



What Is Sustainable Agriculture?

Lesson 1 - Sustainable Agriculture: Introduction

National Learning Standards:

- **HS-ESS3-1 Human Sustainability:** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-4 Earth and Human Activity:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Grade Level: 9-12

Lesson Length: 60 minutes

Learning Objectives:

Participants will:

- Define key terms related to sustainable agriculture.
- Identify key events throughout agricultural history and their effects.

Materials and Equipment Needed:

- Introductory Lesson PowerPoint
- KWL posters (3)
- Introduction to Sustainable Agriculture Activity Sheet (1 per student)
- Post-it notes (at least 3 notes per student)
- Access to the internet

Cross-Curricular Connections:

Use these suggested adaptations to make learning across the curriculum easy!

Science	Technology	Engineering	Mathematics
Experience the plant life-cycle by growing a small historical garden in/near your classroom. Select crops that were originally grown in your area.	Conduct a mini- research project on technological advances throughout agricultural history and their impact on sustainability.	Design a prototype of a system that could help make their school more sustainable.	Visit NASA's (www.nasa.gov) or NOAA's website (www.noaa.gov) to evaluate and chart climate change data.

Teacher Preparation:

- Create KWL posters.
- Print Introduction to Sustainable Agriculture Activity Sheets.
- Reserve access to the computer lab, if necessary.



Lesson

Introduction (Anticipatory Set) • 15 minutes

STEP 1: In this step, students will view the video *The Future of Agriculture*, by OECD Trade and Agriculture. Before you play the video, ask students to write down answers to the question, “What are the challenges?” as they watch the video. Let students know that you’ll ask them to share after the video. Play video and then facilitate a short discussion around students’ answers while writing down student answers on the whiteboard or poster.

Video: https://www.youtube.com/watch?v=uAM4Si_WhDk

- What are the challenges? (Climate change, growing population, hunger, obesity, the need to produce more food, demand on natural resources, etc.)
- *There are significant challenges facing both farmers and consumers – climate change, food waste, and a growing population that needs more food grown on less land using less natural resources, to name a few. Many individuals are working worldwide to try and solve these challenges. Let’s see if we can come up with solutions for these challenges.*

Think-Pair-Share

- Within partners or groups of three, have students brainstorm solutions for the challenges the class listed.
- Have groups share their ideas. Remind and encourage students that innovation and creativity are key to solving these large challenges.
- *In an ideal world, these solutions would help us solve these challenges. The agricultural industry is also working to solve these challenges by implementing practices and initiatives to reach a broad goal of sustainably producing food, fiber, fuel, and shelter. This will be our focus, sustainable agriculture.*

Know, Want to Know, Learned (KWL charts)

- Place the three K-W-L posters around the classroom.
- *Before we dive in any further, let’s find out what we know. Let’s start with the “K” column – what you know. Brainstorm words, terms, or phrases that you associate with sustainable agriculture. Write as much as you know on a sticky note(s) and place it on the poster in the “K” column.*
- *Now let’s move on to the “W” column – what you want to know. What do you want to learn about this topic? What are you curious about?*
- Explain that the “L” column, what they’ve learned, will be filled out at the very end once they’ve completed all the lessons.



Input and Modeling • 15 minutes

STEP 2: Have students try to match up the correct definitions and terms (using pencil only) on their activity sheets. Then reveal the definitions before they create their icon/image to represent each term.

Let's develop some common language and understanding of these concepts starting with some basic definitions.

Agriculture: "The science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products."ⁱ

Sustainable: "The ability to meet core societal needs in a way that can be maintained indefinitely without significant negative effects."ⁱⁱ

Sustainable agriculture: Satisfying production needs for human food, feed, fiber, and biofuel, enhancing environmental quality and the resource base, sustaining the economic viability of agriculture, and improving the quality of life for farmers, farm workers, and society as a whole.ⁱⁱⁱ

Agriculture sustainability is all about balance. There are also a few fundamental qualities that are important for sustainable agriculture systems. They are:

Vulnerability: The quality or capability of a system to be exposed to risk and uncertainty.^{iv}

Adaptability: "The ability of a system to evolve and change in response to long-term changes in the surrounding environment."^v

Resistance: "The ability of a system to resist being dislodged from a stable condition by a disturbance such as some sort of system stressors and fluctuating conditions."^{vi}

Resilience: "The capacity of a system to absorb a spectrum of shocks or perturbations and still retain and further develop the same fundamental structure, functioning, and feedbacks."^{vii}

Robustness: "The ability of a system to withstand stresses, pressures, and changes in circumstances."^{viii}

Facilitate discussion around terms. After the discussion, have students create and draw an icon or image to represent each key term. Use the analogy of a four-legged chair to talk about balance. Each of the legs represents one of the four objectives.

