Overview

Estimated lesson time: 105 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, timeline activity and lecture

Students will brainstorm responses to the question, How has the food system changed? After they generate a list of changes, they will estimate when each change occurred and mark it on a timeline.

During each of the following sections, students will take notes on handouts, then update the timeline to reflect what they have learned.

20 min  Agriculture and the dawn of civilizations
Lecture, discussion and timeline activity

The lecture will cover food sources of early humans, the transition to agriculture and its effect on lifestyle, population and the growth of civilizations.

20 min  Cycles of boom and bust
Lecture, discussion and timeline activity

The lecture will cover production challenges, technological changes, population growth and food security from early civilizations to the early 20th century.

20 min  Industrialization of the food system
Lecture and timeline activity

The lecture will cover the rationale for industrializing the food system, and the themes associated with it.

15 min  Concentration of food industries
Lecture, discussion and timeline activity

The lecture will cover the factors that led to concentration of food industries and its effects on the food system.

15 min  Reflection
Journal and discussion

Students will reflect on the question, What lessons can be learned from the history of food?
Essential questions

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

• How has the food system changed? How have these changes affected lifestyles, diet and health? Have these changes been for the benefit of humanity?
• How are food systems connected to population growth and decline?
• What was the rationale for industrializing the food system? Did it achieve its purpose?
• What are the hidden costs of inexpensive food?
• Who controls the food system?
• What lessons can be learned from the history of food?

Learning objectives

Students will be able to:

• Respond to the essential questions listed above;
• Describe major milestones in the history of the food system and mark them on a timeline;
• Graph the human population from the beginning of human history to the present.

Materials

Educators must provide:

• Large sticky notes or other media that can be posted to a timeline and easily moved

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
• Answer keys:
  o Sample timeline
  o Sample population graph
• Student handouts:
  o Timeline
  o Population graph
Introduction
Brainstorm, timeline activity and lecture

Students will brainstorm responses to the question, How has the food system changed? After they generate a list of changes, they will estimate when each change occurred and mark it on a historical timeline.

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.

Pre-class preparation
• Draw a timeline on the board, spanning 150,000 BCE to the present. Refer to student handouts for an example.
• Leave space below the timeline for a line graph of the human population. Provide horizontal gridlines at each billion mark.

Brainstorm and timeline activity

Title slide
• In this lesson, you will:
  o Explore the history of the food system from prehistoric hunter-gatherer societies to the current industrial system;
  o Create timelines and graphs depicting changes over time.

Overview
• Briefly indicate some of the topics that will be covered in lectures and discussions.

Essential questions
• These questions point to the big ideas of this module.
  o 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.
  o Leave this slide on display during the remainder of the introduction.
  • How has the food system changed over human history? For example, how are the ways we produce, process, transport and acquire food today different from how our ancestors performed these tasks? What historical events precipitated those changes?
    o Provide enough clues so that students are able to generate at least 10 events or changes in the food system. Refer to the answer key for examples.
    o Students will revisit these later, so they don’t yet need to be entirely factually accurate.
    o Write student responses on large sticky notes, or any other media that can be posted to the timeline and easily moved.
  • When do you think those events or changes took place?
    o Distribute sticky notes to volunteers.
Have students place their sticky notes on the timeline wherever they think their change roughly took place. For events or changes that occurred over a long period of time, have them draw a line spanning its duration.

Students will revisit the timeline later, so the dates don’t yet need to be factually accurate.

- How have these changes affected lifestyles, diet and health?
- Have these changes been to the benefit of humanity?
- How has the size of the human population changed over history? How are food systems connected to population growth and decline?

On the timeline, have several volunteers mark their estimates of the size of the global human population in 150,000 BCE, 10,000 BCE, 1000 BCE, 1 CE, 1000, 1650, 1850, 2000 and the present. Invite feedback from other students.

Provide a few established population estimates, as needed, to provide students with some frame of reference.

Students will revisit the population graph later, so they don’t yet need to be factually accurate.

