Agriculture and Water in the United States

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Unit Description

This unit includes two 90-minutes lessons focusing on agriculture and water. For background readings and resources on agriculture and water, go to the Geography: Teaching with the Stars web site at http://geoteach.org and click on the Teacher Resources page. This page also includes a profile of Lori Barber.

The purpose of this unit is to examine two different aspects of agriculture and water in the United States. It is part of a Grade 12 AP Human Geography course. In the first lesson, students examine the distribution of grain crop production in the U.S., along with the factors that influence those distributions, including precipitation. The second lesson examines the impact of dairy production on water quality.

Instructional Objectives

After participating in these lessons, students will be able to:

- interpret maps showing dairy and grain production in the United States
- explain how the distribution of grain crops is affected by temperature, precipitation, and landform patterns.
- explore different perspectives of a water quality problem associated with dairy farming.
- develop and present arguments for and against a law intended to manage water quality.

National Standards

Note: New Geography Standards will be available in December, 2011.

Materials and Advance Preparation

All materials you need to conduct these two lessons are either provided in this guide or are available via links contained in the guide. The following is a list of the materials and links contained in the guide, along with some suggestions for preparing them for use.

Lesson One: Amber Waves

- **Crop Overview** transparency master(Pages 4–5)
- Three or four copies of each of six **Crop Maps** (corn, sorghum, oats, wheat, rice, barley).These maps are available on-line at the address below. **Note:** For consistency, use the production acreage by county maps for each crop.
  http://www.nass.usda.gov/Charts_and_Maps/index.asp
- Six copies (one set for each group) of the **Precipitation, Temperature, and Elevation** maps. These three maps are available on-line at the addresses below.

United States Geological Survey
The Geographic Face of the Nation—**Elevation**
http://www.virtualfieldwork.org/MapPing_US_%26_North_American_Earth_Systems/Entries/2009/9/19_THE_GEOGRAPHIC_FACE_OF_THE_NATION_-_ELEVATION.html

National Atlas: **Precipitation**
http://nationalatlas.gov/printable/precipitation.html

National Atlas: **Annual Mean Daily Maximum Temperature**
http://nationalatlas.gov/printable/images/pdf/climate/max_temp_6.pdf

Houghton Mifflin
Education Place: USA Average Precipitation and Temperature
http://www.eduplace.com/ss/maps/pdf/usclim.pdf

- **Guiding Questions** transparency (Page 6)
- A copy of the **Map Interpretation Worksheet** for each student. (Pages 7–9)

Lesson Two: Got Milk?

- A copy of the **Milk Cow Map** for each student. This map is included in the guide. (Page 11) A link to the source is also provided.
- A copy of the **Map Interpretation Worksheet** handout for each student. (Pages 7–9)
- A copy of **Joel Rekas' Decision** handout for each student. (Pages 12–13) (The handout includes four guiding questions for students to use as they read.)

Lesson One:
Amber Waves

Opening the Lesson

1. Indicate that in this lesson, students will examine the general distribution of major grain crops in the United States.

2. Project the **Crop Overview** transparencies on the screen. Take a few minutes to highlight each crop. Encourage students to comment on and ask questions about the information presented.

Developing the Lesson

3. Divide students into six groups of three or four (one group for each of the six crops included in the lesson). Assign each group to a particular crop and distribute copies of their assigned **Crop Map** to the members of each group. Distribute a copy of the **Precipitation, Temperature, and Elevation** maps to each group.

4. Project the **Guiding Questions** transparency on the screen. Ask the groups to address the four questions contained on the transparency as they examine their assigned map and prepare their presentation.

5. Distribute a copy of the **Map Interpretation Worksheet** to each student. Encourage students to use the procedure outlined in the handout to help work through the activity.

6. Give the groups between 45 and 60 minutes to complete their analysis. Encourage the students in each group to share and discuss what they are learning about their assigned group among themselves and to select a spokesperson for their group. You might want to circulate among the groups to monitor their progress and to ask and answer questions, as necessary.

Closing the Lesson

7. After the allotted time, ask the spokesperson for each group to share their work with the class, using the guiding questions as a framework. Have the groups use a wall map of the United States in their presentations. Presentations should take no more than 3-5 minutes. Encourage other class members to ask questions to clarify their understanding of the information presented. You can ask presenters questions to clarify or extend what they have said.

