

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 lifecycle 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 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 the OECD Trade and Agriculture. Before you play the video, ask students to think about the following question as they watch the video. Show video and then facilitate a short discussion around student's answers.
- Video: https://www.youtube.com/watch?v=uAM4Si_WhDk
 - What are the challenges? (Climate change, growing population, people are hungry, people are obese, need to produce more food, demand on natural resources, etc.)
 - *There are significant challenges facing both farmers and consumers – climate change, food waste, a growing population that needs more food grown on less land using less natural resources to name a few. As a result of these challenges, the agricultural industry is working toward a broad goal of sustainably producing food, fiber, fuel, and shelter.*
- 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 first 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 of 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.
- *Let's develop some common language and understanding around these concepts. Let's start 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. Use the analogy of a four-legged chair to talk about balance. Each of the legs represents one of the four objectives.
 - *Why is it important for an agricultural system to have these qualities? What could happen if a farm wasn't resilient? How are they all connected?*

Checking Understanding and Guided Practice: (5 minutes)

- **Step 3:** Instruct students to turn to a partner and work together to create their own 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 historical timeline. Direct students to read over the timeline and then choose 5 events to write the production, environmental, economic, and social effects of those events. Have students share what they wrote.
 - *Earlier today 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.
 - Challenge students to review the content and reflect in their notes two new concepts they discovered, and one question they still have.
 - Have students share their reflections and note information for continued investigation.

Introduction to Sustainable Agriculture Activity Sheet

What are some of the challenges we face today?

Directions

Define these terms by drawing a line to match the term with the correct definition.

Word Bank

Resistance	Sustainable Agriculture
Agriculture	Robustness
Resilience	Sustainable
Adaptability	Vulnerability

_____ 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.

_____ The ability to meet core societal needs in a way that can be maintained 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.

_____ The ability of a system to evolve and change in response to long term changes in the surrounding environment.

_____ 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.

_____ 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.

_____ The ability of a system to withstand stresses, pressures, and changes in circumstances.

My Sustainable Qualities Analogy/Metaphor:

Introduction to Sustainable Agriculture Activity Sheet

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.
- 1793** Eli Whitney invented the cotton gin.
- 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.
- 1862** President Abraham Lincoln signed legislation creating the first Department of Agriculture. Lincoln also signed the Morrill Land Grant College Act, creating agricultural universities.
- 1869** Transcontinental railroad completed.
- 1881** Hybridized corn produced.
- 1900** The amount of labor needed to produce 100 bushels of corn is down to 35–40 hours using a 2-bottom gang plow, disk and peg-tooth harrow and 2-row planter. Yields remain about the same as in 1850.
- 1902** Reclamation Act passed, leading to water projects for irrigation.
- 1907** The Federal Meat Inspection Act was passed.
- 1914** World War I began.
- 1929** The Great Depression began.
- 1938** The Agricultural Adjustment Act was enacted; authorizing farm price supports and adjustment programs.
- 1939** World War II began.
- 1945** Commercial fertilizer use helps increase yields. Corn yields now 50 bushels per acre. One farmer works 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 is involved in production agriculture.
- 1946** The first National School Lunch Act enacted.
- 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.
- 1950** Starting in 1950, the number of record high temperature events in the United States have been increasing, while the number of record low temperature events have been decreasing.^x The Korean War also began.

Introduction to Sustainable Agriculture Activity Sheet

- 1964** National Food Stamp Act passed.
- 1970** Norman Borlaug received a Nobel Peace Prize for developing hardy wheat varieties.
- 1980** Farm crisis of the 1980's began. Many rural farms and banks went broke. Farmer suicide rates increased.
- 1987** Less than three hours of labor and about one acre of land are 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.
- 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.
- 2008** The housing market crashes and the Great Recession began. The Food, Conservation and Energy Act enacted.
- 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.
- 2016** 2016 was the warmest year on record. At least 97% of climate scientists agreed the climate-warming trends over the past century are extremely likely due to human activities.^{xi}

Introduction to Sustainable Agriculture Activity Sheet

1. _____

Environmental:

Production:

Economic:

Social:

2. _____

Environmental:

Production:

Economic:

Social:

3. _____

Environmental:

Production:

Economic:

Social:

4. _____

Environmental:

Production:

Economic:

Social:

References:

- i. Merriam-Webster Dictionary. (2017). *Agriculture*. Retrieved from <https://www.merriam-webster.com/dictionary/agriculture>
- ii. National Research Council of the National Academies. (2010). *Toward Sustainable Agricultural Systems in the 21st Century*. Washington, DC: National Academies Press.
- iii. National Research Council of the National Academies. (2010). *Toward Sustainable Agricultural Systems in the 21st Century*. Washington, DC: National Academies Press.
- iv. Merriam-Webster Dictionary. (2017). *Vulnerable*. Retrieved from <https://www.merriam-webster.com/dictionary/vulnerability>
- v. National Research Council of the National Academies. (2010). *Toward Sustainable Agricultural Systems in the 21st Century*. Washington, DC: National Academies Press.
- vi. National Research Council of the National Academies. (2010). *Toward Sustainable Agricultural Systems in the 21st Century*. Washington, DC: National Academies Press.
- vii. Chapin et al. (2009). *Principles of ecosystem stewardship: Resilience-based natural resource management in a changing world*.
- viii. American Farm Bureau Foundation for Agriculture. (2017). *Food and Farm Facts*.
- ix. NASA. (2017, June 1). *Climate change: How do we know?* Retrieved from <https://climate.nasa.gov/evidence/>
- x. NASA. (2017, June 1). *Climate change: How do we know?* Retrieved from <https://climate.nasa.gov/evidence/>