- You’ll expand this timeline with what you learn over the course of this lesson.
- What lessons can be learned from the history of food?

**Lecture**

- The food system is continually evolving. The development of agriculture, the invention of the plow, the dawn of agricultural chemicals and the ongoing process of industrialization are among the revolutions that have transformed nations through food.
- Many of the most dramatic changes have taken place over the past century, ushering in an era of relatively abundant food production.
- With the benefits of plentiful calories, however, have come many costs, including ecosystem degradation, the loss of natural resources, rising rates of diet-related chronic disease and ongoing inequalities in access to food.
- Many authors speculate that the current period of fossil-fuel derived abundance will be a brief one, calling attention to the question of where our food system is headed next.2-4
- To successfully navigate the future, we must first gain an understanding of how we got here. What follows is a brief and simplified overview.
**Agriculture and the dawn of civilizations**

Lecture, discussion and timeline activity

The lecture will cover food sources of early humans, the transition to agriculture and its effects on lifestyle, population and the growth of civilizations. Students will take notes on graphic organizers, then update the timeline to reflect what they learn.

- Provide each student with a copy of the Timeline and Population graph handouts.
- Instruct students to take notes on their handouts during the following lecture.
  - In the labeled boxes on their timelines, students should write down key events and the defining qualities of that period.
  - Students should update their population graphs with data they glean from the lecture.

**Overview: Agriculture and the dawn of civilizations**

- Most modern, industrialized societies depend on agriculture, the practice of growing crops and raising animals for food and other needs.
- Agriculture has been practiced sporadically for roughly 10,000 years but widely established for only 5,000–just 3 percent of the span of human history.
- Although it is a relatively recent phenomenon, agriculture has had profound effects on human societies.

**Early humans**

- Paleoanthropologists estimate that *Homo sapiens*—anatomically modern humans—originated about 150,000 years ago.
- What do you think early humans ate? How did they acquire their food? Were their diets healthy?
- Throughout the vast majority of their history, humans acquired their food by hunting wild animals (including prehistoric megafauna like mammoths, wooly rhinos and giant elk) or gathering food from wild plants.
- Recent research suggests our ancestors may have:
  - Lived well into their 70s;
  - Eaten healthy diets high in fruits, vegetables, lean protein and healthy fats (though not by choice—this was all that was available);
  - Not suffered from the diet-related chronic illnesses that are common today.

**Present-day hunter gatherers**

- Some present-day communities still follow a hunter-gatherer lifestyle.
- Studies of these populations sometimes inform our ideas about the diets, health and lifestyles of pre-agricultural early humans.
Transition to agriculture
• From as early as 11,000 BCE, humans began a gradual transition away from a hunter-gatherer lifestyle toward cultivating crops and animals for food.5
• The shift to agriculture is believed to have originated in several parts of the world, including the Fertile Crescent, a region in the Middle East that cradled some of the earliest civilizations.5
• By 6000 BCE, most of the farm animals we are familiar with today had been domesticated.5
• By 5000 BCE, agriculture was practiced in every major continent except Australia.12

Transition to agriculture (continued, 2 slides)
• What do you think motivated the transition to agriculture?
• Changes in climate may have caused shortages of wild food sources.5
• Growing and denser populations may have demanded more food than could be harvested in the wild.6
• Innovations in food harvesting and processing technology may have made agriculture a more viable lifestyle.9
• Many theories exist, and the actual reasons probably varied across time and place.

Effects of agriculture (2 slides)
• How do you think agriculture changed lifestyles and population growth?
• In some parts of the world, agriculture may have required more time and energy than hunting and gathering.
• It provided a more stable and abundant food supply5—farming yielded 10 to 100 times more food calories per acre.9
• Agriculture’s effect on food production spurred tremendous growth in the global population:
  o 4 million in 10,000 BCE;
  o 50 million in 1000 BCE;
  o Close to 200 million by the beginning of the Common Era.5,13
Agriculture and civilizations (2 slides)