Crop Overview

Overview: Corn

- Corn is the most widely produced feed grain in the United States, accounting for more than 90 percent of total value and production of feed grains.
- Around 80 million acres of land are planted to corn, with the majority of the crop grown in the Heartland region.
- Most of the crop is used as the main energy ingredient in livestock feed.
- Corn is also processed into a multitude of food and industrial products including starch, sweeteners, corn oil, beverage and industrial alcohol, and fuel ethanol.
- The United States is a major player in the world corn trade market, with approximately 20 percent of the corn crop exported to other countries.

Overview: Rice

- Rice is produced worldwide and is the primary staple for more than half the world's population.
- In the United States, rice farming is a high-cost, high-yielding, large-scale production sector that depends on the global market for almost half its annual sales.
- Although the United States ships rice worldwide, the Western Hemisphere is the largest market for U.S. exporters.

Overview: Wheat

- The United States is a major wheat-producing country, with output typically exceeded only by China, the European Union, and India.
- Wheat ranks third among U.S. field crops in both planted acreage and gross farm receipts, behind corn and soybeans.
- U.S. wheat harvested area has dropped off nearly 30 million acres, or nearly one-third, from its peak in 1981 because of declining returns compared with other crops and changes in government programs that allow farmers more planting flexibility.
- About half of the U.S. wheat crop is exported.
- Despite rising global wheat trade, the U.S. share of the world wheat market has eroded in the past two decades.
- Winter wheat, which normally accounts for 70 to 80 percent of U.S. production, is planted in the fall and harvested in the spring or summer.

Overview: Sorghum

- sorghum is a principal feed ingredient for cattle hog and poultry feed.
- Sorghum is ground, cracked, steam flaked, and/or roasted. It can be cooked like rice, made into porridge, baked into flatbreads and popped like popcorn. A small amount is grown for syrup,
- Sorghum originated in Egypt 4,000 years ago.
- It is believed that Benjamin Franklin introduced the first grain sorghum crop to the United States.
- Sorghum ranks fifth among the most important cereal crops of the world, after wheat, rice, maize, and barley in both total area planted and production.

Overview: Barley

- Barley is the fourth most important grain crop in the United States
- It was first discovered as a wild grass in Asia, thousands of years ago
- Christopher Columbus may have brought barley to North America on this 1492 journey.
- Half or more of the barley grown in the US is used for livestock feed.
- It is used as an ingredient in prepared foods such as breakfast cereals, soups, breads, cookies, crackers, and snack bars.

Overview: Oats

- Oats are a cereal grain used primarily as food for livestock, especially horses.
- Only about 5 percent of oats are consumed by humans, chiefly in the form of rolled oats or oatmeal for breakfast foods.
- During the Bronze Age, the time when horses were first used as draft animals, oats were widely grown in N Europe
- Oats were once considered a weed which grew with barley and wheat.
- Oats were introduced into the Americas in 1602 by a sea captain who planted them in one of the islands off the coast of Massachusetts.

Guiding Questions

1. In what regions was the crop grown?

2. What is the climate (temperature and percipitation) where the crop was grown?

3. What was the landscape (elevation) in these areas?

4. Were you surprised by anything you learned about your crop?

Map Interpretation Worksheet

The following three-step procedure can be used for unlocking the information contained in a map.

Step 1: What is the map about?
The first step in obtaining information from a map is previewing. This is done to determine what the map is about. Previewing involves five tasks.

A. **Inspect the title:** This will allow you to quickly determine the subject of the map.

B. **Decode the symbols:** Always study the legend to find out what the symbols used on the map mean. Remember, some of the symbols used are not listed in the legend.

C. **Examine the scale:** The map scale tells the relation between distance on the map and distance on the ground.

D. **Use the direction indicator to find north:** Knowing where north and the other cardinal directions are make it possible to find and describe the location of features on the map.

E. **Check the footnotes:** The map footnotes tell the source of the map information and may provide further information, important to understanding what the map is about.

Complete each of the five tasks outlined above for your assigned crop map. Record your observations of what the map is about in the space below:

Step 2: What does the map say?
The second step in examining a map is determining what the map says. This involves looking carefully at the particular way in which things are arranged over the entire map. A basic distinction is made between clustered arrangements and even arrangements. With a clustered arrangement, things are located close together. With an even distribution, things are more spread over the map area.

Is the crop you are examining clustered in certain places in the United States or is it evenly distributed over the country? If it is clustered, where in the country is it clustered? Record your observations about what the map says in the space below.

