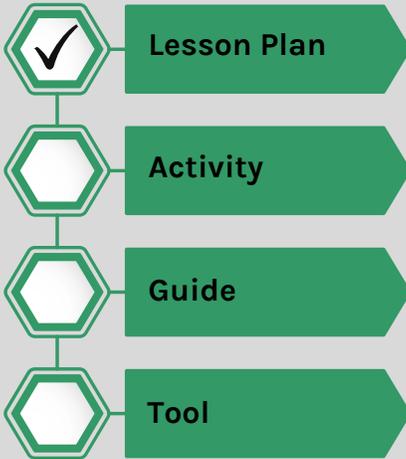




Byte-Sized Farming: Watering with Precision

LifeSmarts Curriculum (25GA4HLP61)

Resource Type:



Authors:

Kasey Bozeman and Ashley Carroll

Intended Audience:

6th - 12th Grades, In-School, Classroom, Day Camp, After-School Practice

Published: June 2025

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Description:

In this lesson, students will learn about common row crops in the southeastern United States (peanuts, cotton, and corn) and how precision agriculture is used in large-scale production of these crops. Precision agriculture uses technology to improve crop yields and make better management decisions. Precision ag can prevent overapplication of resources, erosion and runoff, etc. Students will construct an irrigation apparatus to mimic real-world irrigation precision ag techniques, such as a center-pivot.

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LifeSmarts Environment Lesson: Byte-Sized Farming: Watering with Precision

Lead Authors:	Kasey Bozeman
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Contact Information (email):	kaseyb@uga.edu
Intended Audience/Setting:	Middle and high school youth, in-school/classroom delivery or for LifeSmarts practices
Grade Levels:	6 th - 12 th grades
Subjects:	Science - Agriculture
Description:	In this lesson, students will learn about common row crops in the southeastern United States (peanuts, cotton, and corn) and how precision agriculture is used in large-scale production of these crops. Precision agriculture uses technology to improve crop yields and make better management decisions. Precision ag can prevent overapplication of resources, erosion and runoff, etc. Students will construct an irrigation apparatus to mimic real-world irrigation precision ag techniques, such as a center-pivot.
Objectives:	<p><i>The learner will:</i></p> <ul style="list-style-type: none"> • Define precision agriculture. • Describe how a center pivot works. • Explain why crops need different amounts of water at different times during the growing cycle. • Construct a model to replicate real-world irrigation methods.
Standards:	AFNR-FPM-8.1, AFNR-NL-12, AFNR-ESS-6.3
Vocabulary:	<ol style="list-style-type: none"> 1. Agriculture - the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products. 2. Precision agriculture - Using technology to improve crop yields and make better management decisions. 3. Row crop - an agricultural crop planted in rows, typically using machinery for planting and harvesting. These crops are often grown for commercial purposes and include corn, cotton, peanuts, and soybeans. 4. Irrigation - artificial application of water to land, typically for agricultural purposes, to support plant growth.

	<ol style="list-style-type: none"> 5. Weather - the short-term conditions of the atmosphere at a specific time and place. 6. Climate - long-term average of weather patterns in a region, usually over 30 years or more. 7. Soil moisture sensor - is a device that measures or estimates the amount of water in the soil. 8. Soil erosion - the removal of the top layer of soil due to natural forces such as wind and water. 																
Estimated Time to Prepare the Lesson:	20 minutes																
Estimated Time for Lesson Delivery:	45-60 minutes																
Materials:	<ul style="list-style-type: none"> • Canva slide presentation template <ul style="list-style-type: none"> • https://www.canva.com/design/DAGsENBk0SY/lyKVFFjwzrc82K2cjx7zXQ/view?utm_content=DAGsENBk0SY&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink&mode=preview • Precipitation worksheet • Cup labels 																
Supplies	<ul style="list-style-type: none"> • Pencils/pens • Scissors • Tape • 3 clear, plastic cups per group • 1 Styrofoam cup per group • Various sizes of straws • Wooden skewer • Modeling clay • Water pitcher • Water • Blue food coloring (optional) • Permanent marker (for additional challenge) • Measuring cup set (for additional challenge) • Access to slide presentation (thumb drive, laptop/projector, etc.) • Access to internet to show YouTube Video • Quizbowl buzzers (optional) 																
Lesson Overview:	<table border="1"> <thead> <tr> <th>Content</th> <th>Estimated Time</th> </tr> </thead> <tbody> <tr> <td>Introduction</td> <td>5 minutes</td> </tr> <tr> <td>Topic 1: Row Crops and Rain</td> <td>3 minutes</td> </tr> <tr> <td>Activity 1: Weather Investigation</td> <td>10 minutes</td> </tr> <tr> <td>Topic 2: The Center Pivot</td> <td>5 minutes</td> </tr> <tr> <td>Activity 2: Build An Irrigation System</td> <td>20 minutes</td> </tr> <tr> <td>Optional Activity: Challenge Questions</td> <td>15 minutes</td> </tr> <tr> <td>Wrap Up & Reflection</td> <td>2 minutes</td> </tr> </tbody> </table>	Content	Estimated Time	Introduction	5 minutes	Topic 1: Row Crops and Rain	3 minutes	Activity 1: Weather Investigation	10 minutes	Topic 2: The Center Pivot	5 minutes	Activity 2: Build An Irrigation System	20 minutes	Optional Activity: Challenge Questions	15 minutes	Wrap Up & Reflection	2 minutes
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Preparation:	<ul style="list-style-type: none"> • Print worksheet and cup labels. 																

