SOIL&WATER

CONSERVATION VIRTUAL FIELD TRIP

U of A DIVISION OF AGRICULTURE RESEARCH & EXTENSION University of Arkansas System | USDA United States Department of Agriculture Natural Resources Conservation Service

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Stevens Cotton Discovery Farm Virtual Field Trip

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

Arkansas NGSS Suggestions:

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 (EVS-ESS2-5)

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

Connections to the Arkansas Mathematic Standards: HSN.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. (EVS1-ETS1-1)

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 4: Sustainability

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-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. (EVS-LS2-7).

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, ETS1.B: Developing Possible Solutions (EVS-LS4-6).

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

EVS4-ETS1-3: Evaluate a solution to a complex real world problem based on prioritized criteria and tradeoffs 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: Using Mathematics and Computational Thinking (EVS-ESS3-3)

Crosscutting Concepts: Cause and Effect (EVS-LS4-6), Stability and Change (EVS-ESS3-3), Systems and System Models (EVS-ESS3-6)

Disciplinary Core Ideas: ETS1.B: Developing Possible Solutions (EVS-LS4-6).

Connections to the Arkansas Mathematic Standards: MP.2

Physics:

Topic 1: Motion

P-PS1-1AR Create a model of motion and forces, including vectors graphed on the coordinate plane, to describe and predict the behavior of a system.

Science and Engineering Practices: Developing and Using Models (P-PS1-1AR), Using Mathematics and Computational Thinking (P-PS1-2AR)

Crosscutting Concepts: System and System Models (P-PS1-1AR)

Disciplinary Core Ideas: PS2.A: Forces and Motion

Connections to the Arkansas Disciplinary Literacy Standards: RST.9-10.7

Connections to the Arkansas English Language Arts Standards: SL.11-12.2

Connections to the Arkansas Mathematic Standards: HSN.VM.A.1, HSN.VM.B.4

P-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Science and Engineering Practices: Analyzing and Interpreting Data (P-PS2-1)

Crosscutting Concepts: Structure and Function (P-PS2-1)

Disciplinary Core Ideas: PS2.A: Forces and Motion

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.1, RST.11-12.7, WHST.9-12.9

Connections to the Arkansas Mathematic Standards: MP.2, MP.4, HSN.Q.A.1-3, HSN.VM.A.1,3, HSN.VM.B.4, HSA.SSE.B.3

P1-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 (P1-ETS1-2)

Crosscutting Concepts: Interdependence of Science and Technology (P1-ETS1-2)

Disciplinary Core Ideas: PS2.A: Forces and Motion, ETS1.C: Optimizing the Design Solution.

Connections to the English Language Arts Standards: SL.11-12.2

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

Topic 2: Work and Energy

P-PS2-5AR: Use mathematical representations to support the claim that the change in kinetic energy of a system is equal to the net work performed upon the system.

Science and Engineering Practices: Using mathematics and computational thinking (P-PS2-5AR).

Crosscutting Concepts: Energy and Matter (P-PS2-5AR).

Disciplinary Core Ideas: PS3.C: Relationship between energy and forces.

Connections to the English Language Arts Standards: SL.11-12.4

Connections to the Arkansas Mathematic Standards: MP.2, MP.4, HSN.Q.A.1-3, HSF.IF.C.7

Topic 3: Heat and Thermodynamics

P-PS3-3AR: Use mathematical representations to model the conservation of energy in fluids.

Science and Engineering Practices: Using mathematics and computational thinking (P-PS3-3AR)

Crosscutting Concepts: Energy and Matter (P-PS3-3AR)

Disciplinary Core Ideas: PS3.B: Conservation of Energy and Energy Transfer

Connections to the Arkansas Mathematic Standards: MP.2, MP.4, HSN.Q.A.1-3, HSA.CED.A.3, HSA.CED.A.4

Objective: Students will understand the importance of irrigation watering with regard to conservation of water, and the lessening of the environmental impact contaminated runoff water will have on the local ecosystem. Students will understand the science behind the checking of irrigation water level usage and water chemistries.

Assessment: Students will write a reflection paper on what they learned about irrigation conservation and testing in the Stevens Discovery Farm Virtual Field Trip video.

Key Points: Conservation Tillage Management, cover crops, Flowlink computer program, water flow pacing, water runoff chemistries

Materials:

- You will need to register online if you plan to watch the field trip 'live' on August 21. Once you have registered, (you will receive a registration link via Constant Contact. If you do not have a link, email dyoung@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 *Stevens Cotton Discovery Farm 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.
- Paper writing utensils for students.

Preparation:

It is highly recommended that you, the teacher, watch *The History of Discovery Farms* Virtual Field Trip before the *Stevens Cotton Discovery Farm* VFT as it will give you a strong understanding about how and why Discovery Farms work in Arkansas. This will provide background when explaining the *Stevens Cotton* video to your students.

No other significant preparation is necessary.

Time Duration: 1-2 class periods

The video is about 45 minutes long. 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 irrigation and runoff water. How do farmers water their crops? How do farmers measure irrigation water to prevent waste? Get students thinking about the drawbacks of irrigation runoff by asking students how do farmers keep plants healthy (fertilizers) and do they think all the fertilizer that is placed on the field goes into the plant? If not, where does the excess fertilizer go? Considering the properties of water and the interaction water has on the environment, how could this excess fertilizer impact our ecosystem? How can farmers measure this excess and what can they do to prevent this?

Engage:

Tell the students that they are going to watch a video titled '*Stevens Cotton Discovery Farm Virtual Field Trip'*. Before they start the video, have the students break into groups to define the following word groups:

- Conservation Tillage Management
- Conventional Tillage
- Conservation Tillage (no tillage)
- Poly-Pipe tubing furrow irrigation
- Cover Cropping
- Water Flow pacing
- Hydrologist
- Hypoxic Zone
- Flowlink Computer Program
- Watermark Granular Matrix Sensors
- Nitrates in water
- Nitrites in water
- Ammonia in water
- Water Quality Analysis; focus on salts, pH, Salinity, Sediments and Solids in water.

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 irrigation water is a precious commodity both economically and ecologically. Water that is getting to the plant roots isn't becoming runoff and isn't taking fertilizer with it.

If you are in chemistry, this is a good time to discuss the water cycle, the properties of water, the structure and function of the dipole molecule and its impact on systems around it.

Environmental Science concepts could involve ecosystem dynamics, natural resources, human impact and the role of water in surrounding systems.

Physics teachers: This video covers the physics of flow (open and closed channel) involving diameter of pipes, volume, height, pressure flow and velocity of water. It also discusses the

velocity of particulates in a water stream. Consider developing some problems before hand for your students to work on after the video.

Explore:

Farmers have to be constantly aware of the amount of water they use to irrigate their crops. Water availability has dropped in recent years so farmers are always looking for ways to conserve; lower water usage means less cost, better sustainability and less contaminated water runoff.

Show the video *Stevens Discovery Farm Virtual Field Trip.*

Elaborate:

After the video, break the students into three groups; the *Measurement of Water Flow* Group, the *Conservation Tillage of Furrow* group and the *Water Quality Analysis* group. Have each group brainstorm how their 'area of study' affects their daily lives. Tell students they need to come up with at least five ways 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 affect their personal lives and the answers to their two questions from the video.

Extend:

End the lesson with how conservation practices of farmers also have a huge impact on our personal lives through the water we use and the food we eat.

Assign a brainstorming project that allows students to design their own alternate irrigation method, run-off water chemistry testing protocols or calculate flow based on different pipe and water diameters.

Have an extension agent or local farmer come to your classroom and talk about irrigation of crops in your local community.