Step 3: Summarizing the Information
The information obtained from the map should be combined into a brief , well-oragized summary paragraph.

Record your summary paragraph about your crop map in the space below.

Step 4: What does the map mean?
Once the arrangement of things on the map has been described, the final step in examining the map is to determine what the arrangement means. An even or clustered arrangement of things suggests that there is an explanation for why those things are located where they are. For example, in this lesson, you might ask why is a particular crop clustered where it is?

A strategy for beginning to explain a particular arrangement, for example a crop clustered in a particular region of the country, is to compare it to the arrangement of other related phenomena. For example, you might ask, "What other phenomena are related to the distribution of the crop I am studying?. This strategy involves four parts:

1. Determine what to compare.
   - Develop one or more possible explanations of the arrangement of the phenomenon you are studying. For example, elevation patterns may help explain the distribution of rye production in the US.
   - Describe why a relationship might exist between the arrangements under consideration. For example, rye thrives when it is grown on relatively flat land.
   - Use that explanation as a guide in deciding what to compare. For example, I will compare a map of rye production to a map of elevation.
   - Ask the question, "How does the arrangement of one phenomenon (for example rye) compare with the other arrangement (for example, elevation).

Follow these four steps to determine what phenomena to compare to your crop map. Record your ideas in the following space.

2. Use comparable maps.
   - Information contained on the maps being compared must be for the same study area. For example, a map that has information for a state cannot be compared with a map that has information of the entire country. Note: You will be given comparable maps to use in this activity.
   - Important: Before going further, answer the "What does it mean?" and the "What does it say?" questions for all maps being used to make comparisons.
3. Compare the arrangements.
   - Once the arrangements to be compared have been determined, comparable maps showing those arrangements have been secured, and you know what all of the maps you plan to use are about and what they say, the actual comparison can be made. To do this, lay the map transparency of one of your possible explanations (for example, elevation) over the distribution you are trying to explain (for example rye production), and compare them. You might find, for example, that, in comparing the elevation map to the rye production map, that rye grows at low lying flat areas. Repeat this step for each of your possible explanations.

Describe the similarities and differences between the maps that you compared in the space below.

4. Draw conclusions from the comparison.
   - Once the arrangement of phenomena on the maps has been compared, it is possible to draw conclusions about the relationship between the two distributions. If the arrangement of one phenomenon is similar to that of another, it can be concluded that the arrangements are related. For example, if two maps show that the location of low lying areas and the location of rye production are generally similar, you can tconclude that rye grows at low elevations
   - There may be some differences within the generally similar patterns. That inconsistency may suggest that other factors are also at work. For example, the fact that there are areas of low elevation elsewhere in the country where rye is not grown indicates that while elevation is one of the factors that influences where barley is grown, it is not the only factor. You can then test other possible explanations.

Draw conclusions from the maps you compared. Record your observations in the space below.

Lesson Two:
Got Milk?

(2 days)

