



Environmental Stewardship

Lesson 3 - Sustainable Agriculture: Environment

National Learning Standards:

- **HS-ESS3-4 Earth and Human Activity:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- **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.
- **RST.11-12-7** Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or a problem.
- **CCSS.ELA-LITERACY.W.9-10.6** Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.

Grade Level: 9-12

Lesson Length: 60 minutes

Learning Objectives:

Participants will:

- Identify the five factors that contribute to environmental quality and their significance.
- Describe how farmers care for the environment.

Materials and Equipment Needed:

- Environmental Sustainability PowerPoint
- Access to the internet
- Environmental Stewardship Activity Sheet (1 per student)
- Group presentation prompts (1 per group)

Cross-Curricular Connections:

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

Science	Technology	Engineering	Mathematics
Have students research the physical, chemical, and biological properties of soil.	Have students research how historical advancements in technology have aided in environmental sustainability for agriculture.	Instead of creating a PowerPoint, have students construct a management practice model.	Have students calculate the cost of implementing a new management practice.

Teacher Preparation:

- Print Environmental Stewardship Activity Sheets.
- Print and cut group presentation prompts.
- Reserve access to the computer lab/cart, if necessary.



Lesson

Introduction (Anticipatory Set) • 5 minutes

STEP 1: Instruct students to think of at least three ways that humans impact the environment. Have students share out and capture ideas on the board.

- *Most human activity has an impact on the environment. Farming, by its very nature, alters natural ecosystems to produce food, fiber, and fuel for humans. Agriculturists work hard to ensure they are minimizing the impact they have on the environment. In some cases, they are even working to improve soil and water quality and create a habitat for wildlife. Today we will explore environmental challenges and how farmers use environmentally conscious strategies to grow crops and raise animals.*

Input and Modeling • 15 minutes

STEP 2: Reveal the five main components of the relationship between the environment and agriculture.

1. Soil quality and health
2. Water quality and availability
3. Air quality
4. Biodiversity
5. Animal health and welfare

Direct students to read through the information on their handout and do the following:

- Put a "!" by interesting new information
- Put a "?" for items you would like clarity on
- Put a "*" by one cool fact you want to share

Note: The information below is on the activity sheets and in the lesson PowerPoint

1. Soil Quality and Health

- What is soil?
 - "Soil is made of different sized mineral particles (sand, silt, and clay), organic matter, and numerous species of living organisms."
- What does it do for us?
 - Supports plant life
 - Helps cycle nutrients like water and carbon
- What are people talking about regarding the environment and soil?
 - Soil erosion – loss of topsoil from wind or water
 - Nutrient loss or imbalance – low fertility, high salinity, high pH, etc.
 - Soil compaction – reduced infiltration and increased runoff



2. Water Quality and Availability

- What is water?
 - “A colorless, transparent, odorless, tasteless liquid that forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms.”
- What does it do for us?
 - Water is essential for growing crops and raising animals
- What are people talking about regarding the environment and water?
 - Runoff and degradation – sediment, pesticides, and nutrients
 - Demand – Residential vs agricultural use and climate change
 - Pathogens – bacteria (e.g., E. coli)

3. Air Quality

- “Air is the invisible gaseous substance surrounding the earth, a mixture mainly of oxygen and nitrogen.”
- What does it do for us?
 - Plants and animals need air to stay alive
 - Plants use CO₂ from the air to make food
- What are people talking about regarding the environment and air quality?
 - Human health – Odor, particulate matter, and ozone precursors
 - Climate change – Greenhouse gases and carbon sequestration

4. Biodiversity

- What is biodiversity?
 - The variety of life in the world or in a particular habitat or ecosystem
- What does it do for us?
 - Increases ecosystem resilience and increases production
- What are people talking about regarding the environment and biodiversity?
 - Species diversity – animals, plants, insects, microbial
 - Habitat

5. Animal Health and welfare

- What is animal health and welfare?
 - “Animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling, and humane slaughter.”
- What does it do for us?
 - Promotes animal well-being and produces animal food products of the highest quality
- What are people talking about regarding the environment and animals?
 - Climate change – methane gas and carbon sequestration
 - Feed and transportation



Checking Understanding and Guided Practice • 35 minutes

STEP 3: *We know the five components; now, let's discover how farmers prioritize those components through their management practices.*

