



High School Digital Lesson Educator Guide Geographical Factors that Influence Farming

Lesson Overview

In order to provide a variety of choices for all Americans, farmers and ranchers must collectively respond to the marketplace, sharing best practices to meet the needs and desires of a growing population. Different parts of the country – with variable soil composition, weather conditions, and other factors – are most efficient for different types of farming and ranching. In this lesson, students will investigate the geographic (abiotic) factors that influence crops/products grown, as well as evaluate the significance of the agricultural production area's proximity to the marketplace. Students also will analyze national data from the USDA's Census of Agriculture and the Survey of Organic Farming to determine how to optimize farm size, location, and the crops to be grown for the greatest benefit to consumers and the economy.

Content Areas: Earth Science/Environmental Science

Grade Level: Grades 9-12

National Standards:

Next Generation Science Standards (NGSS)

HS-ETS1: Engineering Design

Students who demonstrate understanding can:

HS-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.

Standards for Technological Literacy – International Technology and Engineering Educators Association (ITEEA)

Standard 15: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.

K. Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products. Crops (e.g., cotton, vegetables, fruits, and grains), livestock, and poultry, are bought and sold by individuals, corporations, and financial institutions. Local, state, and federal governments regulate the marketing and safety of agriculture products and systems.

N. The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna. For example, wise water use for gardens or farmland involves considering plant needs and efficient watering methods before installing, using, and maintaining irrigation systems. Management of agriculture requires considering such topics as the amount, orientation, and distribution of crops and other plants, the effects of pests, and the management of land and animals to prevent fire or drought. For example, pest management involves managing agricultural infestations (including weeds, insects, and diseases) to reduce adverse effects on plant growth, crop production, and environmental resources.

Essential Questions:

1. What geographical/abiotic factors affect the cultivation and distribution of agricultural products? How do consumer selection and marketing influence local buying trends?
2. When does it make more economical sense to grow crops/products close to the market place?

3. How does the analysis of national agricultural data and statistics aid in farm site selection and the choice of specific crops to be grown on farmland?

Materials:

- Computers connected to the Internet
- Chart Paper (self adhesive or with tape) and colored markers
- Copies of *Think-Pair-Share: Abiotic vs. Biotic Characteristics* student handout
- Copies of *3-Minute Pause* formative assessment student handout
- Copies of *Farm-Site Selection & Data Graphic Organizer* student handout
- Copies of *Exit Ticket: Sustainability* student handout

Objectives:

- Differentiate between abiotic and biotic characteristics.
- Investigate the geographic (abiotic) factors that influence crops/products grown, as well as evaluate the significance of the agricultural production area's proximity to the marketplace.
- Analyze USDA data to determine how to optimize farming and food-related business decisions for the greatest benefit to consumers and the economy.

Background Information:

During the first day of the lesson, students will participate in a Think-Pair-Share activity to identify biotic versus abiotic characteristics in agriculture. Students will be encouraged to imagine that they will be investing in a new “farm to table” restaurant venture for which they will need to select a site near the farms that produce many of the key ingredients needed for the restaurant. In selecting this site, students will take into consideration many variables, such as the size, location, type of crop(s) grown, and production methods (“organic” or “conventional”) common in that area. As part of this process, students also will complete a Gallery Run to focus on the geographical factors that influence farming, such as climate, soil, and landscape to determine the types of crops/products that should be grown close to the marketplace. They will investigate how consumer selection and marketing influence local buying trends.

On the second day of the lesson, students will describe the barriers to growth and future growth opportunities that have the potential to yield the greatest benefit to consumers and the economy, using real government data to inform their choice of farm site/size, crop produced, and production technique (organic/conventional). In addition, students will engage in a discussion of land-use and marketing strategies to promote sustainability (considering economic, environmental, and social objectives).

Procedure:**Day 1 (Slides 1-5)****Slide 1:**

- Provide background information and review the lesson objectives using the slide.