Opening the Lesson

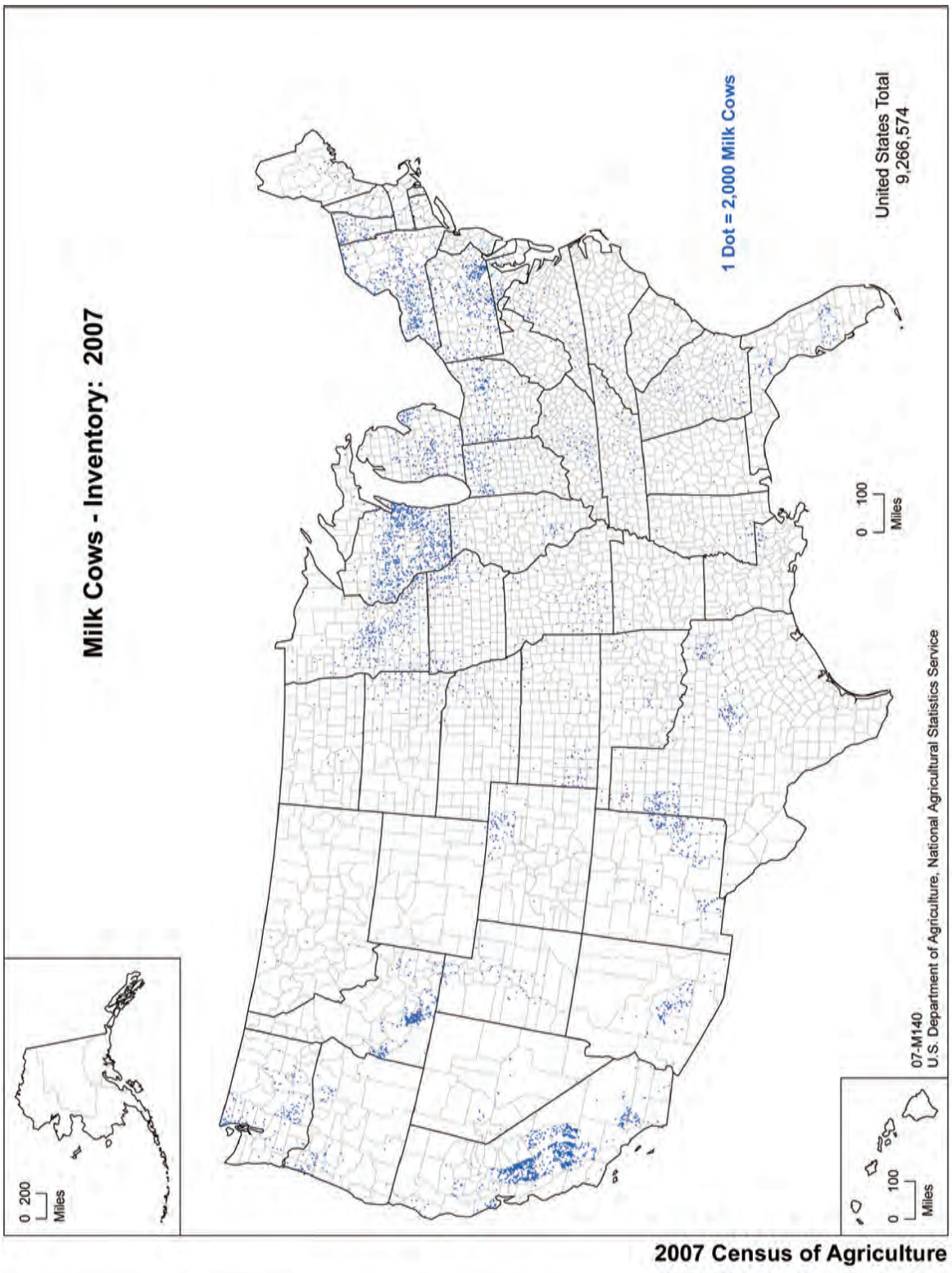
1. Distribute a copy of the **Milk Cow Map** handout to each student.
2. Ask for volunteers to describe the pattern of dairy production in the United States, portrayed on the map.
3. If students need practice in interpreting maps, you might distribute a copy of the **Map Interpretation Procedure** handout to each student, and have them work in pairs to interpret the map using the handout as a guide. Give the pairs about 15-20 minutes to complete this task. After the time allotted, ask for volunteers to share their work for the three step procedure with the class.
4. Indicate to students that in this lesson they will explore one of the problems that results from intensive dairy farming.

Developing the Lesson

5. Remind students that one of the areas on their maps where dairy farming is clustered is Wisconsin. Indicate that they will be examining a case study focusing on a dairy producing county in Wisconsin.
6. Distribute a copy of the **Joel Rekas' Decision** handout to each student. Have students read the story, using the guiding questions contained in the handout to structure their reading.
7. Call on students to recount the basic aspects of the story. For example, you can call on one student to give the name of the main character involved. Others could be asked to summarize the story as they understand it. Focus the discussion on the situation the central character confronts, the decision he must make, and the possible alternatives.
8. Divide the class into four groups: the County Council, including Joel Rekas; environmentalists, home owners, and dairy farmers and businessmen. Have each group prepare a position statement, based on the role they are playing, and choose a spokesperson for the role. You could move among the groups explaining in more detail what their roles are, suggesting possible strategies to use, and answering any questions that the groups have. Give the groups between 30 and 45 minutes to complete this task.

Concluding the Lesson

9. After the allotted time, have the county board spokesperson assemble the meeting, lay out the general issue to be considered, and invite the spokespeople for the various groups to present their arguments. After the formal comments by stakeholders, the Council should encourage individuals to comment further on the proposed law.
10. Call for a short break while the County Council decides on a course of action. Then have the Council spokesperson present the Council's decision to the meeting participants. After the Council spokesperson presents the decision, meeting participants should be encouraged to express their opinions on the decision, based on what they learned in the activity.