- What role do you think agriculture played in the birth of civilizations?
- Because agriculture tied people to their land, much of the resulting population growth occurred around densely populated settlements.9
- By 6500 BCE, towns of several thousand people were common in the Middle East.5
- By 3000 BCE, Uruk—possibly the world’s first city, located in what is now modern day Iraq14—was home to around 50,000 people.5
- As cities began to acquire more than enough food to support their population, people became free to pursue interests other than farming.5
- Some people took on roles as political leaders. The rise of political elites, responsible for overseeing the distribution of surplus food and other resources, created social inequalities.5
- Others devoted their energies to pursuits such as the arts, literature and technology that would drive the growth of civilizations.5

- Have students revisit the timeline on the board, drawing from the notes they took in their handouts:
  - Ask students to share any major events or defining qualities of the time periods covered in the lecture. Create sticky notes for these and have students affix them to the timeline on the board.
  - Based on new information they have learned, have students move, modify or remove any of the sticky notes they had placed earlier.
  - Have students update the population graph on the board with any new data they gleaned from the lecture.
Cycles of boom and bust
Lecture, discussion and timeline activity

The lecture will cover production challenges, technological changes, population growth and food security from early civilizations to the early 20th century. Students will take notes on graphic organizers, then update the timeline to reflect what they have learned.

- Instruct students to take notes on their handouts during the following lecture.
  - In the labeled boxes on their timelines, students should write down key events and the defining qualities of that period.
  - Students should update their population graphs with data they glean from the lecture.

Overview: Cycles of boom and bust

- Although agriculture was a driving force in the growth of civilizations, it has never been a safeguard against collapse.
- Throughout history, societies’ food systems have swayed between times of prosperity (“boom”) and hardship (“bust”).
- Increases in global food production competed against population growth, resource degradation, changing climates, droughts, flooding, disease, war and the many other forces that periodically plunged civilizations into famine.

New technologies

- Major innovations like **irrigation** (circa 6000 BCE) and the plow (circa 3000 BCE) brought enormous gains in productivity, helping to spur growth in populations.
- In some cases, these same innovations contributed to long-term losses in **soil** fertility.5,15
  - Soil is the foundation of most of our food supply.16
  - Fertility refers to its capacity to support plant growth.
- **Photos**: Irrigation canal; plow pulled by oxen.
Erosion and soil fertility

- In the words of one soil expert, “In the history of civilization... the plowshare [part of a plow] has been far more destructive than the sword.”17

- Plowing is one of several farming practices that can make fertile soil more susceptible to erosion (pictured) 5,18—the process by which materials are carried away by wind, water or other forces.

- As shortsighted practices “mined” surrounding farmland of its fertility, many cities grew dependent on faraway lands for food.
  - By the beginning of the Common Era, the farmland surrounding Rome had been depleted of its fertility.
  - To feed the growing populace, Romans came to rely on wheat shipments from over 1,000 miles away in Egypt and North Africa.5
  - Commenting on how a reliance on distant food sources can leave a region more vulnerable to political, economic or environmental forces, the Roman Emperor Tiberius wrote, “The very existence of the people of Rome is daily at the mercy of uncertain waves and storms.”5
  - Like Sumeria and Greece before her, Rome’s eventual decline was aided by depleted soils and a weakened food supply.5

- In the 1930s, the Dust Bowl across much of the American Midwest was a similarly tragic example of poorly managed farmland.

Continued population growth

- Following the fall of the Roman Empire, a favorable climate aided the growth of European agriculture. Alongside it, the population also continued to grow.5
  - By 1300, Europe’s population had reached 80 million;5
  - The global population had reached 360 million.13
  - Europe’s population had neared the limit of what its agricultural system could support.5

1300-1800s: Periodic famine

- Over the following centuries, poor weather, shifts in climate and degraded soil dampened agricultural production, while parts of Europe periodically fell into famine as its food supply struggled to keep pace with a growing population.5

- By the 17th century, European farmers had managed to increase crop yields by promoting the use of animal manure, crop rotations, cover crops and other practices that improve soil fertility.5

- But as before, even with these improvements to agriculture, population growth overtook the increased food supply, leaving large segments of the populace in a state of malnutrition.5

- Image: The Dance of Death, created in 1493, reminds viewers of the inevitability of death.19
1798: Malthus’ warning
- British economist Thomas Malthus famously wrote that unchecked exponential population growth would outpace food production, plunging humanity into long periods of famine.\(^2\)
- Though his prediction has yet to unfold on a global scale, his work reminds us that the Earth has a finite capacity for human growth.

