18. How the size and organization of farms has been influenced by the Green Revolution (locally, nationally, internationally)

Overview
The Green Revolution, or Third Agricultural Revolution, has had a major impact on the location of where a wide variety of agricultural products can be grown. It has also had a major impact on how crops are grown and the way farms are organized. These changes are often a source of discussion and debate. To be informed citizens and consumers students need to have an understanding of these changes.

Grade Levels: 9 – 12
Time: Each activity will take 1 - 2 days, maximum of 4 - 8 days.

Minnesota State Standards: Geography
Benchmark: 9.3.2.4.3
Explain how technological and managerial changes associated with the third agricultural revolution, pioneered by Norman Borlaug, have impacted regional patterns of crop and livestock production.

Prior Knowledge
In order to complete this lesson, students will need to know who Norman Borlaug was and the contributions he made to agriculture both in the United States and the World and the role he played in the Green Revolution. Students will need to be taught about Norman Borlaug and the Green Revolution prior to completing this lesson.

Lessons 18 Links for Prior Knowledge are available at www.mda.state.mn.us/ftt
1. Norman Borlaug video
2. Norman Borlaug: The Genius Behind the Green Revolution

Objectives
1. Students will be able to read and interpret choropleth and dot maps.
2. Students will be able to list and explain conclusions regarding what is happening to the size of farms in the United States.
3. Students will be able to explain why many farms are either small or large, but not as many medium sized farms.
4. Students will be able to explain how the Green Revolution has affected the size of farms.
5. Students will be able to explain how the Green Revolution has affected the spatial distribution of agricultural products.

Key words
• Green Revolution, Third Agricultural Revolution, kilofarm, family farm, partnership, corporate farm, Norman Borlaug, choropleth map, region, irrigated land

Materials
• Food for Thought Maps found at www.mda.state.mn.us/ftt
  ▶ Farmland Value in MN Counties (Map 26)
• 5-6 maps, selected by the teacher from www.agcensus.usda.gov. There are many maps to choose from. Some that are suggested for this lesson include:
  ⚫ Change in Number of Farms/Average Size of Farm
  ⚫ Change in Number of Farms
  ⚫ Land in Farms
  ⚫ Percent of Farms Operated by Family; Partnership; Corporation
  ⚫ Crop maps

• Lesson Links for additional resources at www.mda.state.mn.us/fft
  ⚫ Norman Borlaug Video
  ⚫ Norman Borlaug: The Genius Behind the Green Revolution
  ⚫ Kilofarms in the Agricultural Heartland
  ⚫ Comparing Agriculture of the Past with Today
  ⚫ Top 10 Technologies for the Farm
  ⚫ Changing Farming Practices Accompany Major Shifts in Farm Structure
  ⚫ Irrigated Land - Change in Acreage: 2007 - 2012
  ⚫ Corn Harvested for Grain - Change in Acreage: 2007 - 2012
  ⚫ All Wheat Harvested for Grain - Change in Acreage 2007 - 2012
  ⚫ Hogs and Pigs - Change in Inventory: 2007 - 2012
  ⚫ Milk Cows - Change in Inventory: 2007 - 2012
  ⚫ Behind the Movable Feast
  ⚫ Green Revolution
  ⚫ World Bank - Agriculture
  ⚫ The Next Breadbasket
  ⚫ Africa: Missing out on the Biotech Revolution
  ⚫ 40 Maps that Explain Food in America
  ⚫ New Technology in Agriculture Information

Procedure

Activity 1

1. Place students into groups of three or four. Provide each group of students with a packet of 5 - 6 maps (that the teacher selected from the USDA website) that will help the students to answer the following question: What is happening to the size of farms in the United States?

   Based on their analysis of their maps, students should be able to list three changes they are seeing in regards to the size of farms in the United States and be able to explain, using at least three pieces of evidence from the maps, why they believe these changes are occurring.

2. Provide each student with a copy of the reading “Kilofarms in the Agricultural Heartland.” This article is available in the Lesson 18 Lesson Links at www.mda.state.mn.us/fft. Using the student groups created to complete step #1, assign each group of students one portion of the article to read and summarize it (using the jigsaw reading strategy). While reading their portion of the article, have the students focus on information regarding the changes that have occurred to the size of U.S. farms.

   Have each group of students share their summary of their portion of the article with the rest of the class. The students’ summaries of their portion of the article should include information regarding what is happening to the size of the U.S. farms and at least three reasons why they think this is occurring, based on information they read and other knowledge they have regarding farming. While the students are sharing their summary, the teacher will be writing on the white board the major changes the students identified about farming in their reading. (Notes: Teachers could also modify this reading for your students before giving it to them to read. Or teachers could give the students a brief overview of the reading and the information it presents regarding the changes made to farming.)
3. Ask students to hypothesize, based on what they know, why the size of farms is changing. What is happening to the size of farms in Minnesota and the United States? While the students are sharing their responses, the teacher will record their responses on the whiteboard.

