Chapter 9
Food and Agriculture
1. Where Did Agriculture Originate?
2. Why Do People Consume Different Foods?
3. Where Is Agriculture Distributed?
4. Why Do Farmers Face Sustainability Challenges?
Key Issue 1: Where Did Agriculture Originate?

1.1 Introducing Food and Agriculture

1.2 Subsistence and Commercial Agriculture
Agricultural Revolution

• Environmental and cultural factors: end of ice age, preference for settlement

• Agriculture hearths developed from local plants and animals.
Figure 9-2: Multiple hearths emerged from locally available plants and animals.
Developed versus Developing World

1. Physical Environment
2. Types of crops grown
3. Stability of food supplies
4. Technology and tools
5. Methods of production
# Whittlesey’s Agricultural Regions

<table>
<thead>
<tr>
<th>Developing World</th>
<th>Developed World</th>
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<tbody>
<tr>
<td>1. Pastoral Nomadism</td>
<td>1. Mixed Crop and Livestock</td>
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<td>2. Shifting Cultivation</td>
<td>2. Dairying</td>
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<td>3. Intensive Subsistence, wet rice dominant</td>
<td>3. Grain</td>
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<td>4. Intensive Subsistence, other than rice dominant</td>
<td>4. Ranching</td>
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<td>5. Plantation</td>
<td>5. Mediterranean</td>
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<td>6. Commercial Gardening</td>
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What type of agriculture is being represented in each of the following images?
If you were a farmer, what type of agriculture would you do in each of the following locations?
Subsistence and Commercial Agriculture

- Percentage of farmers: high in subsistence, low in commercial
- Role of machinery, science, technology: low in subsistence, high in commercial
- Farm size: commercial generally much larger than subsistence
Figure 9-3: Developing countries have a higher percentage of the labor force engaged in agriculture, primarily subsistence.
Figure 9-4: Small amounts of farmland per tractor indicate a strong role of machinery in agriculture.
Key Issue 2: Why Do People Consume Different Foods?

2.1 Diet and Nutrition

2.2 Source of Nutrients
Diet and Nutrition

• People in developed countries eat more from different sources than people in developing countries.

• Climate affects what can be grown.

• Culture determines food choices too.
Figure 9-6: The largest source of calories varies by country, with maize, rice, and wheat being the most important. Maize is called corn in the United States and Canada.
Figure 9-7: Developed countries consume more calories per person on average than many developing countries.
Figure 9-8: A greater percentage of income is spent on food in developing countries.
Figure 9-11: A greater percentage of protein comes from meat for people in developed countries.
Cereals are the leading source of protein in developing countries.
Key Issue 3: Where Is Agriculture Distributed?

3.1 Agricultural Regions and Climate

3.2 Subsistence Agriculture in Dry Regions

3.3 Subsistence Agriculture in Tropical Regions

3.4 Subsistence Agriculture in Population Concentrations

3.5 Fishing

3.6 Commercial Agriculture: Crop-based

3.7 Commercial Agriculture: Mixed Crop and Livestock

3.8 Commercial Agriculture: Animal-based
Agricultural Regions and Climate

Figure 9-13: Agriculture around the world can be classified into 11 regions based on the commercial/subsistence divide and other characteristics.
Agricultural Regions in Developing Countries

- Intensive subsistence, wet-rice dominant
- Intensive subsistence, crops other than rice
- Pastoral nomadism
- Shifting cultivation
- Plantation: an exception because it is commercial
Figure 9-16: Pastoral nomadism is a subsistence agricultural practice where animals are herded across lands too dry to grow crops.
Figures 9-17 and 9-18: Found in tropical climates where soils are usually low in nutrients, shifting cultivation involves slashing and burning the forest (left, in Mozambique) before planting crops for a few years (right, in Côte d’Ivoire).
Figure 9-19: Rice is an especially popular crop in Asia to grow with intensive subsistence. Other crops may be grown with intensive subsistence based on climate or cultural preferences.
Figure 9-24: Fishing is practiced both commercially and in subsistence.
Figures 9-26 and 9-27: Fish production (left) and human consumption of fish (right) have increased dramatically. Increases since 1990 are from aquaculture, raising concerns about overfishing.
Figure 9-29: China accounts for one-third of fish production in the world.
Agricultural Regions in Developed Countries

- Mixed crop and livestock
- Dairying
- Grain
- Ranching
- Mediterranean
- Commercial gardening
Figure 9-30: Commercial grain farming includes the production of wheat in developed countries. Developing countries also produce wheat through intensive subsistence.
Commercial Agriculture: Crop-based: Mediterranean

Figure 9-31: The Mediterranean climate region and agricultural type features extensive production of crops like grapes (here pictured in Italy), olives, and tree nuts.
Figure 9-32: Commercial gardening and fruit farming, also known as truck farming, includes peanut farming.
Figure 9-33: In many countries, corn is grown to feed livestock more often than for direct human consumption.
Challenges for Farmers in Developed Countries

• Importance of Access to Markets
  – The von Thünen model helps to explain the importance of proximity to market in the choice of crops on commercial farms.
  • Specific crops are grown in different rings around cities
    – 1\textsuperscript{st} ring: Highly perishable foods e.g. milk
    – 2\textsuperscript{nd} ring: Items more difficult to transport e.g. wood
    – 3\textsuperscript{rd} ring: Various crops and pasture lands
    – 4\textsuperscript{th} ring: Spacious lands for animal grazing.
  – von Thünen’s model can be scaled up for national and global markets.
Von Thünen modeled the location of agricultural activities based on the value of products and their transportation cost.

