Rural Land Use Patterns

To most people, this is just dirt. To a farmer, it is potential.
—Anonymous

**Essential Question:** How do farmers and others who live in rural areas decide how to use land?

The distribution of people in rural areas, and the distribution of agricultural production, indicates a great deal about how people in rural areas live. Using the agricultural landscape as his canvas, Johann von Thünen produced one of the most significant models ever created to illustrate the relationship among markets, production, and distance. Because it became the foundation of many economic location models, von Thünen’s work illuminates many areas of geography.

The Cultural Landscape of Rural Settlements

The rural landscape reflects both the economic activities and the cultural attributes of the people who live in an area. Landscape features such as place names, road signs, churches, and the layout of villages often provide evidence of the origins, languages, and religious beliefs of generations of inhabitants. Several factors affect rural settlement patterns. In addition to personal preferences, politics, religion, and the physical landscape can all play a role.

**Clustered and Dispersed Rural Settlement Patterns**

Throughout European history, rural residents commonly lived in **clustered settlements**, groups of homes located near each other in a hamlet or village. Clustered settlements fostered a strong sense of community and were convenient for sharing services, such as schools and churches. However, farmers spent part of each day walking to and from their fields, and watching over crops and animals was difficult.

In contrast to Europeans, North American farmers usually created **dispersed settlements**, a pattern in which farmers lived in homes spread throughout the countryside. In Canada and the United States, the governments promoted westward expansion by giving farmers land (in the United States, usually 160 acres) if they agreed to reside on it for several years. As a result, agricultural villages were extremely rare in this region.
Establishing Property Boundaries

In England, fields often had irregular shapes that reflected the location of physical features and traditional patterns of use. Plot boundaries were described using the metes and bounds system. Metes were used for short distances and often referred to features of specific points, such as “from the oak tree, 100 yards north, to the corner of the barn.” Bounds cover larger areas, and were based on larger features, such as streams or roads.

The English colonists in America also used metes and bounds. However, beginning in 1785, the United States switched to a system based on surveying rather than landscape features. The government organized land into townships, areas six miles long and six miles wide. Each square mile, or section, consisted of 640 acres, and it could be divided into smaller lots, such as half sections or quarter sections. The Public Land Survey System created rectangular plots of consistent size.

Two groups of Christians created their own distinctive patterns in order to emphasize their sense of community:

- Hutterites in Canada and the northern United States clustered all homes together in one rectangle, often with a large dining hall in the center where people shared meals. Barns were located in a separate part of the colony.
- Mennonites created street villages. Each family had a house and a barn, but all were along a single street. The land surrounding the region of homes and barns was divided into three areas, with each family working a thin strip of land in each area.

French settlers in North America emphasized the value of access to a river for water and trade. So that many farmers could have some river frontage, they developed the French long-lot system, in which farms were long thin sections of land that ran perpendicular to a river. The best examples of this system in North America occur in Quebec and Louisiana.
Von Thünen’s Land Use Model Zones

In 1826, Johann von Thünen, a farm owner in Germany, created an economic model that suggested a pattern for the types of products that farmers would produce at different positions relative to the market where they sold their goods. He assumed that farming was an economic activity, that farmers were in business to make a profit, that there was one market where farmers in the surrounding lands sold their products, and that the market was situated in the center of a plain that is **isotropic**, which means flat and featureless.

Von Thünen believed that decisions regarding what to produce were based largely upon transportation costs and that these costs were proportional to the distance from the market. The cost of land was another factor that influenced decisions regarding agricultural products, and there was a distance decay pattern between the cost of land and the distance from the market. His model showed similar distance decay patterns existed between intensity of land use and distance from market, as well as between perishability of the product and distance from market.

**Description and Explanation of the Model**

In the zone closest to the market, von Thünen suggested that **horticulture**, a type of agriculture that includes **market gardening/truck farming**, and
dairying would occur. Horticulture produces perishable items, and farmers need to get them to market quickly. In the days before trucks and refrigeration, this was particularly important. Growing highly perishable crops, such as tomatoes and strawberries, and dairy farming are considered to be intensive forms of agriculture.