4. Following this discussion, the teacher should show students the Farmland Value in Minnesota Counties (Map 26) from the Food For Thought map collection. Ask the students to analyze the map and look for information that would help them explain the changing size of farms. Students should share their ideas and while they are sharing them, identify if they match their previous responses listed on the board. Discuss with the students the possible explanation for the similarities in their hypothesis and the evidence presented in the map.

Assessment
1. Students will be assessed on their analysis of the maps and their ability to identify three changes they are seeing in regards to the size of farms in the United States and their ability to support their analysis with at least three pieces of evidence from the maps, as well as their hypothesis as to why these changes are occurring

2. Each student will individually write a reflection paragraph on the article “Kilograms in the Agricultural Heartland” in which they identify what they think is the most important and/or interesting ideas presented in the reading regarding changes made to farms.

Activity 2
1. Have students read the following article to gain background information on the changes made to farming over the past 200 years in the U.S. “Comparing Agriculture of the Past with Today” which can be found at Lesson 18 Lesson Links at www.mda.state.mn.us/ftt.

While reading the article, have the students identify the 2-3 most significant changes (in their opinion) that have occurred in agriculture over the past 200 years. Have the students share the changes they identified with a partner and have each pair identify the most significant change that has occurred in agriculture. Have each pair of students share their most significant change with the rest of the class. While the students are sharing their changes, the teacher will write the changes on the board. After all the students have shared their changes, have a class discussion regarding the changes listed and why these are the most significant changes that have occurred in agriculture in the past 200 years.

2. Have students conduct a gallery walk of the 10 Technologies that are Changing Farming. (Hint: Teachers can print out the images and descriptions of each of these 10 technologies from the Lesson 18 Lesson Links at www.mda.state.mn.us/ftt website to hang around the room or in the hallway for students to view as they conduct the gallery walk). While the students are conducting their gallery walk, they are to identify one (1) positive impact and one (1) negative impact each type of technology has had on farming. (Hint: Teachers may want to create a chart for this to assist students in organizing the information they are gathering.)

After the students have completed their gallery walk and completed their chart on the positive and negative impacts these technologies have had on agriculture, have a class discussion on the impact these changes are having on farming. Use the following questions to help guide your discussion: What impact has the increased use of technology had on farming? What do these changes mean for the farmer? What do these changes mean for the farm worker? What impact do these changes in agriculture have on the economy of Minnesota?

Assessment
1. Students should be evaluated on their discussion of the history of agriculture and their discussion of the changes technology made to agriculture.

2. Students could also be assessed on their individually completed chart on the gallery walk of the 10 Technologies that are Changing Farming.

Activity 3
1. Provide each student with a copy of the following article “Changing Farming Practices Accompany Major Shifts in Farm Structure” found at Lesson 18 Lesson Links at www.mda.state.mn.us/ftt. While reading the article in pairs, have the student create a Top 10 List of reasons for the changes that have occurred to the structure of farms in the United States. After the students have created their list, have a member from each pair share their list with the class. While the students are sharing the list, the teacher will list the students’ reasons on the board. Once all the students have shared their reasons, have a class discussion about the commonalities that appeared in the students’ lists. What was the most significant reason(s) the students identified for the change in the structure of farms in the United States?
2. In this activity students will be answering the question, “How has the technology affected where agricultural products are located”?

In groups of three or four have students read and analyze the five maps listed below and answer the following question: What changes have occurred in locations on each map? Links to the maps are at Lesson 18 Lesson Links at www.mda.state.mn.us/ftt.

- Irrigated Land Change 2007 - 2012
- Corn Harvested for Grain Change 2007 - 2012
- All Wheat Harvested for Grain Change 2007 - 2012
- Hogs and Pigs Change in Inventory 2007 - 2012
- Milk Cows Change in Inventory 2007 - 2012

3. Based on their analysis of the five maps listed above and information gathered in the previous activities, students are to answer the following question with another group and in writing. Based on the group’s analysis of the maps provided, what conclusions can be drawn regarding the spatial distribution of the five commodities being displayed? Students need to support their conclusions with at least five pieces of evidence from the maps.

4. Have each group of students share their answers with another group of students. After the groups of students have shared their information with each other, the two groups of students will share their conclusions with the class and provide at least one piece of evidence from the maps to support their conclusions. As students are sharing their conclusions and evidence, the teacher will write the students’ hypotheses and pieces of evidence on the whiteboard. Based on the evidence provided by the students, have a discussion regarding the hypotheses the students developed and any similarities and/or differences that exist between the students’ hypotheses.

5. After the discussion of the hypotheses, assign each group of students one of the agricultural product maps used in step #1 above and one hypothesis developed and shared in step #4 above. Each group will need to analyze their map to determine if the hypothesis developed by their classmates was correct or not. Students will need to conduct additional research to help them in their analysis. The resources listed at the beginning of this lesson could be shared with the students.

6. After the groups have conducted their research, each group will share with the class the information they gathered, whether the hypothesis was correct and explanations, using geographic data from their research to support their conclusions.

7. After all the groups have shared their research, each student is to individually answer the following question: (Students responses should be a minimum of two paragraphs in length)
   - What impact, if any, has the increased use of technology had on the location of these agricultural products?

Assessments

1. Students should be evaluated on their discussion of their analysis of the maps and their explanation of the accuracy of the hypothesis based on research conducted.