- Display supplies for irrigation engineering challenge.
- Set up laptop and projector.
- Set up buzzers for challenge questions (optional).

Lesson Procedure:

Introduction:

Say:

What is agriculture? Take a look at the two pictures on this slide. Both represent agriculture scenes. Agriculture the science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, wool, and other products.

Think about these questions:

- What's different between these two scenes?
- Which one do you think is more efficient? Why?
- What kind of technology do you think farmers use today?

Just like we use different technologies throughout the day (computers, smartphones, smartwatches, etc.), farmers use technologies to grow crops and raise animals. Today, we are going to learn about precision agriculture - this is where farmers use technology to improve crop yields and make better management decisions. Precision agriculture helps farmers save water, resources (like fertilizers and pesticides), time, and other financial means.

Topic 1: Row Crops and Rain

Say:

A row crop is an agricultural crop planted in rows, typically using machinery for planting and harvesting. These crops are often grown for commercial purposes. According to the USDA, row crops are a major part of the Southeastern United States' agricultural economy. Some examples of row crops grown in this area include peanuts, cotton, corn, soybeans, and wheat. The fertile soil in parts of these states make them well-suited for growing these types of crops. Sometimes, this area is called the "row crop belt" due to the lots of these crops being grown there. Farmers invest significant time in planning, planting, caring for, and harvesting these row crops.

Irrigation is the artificial application of water to land, typically for agricultural purposes, to support plant growth. Across our state, farmers use different irrigation methods to help supplement natural rainfall, especially during crucial growth periods for plants. While this area of the United States receives a good amount of average rainfall, it's not always distributed evenly throughout the year, especially during hotter, drier periods.

- Some farmers will use micro-irrigation, where water hoses will drip (or trickle) water beside specific plants. Most orchard crops and other permanent type crops will use this method.
- Sprinkler or spray irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes and then sprayed into the air through sprinklers. The water drops fall to the ground and land on the crops.

Activity: Weather Investigation

Say:

The National Oceanic and Atmospheric Administration (NOAA) operates the National Weather Service (NWS). NWS Scientists use 30 years of weather data to make conclusions about an

area's climate. Currently, weather data from 1991-2020 is available for view. Many times, farmers will study weather and climate trends to predict the best times for planting crops, watering, etc.

Weather is the short-term conditions of the atmosphere at a specific time and place. This includes the temperature, humidity, precipitation, wind, and visibility. For example, "it's sunny and 85°F today," is the weather. The long-term average of weather patterns in a region, usually over 30 years or more, is the climate. This includes typical weather conditions, seasonal trends, and extremes. For example, "Florida has a warm, humid climate with mild winters," describes the climate.

Today, you are going to visit the NWS website and record rainfall data for your area.

Do:

This activity can be completed as a full group or individually if students have their own devices. If all students are from the same area, you may want them to choose different cities to investigate. Have the students complete each of the steps below while you model them on the projected screen.

- Visit <https://www.weather.gov/wrh/Climate?wfo=ffc>.
- Ensure the NOWData tab (first on left) is selected. (It normally defaults to this.)
- Then, complete the four-part request:
 - 1: Choose your Location. (If your exact city isn't listed, choose a city that's close to where you live.)
 - 2: Choose your Product – select Daily/monthly normal.
 - 3: Choose your Options. Monthly should be selected for Type. Precipitation should be selected for Variable.
 - 4: Click Go!

