

# SCIENCE & AGRICULTURE

## Lessons and resources for grades 9-12



Iowa Agriculture  
Literacy Foundation



Agriculture is a topic that students can easily connect to because they encounter it often. Nearly everything we eat, wear, use -- even the fuel that powers the cars and buses we ride in -- comes from plants and animals grown on farms. Agriculture provides perfect real-world connections and makes learning relevant to students.

Agriculture connections in science are abundant! Agriculture relates to **physical science** (How can energy from plants can be converted to fuel?), **life science** (What factors affect a pasture ecosystem?) and **earth science** (How do farmers monitor and improve soil erosion and water quality?), and **engineering design** (How can science and technology improve food production?).

## FEATURED 9-12 LESSONS

### Biology of Soil (13 lesson unit - life science)

- [Why Are Soils Important](#)
- [What is Soil Health](#)
- [How Soil Behaves](#)
- [Issues of Soil Degradation](#)
- [Plant and Soil Interactions](#)
- [Organic Matter in Soil](#)
- [Invertebrates in Soil](#)
- [Fungi in Soil](#)
- [Bacteria in Soil](#)
- [Soil Biome](#)
- [History of Soil](#)
- [Future of Soil](#)
- [Careers](#)

### Nutrient Management & Water Quality (15 lesson unit - life science & earth and space science)

- [Soil Conservation - Lesson 1](#)
- [Soil Conservation - Lesson 2](#)
- [The Water Cycle](#)

- [Watershed Decisions](#)
- [Nitrogen Cycle \(Option 1\)](#)
- [Nitrogen Cycle \(Option 2\)](#)
- [Nitrogen Runoff](#)
- [Soil Structure](#)
- [Solutions to Runoff Management](#)
- [No-till Farming](#)
- [Cover Crops](#)
- [Terracing](#)
- [Tiling](#)
- [Bioreactors](#)
- [Buffer Zones](#)
- [Riparian Areas](#)

### Energy & Matter

- [Let's Make Ethanol](#)
- [Algaculture and Biofuel](#)
- [Energy and the Commodity Trace-back](#)
- Agriculture & Energy (20 lesson unit – physical science, life science, earth & space science)

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- [Agriculture and Energy](#)
- [Conservation Infrastructure](#)
- [Conservation Practices](#)
- [Agriculture & Renewable Energy](#)
- [Agriculture & Solar Energy](#)
- [Agriculture & Wind Energy](#)
- [Agriculture & Biogas Energy](#)
- [What are Biofuels?](#)
- [Ag & the Biofuels Industry](#)
- [Ethanol Then to Now](#)
- [Ethanol Inputs](#)
- [Chemical Reactions](#)
- [Ethanol Production](#)
- [Geography](#)
- [Vehicle Technology](#)
- [Engine Performance](#)
- [Ethanol and the Environment](#)
- [Production and Utilization](#)
- [Biofuels Impact on Corn Supply](#)
- [Biofuels Careers](#)

### Genetics

- [GMO Decisions](#)
- [FARMLAND: GMOs & Organic Agriculture](#)
- [The Science of a GMO](#)
- [Apples and the Science of Genetic Selection](#)
- [Double the Muscle: Probabilities and Pedigrees](#)
- [Evaluating GMO Perspectives](#)
- [Good Taste: Honey Bee Forager Food Preference](#)
- [Melons, Mitosis and Meiosis](#)
- [Strawberry Breeding and Genetics](#)
- [Genetically Modified Organisms \(GMOs\) and Organic Foods](#)
- [Plasmid Problem Solving](#)
- [Silky Genes](#)

### Plants, Soil, Ecosystems

- [Managing the Threat - Soybean Aphids](#)
- [Impacts of Invasive Species](#)
- [Photoperiod Phenomena](#)
- [Plant Nutrient Deficiencies](#)
- [Plant-Soil Interactions](#)

### Engineering Design

- [Pig Housing and Facility Design](#)
- [Aeroponic Engineering and Vertical Farming](#) (designing innovative production methods)
- [Hen House Engineering](#)

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# FEATURED RESOURCE

## Teacher Supplement Grant



The Agriculture in the Classroom Teacher Supplement Grant exists to help teachers purchase materials that would help them integrate agriculture into their classroom.

Each year, teachers can apply for up to \$250 in grants to help buy hydroponics systems, microscopes, books, transportation for an educational field trip, or much, much more.

Find more information at [www.iowaagliteracy.org](http://www.iowaagliteracy.org).

## Earth's Systems & Human Activity

- [Agricultural Land Use](#) (algae growth, soil erosion, and conservation practices)
- [Whey Waste](#)
- Journey 2050 (Sustainable agriculture unit – life science, earth and space science, & engineering design)
  - [Journey 2050 Lesson 1: Introduction to Sustainable Agriculture](#)
  - [Journey 2050 Lesson 2: Plant Health](#)
  - [Journey 2050 Lesson 3: Water](#)
  - [Journey 2050 Lesson 4: Economy](#)
  - [Journey 2050 Lesson 5: Land Use](#)
  - [Journey 2050 Lesson 6: Careers for 2050 and Beyond!](#)
  - [Journey 2050 Lesson 7: Technology and Innovations](#)

# WHERE DOES AGRICULTURE FIT INTO THE IOWA CORE STANDARDS?

## Physical Science

- HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

## Life Science

- HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
- HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
- HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
- HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter

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and flow of energy among organisms in an ecosystem.

- HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
- HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
- HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
- HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

## **Earth & Space Science**

- HS-ESS3-1. 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-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

## **Engineering Design**

- HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

**The Iowa Agriculture Literacy Foundation** serves as a central resource for educators and volunteers who want to teach Iowa's students about agriculture. Information about additional resources, including grants, professional development, and outreach opportunities is available at: [www.iowaagliteracy.org](http://www.iowaagliteracy.org).