2. Students could also be assessed on their individual writing assignment.

Activity 4

1. Show the students the following map from National Geographic “Behind the Moveable Feast.” This map can be found at Lesson 18 Lesson Links at www.mda.state.mn.us/ftt. Have the students study the map and identify the areas of the world that export the most food. Have the students then brainstorm reasons why the countries/areas of the world they identified were able to export so much food. Remind the students to use information learned in previous activities to help them with their brainstorming. Have the students share their reasons with the rest of the class. The teacher will then ask the students to look at their reasons and identify, as a class, those that are related to the Green Revolution. Then have the students consider the following question: How did the Green Revolution allow Latin America and Asia to be able to export so much food?

2. As a class, have the students analyze Africa on the previous map. While analyzing the map and previous knowledge they have of Africa, students are to identify 3 - 4 reasons why Africa is not a major food exporter. (Possible answers: too dry, soil fertility, aridity, subsistence vs. commercial farmers, lack of money, lack of technology, conflict - political or religious, etc.)

3. Ask students the following question: “Is Africa ready for the Green Revolution to help them become a major food exporter? Will that be good for Africa?”
4. Place students into pairs and have each pair of students answer the two questions listed in #3 and provide at least 8 - 10 reasons to support their answer. (Students may identify that African countries are ready for the Green Revolution and that it would be good for Africa; that African countries are not ready for the Green Revolution and why it would not be good for Africa; or that African countries are ready for the Green Revolution but it would not be good for Africa.)

5. Listed below are resources students can use to gather more information regarding Africa and whether or not it is ready for the Green Revolution. All articles can be found at Lesson 18 Lesson Links at www.mda.state.mn.us/ftt.
   a. Green Revolution
   b. World Bank - Agriculture
   c. The Next Breadbasket
   d. Africa: Missing out on the Biotech Green Revolution

6. Have each pair present their answers with the class. On the whiteboard, the teacher should write the following headings for columns on the board: Africa is ready for the Green Revolution, Africa is not ready for the Green Revolution, Green Revolution is good for Africa, Green Revolution is bad for Africa. As the students share their answers, the teacher should write the student reasons under the appropriate heading on the whiteboard.

7. Conclude the lesson by having students, individually, write a two paragraph reflection on if Africa is ready for the Green Revolution and whether or not it would be good for Africa.

**Assessment**
1. Students will be assessed on the discussion of their reasons and their individual two paragraph reflection.

**Resources**
+ Handout One: Historical Timeline
+ Handout Two: Crops Moving North
### Directions:
Use the information provided on the Historical Timeline – Farmers and the Land to complete the chart listed below. This information can be found on the website “Growing a Nation: The Story of American Agriculture” which can be found at [https://www.agclassroom.org/gan/timeline/farmers_land.htm](https://www.agclassroom.org/gan/timeline/farmers_land.htm). Note: For some of the years, not all of the data is provided so for these years, place NA in those categories not provided on the timeline.

### Historical Look at Farming in the United States from 1790 – 1990

<table>
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<th>Year</th>
<th>Total Population</th>
<th>Farm Population (est.)</th>
<th>Percent (%) Farmers in Labor Force</th>
<th>Number of Farms</th>
<th>Average Acres Per Farm</th>
<th>Number Irrigated Acres</th>
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Crop Production Moving North

MAPLE GROVE — Planting of major commodity crops is shifting northward in greater amounts than ever before, according to the June 30 Crop Acreage Report from USDA’s National Agricultural Statistics Service.

“This report is particularly useful because it shows in real terms how farming is moving farther north as we see longer growing seasons and other shifts that lend themselves to new production areas. It’s a trend that many have predicted as folks look at climate change impacts on agriculture,” said Bill Bond, executive director of the Minnesota Crop Production Retailers Association. “As we begin to see these shifts, it’s critical for those of us in production agriculture to continue a strong dialogue on what the future might hold — both in terms of new opportunities for production, as well as long-term challenges to meeting consumer demand.”

In the new report, Minnesota followed a trend that stretches across the northern U.S., with the total amount of corn, wheat and soybeans planted in the state reaching a new record high for 2014 at more than 17.3 million acres. This is just the second time the figure has topped 17 million acres statewide in Minnesota — and total combined planting of those crops in the state is up 580,000 acres from 2010 levels.

Record planting in Minnesota was mirrored across traditional commodity production states of the northern plains, as well as areas farther east. The USDA report shows record high planted acreage of combined corn, wheat and soybean crops in Michigan, North Dakota, South Dakota, Ohio, Pennsylvania, New York and Wisconsin.

While the phenomenon of conservation land returning to production could help to explain some of this change, the increase in planting documented by USDA significantly outpaces the reduction in acres set aside for conservation in Minnesota. While total Minnesota enrollment in the Conservation Reserve Program, for example, is down about 340,000 acres since June 2010, planted acres of corn, wheat and soybeans are up by 580,000 acres — a difference of nearly a quarter of a million acres.

“The recent crop report is a reminder of a changing landscape,” said Bond. “This is something our industry should closely follow as we prepare for the coming years and generations.”