Von Thünen’s second zone included forests. Wood was an extremely important resource in 1826, both as building material and as a source of fuel. Von Thünen thought that wood products would be close to the market because they were not only important, but heavy and hence difficult to transport.

Farther from the market, in the third ring, were crops such as wheat and corn. Though valuable, they did not perish as quickly as vegetables and milk and were not as difficult to transport as wood.

The final ring was used for grazing of livestock such as beef cattle. They could be farther from the market because they could walk when it was time to transport them.

The extensive nature of grain and livestock farming meant that the farms were larger than those located in the inner ring of the model. While there is more farmland available in the larger outer rings, that was not necessarily the reason for these crops locating here. Grain and livestock farmers could find adequate space in the innermost ring if they were willing to pay enough to acquire the land.

**Land Value**

The value of land was influenced by its relationship to the market. Because the land in the inner ring was closest to the market, it was more valuable. Therefore, most farmers could not afford large amounts of it. Consequently, only farmers who used the land intensely and could make a profit from a small amount of land could be successful in the inner ring.

Land farther from the market was less valuable. Because grain and livestock are less perishable than the crops in the inner ring, the farmers could locate in the area of cheaper land farther from the market and still transport the product to market successfully. Though meat is perishable, and this was a significant concern in 1826, spoilage could be avoided if the animals were walked to market and were slaughtered there.

**The Bid Rent Curve**

In the case of von Thünen’s model, a bid rent curve, also known as a bid price curve, can be used to indicate the starting position for each land use relative to the market, as well as where each land use would end. Each line on the graph reflects the farmers’ willingness to pay for land at various distances from the market. Notice that each type of farmer is willing to pay more closer to the market than farther away. However, how much more varies with the types of activities. In a free market economy, the farmer willing to pay the most at each
location will occupy the land. It is where the uppermost line on the graph intersects with the next uppermost line that represents the start and/or end of a zone.

For example, where the strawberry line intersects the forest line indicates the end of where strawberries will be grown and the beginning of where forests will be found. Where the forest line intersects the wheat line indicates where the forest zone ends and the wheat zone begins.

**Applying Von Thünen's Model**

Von Thünen's model has been valuable in many ways. It has had application far beyond the topic of agriculture. His recognition of the spatial pattern in how farmers made decisions about using resources was the first economic location model. It provided the basis for the industrial location models of Alfred Weber and others who followed.

In addition, even though Von Thünen created his model nearly two centuries ago, it continues to apply today. Like all models, it needs to be adapted to actual conditions and changes in technology.
Non-Isotropic Plains Von Thünen’s model assumed that land was an isotropic plain—but real land includes rivers, mountains, and other physical features that make it non-isotropic. Von Thünen considered how various landscape situations would alter the shape of each land use ring. For example, if a river flowed through the plain, making transportation easier and cheaper along the river, then the zones would stretch out along the river. In addition, some areas have better climates or soil conditions for certain crops. These areas have a comparative advantage, or naturally occurring beneficial conditions that would prompt farmers to plant crops different from those predicted by von Thünen’s model.

Multiple Markets Von Thünen assumed that a farmer had one primary market, but they often have secondary markets as well. A dairy farmer might primarily sell milk to a local dairy. But the farmer might also make and sell some cheese, which does not spoil as quickly as milk, in a distant market.

Changes in Transportation The development of trains, cars, planes, and storage techniques such as refrigeration has allowed food to be transported much longer distances without spoiling than in 1826. As a result, the rings in the model are wider than originally. For example, rapidly perishable goods such as strawberries and milk can be produced much farther away from the market than in Von Thünen’s time. But relative locations remain the same. They are still produced closer to the market than are grains and livestock.

The cut flower market demonstrates the impact of transportation on the application of von Thünen’s model. Since cut flowers perish quickly and thus have to arrive at the market quickly, they are similar to horticulture and dairy products that the model predicts will be produced nearby and trucked to market. However, many flowers sold in New York City were grown in the Caribbean and flown to market. While air travel costs from the Caribbean are far higher than truck transport from the outskirts of New York, other costs of flower production are much less. Land, labor, and energy costs are so much lower in the Caribbean than they are in the outskirts of New York that they outweigh the extra transportation costs. Hence, producers can grow flowers for New York more profitably in the Caribbean than in nearby states.
Other Changes in Technology Changes in technology have modified demand for products. Since 1826, wood has been mostly replaced by oil, natural gas, and electricity as a fuel for heating homes, so forests are rarely located near communities today. Now, forested land at a city’s edge is probably highly valued as a greenbelt, an area of recreational parks or other undeveloped land, rather than a source of fuel.