Slide 2:

- Distribute the ***Think-Pair-Share (TPS) student handout***. Guide students to Think-Pair-Share and list biotic versus abiotic characteristics. First, students will think individually, then pair up with a classmate (discuss with partner), and lastly share their thoughts with the rest of the class. As they work, they should complete the Think-Pair-Share capture sheet.
 - Examples of biotic factors may include any of the following:
Biotic factors are all the living things in an ecosystem, including producers (plants, trees, etc.), consumers (mostly animals), and decomposers (such as mushrooms).
 - Examples of abiotic factors may include any of the following:
Abiotic factors are the non-living parts of the environment, such as

climate, water, sunlight, temperature, soil, landscape, oxygen, etc. It is some of these abiotic factors that we will be focusing on in the upcoming "Gallery Run" Activity.

Slide 3:

- Explain that a "Gallery Run" is a sped-up version of a Gallery Walk in which students add comments and respond to comments for a series of questions written on chart at different stations around the room. Since the answers will be more concrete, the groups can be "run" through the stations at a much quicker pace. This lesson is centered on the geographical factors that influence farming. Write the following questions on separate self adhering sheets of chart paper. Since there are only three questions, repeat the same set of questions, posting the same question set in different sections of the class. Groups can respond to each question more than once, as they may have a different perspective on the question or have additional thoughts to share the second time around.
 - How does the climate in a given geographical region influence farming?
Climate is the average pattern of weather for a specific region.
 - How does the soil in a given geographical region influence farming?
 - How does the landscape in a given geographical region influence farming?
Landscape is scenery seen from a single viewpoint.
- Arrange students into six teams and provide each team with a different colored marker.
- Direct teams to different charts or "stations." Upon arriving at the station, each team writes comments for the question posed at the station. To avoid chart clutter and rambling comments, encourage the recorder to write in a bulleted format closest to the top of the chart. After a couple of minutes, announce that the groups should rotate clockwise to the next chart. At the new station, the group adds new comments and responds to comments left by the previous group. To involve all group members, switch recorders at each station.
- As groups rotate, encourage student discussion and involve all group members. Be ready to rephrase questions or to provide hints if students either do not understand or misinterpret questions; be ready to provide instructions for those that still do not understand how to conduct a Gallery Run.
- Teams continue to review the answers already contributed by previous groups, adding their own comments. This procedure continues until groups have visited all stations and return to the station at which they started. Instruct students to record their original (starting) question and to sit down in their teams to begin the "Report Out" stage.
- During the next phase of the activity, groups work to synthesize and evaluate what has been written about their original discussion question. Call on different groups to report out their experience of the Gallery Run and what they learned. During "Report Out" stage, reinforce correctly expressed concepts and correct for misconceptions and errors.
- Emphasize that these geographical (abiotic) characteristics of agricultural production clearly have a significant impact on what and how various crops are produced.

Slide 4:

- Next, tell students that you'll be evaluating another abiotic factor: how close a farm or other agricultural production area is to the marketplace where those products are sold to consumers. Lead a discussion to come up with possible types of crops/products that should be grown close to the marketplace and the justifications for those decisions.

Key Points for the Discussion:

- Perishable products (like fresh fruits and vegetables) require more expensive and less efficient transportation, so it likely makes sense to grow these closer to

- where they will be sold. However, some products that are perishable are not able to be grown locally due to climate.
- Similarly, bulky items (like meat and corn) can be difficult to transport and store, so it would be more efficient to grow/produce these close to the marketplace.
 - Products that are in high demand during particular seasons (turkeys, pumpkins, Christmas trees) that can be grown/produced locally can also be sourced near the marketplace.
 - Encourage students to think of additional examples.

Slide 5:

- Next, students will investigate how consumer selection and marketing influence local buying trends. Depending upon students' access to computers connected to the internet, students can work individually, in pairs or in small groups to review the following online resources:
 - **2015 Local Food Marketing Practices Survey**
https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Local_Food/index.php
 - **What Influences Consumer Choice of Fresh Produce Purchase Location?** <http://ageconsearch.umn.edu/bitstream/48755/2/jaae162.pdf>
 - **Marketing Functions, Markets, and Food Price Formation**
https://web.stanford.edu/group/FRI/indonesia/documents/foodpolicy/chapt4_fm.html
- After the research phase, students will complete the 3-Minute Pause Activity. The Three-Minute Pause provides a chance for students to stop, reflect on the concepts and ideas that have just been introduced, make connections to prior knowledge or experience, and seek clarification. Have students fill in the **Three-Minute Pause student handout** and close Day 1 of the lesson.