1650-1850: Global agricultural evolution (2 slides)
- Between 1650 and 1850, the population more than doubled, from roughly 550 million to 1.2 billion. By 1900, it had reached 1.6 billion.\(^2\)
- What do you think kept Malthus’ doomsday prediction at bay?
  - There were many factors that led to lower death rates, including what has been called a “global agricultural evolution.”\(^1\)
  - Food plants imported from the Americas, such as corn, sweet potatoes and cassava, rapidly spread across the globe. Some scholars suggest that the improved nutrition provided by these prolific crops helped stave off disease.\(^1\)
  - Refrigerated transport, improved processing techniques for preserving perishable foods and a growing network of railways and shipping routes allowed prolific farmers to ship their surplus goods over greater distances.\(^2\)
  - From the 1850s onward, much of this food came from the U.S., where a favorable climate and fertile soils allowed American farmers to produce enough surplus grain, and eventually meat, to supply much of Europe.\(^2\)

Early 1900s: Synthetic fertilizers
- Technological innovations would further boost food production in the U.S. and abroad; perhaps none was more influential than the invention of synthetic (man-made) fertilizers in the early 1900s.\(^2\)
- These chemicals dramatically increased crop yields (at least in the short term).\(^2\)
- Synthetic fertilizers have been credited with feeding the lion’s share of a global population that grew from 1.6 to 6 billion over the 20th century,\(^2\) though not without ecological consequences (refer to Agriculture and Ecosystems).
- The use of these and other chemicals would become a hallmark of modern industrial agriculture.
- Discuss the following “chicken and egg” question: Did synthetic fertilizers cause the global increase in population, or did they help feed a population that would have grown regardless of whether synthetic fertilizers were invented? There is no consensus on the answer.
• **Have students revisit the timeline on the board, drawing from the notes they took in their handouts:**
  o **Ask students to share any major events or defining qualities of the time periods covered in the lecture. Create sticky notes for these and have students affix them to the timeline on the board.**
  o **Based on new information they have learned, have students move, modify or remove any of the sticky notes they had placed earlier.**
  o **Have students update the population graph on the board with any new data they gleaned from the lecture.**
20 min  Industrialization of the food system
Lecture and timeline activity

The lecture will cover the rationale for industrializing the food system and the themes associated with it. Students will take notes on graphic organizers, then update the timeline to reflect what they learn.

- Instruct students to take notes on their handouts during the following lecture.
  - In the labeled boxes on their timelines, students will write down key events and the defining qualities of that period.

Overview: Industrialization of the food system

- The largely industrialized U.S. food system has only been widely established for less than a century, a blip in the long span of human history.
- During this brief period, the food system underwent a greater transformation than it had experienced during the previous 10,000 years.

Essential questions

- During this lecture, keep in mind the following questions:
  - What was the rationale for industrializing the food system? Did it achieve its purpose?
  - What are the hidden costs of inexpensive food?

Rationale

- In the early 1900s, more than half of Americans were either farmers or lived in rural communities.
- In order to fuel the newly industrializing U.S. economy, some believed:
  - Americans ought to be freed from the drudgery of farming so they could join the labor force in offices and factories;
  - Food and farming needed to be cheaper so Americans could afford the products offered by emerging industries.
- The industrialization of the U.S. food system was intended to achieve these objectives by transforming the food supply chain.