Special Circumstances No model accounts for every variation that occurs in practice. For example, von Thünen’s model does not fit some areas of specialty farming, such as citrus farming in Florida, or the variety of crops grown in the Central Valley of California. Nor does it explain the decisions by developers who purchase land close to a city and use it for less intensive agricultural use than they could. They usually want to invest as little money as possible into the farmland while they decide when the time is right to build homes, retail space, or commercial structures on it.

Despite these issues in applying the von Thünen model, it remains important. When adjusted for real circumstances, it can still guide geographers as they study the relative value of land and transportation costs.

Modification of Natural Ecosystems

The development of agriculture significantly modified the natural landscape. Subsistence farming brought some change, but large-scale commercial agriculture brought far more.

Side Effects of Modern Food Production

Modern farming methods have made healthy diets possible for billions of people. However, each change to the natural ecosystem to increase food production has come with costs:

- Farmers have replaced forests with fields. These developed fields are unlikely to ever return to forest. In order to farm these fields year after year, farmers constantly replace nutrients with chemical fertilizers that can pollute rivers and lakes.
- Farmers have grazed animals in areas too arid to support crop production. Herders must be careful to prevent overgrazing or a somewhat productive area can undergo desertification and be unable to produce food.
- Farmers have used irrigation to make some arid areas productive for crops. Irrigation of land near the Nile River and in many parts of the western United States has led to conflicts between farmers and others who need water in these dry areas.
- Farmers have drained lands too wet for agricultural practices. The loss of wetlands can damage the ecosystem and lead to greater flooding.
- Farmers have terraced hilly or mountainous areas in order to produce flat areas for easier and more productive agriculture. Altering the natural flow of water and soil changes the conditions in which wild animals live.
Protecting Natural Ecosystems
To counter the damaging effects of destroying the natural landscape and the various flora and fauna that inhabit it, people are finding ways to preserve or restore ecosystems. At a global scale, people around the world in the 1980s joined a “Save the Rainforest” movement that supported farming and logging practices that did not damage the Brazilian rainforest. At a regional scale, in the tar sands of Alberta, scientists are attempting to return the disturbed landscape from open pit mining to its natural state. At a local scale, many communities have created natural habitats in their parks for plants and animals.

Agricultural Innovations
Agricultural scientists are constantly doing research to increase yields to feed the growing population, improve foods’ nutritional value, and increase the profitability of farming. While agricultural innovations often accomplish at least one of these three goals, people disagree over their other affects. As noted in Chapter 12, the Green Revolution was both successful and controversial. Similarly, other innovations often raise concerns.

Genetically Modified Organisms
A more recent controversial innovation has been the use of genetically modified organisms (GMOs), which are plants or animals that scientists in a laboratory modified by extracting genes of one species and inserting them into the DNA of another species. Compared to traditional foods, GMOs can be more nutritious, more resistant to weather and pest-related damage, and more long-lasting before they spoil. The majority of scientists have found them safe for humans. However, only a few countries such as the United States, Brazil, and Argentina have large GMO production. Many countries, particularly in Europe, have restricted the use of GMOs. Some concerns about GMOs include:

• GMO seeds are too expensive for poor farmers to use, in part because they are often sterile, so new seeds must be purchased each year.
• GMO seeds that are resistant to pests and herbicides might lead to the development of super pests or super weeds.
• GMOs might have potential long-term risks to consumers, such as organ problems or reduced immunity to diseases, that no one yet recognizes.