Day 2 (Slides 6-9)

Students will investigate and describe the barriers to growth, as well as future growth opportunities, that have the potential to yield the greatest benefit to consumers and the economy.

Slide 6:

- Direct students to read through the information presented within the articles (links below) and summarize key aspects on a separate sheet of paper or in their notebooks:
 - **Economic/Social Dimensions of the Sustainability of Farming Practices and Approaches** <https://www.nap.edu/read/12832/chapter/7>
 - **Livestock production: recent trends, future prospects**
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2935116/>
- Select students using equitable calling strategies to share examples uncovered during their research. Record these ideas on the whiteboard and circle any ideas that have been repeated or reemphasized. Use this as an opportunity to review or re-introduce the concept of sustainable agriculture:
Sustainable Agriculture (SA) = The production of plant/animal food and/or products using farming techniques that protect public health, human communities, the environment, and animal welfare.

Slide 7:

- Next, students will use real government data to inform their choice of a “farm to table” restaurant site based upon the farm sizes, crops produced, and production techniques (organic/conventional) common to a given area. Teachers should select three geographically diverse counties from within their state or different states for

groups of students to analyze. Students will navigate to the county level report for each in the 2012 USDA Census of Agriculture (link below) and also review the Organic Farming Survey to compare and contrast agricultural production in these areas to select their hypothetical restaurant site based on farm sizes, agricultural products, and methods of production. Then, they should complete the **Farm-Site Selection & Data Graphic Organizer**, justifying their selections based upon evidence in the data.

- **2012 USDA Census of Agriculture: Reports by State and County**
https://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/
- **Organic Farming Survey 2014**
https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Organics/2014_Organic_Survey_Highlights.pdf

Slides 8 & 9:

- Lastly, students will engage in a discussion of land-use and marketing strategies to promote sustainability. Show students the sustainability triangle image to emphasize the different dimensions associated with agricultural sustainability (economy, social equity, and environment).

Key Points for the Discussion:

- The economic corner involves such factors as infrastructure, security, fair trade/wages, and good jobs.
- The social equity corner entails working conditions, health services, educational services, community/culture, and social justice.
- The environmental corner deals with issues such as renewable energy, conservation, restoration, and pollution/waste.
- In the discussion, connect these factors to specific land-use and marketing strategies. For example, in the economic and social legs, producers could use marketing strategies that highlight "farm worker-friendly" practices, such as "fair labor" certification. In the environmental leg, producers could engage in land use practices, such as the use of smart sensors for irrigation or retaining/recycling nutrients on the farm.
- After debriefing, have students complete the **Exit Ticket: Sustainability student handout**. They should choose one factor (economic, environmental, or social) and describe how specifically it promotes agricultural sustainability through either land-use or marketing strategies.

Name: _____

Think-Pair-Share (TPS) <i>What are examples of biotic and abiotic characteristics?</i>
THINK - My thoughts and ideas:
PAIR – What my partner and I think:
SHARE – What my classmates shared:

Name: _____

3-Minute Pause <i>How consumer selection and marketing influence local buying trends</i>	
I changed my attitude about...	
I became more aware of...	
I was surprised about...	
I felt...	
I related to...	

Name: _____

“Farm to Table” Restaurant Site Selection & Data Graphic Organizer	
SITE SELECTED: _____	
FACTOR	JUSTIFICATION BASED ON EVIDENCE FROM DATA
Farm Size	
Crops Grown	
Production Technique (Organic/ Conventional)	

Name: _____

Exit Ticket (Sustainability)

Instructions:

Choose one factor (economic, environmental, or social) and describe specifically how it promotes agricultural sustainability through either land-use or marketing strategies. Make sure to write in complete sentences.