Four Objectives of Sustainability

- Production
- Economics
- Social
- Environment

Why is it important for an agricultural system to have these qualities? What could happen if a farm wasn't productive while using environmental practices? How are these all connected?



Checking Understanding and Guided Practice • 5 minutes

STEP 3: Instruct students to turn to a partner and work together to create their analogy or metaphor for illustrating the connection between the four sustainable agriculture objectives and the other ecological terms. Elicit a few examples once everyone is finished.

Independent Practice • 15 minutes

STEP 4: Hand out the historical timeline. Direct students to read over the timeline. Then have students choose four events to write their production, environmental, economic, and social effects. Have students share what they wrote.

Earlier, we watched a video and discussed where we are today, but what about the past? History helps us understand change and how we came to be. Let's take some time to review some agricultural history.

Wrap-Up (Review, Assess, Challenge) • 10 minutes

STEP 5: Have students individually, or in pairs, visit www.agfoundation.org and complete the "Sustainable Agriculture: Introduction" module within the "Sustainable Agriculture Online Learning Experience" https://www.agfoundation.org/files/sustainable_agriculture_rise/#/.

- Challenge students to review the content and reflect in their notes on two new concepts they discovered, and one question they still have.
- Have students share their reflections and note information for continued investigation.



What are some of the challenges we face today?

Directions

Define these terms by matching the term with the correct definition. Then draw an icon/image to represent and help with remembering the term.

WORD BANK

Sustainable Agriculture
Vulnerability
Resistance

Sustainable
Resilience
Robustness

Adaptability
Agriculture

Term	Definition	Icon/Image
	The science, art, or practice of cultivating the soil, producing crops, raising livestock and in varying degrees, the preparation and marketing of the resulting products.	
	The ability to meet and maintain core societal needs indefinitely without significant negative effects.	
	Satisfying production needs for human food, feed, fiber, and biofuel, enhancing environmental quality and the resource base, sustaining the economic viability of agriculture, and improving the quality of life for farmers, farm workers, and society as a whole.	
	The quality or capability of a system to be exposed to risk and uncertainty.	
	A system's ability to evolve and change in response to long-term changes in the surrounding environment.	



WORD BANK

Sustainable Agriculture
Vulnerability
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Term	Definition	Icon/Image
	A system's ability to resist being dislodged from a stable condition by a disturbance such as system stressors and fluctuating conditions.	
	A system's capacity to absorb a spectrum of shocks or perturbations and still retain and further develop the same fundamental structure, functioning, and feedback.	
	A system's ability to withstand stresses, pressures, and changes in circumstances.	

My Sustainable Qualities Analogy/Metaphor:



Directions

Read through the timeline.^{ix} Choose four events to explain the environmental, production, economic, and social implications that event had.

AGRICULTURAL HISTORY	
8000 B.C.	Animals and grain domesticated in the Middle East—the birth of agriculture.
1493	Christopher Columbus brought calves, goats, sheep, pigs, hens, citrus, melons, and many kinds of vegetables to America.
1607	English colonists in Jamestown, Va., planted grain, potatoes, pumpkins, melons, cotton, oranges, and pineapples.
1609	Native Americans taught the Jamestown settlers how to grow corn.
1731	Jethro Tull introduced the horse-drawn cultivator and seed drill to English farming.
1783	Improved cattle, probably Shorthorns, were introduced to the U.S. from England.
1784	James Small invented the iron plow in England.
1793	Eli Whitney invented the cotton gin.
1798	John (Johnny Appleseed) Chapman planted some of his first apple trees in western Pennsylvania.
1834	Cyrus McCormick patented the grain reaper.
1837	John Deere began manufacturing steel plows.
1843	Sir John Lawes founded the commercial fertilizer industry by developing a process for making superphosphate.
1850	About 75–90 hours of labor required to produce 100 bushels of corn with walking plow, harrow, and hand planting. Yields were about 40 bushels per acre.
1854	Self-governing windmill perfected.
1855	Michigan and Pennsylvania established the first state agricultural colleges.
1856	A patent for condensing milk was issued to Gail Borden.
1858	Mason jars, used for home canning, were invented.
1862	The Department of Agriculture was created. The Morrill Land Grant College Act was signed into law.
1867	Barbed wire for livestock fencing invented.
1869	Transcontinental railroad completed.
1870	Silos came into use.
1874	Georgia established the first state Department of Agriculture.
1879	The grain combine was patented.
1881	Hybridized corn was produced.
1887	The Hatch Experiment Station Act was passed, providing federal grants to states for agricultural experimentation.
1888	The first long-haul shipment of a refrigerated freight car was made from California to New York.
1892	The first gasoline tractor was built by John Froelich.
1900	Special work projects for farm youth were organized in Illinois; the name “4-H” was adopted in 1913.



