SOIL&WATER CONSERVATION VIRTUAL FIELD TRIP SERIES

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CONSERVATION VIRTUAL FIELD TRIP SERIES
DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System
USDA United States Department of Agriculture Natural Resources Conservation Service

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Improving Soils and Profitability through Collaboration Virtual Field Trip

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

Arkansas NGSS Suggestions:

Integrated Biology:

Topic one: Cycling of Matter and Energy

BI-LS1-5: Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy.

Science and Engineering Practices: Developing and Using Models (BI-LS1-5), Constructing Explanations and Designing Solutions (BI-LS1-5)

Crosscutting Concepts: Energy and Matter (BI-LS1-5)

Disciplinary Core Ideas: LSI.C: Organization for matter and energy flow in organisms

Connections to the Arkansas English Language Arts Standards: SL11-12.5

BI-LS2-3: Construct and revise an explanation based on evidence for cycling of matter and flow of energy in aerobic and anaerobic conditions.

Science and Engineering Practices: Constructing explanations and designing solutions (BI-LS2-3)

Crosscutting Concepts: Energy and matter (BI-LS2-3)

Disciplinary Core Ideas: LS2.B: Cycling of matter and energy transfer in ecosystems.

Connections to the Arkansas Disciplinary Literacy Standards: RST11-12.1, WHST.9-12.2, WHST.9-12.5

BI-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, hydrosphere, atmosphere and geosphere.

Science and Engineering Practices: Developing and using models (BI-LS2-5)

Crosscutting Concepts: Systems and system models (BI-LS2-5)

Disciplinary Core Ideas: LS2.B: Cycling of matter and energy transfer in ecosystems. PS3.D: Energy in chemical processes

Topic 6: Life and Earth's Systems

BI-ESS2-2: Analyze geoscience data to make the claim that one change to the Earth's surface can create feedbacks that cause changes to other Earth's systems.

Science and Engineering Practices: Analyzing and interpreting data (BI-ESS2-2)

Crosscutting Concepts: Stability and Change (BI-ESS2-2)

Connections to Engineering, Technology and Applications of Science: Influence of Science, Engineering and Technology on Society and the Natural World (BI-ESS2-2)

Disciplinary Core Ideas: ESS2.A: Earth Materials and Systems. ESS2.D: Weather and Climate

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.1-12.12

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

BI-ESS2-5: 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's systems.

Science and Engineering Practices: Planning and Carrying Out Investigations (BI-ESS2-5)

Crosscutting Concepts: Structure and Function (BI-ESS2-5)

Disciplinary Core Ideas: ESS2.C: The Role of Water in Earth's Surface Processes

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

Connections to the Arkansas Mathematical Standards: HSN.Q.A.3

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, 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 Solution

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

Connections to the Arkansas Mathematical Standards: MP2, 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: MP2, MP4

Integrated Chemistry:

Topic One: Matter and Chemical Reactions:

Cl-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Science and Engineering Practices: Planning and Carrying Out Investigations (CL-ESS2-5)

Crosscutting Concepts: Structure and Function (CL-ESS2-5)

Disciplinary Core Ideas: ESS2.C: The roles of water in Earth's Surface Processes (CL-ESS2-5)

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

Connections to the Arkansas Mathematic Standards: HSN.Q.A.3

Cl1-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

Science and Engineering Practices: Constructing Explanations and Designing Solutions (Cl1-ETS1-2)

Disciplinary Core Ideas: ETS1.C: Optimizing the Design Solution (Cl1-ETS1-2)

Connections to the Arkansas Mathematic Standards: MP.4

Environmental Science:

Topic One: Systems

EVS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Science and Engineering Practices: Planning and Carrying Out Investigations (EVS-ESS2-5)

Crosscutting Concepts: Structure and Function (EVS-ESS2-5)

Disciplinary Core Ideas: ESS2.C: The roles of water in Earth's Surface Processes.

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

Connections to the Arkansas Mathematic Standards: HSN.Q.A.3

EVS-ESS2-6: Develop a quantitative model to describe the cycling of carbon through the hydrosphere, atmosphere, geosphere and biosphere.

Science and Engineering Practices: Developing and Using Models (EVS-ESS2-6)

Crosscutting Concepts: Energy and Matter (EVS-ESS2-6)

Disciplinary Core Ideas: ESS2.D: Weather and Climate

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

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.

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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)

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)

Disciplinary Core Ideas: LS4.C Adaptation. LS4.D Biodiversity and Humans

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, 4MP

Objective: Students will understand the importance of moisture sensing and cover crops in regards to conservation of water, and the lessening of the environmental impact the loss of nutrients and water have on the local ecosystem. Students will learn that collaboration between farmers and local districts helps everyone by improving productivity while protecting the local ecosystems.

