Soil AND WATER
CONSERVATION VIRTUAL FIELD TRIP SERIES

UofA DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System

USDA United States Department of Agriculture Natural Resources Conservation Service

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Introduction to Discovery Farm-based Water and Soil Conservation Practices Field Trip

Grades 9-12 Integrated Biology, Integrated Chemistry, Environmental Science, and Agricultural Science

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Arkansas NGSS Suggestions:

Integrated Biology:

Topic 6: Life and Earth's Systems

B16-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.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (B16-ETS1-3)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World. (BI16-ETS1-3)

Disciplinary Core Ideas: ETS1.B: Developing Possible Solutions

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.7, 11-12.8, 11-12.9

Connections to the Arkansas Mathematical Standards: MP.2, MP.4

Topic 7: Human Impacts on Earth Systems

BI-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, the occurrence of natural hazards, and changes in climate have influenced human activity.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (BI-ESS3-1)

Crosscutting Concepts: Cause and Effect (BI-ESS3-1)

Disciplinary Core Ideas: ESS3.A: Natural Resources, ESS3.B: Natural Hazards

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.1, WHST.9-12.2

Connections to the Arkansas Mathematical Standards: MP.2, HSN.Q.A.1

BI-ESS3-2: Evaluate competing design solutions for developing, managing and utilizing energy and mineral resources based on cost benefit ratios.

Science and Engineering Practices: Engaging in Argument from Evidence (BI-ESS3-2)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (BI-ESS3-2). Science Addresses Questions About the Natural and Material World (BI-ESS3-2)

Disciplinary Core Ideas: ESS3.A: Natural Resources, ETS1.B: Developing Possible Solutions *Connections to the Arkansas Disciplinary Literacy Standards:* RST.11-12.1, RST.11-12.8 *Connections to the Arkansas Mathematical Standards:* MP.2

BI-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (BI-ESS3- 4)

Crosscutting Concepts: Stability and Change (BI-ESS3-4)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (BI-ESS3-4)

Disciplinary Core Ideas: ESS3.C: Human Impacts on Earth Systems, ETS1.B: Developing Possible Solutions.

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.1, RST.11-12.8

Connections to the Arkansas Mathematical Standards: MP.2, HSN.Q.A.1

B17-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Science and Engineering Practices: Asking Questions and Defining Problems (B17-ETS1-1)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (B17-ETS1-1)

Disciplinary Core Ideas: ETS1.A: Defining and Delimiting Engineering Problems *Connections to the Arkansas Disciplinary Literacy Standards:* RST.11-12.7-9 *Connections to the Arkansas Mathematical Standards:* MP.2, MP.4

<u>Integrated Chemistry:</u>

Topic One: Matter and Chemical Reactions:

CI1-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

3 Introduction to Discovery Farm-based Water and Soil Conservation Practices Field Trip

Science and Engineering Practices: Constructing Explanations and Designing Solutions (CI1- ETS1-2)

Disciplinary Core Ideas: ETS1.C: Optimizing the Design Solution (CI1-ETS1-2)

Connections to the Arkansas Mathematic Standards: MP.4

Environmental Science:

Topic One: Systems

EVS1-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Science and Engineering Practices: Asking Questions and Defining Problems (EVS1-ETS1-1)

Crosscutting Concepts: Influence of Engineering, Technology and Science on Society and the Natural World (EVS1-ETS1-1)

Disciplinary Core Ideas: ETS1.A: Defining and Delimiting Engineering Problems

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.7, RST.11-12.8, RST.11- 12.9

Connections to the Arkansas Mathematic Standards: MP.2, MP.4

Topic 2: Energy

EVS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller more manageable problems that could be solved through engineering.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (EVS- ETS1-2)

Disciplinary Core Ideas: ETS1.C: Optimizing the Design Solution

Topic 4: Sustainability

EVS-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.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (EVS- ESS3-1)

Crosscutting Concepts: Cause and Effect (EVS-ESS3-1)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (EVS-ESS3-1)

Disciplinary Core Ideas: ESS3.A: Natural Resources. ESS3.B: Natural Hazards *Connections to the Arkansas Disciplinary Literacy Standards:* RST.11-12.1, WHST.9-12.2 *Connections to the Arkansas Mathematic Standards:* MP.2, HSN.Q.A.1,2,3

EVS-ESS3-2: Evaluate competing design solutions for developing, managing and utilizing energy and mineral resources based on cost-benefit ratios.

Science and Engineering Practices: Engage an Argument from Evidence (EVS-ESS3-2)

Crosscutting Concepts: Influence of Science, Engineering and Technology on Society and the Natural World. Science Addresses Questions about the Natural and Material World. (EVS-ESS3- 2)

Disciplinary Core Ideas: ESS3.A: Natural Resources, ETS1.B: Developing Possible Solutions (EVS- ESS3-2)

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.8

Connections to the Arkansas Mathematic Standards: MP.2

EVS-ESS3-3: Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

Science and Engineering Practices: Using Mathematics and Computational Thinking (EVS-ESS3- 3)

Crosscutting Concepts: Stability and Change (EVS-ESS3-3)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (EVS-ESS3-3)

Disciplinary Core Ideas: ESS3.C: Human Impacts on Earth Systems

Connections to the Arkansas Mathematic Standards: MP.2, MP.4

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

Science and Engineering Practices: Constructing Explanations and Designing Solutions (EVS-LS2- 7)

Crosscutting Concepts: Stability and Change (EVS-LS2-7)

