16. Does the von Thunen Model fit Minnesota Agricultural Production Patterns?

Overview
Often students wonder why they need to learn geographic models, especially those that were created in the 1800’s. Applying models to modern day reality is one way to have students test a model. Students will need to be reminded that models are never exact in the real world, but do give us guidelines to help explain the spatial patterns that are observed. This particular lesson helps students to better understand the von Thunen model using the location of production of Minnesota agricultural products.

Grade Levels: 9 – 12
Time: Two 50 minute class periods.
   One class period to introduce and practice von Thunen’s Model.
   Second class period to do the mapping exercise.

Minnesota State Standards: Geography
Benchmark: 9.3.2.4.1
Apply geographic models to explain the location of economic activities and land use patterns in the United States and the world.

Prior Knowledge
• Students need to be familiar with the von Thunen Model
• Resource 1 – Pages 81 & 82

Objectives
• Create a map that will display the dominant counties that grow/raise eleven Minnesota agricultural commodities.
• To determine if von Thunen’s Model helps to explain the spatial pattern of Minnesota’s agricultural commodities.
• Explain why von Thunen’s Model applies/does not apply. List and explain three reasons for your answer.

Materials
• Food for Thought Maps found at http://www.mda.state.mn.us/fft
  ➢ Sweet Corn and Green Peas in MN (Map 17)
  ➢ Nurseries in MN (Map 18)
  ➢ Apple Growers in MN (Map 21)
  ➢ Vegetable Canning and Freezing Sites in MN (Map 28)
  ➢ Meat Processing Plants in MN (Map 30)
  ➢ Major Highways in MN (Map 38)
  ➢ Railroads in MN (Map 39)
  ➢ Minnesota Counties (named) (Map 41)
• Food for Thought Color Student Desk Map, one for each student
  (Order this free resource at http://www.mda.state.mn.us/fft)
• Resource 1: von Thunen Reading and Activity
• Colored Pencils
Key words
• von Thunen Model, extensive agriculture, intensive agriculture

Procedure
• Once students have been taught von Thunen’s Model and have practiced working with it (Resource 1) they are then ready to apply it to the real world.

Put students into pairs.
• Give each pair the Food for Thought Color Student Desk Map, and the and the Food for Thought Online Maps: Sweet Corn and Peas, Nurseries in Minnesota, Apple Growers and Minnesota Counties (Named).
• Each pair will also need colored pencils.
• Review with students how to read a choropleth map, reminding them that the darker the color the more dominant the product is in a county.
• Have student locate and label Minneapolis/St. Paul on their Minnesota Counties (Named) Map (Map 41). In this exercise Minneapolis/St. Paul will be the Market.
• Inform students they will be putting all eleven maps onto the Counties Named Map. They will do this by only using the darkest colored counties for each product. Some counties will have more than one product so students should use the following guidelines when creating their map:
  ➤ Use a letter to indicate livestock; such as T – turkey, H- Hogs and pigs, etc. For crops students will use a different color for each crop, but they should put a small circle in the county it is located in and NOT color in the entire county. Students will need 7 different colored pencils.
• Once students have completed their maps, have them look at the von Thunen Model in Resource 1. Ask students; do Minnesota agricultural commodities follow the von Thunen Model using Minneapolis/St. Paul as the market? Each pair will write Yes or No at the top of the map. On the back of their map have each pair list and explain three reasons for their answer.
• Have pairs share their answers with the class.
• After this brief sharing period, have students write on the back of their maps, three reasons why they think von Thunen’s Model is still relevant and three changes in technology that would cause his model to be not as relevant as it was in the late 1800’s and early 1900’s.

Assessment
Students will turn in their maps. You are not assessing for a right or wrong answer, but you are assessing how correctly they justified their answers.

Teacher Notes:
When you use just Minneapolis/St. Paul von Thunen’s Model does generally apply. Remind students that models do not perfectly fit/explain the real world, but are useful tools to help explain the spatial distribution of human activity.
Many students will comment that extensive grains and livestock are reversed in Minnesota from von Thunen’s Model. Looking at Online Maps: Vegetable Canning and Freezing Sites in Minnesota (Map 28), Meat Processing Plants in Minnesota (Map 30), Major Highways in Minnesota (Map 38) and Railroads in Minnesota (Map 39). Have students use these maps to help explain why these would be reversed. Also bring up the idea of refrigeration and how that may impact where agricultural products are located.

