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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The Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing Farm

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

Arkansas NGSS Suggestions:

Chemistry:

Topic One: Matter and Chemical Reactions:

CI-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 (CI-ESS2-5)

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

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

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

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

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

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

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

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

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

Assessment: Students will write a reflection paper on what they learned about watershed protection and conservation and waterway testing in *The Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing Farm Virtual Field Trip* video.

Key Points: Watershed management, grassed waterways, aerated pastures, farm pond, water chemistries

Materials:

- You will need to register online if you plan to watch the field trip 'live' on June 23. 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 *Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing Farm 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.
- Paper writing utensils for students.

Preparation:

It is highly recommended that you, the teacher, watch *The History of Discovery Farms* Virtual Field Trip located on the *soywhatsup* website, before watching the *Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing 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 *Marley Discovery Farm* VFT video to your students. It is also recommended you become familiar with the vocabulary.

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 manure and runoff water. How do livestock farmers deal with runoff? How do farmers measure irrigation water to prevent waste? Get students thinking about the drawbacks of runoff by asking students how do farmers deal with livestock manure? Where does the manure runoff go? Considering the properties of water and the interaction water has on the environment, how could this excess manure runoff impact our ecosystem? What could farmers do to prevent this water from entering our local watersheds? How can farmers measure these excess contaminants?

Engage:

Tell the students that they are going to watch a video titled '*The Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing Farm*. Before they start the video, have the students break into groups to define the following word groups:

- Watersheds
- Aerated pastures
- Grassed waterways
- Farm ponds
- Eutrophication
- Hypoxia
- Nitrates in water
- Phosphates in water

- Water Quality Analysis; focus on nitrogen, phosphates, pH, 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 watershed water is a precious commodity as it is what local communities use for their drinking water. This water needs to be protected and any contaminated runoff needs to be curtailed before reaching it. Local waterways also need to be protected as ultimately that water ends up in the Gulf of Mexico, where excess nutrients lead to eutrophication and hypoxia in the gulf.

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. Also discuss the chemistries of water and water testing.

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

Physics teachers: This video covers the physics of flow involving volume, height, pressure flow and velocity of water. It also discusses the velocity of particulates in a water stream. Consider developing some problems beforehand for your students to work on after the video.

Explore:

Farmers must be constantly aware of how their farms may impact local watersheds and waterways, and the need to be proactive to protect them from contaminated runoff.

Show the video *The Marley Discovery Farm in NW Arkansas: Protecting Water Resources Through Conservation on a Poultry-Beef Grazing Farm.*

Elaborate:

After the video, break the students into three groups: the *Aerated Pasture* Group, the *Grassed Waterways* group and the *Farm Ponds* 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 ways of keeping manure tainted runoff from entering local watersheds.

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