Organic Foods
The demand for organically grown food is increasing in the United States. Many consumers believe that food produced without the use of pesticides, synthetic fertilizers or other unnatural processes is healthier for them and for the environment. Since organic farming tends to be more labor-intensive than other forms of agriculture, it creates more jobs but the food produced is more expensive.
Organic agriculture has possible drawbacks. One potential environmental cost resulting from organic farming is that it might require more land in order to produce the same quantity of food. This could result in deforestation or destruction of wetlands and the corresponding loss of flora and fauna from these ecosystems. Also, some organic production of such commodities as milk, cereal, and pork produce more greenhouse gases than conventional farming techniques. And while organic farming regulations prohibit the use of synthetic pesticides, they do allow farmers to use naturally occurring chemicals that can be very harmful to humans and other life forms.

**Aquaculture**

With population growth increasing the demand for food, and supplies of fish in the ocean and some lakes being depleted by overfishing, people have turned to **aquaculture**, the practice of raising and harvesting fish and other forms of food that live in water. People in China and Southeast Asia have practiced aquaculture for thousands of years, but it is newer in the rest of the world. Aquaculture has dramatically increased the availability of fish protein to many people. Often referred to as the **Blue Revolution**, the practice is now the fastest growing form of food production on the planet and responsible for approximately 50 percent of the world’s seafood.

![The Growth of Aquaculture](futuretimeline.net)
As with other forms of food production, there are environmental concerns related to the practice. Critics of open-pen systems, in which a cage or net is moored to the seafloor and the farm fish are able, to some extent, to interact with the wild surroundings, point out these problems:

- High fish density in enclosures means diseases and parasites thrive and spread easily.
- Parasites and diseases can easily spread from fish in the enclosures to the nearby wild stock.
- Chemicals and antibiotics used to counter parasites and diseases can damage the ecosystem around the enclosures.
- Fish can escape pens and may breed or compete with native stocks of fish.
- Excess feed and the concentration of fish waste can produce dangerously high levels of organic matter in the ocean.

There are also social concerns regarding aquaculture. The installation of fish farms can challenge traditional fishing and lead to conflicts between the two groups of fishers, disrupting the local way of life. Another concern is that owners of the aquaculture operations may unethically exploit both the local labor as well as the local environment. Some people are concerned that fish from fish farms contain high levels of pesticides that could harm humans.

Environmental Issues Related to Agriculture

Modern agriculture has dramatically modified the natural landscape. Some of these changes constitute significant environmental damage.

Agricultural Chemicals and Fossil Fuels

Much of the environmental impact of farming comes from the use of chemicals. Farmers have long used fertilizers to replace nutrients in the soil. Traditionally, the fertilizer was human or animal waste. When used properly, these products both provided the soil with nutrients and disposed of wastes. While some farmers still use waste as fertilizer, most rely more on chemical fertilizers. If too much is applied, the excess contaminates nearby water supplies, producing significant environmental damage, including algal blooms.

A second group of potentially harmful chemicals includes ones designed to kill unwanted insects or plants. Both pesticides and herbicides destroy parts of the natural ecosystem. When used or disposed of incorrectly, they can cause significant damage to other life forms, including humans.

A third group of powerful chemicals are those given to livestock, such as antibiotics to prevent disease and hormones to promote growth. Many consumers fear the consequences of consuming meat from these animals.

Lastly, modern farming machines that run on fossil fuel, such as combines and tractors, result in air pollution from the exhaust, depletion of fossil fuel
reserves, and leaks or spills of various petroleum products that can contaminate soil and water.

**Depletion of Water Supplies**

Farming can also damage the environment by misusing water. Worldwide, approximately 70 percent of all accessible fresh water is used for agriculture. Some of this water is wasted through inefficient irrigation. Farmers sometimes apply more water than their crops need, operate irrigation pipes that leak, or try to grow crops in arid places. Poor irrigation can cause several problems:

- Excessive irrigation can increase the level of salts in the soil, a process known as salinization. This reduces the ability of plants to grow.
- Irrigation can reduce the amount of underground water in aquifers. India, Pakistan, and other countries that adopted the crops of the Green Revolution have suffered from this problem.
- Irrigation can reduce the amount of surface water in rivers and lakes. In central Asia, the Aral Sea has shrunk by more than 60 percent over the past five decades, as the photos below indicate.