Say: Once you have completed those steps, a bar graph and chart will display the average precipitation (reported in inches) for each month from 1991-2020. Record the values on your worksheet. [If time permits, you can also have students create a bar graph].

Answer the questions on the worksheet:

- What month had the most rainfall?
- What month had the least rainfall?
- What can you conclude about your area's climate? What are some generalizations you could make about the summers and winters as it relates to precipitation?

Do: Once students have completed the questions on their worksheet, allow them to share out what they learned about each of their locations.

Topic 2: The Center Pivot

Say:

The center pivot is one of the most widely used irrigation system on farms across the United States with tens of millions of acres irrigated using this method annually. It is a self-propelled system that rotates around a central pivot point. The spans (or arms) have sprinkler heads attached. The purpose of the sprinkler is to take water from the source and distribute it across the plants in the field. Sometimes, farmers will put soil moisture sensors in their field at different places. A soil moisture sensor is a device that measures or estimates the amount of

water in the soil. If an area of a field already has enough water, when the pivot's sprinkler gets close to that area, the sprinkler can turn off and save energy and water for the farmer. This can also prevent soil erosion, where the top layer of soil is removed due to natural forces such as wind and water. The time required for a center pivot to rotate depends on the system size, pump, or well capacity and the amount of water to be applied at each application; this time can range from hours to days.

Do:

Show Video: What is a Center Pivot? Pivot 101 - Valley Irrigation:

<https://www.youtube.com/watch?v=2bILpvH3EuQ>.

Activity: Build an Irrigation System

Say:

What are some things that stood out to you about what was said in that video? [Allow students to recall information from the video.] Today, we are going to use the engineering design process to create an irrigation system for different row crops. Our ideas mimic how ag engineers and farmers work together to ensure crops get the right amount of water they need. The Styrofoam cup is the irrigation apparatus, and it will distribute water to the crops (clear cups) through the spans (straws).

Your first step is to cut out the labels for the cups. Using tape, attach the corn, cotton, and peanut labels to the clear cups. Attach the irrigation label to the Styrofoam cup using tape.

Next, you will use the wooden skewer to poke holes in the Styrofoam cup. Be careful to not make the holes too big. Use straws to connect the Styrofoam cup to the clear cups. Modeling clay can be used to hold the straws in place.

Test your irrigation device by pouring water into the Styrofoam cup and having it drip to the crop cups. (You can dye the water blue to see it easier.). Did it work? What modifications do you need to make? How does this simulate irrigation methods and precision agriculture in real life?

Do: As groups are assembling their irrigation units, walk around to make sure they understand the activity and assist as needed. Students may start by drawing out their design plans as a group before beginning to engineer them. You can ask questions about design plans as students plan/build. Once they have their plans and first irrigations built, allow them to test out their device by pouring water into the Styrofoam cup and having it drip to the crop cups. (You can dye the water blue to see it easier.).

Say: Did your design work as you envisioned? [Allow groups to share out.] What modifications do you need to make to make it work as you planned? How does this simulate irrigation methods and precision agriculture in real life? Now, take a couple of minutes to adapt your original design to make it more efficient.

Do: Allow youth time to make modifications to designs and try again. If time permits, have them do an additional challenge where each plastic cup/crop gets a specific amount of water.

Say: In some situations, a center pivot irrigation may need to provide different amounts of water to different parts of a field. This can be based on the crops planted, soil types or topography. While it is not typical to have corn, cotton and peanuts all growing in the same

field at the same time, today we are going to pretend you are an ag engineer assisting a farmer with that exact scenario. Your job is to help the farmer use precision ag technology to make sure each crop gets the needed amount of water. Adjust your design so that your corn cup gets $\frac{3}{4}$ cup of water, your cotton cup gets $\frac{1}{4}$ cup and your peanut cup gets $\frac{1}{2}$ cup.

Say: Great job everyone! Let's talk a little bit about how this activity applies to real precision ag concepts. Just like in your models, farmers and agricultural engineers use tools and data to make sure every part of a field gets the right amount of water. This helps conserve resources, protect the environment, and grow better crops. In the real world, technologies like soil moisture sensors, GPS, and automated irrigation systems are used to decide where, when, and how much to water. You acted as ag engineers today by designing a system that delivered water based on crop needs just like how real precision agriculture works on farms.

