Agricultural Science - Unit 1 - Sustainable Agriculture

Unit Focus

Students will explore the principles, concepts, and techniques of sustainable production of crops. This will cover biological, social, and economic components of sustainable farming systems; including soil and water management, cultural practices, pest control, and harvest. Studies of human activities that affect the condition of the atmosphere and how sustainable agriculture can be used to undo the damage caused to the earth's systems will be examined. Students will perform an analysis of traditional vs. industrial farming through the lens of alternative perspectives, competing interests, the increasing human population, and environmental protection. Ultimately, students will apply their understanding of farming techniques and environmental health to develop and justify a farming plan.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science

High School Earth and Space Sciences: 9 - 12

- 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-ESS3-1*
- Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. *HS-ESS3-2*
- Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. *HS-ESS3-4*

High School Life Sciences: 9 - 12

- Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *HS-LS2-7*

Next Generation Science Standards (DCI)

Science: 10

- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. *ESS3.9.C1*
- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. *ESS3.9.C2*

Transfer

T1 Evaluate scientific claims and analyze issues to verify the credibility of the source, data, and/or approach.
T2 Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.

Meaning

Understanding(s)	Essential Question(s)
U1 Human society is dependent on the availability of resources. **U2** Feeding the world's population is a challenge for human society. **U3** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources (maybe earth's systems?) **U4** When making agricultural decisions, one must consider competing interests including, land use, economics, and health of the environment. **U5** The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. **U6** Industrial farming is typically more lucrative than sustainable farming and can provide more food to people and products that people and industries need and want to use. **U7** Sustainable agriculture must provide a fair and reasonably secure living for farm families. It should minimize harm to the natural environment and should maintain basic natural resources such as healthy soil, clean water, and clean air. **U8** Human activities significantly alter natural habitats, causing changes to Earth's environment that can impact living things.	**Q1** How are people trying to preserve the Earth's resources and protect the environment? **Q2** How will the growth in human population impact the environment? **Q3** Is sustainable agriculture realistic in light of our high human population and struggle for resources? **Q4** How can we feed a growing population and maintain environmental health?

Stage 1: Desired Results - Key Understandings

- Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. *ETS1.9.A2*
- When evaluating solutions it is important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts. *ETS1.9.B1*
- Moreover, anthropogenic changes (induced by human activity) in the environment-including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change-can disrupt an ecosystem and threaten the survival of some species. *LS2.9.C2*
- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *LS4.9.D2*

Madison Public Schools Profile of a Graduate

Self-Direction

- Decision Making: Make responsible decisions, based on potential outcomes. (POG.4.2)

Global Thinking

- Alternate Perspectives: Interpret or critique complementary and competing approaches, experiences, and worldviews in order to develop an empathetic perspective. (POG.5.2)

Acquisition of Knowledge and Skill

Knowledge

K1 Sustainable agriculture is an approach which is profitable, environmentally sound, and beneficial to family and community interaction
K2 Sustainable farming is a set of production practices that rely on minimal use of off-farm inputs and aim to restore, maintain, or enhance the ecological systems that can benefit agriculture. This can include organic farming.
K3 The 3 legs of sustainability considers the economic, environmental, and social impacts of agriculture
K4 Sustainable agriculture must provide a fair and reasonably secure living for farm families. It should minimize harm to the natural environment. It should maintain basic natural resources such as healthy soil, clean water, and clean air.
K5 Agricultural ecosystems follow the same energy and nutrient rules as natural ecosystems.
K6 A food system is the way the food moves from the farm to the consumer
K7 The majority of food is supplied through industrial farming.
K8 Industrial farming requires a great deal of land and resources.
K9 Vocabulary: Biogeochemical cycles, sustainability, biodiversity, production, processing, distribution, consumption, tillage, silt, loam, wetlands, pasture, manure, anhydrous ammonia, phosphate, potash, economic and environmental sustainability, riparian buffers, crop rotation, integrated pest management, organic, grazing, restoration, grassed waterways.

Skill(s)

S1 Comparing and contrast sustainable farming techniques with commercial farming techniques
S2 Analyzing sustainable farming methods to determine ways to reverse damage to the environment by an ever growing human population.
S3 Collaborating with local farmers to determine the types of sustainable methods being used locally.
S4 Evaluating claims made about industrial and sustainable farming and making a judgement based on evidence to support or not support whether sustainable farming can support the growing human population.