KEY

<table>
<thead>
<tr>
<th>Product</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cattle</td>
<td>2</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>4</td>
</tr>
<tr>
<td>Strawberries</td>
<td>2</td>
</tr>
<tr>
<td>Feed grains</td>
<td>3</td>
</tr>
<tr>
<td>Field corn</td>
<td>3</td>
</tr>
<tr>
<td>Soybeans</td>
<td>3</td>
</tr>
<tr>
<td>Eggs</td>
<td>2</td>
</tr>
<tr>
<td>Lettuce</td>
<td>3</td>
</tr>
<tr>
<td>Wheat</td>
<td>3</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>2</td>
</tr>
<tr>
<td>Broccoli</td>
<td>2</td>
</tr>
<tr>
<td>Apples</td>
<td>4</td>
</tr>
</tbody>
</table>
The von Thunen model of agricultural land use was created by farmer and amateur economist J.H. von Thunen (1783-1850) in 1826. Von Thunen’s model was created before industrialization and is based on several limiting assumptions:

- The city is located centrally within an “Isolated State” which is self sufficient and has no external influences.
- The Isolated State is surrounded by an unoccupied wilderness.
- The land of the State is completely flat and has no rivers or mountains to interrupt the terrain.
- Fertility is the same.
- The soil quality and climate are consistent throughout the State.
- Farmers in the Isolated State transport their own goods to market via oxcart, across land, directly to the central city. Therefore, there are no roads.
- Farmers act to maximize profits.
- Because the environment is uniform there is no difference in the quality of a crop no matter where it is produced, and because the environment is the same everywhere and people are the same everywhere production cost for a crop are the same everywhere. Therefore, the market price for a crop will be the same for the crop no matter where the crop is grown. Profit for an acre of product is equal to Market price per acre minus the Transportation cost plus Production costs. Profit per acre = Market price per acre - (Production cost per acre + Transportation cost per acre).

In an Isolated State with the foregoing statements being true, von Thunen hypothesized that a pattern of rings around the city would develop. There are four rings of agricultural activity surrounding the city.

Dairying and intensive farming occur in the ring closest to the city. Since vegetables, fruit, milk and other dairy products must get to market quickly, they would be produced close to the city (remember, we didn’t have refrigerated oxcarts!)

- Timber and firewood would be produced for fuel and building materials in the second zone. Before industrialization (and coal power), wood was a very important fuel for heating and cooking. Wood is very heavy and difficult to transport so it is located as close to the city as possible.
- The third zone consists of extensive field crops such as grains for bread. Since grains last longer than dairy products and are much lighter than fuel, reducing transport costs, they can be located further from the city.
- Ranching is located in the final ring surrounding the central city. Animals can be raised far from the city because they are self-transporting. Animals can walk to the central city for sale or for butchering.
- Beyond the fourth ring lies the unoccupied wilderness, which is too great a distance from the central city for any type of agricultural product.

Even though the von Thunen model was created in a time before factories, highways, and even railroads, it is still an important model in geography. The von Thunen model is an excellent illustration of the balance between land cost and transportation costs. As one gets closer to a city, the price of land increases. The farmers of the Isolated State balance the cost of transportation, land, and profit and produce the most cost-effective product for market. Of course, in the real world, things don’t happen as they would in a model.
Profit for an acre of product is equal to Market price per acre minus the Transportation cost plus Production costs.
Profit per acre = Market price per acre - (Production cost per acre + Transportation cost per acre)

von Thunen Activity
Where would you choose to locate a farm specializing in the following products?

Dairy cattle ______  Soybeans ______  Broccoli ______
Beef cattle ______  Eggs ______  Apples ______
Strawberries ______  Lettuce ______
Feed grains ______  Wheat ______
Field corn ______  Tomatoes ______