

9-12th Grade Sustainable Agriculture Curriculum
by

Michaela Gallup

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Capstone Project Facilitator(s): Karen L. Moroz

Content Expert: Kevin Dahlman

Peer Reviewer: Elizabeth Callaghan, Kyle Anne Koyle, Stephanie Stickney, Zachary Hoffmann.

Capstone Project: Sustainable Agricultural Curriculum

Project Summary

The research question for my capstone project was identifying the best resources for a sustainable agricultural curriculum that can be implemented in a 9th-12th grade agricultural class. Early on, it was decided that the project would be a curriculum, which could be implemented in my wildlife and natural resources course. By the end of the project, I chose to write and implement a 4-6 week long unit instead of a semester-long curriculum to ensure that it could be shared and implemented by different teachers and educational programs.

The first section of the curriculum begins by having students complete a survey about their knowledge of climate change. Not only does it ask students to identify what they know, it asks them to identify and reflect on how they learned the information. The next step in this section is to teach students about climate change using a variety of notes and the video *Climate Change: Lines of evidence*. There is a worksheet to help students keep track of the information from the video. The worksheet should be gone over as a class to ensure everyone has the correct information. This notes session leads students into an inquiry based project where they are in charge of teaching the class about the effects of climate change. A rubric has been included with the project in order to give students a direction for their research. The research serves as an opportunity for students to learn more about climate change, and students should be expected to take notes on classmates' presentations.

The second subunit begins with a lab that examines how plants germination is affected by different temperatures. The curriculum includes a student lab sheet and teacher notes to help set up the project and evaluate the results. The students should collect data on this lab over the next seven to ten days at a minimum. Once the lab set up has been completed students will learn more

about how specific agricultural practices are contributing to climate change. The notes include a combination of written information, infographics, and relevant youtube videos. The intention of these notes is to provide students with a variety of learning opportunities. The notes lead students into a short project that examines how specific agricultural practices could be changed in order to adapt to climate change or reduce the agricultural industries production of greenhouse gasses.

The final unit serves as a summative assessment for the students. The unit asks students to identify any issues in their community that could be contributing to or are being affected by climate change. The students are asked to propose solutions to the issues and then share that information with the class. Inorder to raise the importance of this project, I suggest inviting community members that could help implement the project or address the issues students identified. An optional extension to this unit is having the students select one of the proposed issues, and work as a class to try and solve the issues.

The next section of the paper includes the curriculum teacher notes. All handouts, labs, notes, and rubrics are linked throughout the notes. All documents will be attached to this project via a pdf.

Unit: Sustainable Agriculture Curriculum for 9-12 grade students

Unit Summary: This unit teaches students the science of climate change, how climate change impacts the food system, and how agriculturalists can use technology to reduce contributing factors to climate change.

Standards:

ESS.03. Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry and ecology.

ESS.04. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).

ESS.05. Use tools, equipment, machinery and technology common to tasks in environmental service systems.

NRS.01. Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.

NRS.02.01. Analyze the interrelationships between natural resources and humans.

NRS.03. Develop plans to ensure sustainable production and processing of natural resources.

NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

CS.04.02.01.b .Analyze natural resources trends and technologies and explain how they impact AFNR systems (e.g., climate change, green technologies, water resources, etc.).

Student Objective: Students will learn how the agricultural industry will be impacted by climate change. They will identify specific agricultural practices that contribute to climate change and explore how those practices can be adapted into a more sustainable system.

Approximate Time Frame: 4-6 weeks

Student Objective/Learning Outcomes: Students will be able to explain the relationship between agriculture production and climate change. They will be able to identify specific agricultural practices that can be altered to reduce the impact of production on the environment.

Curriculum Framing Questions:

What is sustainability?

How does climate change affect the agricultural industry?

How does the agricultural industry affect climate change?

What technologies can be used to reduce the agricultural industry's contribution to greenhouse gas emissions?