5 Introduction to Discovery Farm-based Water and Soil Conservation Practices Field Trip

Disciplinary Core Ideas: LS2.C: Ecosystem Dynamics, Functioning, and Resilience, ESS3.A: Natural Resources, ESS3.C: Human Impacts on Earth Systems, ETS1.B: Developing Possible Solutions

Connections to the Arkansas Disciplinary Literacy Standards: RST.9-10.8, RST.11-12.1, RST.11- 12.8, WHST.9-12.7

Connections to the Arkansas Mathematic Standards: MP.2, HSN.Q.A.1, HSN.Q.A.2, HSN.Q.A.3

EVS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Science and Engineering Practices: Using mathematics and computational thinking (EVS-LS4-6)

Crosscutting Concepts: Cause and Effect (EVS-LS4-6)

DisciplinaryCoreIdeas: LS4.CAdaptation,LS4.DBiodiversityandHumans

Connections to the Arkansas Disciplinary Literacy Standards: WHST.9-12.5, 9-12.7

Connections to the Arkansas Mathematic Standards: MP.2

EVS4-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.

Science and Engineering Practices: Constructing Explanations and Designing Solutions (EVS- ESS3-4)

Crosscutting Concepts: Cause and Effect (EVS-ESS3-1)

Disciplinary Core Ideas: ESS3.A: Natural Resources

Connections to the Arkansas Disciplinary Literacy Standards: WHST.9-12.5, 9-12.7

Connections to the Arkansas Mathematic Standards: MP.2, MP.4

Objective: Students will understand the importance of soil and water conservation regarding the lessening of the environmental impact that the loss of soil nutrients and water resources have on the local ecosystems. Students will learn that these impacts have an indirect influence on environments such as the water cycle and meteorological systems. Students will learn that current conservation methods can make a difference not only ecologically but also economically to a farmer.

6 Introduction to Discovery Farm-based Water and Soil Conservation Practices Field Trip

Assessment: Students will write a half-page research paper on a conservation practice of their choice, explaining why they feel this practice is the most important.

Key Points: Conservation Practices in Agriculture, Discovery Farms

Materials:

To watch the recorded *'Introduction to Discovery Farm-Based Water and Soil Conservation practices Field Trip*', go to www.uaex.uada.edu/soywhatsup and click on the 'Virtual Field Trips and Lessons' icon to the left of the webpage.

Paper and writing utensils for students in the classroom.

Preparation: If this is to be done in class, it's highly recommended that the teacher understands the key vocabulary words below.

Time Duration: one and a half class periods.

The video is about 60 minutes long (45 minutes plus 15 minutes question/answer). Assume about 10 minutes for students to look up vocabulary, and 10 minutes to teach essential concepts. Assume 10 minutes for reflection and discussion after the video.

Elicit:

Do a KWL Chart about soil and water conservation. What is conservation? How does one measure conservation? What are the advantages of practicing conservation at all economic levels? What are some conservation practices that farmers are doing? How can these practices help farmers ecologically and economically? Where do you think farmers could get help with these practices?

Engage:

Tell the students that they are going to watch a video titled 'Introduction to Discovery Farm-Based Water and Soil Conservation Practices Field Trip." Before they start the video, the students break into groups to define the following words:

Conservation
Arkansas Discovery Farms
Biochar
Cover crops
No Tillage

Surge irrigation
Polypipe irrigation
Soil health
Crop rotation
Crop Cover

Explain:

BEFORE THE VIDEO, be sure the students understand that agricultural sustainability not only benefits the environment, but also the farmers. Farmers need to learn that water and nutrient conservation can translate into more profit for them.

Biology Teachers: This is a good time to cover/review human impact on ecological systems and how population dynamics/agriculture affect the local ecology and economics.

Chemistry Teachers: Cover how today's technology is preserving water and nutrients in our ecosystems.

Environmental Science Teachers: This is a good time to cover/review human impact on ecological systems and how population dynamics/agriculture affect the local ecology and economics.

AG Teachers: This is a good time to cover/review human impact on ecological systems and how population dynamics/agriculture affect the local ecology, and the economics of farming profitability by using continuous agricultural improvement.

Explore:

Farmers must be constantly aware of the resources they use to grow their crops. Practicing conservation in the field means less water and chemicals (herbicide and insecticide) treatments. This translates into more profit for the farmer and is environmentally friendly.

Many farmers are aware that by continuously improving agricultural conservation on their farms, they can appeal to big businesses who are interested in marketing products that come from ecological friendly farms, thus improving their overall profit.

Show the video ''*Introduction to Discovery Farm-Based Water and Soil Conservation Practices Field Trip*'.

Elaborate:

8 Introduction to Discovery Farm-based Water and Soil Conservation Practices Field Trip

After the video, the students break into three groups: the *Biochar* group, the *No till and Cover Crop* group, and the *Surge and Polypipe Irrigation* group. Each group brainstorms their area of study and explains to the class how important their area is to conservation. Tell students they need to come up with at least six ways in total and then report them to the rest of the class.

Evaluate:

Students will turn in a two-paragraph reflection paper on what they learned and how these conservation efforts can affect where they live.

Extend:

End the lesson with how the conservation practices of farmers decrease their dependence on water and chemicals has also had a huge impact on our personal lives through the water we use and the food we eat. Reiterate how the concern for ecological friendly products can, in turn, drive how farmers approach production.

Assign a brainstorming project that allows students to design their own alternate growing methods or have students research cutting edge conservation practices and how they could benefit local farmers.

Have an agent from a local company or a local extension agent come to the classroom to explain how farmers and their people can collaborate.