- Break students into five groups (one group for each of the five components). Assign each group a “component” and give them their half-page prompts. Explain that the students will have 10 minutes to answer the two questions on their prompts. The students will put their findings into a PowerPoint and then present them to the class. The presentations should be no longer than five minutes each. The teacher will backfill with any necessary information.
- As students listen to the presentations, have them answer the questions on the second half of their activity sheets.
- Group prompts (see handouts below):
 - **Soil Quality and Health**
 - * Why do farmers care about soil quality and health?
 - * What are examples of specific soil conservation practices used by farmers?
 - **Water Quality and Availability**
 - * Why do farmers care about water quality and availability?
 - * What are examples of water conservation and purification practices used by farmers?
 - **Air Quality**
 - * Why do farmers care about air quality?
 - * What are examples of distinct air pollution reduction practices used by farmers?
 - **Biodiversity**
 - * Why do farmers care about biodiversity?
 - * How are wildlife habitats created and maintained by farmers?
 - **Animal Health and Welfare**
 - * Why do farmers care about animal health and welfare?
 - * What are specific strategies farmers use to keep animals healthy and safe in livestock production operations?



Independent Practice • 5 minutes

STEP 4: Have students silently reflect on the complexity of finding the best solution for these environmental challenges.

Think-Pair-Share

- o Have students capture their thoughts on any open space on their activity sheets.
- o Have students share with a partner and create conclusions together.
- o Have the partners share their thoughts aloud.

As the demand for agricultural products increases, the debate over how to address that challenge can be polarized, pitting conventional agriculture and global commerce against local food systems and organic farms. Does it have to be one or the other? Is there a one-size fits all solution? No, there's not. There are guiding principles, but there are many ways for farmers and ranchers to enhance environmental quality and the resource base.

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

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

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



1. Soil Quality and Health

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 - Soil compaction – reduced infiltration and increased runoff

Why do farmers care about soil quality and health?

What are examples of specific soil conservation practices used by farmers?



2. Water Quality and Availability

- What is water?
 - “A colorless, transparent, odorless, tasteless liquid that forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms.”
- What does it do for us?
 - Water is essential for growing crops and raising animals.
- What are people talking about regarding the environment and water?
 - Runoff and degradation – sediment, pesticides, and nutrients
 - Demand – Residential vs agricultural use and climate change
 - Pathogens – bacteria (e.g., E. coli)

Why do farmers care about water quality and availability?

What are examples of specific water conservation and purification practices used by farmers?



3. Air Quality

- What is air?
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- What does it do for us?
 - Plants and animals need air to stay alive
 - Plants use CO₂ from the air to make food
- What are people talking about regarding the environment and air quality?
 - Human health – Odor, particulate matter, and ozone precursors
 - Climate change – Greenhouse gases and carbon sequestration

Why do farmers care about air quality?

What are examples of specific air pollution reduction practices used by farmers?



4. Biodiversity

- What is biodiversity?
 - The variety of life in the world or in a particular habitat or ecosystem
- What does it do for us?
 - Increases ecosystem resilience and increases production
- What are people talking about regarding the environment and biodiversity?
 - Species diversity – animals, plants, insects, microbial
 - Habitat

Why do farmers care about biodiversity?

How do farmers create and maintain wildlife habitats?



5. Animal Health and welfare

- What is animal health and welfare?
 - “Animal welfare requires disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling, and humane slaughter.”
- What does it do for us?
 - Promotes animal well-being and produces animal food products of the highest quality
- What are people talking about regarding the environment and animals?
 - Climate change – methane gas and carbon sequestration
 - Feed and transportation

Why do farmers care about animal health and welfare?

What are specific strategies farmers use to keep animals healthy and safe in livestock production operations?



Note: The answers below are not a comprehensive list of every correct answer.

1. Soil Quality and Health

- Why do farmers care about soil quality and health?

Farmers care about soil quality and health because it supports plant life and helps cycle nutrients. Farmers rely on healthy soil to make a living.

- What are examples of specific soil conservation practices used by farmers?

Contour farming	Pest management
Cover crops	Adding organic matter
Increasing diversity	Conservation tillage
Nutrient management	

2. Water Quality and Availability

- Why do farmers care about water quality and availability?

Farmers care about water quality because it is essential for growing crops and raising animals. We all need water, plants and animals included! It's a natural resource we are sharing.