Themes

- The industrialization of the food system has been characterized by:
  - Specialization;
  - Simplification;
  - Routinization;
  - Mechanization;
  - Standardization;
  - Consolidation.
Diversified farms

- Before World War II, most U.S. farmers cultivated a variety of crops, along with livestock, on what are called diversified farms.25,26

Specialization

- As the food system became more industrialized, farmers abandoned diverse farming systems in favor of highly specialized operations that separated crops from animals.27,28
- Specialization in the food system is based on the idea that farms and other operations could function more efficiently by focusing on fewer tasks.28
- Consider two farmers, each producing both corn and beef: According to the principles that drove industrialization, both would be better off if one only grew corn while the other only raised beef cattle.29 Each farmer could then limit his investment to the equipment and routine skills needed to perform his sole task more efficiently.
- Today, industrialized U.S. crop production is characterized by highly specialized, genetically uniform corn and soybean monocultures—fields planted with a single crop species over a given season, typically over a very large area.30,31

Specialization: beef supply chain

- The beef supply chain, meanwhile, is separated into many distinct, specialized industries:27
  - Breeding and birthing calves;
  - Raising cattle on pasture;
  - Growing feed crops;
  - Storing and transporting grain;
  - Transporting cattle;
  - Finishing them in feedlots;
  - Slaughtering them and processing their meat.

Simpler, routine, mechanized

- As food production and processing became more specialized, work became simpler and more routine.28
- This allowed for mechanization—the replacement of human and animal labor with machinery that could aid in routine tasks, such as sowing seeds and harvesting.31
Greater use of off-farm inputs

- Production became more dependent on resources manufactured off the farm, such as agricultural chemicals and fossil fuels,32
- Monocultures, for example, led to a greater dependency on synthetic fertilizers (to manage nutrients in soil) and chemical pesticides (to control crop pests);3,25,31 from 1948 to 2008, the use of agricultural chemicals increased more than fivefold.33
- In food animal production, hormones and antibiotics were introduced to speed the growth of food animals.34
- These new technologies made production more predictable, reliable and repetitive.28
- These transitions were based on an assumption that cheap energy would always be available to fuel the system, and that technological innovation would always overcome production challenges.32

Standardization

- Specialized facilities, including farms, feedlots and processing plants, could work together more efficiently by adopting uniform practices and turning out products of uniform size, weight and consistency.25,35
- Chickens, for example, are now grown to a uniform size so they can be quickly slaughtered, plucked and processed into meat using mechanized assembly lines.36
- Fast food restaurants came to expect uniform cuts of meat that cooked evenly, fit between standardized sandwich buns and met consumer expectations.37

Consolidation, economies of scale

- As the food system became increasingly industrialized, operations grew larger so they could capitalize on economies of scale25,33,38—the gain in efficiency that comes from doing something on a larger scale, such as mass production or buying in bulk.
- During these growth periods, many smaller facilities shut down, often because they could not compete with larger, more efficient operations.38-43
- Mechanized agriculture, for example, allowed farmers to work larger areas of land with fewer farm workers.28 Since 1950, the average U.S. farm has more than doubled in size; less than half as many farms are in operation,44 and they employ roughly an eighth as many farm workers.45
- Supermarkets and other food retailers followed a similar trend,43 partly because they relocated from urban neighborhoods to suburbs, where cheap land allowed them to grow larger in size.39,40
- This trend toward fewer, larger operations within an industry is called consolidation.46
Benefits and costs

- The industrialization of the food system has been tremendously successful in providing enormous amounts of food with a minimal amount of labor, often at lower prices (controlling for inflation) to consumers.\textsuperscript{47,48}

- From 1950 to 2000, production on U.S. farms more than doubled, with a fraction of the human labor.\textsuperscript{33} Not all of these gains have been for direct human consumption; over half of U.S. corn crops, for example, are fed to cattle, hogs and poultry.\textsuperscript{49} The actual amount of calories in the U.S. food supply increased by 20 percent over this period.\textsuperscript{50} It has been said that U.S. agriculture has become the “most efficient in the world, at least in terms of the dollar and cent costs of production.”\textsuperscript{23}

- These benefits have come with costs to the public’s health, social equity, animal welfare and the natural environment.