Today we learned how precision agriculture uses technology to help farmers work more efficiently and make smarter decisions. By using tools like GPS, drones, and sensors, farmers can apply water, fertilizer, and pesticides only where they're needed. This is optimized resource allocation, and it helps reduce waste and save money. Precision agriculture also leads to improved crop quality because plants get exactly what they need to grow strong and healthy. It's good for the environment too using fewer chemicals and reducing runoff helps protect soil, water, and air, making farming more sustainable. Finally, all the data collected through precision tools helps farmers manage their farms more effectively, from deciding when to plant to tracking harvests. In the end, precision agriculture helps farmers grow better crops while taking care of the planet.

Activity: Challenge questions

Note: This trivia-type activity can be done in teams of 4-5 students or individually. If you have buzzers, you may allow students/teams to use them to buzz in to answer questions. If you do not have buzzers, you can include the questions in a Quizzizz or Kahoot-type trivia game or have students raise their hands to answer. Each question is worth 10 points.

Let's put your knowledge of today's lesson to the test with a set of challenge questions. I will read a series of questions related to today's topic. If you think you know the answer, you may buzz in (or raise your hand). Once I acknowledge you by calling your name, you may give your answer. If you are correct, you will earn 10 points. If you are incorrect someone from another team may buzz in. Here we go:

Do: Follow along in the script from the Challenge Questions document.

Great job everyone, now let's check the scores...

Wrap Up & Reflection

As we wrap up our lesson today, what's one thing you learned today that surprised you or changed how you think about farming? [Allow 2-3 students to share.] Nice! You all did a fantastic job today exploring these topics. Farming today is as much about technology and data as it is about soil and seeds. Precision agriculture, including the center pivot irrigation method, helps farmers grow more food using fewer resources. Whether you're interested in science, engineering, or the environment - there's a place for you in the future of agriculture.

Suggestions to Condense the Lesson:	If time is a factor, you can show students how to retrieve NWS data, but they do not have to record it on the worksheet. Challenge questions can also be sent some with students as a study tool.
Suggestions for Expanding the Lesson:	Spend more time engineering the irrigation model, especially allowing students to brainstorm, plan, design, test, and retest. Consider having students use computers or other devices to learn about different irrigation methods besides a center pivot. Other examples include linear move, traveling gun, and drip irrigation. Students can report their findings.
Useful Resources for More Information:	<ul style="list-style-type: none"> • National Agriculture in the Classroom Increasing Food Production with Precision Agriculture Lesson: https://agclassroom.org/matrix/lessons/513/ • PBS Precision Agriculture: https://www.pbs.org/show/precision-agriculture/
GA Counts Keywords:	Under 4-H and Agricultural, Natural Resources, and the Environment <ul style="list-style-type: none"> • Ag Technology • Conservation • Weather/Climate • Water • Science, Engineering & Technology (SET) • Plant & Soil Science • Environmental Stewardship
References/Credit (APA Style):	
<p>Georgia Soil and Water Conservation Commission. (2013). <i>Best Management Practices for Georgia Agriculture: Chapter 2, Section 6</i> [PDF]. Retrieved July 2, 2025, from https://gaswcc.georgia.gov/sites/gaswcc.georgia.gov/files/2013AgManual_Ch2_Section6.pdf</p> <p>University of Georgia Cooperative Extension. (2015, December). <i>Factors to consider in selecting a farm irrigation system</i> (Publication No. B 882_5) [PDF]. University of Georgia. Retrieved July 3, 2025, from https://secure.caes.uga.edu/extension/publications/files/pdf/B%20882_5.PDF</p> <p>University of Georgia Center for Agribusiness and Economic Development. (n.d.). <i>Georgia farm gate value reports</i>. University of Georgia College of Agricultural and Environmental Sciences. Retrieved July 2, 2025, from https://caed.uga.edu/publications/farm-gate-value.html</p> <p>U.S. Geological Survey. (n.d.). <i>Irrigation: Spray or sprinkler irrigation</i>. USGS Water Science School. Retrieved July 2, 2025, from https://www.usgs.gov/special-topics/water-science-school/science/irrigation-spray-or-sprinkler-irrigation</p> <p>Valley Irrigation. (2025, July 2). What is a Center Pivot? Pivot 101 - Valley Irrigation [Video]. YouTube. https://www.youtube.com/watch?v2bILpvH3EuQ</p>	