![Image of water depletion](image)

**Loss of Biodiversity**

Changes in agriculture often reduce biodiversity. As improved varieties of crops are developed, farmers often abandon older varieties. In addition, many farmers are growing fewer varieties of crops than ever before. Specializing in one crop, which is known as **monocropping**, or **monoculture**, then reduces the diversity of the insects, animals, and other organisms that depend on other varieties of plants. To keep abandoned varieties of plants from disappearing forever, scientists save seeds in international and national seed banks.
Soil Degradation and Erosion

The image of grazing animals seems to suggest very low impact on the natural landscape. In a large open area, the animals will simply wander from area to area seeking better grass and giving the grazed areas time to recover. In restricted areas, farmers move their herds between enclosures to allow for the recovery of the grasslands.

However, if the density of animals is greater than the grasslands can support, then in their search for food, the animals will overgraze, damage the grasslands to the extent that the vegetation will not refresh itself even after the animals leave. Overgrazing most often occurs when farmers or herders have too many animals, they control too little land, or climatic conditions worsen and there is less pasture available than usual. With the right combination of overgrazing and environmental circumstances, catastrophic levels of soil erosion become a real danger. The Sahel region of Africa, a continent-wide belt of land on the southern edge of the Sahara Desert, is an excellent example of where this pressure is occurring.

Overgrazing is increasingly occurring in pastoral nomadism/migratory husbandry situations as the amount of land available to the herders and their families has shrunk in recent decades. Since there is less land available for the migratory herders, they have to remain longer in fewer locations, significantly increasing the risk of overgrazing. Several changes have decreased the availability of pasture land, each of which makes overgrazing more likely:

- Governments have become much more protective of their borders, which makes it much more difficult for some herders to follow their traditional migratory routes that often crossed international borders.
- Some former pasture land is now being irrigated and used for growing crops and housing permanent residents.
- Other areas of former pasture land are now being used for mining and petroleum operations.

Once overgrazing occurs, the grasses will not recover as quickly, if at all, and this leaves the exposed soil much more susceptible to erosion.

The practices mentioned above can all lead to soil degradation and soil erosion. When farmers drain the soil of nutrients from practices such as overuse, lack of crop rotation, or failure to replace nutrients, the soil loses its ability to support plant growth. Once this happens, the soil can be much more easily eroded by wind or water. Overgrazing and over tilling, or plowing, can also result in soils susceptible to erosion by wind and water.

Animal Waste

The raising of animals for food today generally includes the use of feedlots. On these lots, thousands of animals might be contained in a very limited amount of land, consuming high-quality feed for several months before they
are slaughtered. The large amount of waste they produce can include gases such as ammonia, methane, and hydrogen sulfide that can pollute the air, and liquid wastes that can pollute the water supply. Feedlots must be well-managed to avoid causing significant environmental damage. Many scientists are concerned about the concentration of waste in small areas.

**Sustainability and Agriculture**

Farmers today face many challenges to operate in ways that are sustainable in the long term. Maintaining soil fertility without degrading the soil is possible, but it takes careful planning. Sustainable grazing and tilling practices help to minimize soil erosion. Managing chemical levels and sedimentation in bodies of water, conserving water, employing renewable energy resources, and preserving biodiversity are all part of an environmentally sustainable perspective. Farmers have to constantly analyze their decisions in order to strike a balance between immediate profitability and long-term sustainability.

**Changes in Food Production and Consumption**

The broad trends in agriculture over the past century have been toward larger farms, more corporate ownership, more intensive use of machinery and chemicals, and higher output. However, smaller trends are also evident, such as the increase in organic farming discussed previously.

**Fair Trade and Local Food**

Some consumers support the fair trade movement, which is designed to get more money into the hands of the small farmers in poor countries who actually raise the crops, rather than supporting large transnational corporations that manage trade in these products. The most widely sold fair-trade products are coffee, tea, bananas, and chocolate.

Another trend among some consumers is to “eat local”—seeking out food produced nearby. Advocates, sometimes called “locavores,” point out that this both supports local farmers and reduces the use of fossil fuel used to transport products. Farmers markets, where consumers can purchase fruits, vegetables, and other food items directly from farmers, have become more popular in the past three decades. Many farmers who cater to local consumers produce specialty crops such as herbs, mushrooms, and free-range chickens that are provided in small quantities but sold at relatively high prices.