- Because these costs are not reflected in the price tag of food, they are sometimes called externalities or hidden costs. These are discussed in detail throughout the rest of the curriculum.

Have students revisit the timeline on the board, drawing from the notes they took in their handouts:

- Ask students to share any major events or defining qualities of the time periods covered in the lecture. Create sticky notes for these and have students affix them to the timeline on the board.

- Based on new information they have learned, have students move, modify or remove any of the sticky notes they had placed earlier.
15 min

Concentration of food industries
Lecture, discussion and timeline activity

The lecture will cover the factors that led to concentration of food industries, and its effects on the food system. Students will take notes on graphic organizers, then update the timeline to reflect what they have learned.

- Instruct students to take notes on their handouts during the following lecture.
  - In the labeled boxes on their timelines, students should write down key events and the defining qualities of that period.

Overview: Concentration of food industries

- During this lecture, keep in mind the question, Who controls the food system?
- Ask students to share their initial responses.

Definition

- One of the more recent trends in the history of the U.S. food system has been the shift toward greater industry concentration—the extent to which a small number of corporations control most of the sales.46
- Examples:
  - Over 80 percent of the beef packing industry is owned by four corporations;51
  - Over half of the corn seed market is owned by two corporations;51
  - Many fast food franchises are owned by larger food corporations.42

Factors that led to concentration

- The industrialization of the food system encouraged industry concentration:25
- The expenses associated with operating large-scale, industrialized facilities generally favored large, well-financed corporations.52
- These corporations grew even larger as they acquired smaller businesses and merged with other corporations.41,43,46
- As a result, many industries along the supply chain have come under the control of fewer corporations,46 including:
  - Seed and chemical manufacturing;
  - Food animal production;
  - Food processing;
  - Supermarket retail;
  - Fast food restaurants.25,43,51
Vertical integration

- One measure of industry concentration is **vertical integration**—the extent to which a single firm controls multiple successive stages along the supply chain of a product.53

- For example, by the turn of the century, one corporation controlled a large or dominant share of the industries that provide agricultural inputs (seeds, fertilizer, pesticides), grain distribution and storage, animal feed manufacture, poultry production and processing, and further processing into packaged TV dinners.54

Benefits, costs

- Concentration in the food system can lead to greater efficiency, reduced costs and in some cases, lower prices for consumers.46

- With fewer competitors in the market, however, dominant corporations gain greater control over setting food prices.25,46

- Concentration can also leave farmers and other citizens with less autonomy over how food is produced, processed, shipped and sold.

- For example, farmers may be pressured into following the practices dictated by dominant agricultural and food processing corporations.25,52

- Individual livestock producers, under contracts with vertically integrated corporations, have limited control over how to raise animals.34

- Many dominant corporations in the food system have a strong presence in the federal agencies responsible for oversight of agriculture and related activities, where they can influence policies in their favor.25

- *Have students revisit the timeline on the board, drawing from the notes they took in their handouts:*
  - Ask students to share any major events or defining qualities of the time periods covered in the lecture. Create sticky notes for these and have students affix them to the timeline on the board.
  - Based on new information they have learned, have students move, modify or remove any of the sticky notes they had placed earlier.
15 min  
Reflection

Journal and discussion

*Students will reflect on the question, What lessons can be learned from the history of food?*

- *In their journals, students will respond to this essential question.*
- *Invite volunteers to share responses aloud. Discuss.*
- Over the past 10,000 years, the world’s food systems underwent enormous changes.
- The current industrialized system in the United States represents only a brief moment in the long span of human history; even agriculture is a relatively recent phenomenon.
- The many trials, tribulations and transformations of the food system over time remind us that the current form is not necessarily here to stay, nor do we necessarily wish it to remain unchanged.
- Along with the benefits that industrialization offers are a significant number of health, social, environmental and economic costs.
- An understanding of how the current system came to be established can help guide efforts to address these harms.
References


49. Leibtag E. Corn prices near record high, but what about food costs? *Amber Waves.* 2008;6(1).