Source: http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Ag_Atlas_Maps/Livestock_and_Animals/Livestock,_Poultry_and_Other_Animals/07-M140-RGBDot1-largetext.pdf

Joel Rekas' Decision

Joel Rekas grew up in Brown County, Wisconsin. Green Bay is the county seat. The county is one of the nation's largest milk-producing regions. His family had little money. It was a real struggle to go to college, which he financed by working on dairy farms near his home in Morrison every summer.

For several years after graduating for the University of Wisconsin Law School, Joel practiced law in Brown and surrounding counties. Many of his clients were dairy farmers. Eventually, some of the local people persuaded him to run for a seat as a commissioner on the Brown County Council. Dairy farmers in the county, whom he knew all his life, contributed substantially to his campaign, which he won.

In his role as commissioner, Joel travelled around the county meeting with constituents. On these trips, he heard some disturbing stories. In Morrison, for example, more than one hundred wells, the main source of water for homes, were polluted in a three month period. As parasites and bacteria seeped into drinking water, residents suffered from chronic diarrhea, stomach illnesses, and severe ear infections. As one woman told him, "Sometimes it smells like a barn coming out of the faucet." Tests of her water showed it contained with E.coli, coliform bacteria, and other contaminants found in, among other things, cow manure. Her young son developed ear infections that eventually required an operation. Her doctor told her that the infections were probably caused by bathing in polluted water.

From his experience working on dairy farms, Joel knew that the dairy herds in Brown County were growing. One farmer he worked for had just 60 cows 20 years ago. Now he has 1, 400 animals milked by suction pumps. The growth of this farmer's herd was easily matched by many other farmers in the county. Joel learned that in his home county, the cows produce more than 260 million gallons of manure each year, much of it spread on nearby grain fields as fertilizer. When the amounts of waste spread on the fields are too great, and the waste is washed off the land, by melting snow or a heavy rainfall for example, bacteria and chemicals can flow into the ground and contaminate residents' well water.

At the beginning of his second term as a commissioner, the Brown County Board of Commissioners was considering a law giving the County Council the powers to regulate discharge of farm waste into streams and groundwater. The law would permit the county to specify and monitor how much and when manure could be applied to fields, in an effort to control water contamination.

A local environmentalist told the Council that she is fairly certain that manure had contaminated well water, making residents ill. As she said, "One cow produces as much waste as 18 people. There just isn't enough land to absorb that much manure, but we don't have laws to force people to stop."

Expert testimony before the County Council indicated that runoff from all but the largest farms is essentially unregulated by many of the federal laws intended to prevent pollution and protect drinking water sources. The Clean Water Act of 1972 largely regulates only chemical contaminants that move through pipes or ditches. That means it does not typically apply to waste that is spread on a field and seeps into the groundwater. As a result, many of the agricultural pollutants that contaminate drinking water sources are often subject only to state and county regulations, which have failed to protect nearby residents. These are the residents who depend on well water for their fresh water supply.

Another expert witness argued that it is often difficult to definitively link a specific instance of disease to one particular cause, like water pollution. Even when tests show that drinking water is polluted, it can be hard to pinpoint the exact source of the contamination. It might be dairy farms, but it could also be rural homes, suburban development or other "non-point" sources of pollution. .And dairy owners argued that it was unfair to blame them for the county's water problems. They noted that state regulators were unable to definitively establish the source of recent contamination episodes.

Joel faces the issue of contaminated water first hand. There were signs above drinking fountains at his children's elementary school warning that the water might be dangerous for young children. He knows there is a problem of well contamination. He also understands that while dairy farming is critical to the county's economy, the dairies collectively create as much as a million gallons of waste every day. If the County regulates how much manure can be spread on the grain fields, what would farmers do with that extra waste? Besides, if they could not use manure, a natural fertilizer, on their grain crop, would they turn to chemical fertilizers to grow their grain, the primary food source for dairy cattle? How would using chemical fertilizers affect the water supply? Also he is not absolutely sure that the contaminants in the water were coming from the dairy farms, based on what he heard from expert testimony.

Should Joel and the other members of the Brown County Council vote to support the bill cracking down on dairy farmers?

Adapted from "Health Issues Abound as Farm Runoff Fouls Wells." Charles Duhigg. New York Times. September 18, 2009.

Guiding Questions

1. What is the issue?

2. What is being polluted?

3. What is the new law being proposed?

4. What are the pros and cons of the proposed law?