Figure 9-35: Von Thünen modeled the location of agricultural activities based on the value of products and their transportation cost.
Von Thunen Model

Profit \( P = \text{Value of his produce} \ (V) \ \text{MINUS} \ \left[ \text{production expenses} \ (E) + \text{transport cost} \ (T) \right] \)

\[ P = V - (E + T) \]
Von Thunen Model

- Grazing
- Three Field
- Enclosed Field
- Crop Rotation
- Forestry
- Horticulture and Dairy
- City
Von Thunen Model

Assumptions
1. New York City the only market
2. Crops ranked by rent paying ability
3. No terrain or climatic variation

Assumptions
1. New York City the only market
2. Crops ranked by rent paying ability
3. No terrain variation
4. Climatic variation considered
Von Thunen Model

Farming Regions of the North Central U.S.

- **Corn, soybean, and livestock**
- **Corn, soybean, and winter wheat**
- **Cotton, rice, and soybean**
- **Dairy**
- **Forest**
- **Grain and pasture**
- **Irrigated corn and winter wheat**
- **Range**
- **Seasonal grazing**
- **Spring cereal grains**
- **Truck crops**
- **Winter wheat and sorghum**

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Problems with Von Thunen

- City is located centrally within an "Isolated State"
  - Self sufficient and has no external influences.
  - Surrounded by an unoccupied wilderness.
  - Land is completely flat and has no rivers or mountains to interrupt the terrain.
  - Soil quality and climate are consistent throughout.
  - Farmers 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.
Figure 9-36: India is the world’s leading milk producer, but dairy is an important commercial agricultural practice in developed regions, especially North America and Europe.
Figure 9-38: The type of animal raised depends on cultural preferences and climate. Developing countries are increasing meat production; China is the world’s largest meat producer.
Key Issue 4: Why Do Farmers Face Sustainability Challenges?

4.1 Losing Agricultural Land
4.2 Improving Agricultural Productivity
4.3 Conserving Agricultural Resources
4.4 Applying Biotechnology to Agriculture
4.5 Global Food Trade
4.6 Global Agriculture and Undernourishment
4.7 Sustainable Agriculture
Figure 9-39: Food production has kept up with population growth despite very little increase in agricultural land. Agricultural land is threatened by urbanization and desertification.
Figure 9-40: Considerable amounts of Maryland’s prime farmland is threatened by urbanization.
Figure 9-41: Dry lands are at high risk of desertification.
Improving Agricultural Productivity

Agricultural production has increased faster than farmland.

- Subsistence intensification: land worked more intensively
- Green revolution: selective breeding, fertilizers
- Increased technology in commercial agriculture
Green Revolution

Figure 9-43: The International Rice Research Institute’s selective breeding programs have developed high-yielding varieties of rice.
Figure 9-44: The amount of milk per cow has increased in the United States.
Figure 9-45: California’s use of irrigation for agriculture is especially apparent after several years of drought.
Figure 9-46: Alternatives to traditional commercial agriculture practices include “no tillage,” shown here, in which harvest residue is not removed before planting a new crop.
Biotechnology: Genetically Modified Crops

Figure 9-47: In the United States, an increasing percentage of grains are genetically modified.

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Figures 9-48 and 9-49: Many countries require genetically modified organisms (GMOs) to be labeled, as in the European label shown inset.
Figure 9-51: The value of agricultural exports has increased to $1.3 trillion in 2012.
Figure 9-52: The Western Hemisphere has many states that export food, while Europe and Asia have many importers.
Figure 9-53: Drug crops grown in the developing world are trafficked (illegally traded) to developed countries in North America and Europe.
Figure 9-54: Increasing food prices represent a challenge to food supply, especially for people who spend a significant percentage of their income on food.
Figure 9-55: In Africa, increases in food supply have barely kept up with population growth.
Figure 9-56: India and China have the largest numbers of undernourished people.
Figure 9-57: The highest rates of undernourishment are in sub-Saharan Africa and South Asia.
Figure 9-58: Undernourishment has decreased since 1990 in every world region except sub-Saharan Africa.
Sustainable Agriculture

Concerns over environment and health leading to:

• Organic farming: reduced herbicides, pesticides, antibiotics; no GMOs

• Pesticides on produce may present health threat.

• Government policies to help farmers may affect sustainability too.
Figure 9-59: Australia has a large share of the world’s organic farming; Europe is also an important region.