are raised, some food animals are subjected to physical and emotional harms, and are restricted from performing many of their natural behaviors.²⁰
- Others are raised primarily on pastures, where they are free to exhibit natural behaviors. Compared to animals in the IFAP system, pasture-raised animals show fewer signs of stress.⁹⁰

Dominant and alternative systems

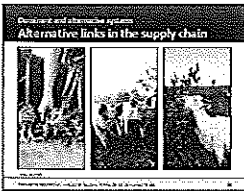


Overview: Dominant and alternative systems



Industrial food system

- Many of the health, environmental and social harms described here result from practices associated with the dominant U.S. food system. We refer to this as the industrial food system.
- Industrialization is not, however, inherently harmful and has in some respects greatly increased efficiency within the food system.^{91,92}



Alternative links in the supply chain

- Alternative parts of the supply chain, such as organic farming, pasture-based livestock systems and other forms of agriculture that strive to be more **sustainable**, may reduce or minimize some of the harms associated with the industrial system.
 - These practices may promote public health, uphold social justice, reduce pollution, conserve biodiversity, minimize the depletion of finite resources or protect animal welfare.¹⁷
- Alternative forms of processing, distribution, marketing and retail can be seen as part of the small but growing efforts to build **local and regional food systems**.⁹³
 - These may support smaller farmers,⁹³ strengthen local economies⁹³ and allow consumers to connect with the origins of their food.^{94,95}
 - In some cases, local and regional food distribution may reduce the energy use and climate impacts associated with transport, though smaller shipments may result in efficiency losses.^{96,97}

- *Give students several minutes to finish filling out their graphic organizers.*
- *Students will revisit their graphic organizers during the next activity.*
- *These can be collected at the end of the lesson and used to assess students' participation.*

35 min Visualizing the food system

Group poster design and presentation

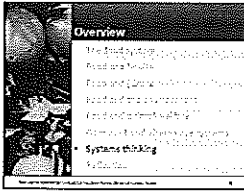
In groups, students will create posters depicting their vision of the food system, then present their work. Students will refer to their graphic organizers from the preceding lecture.

- *Divide students into groups of three or four. Provide each group with a sheet of poster paper and drawing materials.*
- *Instruct groups to draw a poster depicting their vision of the food system and, more importantly, the relationships between each part. Students can use a combination of words, pictures and symbols.*
- *Encourage students to include the relationships they noted in their graphic organizers.*
- *Allow students 25 minutes to work on their posters, and then invite several groups to present their posters to the class. Encourage groups to identify and explain the relationships between parts of the food system depicted on their posters.*

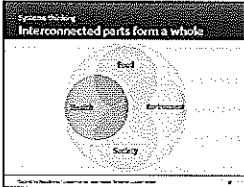
10 min Systems thinking

Lecture and discussion

The lecture will cover the value of systems thinking.

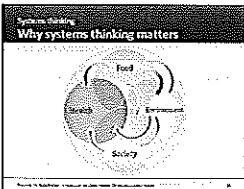


Overview: Systems thinking



Interconnected parts form a whole

- The food system and its relationship with health, society and the environment form a larger, interconnected whole.
- An understanding of how these connected parts are related, and how changing one part might affect the others, is essential to any attempt to foster change in the food system.
- Can you think of scenarios in the food system where thinking about the relationships within a system might be helpful in preventing or solving problems?



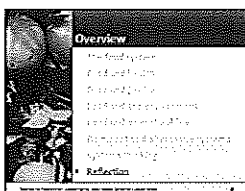
Why systems thinking matters

- Sometimes, methods for addressing a problem are devised without considering how those solutions might affect other parts of a system. When the complexity of systems is not taken into account, unpredicted and undesired outcomes often result.
- The heavy reliance on agricultural chemicals is an example of a practice that may provide short-term benefits (fewer pests and greater crop growth, for example) alongside more indirect harms to health and ecosystems, such as elevated cancer risks¹⁷ and polluted waterways.^{83,84}
- Harms arising from the food system might be prevented or reduced by better accounting for the numerous and complex connections between food, health, society and the environment.
- An effective approach would likely involve partnerships between many different stakeholders in the system, including farmers, policymakers, scientists, industries and citizen groups.
- Are there other scenarios in which thinking about the relationships within a system might be helpful in preventing or solving problems?

10 min Reflection

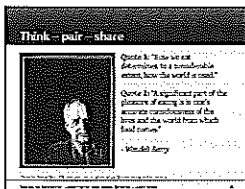
Think-pair-share

Students will respond to quotes about the food system.



Overview: Reflection

- Have students pair up. Assign each pair one of the questions that follow.



Think-pair-share

- The farmer, author and poet Wendell Berry once wrote, “How we eat determines, to a considerable extent, how the world is used.”
 - Do you agree with him? Why or why not? Support your answer in 4–7 sentences.
 - Wendell Berry also wrote, “A significant part of the pleasure of eating is in one’s accurate consciousness of the lives and the world from which food comes.”
 - Do you think this could be true for yourself, or for others? Why or why not? Support your answer in 4–7 sentences.
- *Students will have 5 minutes to think up their responses and write them down. Then they will discuss their responses with their partner. Ask pairs to share their responses aloud.*