Lesson 1: What is climate change and why should Agriculturalists care?

-Activity evaluating students' understanding of and feelings about climate change and its effect on the world.

-Consequences of climate change project

Lesson 2: How does the Agricultural industry affect Climate change?

-notes on how agriculture impacts climate change

- Labs evaluating how climate change could affect agriculture

-Individual project analyzing

Lesson 3: What technologies can be used to reduce climate change impact?

-Students will work in groups to evaluate different agricultural technologies that are improving climate change. Evaluate agricultural practices in the community to assess how they can be improved to reduce climate change and its effects.

Lesson 1: Introduction to Climate Change

Approximate time: 5-8 days (45 minute class periods)

Day 1: Have students complete the [Climate Change & Agriculture Pre-sheet](#). Give students at least 10 minutes. If students rush through, tell them to expand on their answers.

Once students have completed the worksheet, discuss what students know and how they know it. Have students make a list of things the class needs to learn about climate change in order to become experts.

Day 2-3: Use the [Agriculture & Climate Change slides](#) to introduce the topic of climate change. Utilize peardeck to make the conversation interactive.

Watch the [Climate Change: Lines of Evidence](#) video (25 minutes). Have students complete the [Climate Change: Lines of Evidence worksheet](#) while watching the video. Once the video is complete, go over the worksheet as a class.

Day 4-7: Use the Agriculture & Climate Change slides to introduce consequences of climate change. Watch [What will the world look like 2 Degrees warmer?](#) Video to introduce some of the consequences of climate change. Discuss the video and then get students in groups of 2-4 for their project. Each group will be in charge of teaching the rest of the class about one of the consequences of the following consequences of climate change:

- Global Temperature Rise
- Warming Ocean
- Shrinking Ice Sheets
- Glacial Retreat
- Decreased Snow Cover
- Sea Level Rise
- Declining Arctic Sea Level
- Extreme Events
- Ocean Acidification

The Following website is a great resource for students and teachers to learn about each issue; <https://climate.nasa.gov/evidence/>.

Give students the following [rubric](#) to complete the project. Emphasis that their group is teaching the rest of the class. The teacher can assign points to each criteria.

Day 7-8 Have students present their project to the class. Classmates should take notes on other students' presentations.

Lesson 2: Agriculture & Climate Change

Approximate Time: 4 to 8 days.

Day 1-2: Students will set up the [Plant Germination and Climate Change Lab](#). Ensure you have a way to keep seeds both above and below room temperature for at least 7 days. All plants should have access to a growth light or direct sunlight. Make sure students do not over water the plants or the seeds will rot. Students should record soil temperature and observations for the next 7 days. The above average seeds should sprout at a similar rate as the average temperature crops. If you extended the lab until the plants were fully grown you would find the crops exposed to temperatures above 80 degrees Fahrenheit for an extended period would not produce any fruit. The plants that were below average temperature would take much longer to germinate, if they germinate at all. The cold temperature plants will be at a higher risk for rotting.

Day 2-4: Students take notes from the [Agricultural & Climate Change notes](#).

Day 4-8: Students will complete the Agricultural technology project to examine how changing specific agricultural practices will reduce or adapt to climate change.

Lesson 3: Final Project Local Agriculture & Climate Change

Approximate time: 5 to 6 days.

Day 1-3: As a class we will use the [US Climate Data](#) to graph the average monthly temperatures for our county over the last fifty years. The class should then discuss how the change in temperature could affect the agriculture in the county. Compare the results of the plant lab to this experiment.

Day 3-5: Put the students in groups of 3-4 students. Have them Identify a local issues that are either contributing to climate change or could be affected by climate change. Once students have identified the issues they should come up with a proposal for how the class could address the issues.

Day 5-6: Students should present their issues and their proposals to the rest of the class.

Optional Extension: Time will vary based upon project

Have the class vote on one of the proposals and then work as a class to address the issues.

Sources:

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