- What are examples of specific water conservation and purification practices used by farmers?

Cover crops	Drought tolerant crops
Drip irrigation	Conservation tillage
Riparian buffers	Dry farming
Capturing and storing water	Nutrient management

3. Air Quality

- Why do farmers care about water quality and availability?

Farmers care about air quality because they see that it affects everyone – it's a natural resource we share. It affects human health and climate change.

- What are examples of specific air pollution reduction practices used by farmers?

Proper residue management	Cover crops
Windbreaks	Incorporating crop residue into the soil
Conservation tillage	Planting perennial crops



4. Biodiversity

- Why do farmers care about biodiversity?

Farmers care about biodiversity because their operations and the land can stay healthy when various ecosystems are balanced. There are financial and conservational benefits.

- How do farmers create and maintain wildlife habitats?

Conservation tillage

Trees, flowers, and brush

Crop rotations

Wetland protection/restoration

Riparian buffers

Pest management

5. Animal Health and Welfare

- Why do farmers care about animal health and welfare?

Farmers care about animal health and welfare because they recognize they have an ethical obligation to treat animals with respect. They also want to give the consumer a healthy and nutritious product.

- What are specific strategies farmers use to keep animals healthy and safe in livestock production operations?

Proper nutrition and feeding

Proper handling

Environmental management

Health care and monitoring

Appropriate comfort and shelter

Humane transportation, slaughter, and processing



Note: You can use the suggested resources below and other credible resources on the internet or in the classroom.

Group Presentation Prompt: Soil Quality

Directions

As a group, create a PowerPoint that answers the following questions:

- Why do farmers care about soil quality and health?
- What are examples of specific soil conservation practices used by farmers?

Be sure to include pictures and a slide with your sources.

Resources:

- [Sustainable Agriculture Research and Education](#)
 - [Soil Science Society of America](#)
 - [Soil Management and Health, University of Minnesota](#)
 - [Toward Sustainable Agricultural Systems in the 21st Century, The National Academies Press](#)
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Group Presentation Prompt: Water Quality and Availability

Directions

As a group, create a PowerPoint that answers the following questions:

- Why do farmers care about water quality and availability?
- What are examples of specific water conservation and purification practices used by farmers?

Be sure to include pictures and a slide with your sources.

Resources:

- [Water Conservation, USDA National Agricultural Library](#)
 - [How Farmers Conserve Water in a Drought, Food Insight](#)
 - [Toward Sustainable Agricultural Systems in the 21st Century, The National Academies Press](#)
 - [The Sources and Solutions: Agriculture, EPA](#)
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Group Presentation Prompt: Air Quality

Directions

As a group, create a PowerPoint that answers the following questions:

- Why do farmers care about air quality?
- What are examples of specific air pollution reduction practices used by farmers?

Be sure to include pictures and a slide with your sources.

Resources:

- [Air, USDA](#)
 - [Toward Sustainable Agricultural Systems in the 21st Century, The National Academies Press](#)
 - [Agricultural Air Quality Conservation Measures Reference Guide, USDA NRCS](#)
 - [Agricultural Sustainability Institute, UC Davis](#)
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Group Presentation Prompt: Biodiversity

Directions

As a group, create a PowerPoint that answers the following questions:

- o Why do farmers care about biodiversity?
- o How are wildlife habitats created and maintained by farmers?

Be sure to include pictures and a slide with your sources.

Resources:

- o [Help Wild Pollinators, University of Minnesota Extension](#)
- o [Finding Opportunity Areas for Wildlife on Your Farm, Iowa State University](#)
- o [Increasing Farm Biodiversity, University of Tennessee Extension](#)
- o [Toward Sustainable Agricultural Systems in the 21st Century, The National Academies Press](#)

Group Presentation Prompt: Animal Health & Welfare

Directions

As a group, create a PowerPoint that answers the following questions:

- o Why do farmers care about animal health and welfare?
- o What are specific strategies farmers use to keep animals healthy and safe in livestock production operations?

Be sure to include pictures and a slide with your sources.

Resources:

- o [Animal Welfare, Animal Agriculture Alliance](#)
- o [Cattle and the Environment: Leading the Way in Conservation, Beef It's What's For Dinner](#)
- o [Check In On All Things Chicken, National Chicken Council](#)
- o [Animal Well-being, We Care](#)

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