**Location of Food Production Facilities**

Traditionally, companies located food processing facilities in rural areas or small towns. By locating facilities close to where the harvest occurs, companies could work with very fresh products—and benefit from the lower labor and land costs in rural areas. However, improvements in roads, truck efficiencies, and storage techniques have prompted many companies to close older, smaller...
facilities and open new, larger, more efficient ones. These new facilities have allowed them to take advantage of economies of scale. This change has shifted jobs from rural to urban locations.

The importance of transportation and storage techniques is clear in the lobster industry. Worldwide demand for fresh live lobster is so high that lobster processors now use very expensive air freight to ship millions of pounds of live lobster from the east coast of Canada to destinations in Europe and Asia.

**Gender Roles in the Food System**

In most cultures throughout history, males and females have had distinct roles in producing and preparing food. However, some of these roles have changed as technology has changed.

**Food Production** Women have played a major role in agriculture since people first started farming. Today, they make up about 40 percent of the world’s agricultural labor force. In regions where subsistence farming remains common, the figure is 70 percent:

- In many areas of the developing world, men migrate to urban areas in search of employment, while women stay at home and work their farms along with their children. In operations where farms sell their farm products at local market, women are often the sellers.
- Where farming has modernized and machines have been introduced, women have become less involved with the field work.
- In large-scale agribusinesses, women have taken on newer roles. Besides raising crops and tending animals, and processing products, they work in management, sales, distribution, and research.

**Food Preparation** How people prepare food has changed as people changed where they live and work. As people moved from rural areas to urban areas, they grew less of the food they consumed and purchased more of it. And as more women worked outside of the home, they had less time to prepare food.

One result of these changes has been that women spend less time preparing food than did women in previous generations. People purchase more convenience foods than previously, from cake mixes to entire meals that simply need to be heated. The demand for these foods has grown so much that food companies are committing significant research money to developing visually appealing, tasty, healthy food products. In addition, in the regions of the world with greater gender equality, men have become more involved in food preparation, particularly in households where both partners are working.

A second result is that people eat in restaurants more than ever before. In 2015 for the first time in history, Americans spent more money eating out than they spent on groceries.
GEOGRAPHIC PERSPECTIVES: LAND USE FOR ORGANIC FOOD

Washington, Oregon, and California line the west coast of the United States. Despite their location on the edge of the country, they have become the center of organic farming in the United States.

Chemical and Organic Farming
The production of food by means of modern chemical farming—utilizing synthetic fertilizers, pesticides, herbicides, and fungicides—is largely extensive in nature. It is lucrative over vast areas of land.

In contrast, organic farming—which is more expensive—has proven to be more profitable through further intensification. While organic agricultural sales have boomed over the past decade, both the number of farms and total acreage of land have declined, where the individual farms have become more productive.

While the organic food industry has grown, its market share remains under five percent. Furthermore, while non-organic modern agriculture produces food for the masses and is often sold globally, organic food has been largely seized upon by local-food movements.

The Distribution of the Organic Food Market
As is the case with virtually all industries, the location of organic food consumption can be best explained through the spatial analysis of socioeconomic factors, and the concentration of these locations is predictably uneven. Farmers markets and supermarkets offering organic foods are largely found in the more affluent regions. Almost half of all organic food is sold and consumed within 100 miles of its production. Moreover, most consumption takes place around urban areas, where the market demand is greatest, such as Portland, San Francisco, and Seattle.

| KEY TERMS |
|------------------|------------------|------------------|
| clustered settlements | market gardening/truck farming | Blue Revolution |
| dispersed settlements | bid rent curve/bid price curve | monoculture/monocropping |
| metes and bounds | comparative advantage | biodiversity |
| township | greenbelt | overgrazing |
| section | genetically modified | fair trade |
| French long-lot system | organisms (GMO) | pastoral nomadism/migratory husbandry |
| von Thünen Model | organic food | economies of scale |
| isotropic | aquaculture |  |
| horticulture | |  |