Assessment: Students will write a reflection paper on what they learned about collaboration, and protection of our ecosystem resources from the Virtual Field Trip Video.

Key Points: Alternate crop production, soil moisture, water moisture chemistries, group collaborations.

Materials:

- You will need to register online if you plan to watch the field trip 'live' on August 19. Once you have registered, you will receive a registration link via Constant Contact. If you do not have a link, email dyoung@uaex.uada.edu and one will be emailed to you. If you register during the live feed, you will be automatically directed to the site. You will receive an automated email with the link to the live feed and a reminder email with a link one hour before the VFT begins.
- If you plan to watch the recorded *Improving Soils and Profitability through Collaboration Virtual Field Trip*, go to www.uaex.uada.edu/soywhatsup and click on the ' teacher curriculum' icon on the left hand side of the page. This will take you to the link for the video. Give IT a few days to edit for posting.
- Paper writing utensils for students (if in class).

Preparation:

If this is being done in class, it is highly recommended that you, the teacher, do research on the key words given below.

Time Duration: two class periods.

The video is about 60 minutes long (45 minutes plus any questions). Assume about 15 minutes for students to look up vocabulary and prepare questions for the video session, 15 minutes to

teach essential concepts and about 15 minutes for group discussion and reflection after the video.

Elicit:

Do a KWL Chart about what students know about crop cover and soil moisture. What is crop cover? What are the advantages of crop cover? How does a crop cover in the winter help a cash crop for the summer? What can crop cover do for the soil? How can a crop cover be beneficial for local insects? Why is soil moisture important to a farmer? Are there degrees of soil moisture? Is this important, if so why? How is soil moisture measured? What are the agencies in this area that could be beneficial for both farmers and consumers?

Engage:

Tell the students that they are going to watch a video titled '*Improving Soils and Profitability through Collaboration Virtual Field Trip'*. Before they start the video, have the students break into groups to define the following words:

- Cover Crop
- Biodiversity
- Carbon cycling
- Cash crop
- Soil moisture sensors
- Water chemistries
- No-till system
- Local Conservation Agencies for your area
- Biomass

Once all the words are defined, have each group come up with two questions they have about the above word groups that may be answered in the video. ***Their jobs are to turn in the questions and the answers by the end of the virtual field trip*.***

*The live video stream will give your students an opportunity to ask questions throughout the field trip. If they are not finding their questions adequately answered during the broadcast, you can send in their questions to be answered at the end of the video.

Explain:

BEFORE THE VIDEO, be sure the students understand that no till cover crops are an ecological alternative to tilling and standard chemical usage. Crop cover also increases water retention and protects beneficial insects that live in the area. Crop cover adds essential minerals to the soil (especially Nitrates) and discourages weed growth. Many farmers are not aware of this tool for water and nutrient conservation so local conservation districts are now collaborating with farmers to work with them on this profitable and ecologically sustainable alternative.

Biology Teachers: This is a good time to cover/review cycling of matter, the water cycle and water chemistries. You should also cover human impact on ecological systems and how population dynamics/agriculture affect the local ecology.

Chemistry Teachers: Cover water solubility including dipole moments, water's impact on earth systems, and how today's technology is preserving water in our ecosystems.

Environmental Science Teachers: This is a good time to cover/review soil and soil erosion, water cycle, biodiversity of insects, human impact on ecological systems and how population dynamics/agriculture affect the local ecology.

AG Teachers: This is a good time to cover/review soil and soil erosion, water cycle, biodiversity of insects, human impact on ecological systems and how population dynamics/agriculture affect the local ecology, and the economics of farming profitability by switching to no till/cover crop farming.

Explore:

Farmers are constantly aware of the resources they use to grow their crops. No till cover crops mean less water and chemicals (herbicide and insecticide) treatments. This translates into more profit for the farmer, better sustainability and is environmentally friendly. Many farmers are not aware of this alternative, so county agencies are teaming up with local farmers to collaborate on profitable and sustainable cover crop farming.

Show the video '*Improving Soils and Profitability through Collaboration Virtual Field Trip'.*

Elaborate:

After the video, break the students into three groups: The *Local Agency* group, the *Moisture Measuring* group, and the *Winter Cover Crop* group. Have each group brainstorm their area of study and explain to the class how important their area is to agriculture and conservation. Tell students they need to come up with at least six ways 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. They also need to give the answers to their two questions from the video.

Extend:

End the lesson with how the conservation practices of farmers to 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 local government and private agencies can work with farmers in a positive way to not only increase their profitability but also help them to become sustainable responsible businessmen.

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

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

Assign a brainstorming project that allows students to design their own alternate growing methods.