1900	The amount of labor needed to produce 100 bushels of corn was down to 35–40 hours using a 2-bottom gang plow, disk and peg-tooth harrow, and 2-row planter. Yields remained about the same as in 1850.
1902	Reclamation Act passed, leading to water projects for irrigation.
1906	The first rural electric line was constructed at Hood River, Oregon. The Pure Food and Drug Law was enacted.
1907	Congress passed The Federal Meat Inspection Act.
1911	The first county Farm Bureau was formed in Broome County, New York.
1914	World War I began.
1914	Establishment of the federal-state Extension Service was a major step in direct education for farmers.
1919	American Farm Bureau Federation formally organized in Chicago, Illinois.
1921	The first farm market news radio report was broadcast over KDKA, Pittsburgh. The Packers and Stockyards Act was enacted.
1922	Capper-Volstead Act exempts farm cooperatives from federal antitrust statutes. The Grain Futures Trading Act was enacted.
1928	Otto Rohwedder introduced his bread-slicing machine.
1928	Future Farmers of America established in Kansas City, Missouri.
1929	The Great Depression began.
1933	The Farm Credit Administration was established, creating specialized credit for agriculture.
1938	The Agricultural Adjustment Act was enacted; authorizing farm price supports and adjustment programs.
1939	World War II began.
1945	Commercial fertilizer use helped increase yields. Corn yields were 50 bushels per acre. One farmer worked 10–14 hours to produce 100 bushels of corn with a tractor, 3-bottom plow, disk, harrow, 4-row planter, and 2-row picker. About 16 percent of the U.S. population was involved in production agriculture.
1946	The first National School Lunch Act enacted.
1947	The Federal Insecticide, Fungicide and Rodenticide Act passed.
1948	The General Agreement on Tariffs and Trade (GATT) was put in place. It provided the rules for much of world trade for the next 47 years.
1949	Agricultural Act of 1949 passed, incorporating the principle of flexible price supports and giving surplus food to the needy.
1954	Food for Peace Program enacted.
1959	Mechanical tomato harvester developed.
1964	National Food Stamp Act passed.
1967	The American Farm Bureau Foundation for Agriculture is founded.
1970	Plant Variety Protection Act passed.
1970	Norman Borlaug received a Nobel Peace Prize for developing hardy wheat varieties.
1979	Grain embargo imposed against the Soviet Union following its invasion of Afghanistan.
1980	Farm crisis of the 1980s began. Many rural farms and banks went broke. Farmer suicide rates increased.



1981	Soviet grain embargo lifted.
1987	Less than three hours of labor and about one acre of land is required to produce 100 bushels of corn, with one farmer using a tractor, 5-bottom plow, 20-foot tandem disk, planter, 20-foot herbicide applicator, 12-foot self-propelled combine, and trucks.
1988	U.S.–Canada free trade accord ratified.
1990	Yeast for baking bread, introduced in Great Britain, is the first biotech product available worldwide.
1992	Food and Drug Administration declares biotech foods are “not inherently dangerous” and determines no special regulation is required.
1993	Canada, Mexico, and the United States signed the North American Free Trade Agreement (NAFTA).
1994	Farmers began using satellite technology to track and plan their farming practices. USDA approved the use of rBST to improve milk production in dairy cattle.
1996	World Trade Organization (WTO), the principal international forum governing world trade, was created. Food Quality Protection Act was enacted.
1997	The first weed and insect-resistant biotech crops—soybeans and cotton—were available commercially. A sheep named “Dolly” was the first mammal cloned.
2000	USDA unveiled organic standards for food and the official organic seal.
2010	The U.S. Farmers & Ranchers in Action formed to increase consumer trust in farmers and today’s modern food system.
2012	Labor Department withdrew a proposed labor rule that would have unnecessarily restricted youth from working in agriculture and on family farms.
2013	Each U.S. farmer produced food and fiber for 154 people. Globally, 17.3 million farmers grew biotech crops; 90 percent of them on small, resource-poor farms in developing countries.
2014	Food and Agriculture Organization of the UN declares 2014 the International Year of Family Farms.
2016	The warmest year on record. At least 97% of climate scientists agreed that the climate-warming trends over the past century are extremely likely due to human activities.*
2017	Non-browning Arctic Apples, a genetically modified variety, are sold in the U.S. for the first time.
2019	EPA approved year-round sales of E15 fuel.
2020	United States-Canada-Mexico trade agreement goes into effect.
2020	Food and Agriculture Climate Alliance formed and provides recommendations to guide development of federal climate policy.
2020	AquaBounty Salmon, the first genetically modified animal approved by EPA, is sold in the U.S.
2021	The Philippines is the first country to approve nutrient-enriched “golden rice” for planting.



1. _____

Environmental:

Production:

Economic:

Social:

2. _____

Environmental:

Production:

Economic:

Social:

3. _____

Environmental:

Production:

Economic:

Social:

4. _____

Environmental:

Production:

Economic:

Social:



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