are normally processed at the plantation before shipping because processed goods are less bulky and are therefore cheaper to ship long distances to the North American and European markets.

A plantation is a large farm that specializes in one or two crops. Among the most important crops grown on plantations are cotton, sugarcane, coffee, rubber, and tobacco. Also produced in large quantities are cocoa, jute, bananas, tea, coconuts, and palm oil. Latin American plantations are more likely to grow coffee, sugarcane, and bananas, whereas Asian plantations may provide rubber and palm oil. Crops such as tobacco, cotton, and sugarcane, which can be planted only once a year, are less likely to be grown on large plantations today than in the past. Because plantations are usually situated in sparsely settled locations, they must import workers and provide them with food, housing, and social services. Plantation managers try to spread the work as evenly as possible throughout the year to make full use of the large labor force. Where the climate permits, more than one crop is planted and harvested annually. Rubber-tree plantations try to spread the task of tapping the trees throughout the year.

Until the Civil War, plantations were important in the U.S. South, where the principal crop was cotton, followed by tobacco and sugarcane. Demand for cotton increased dramatically after the establishment of textile factories in England at the start of the Industrial Revolution in the late eighteenth century. Cotton production was stimulated by the improvement of the cotton gin by Eli Whitney in 1793 and the development of new varieties of cotton that were harder and easier to pick. Slaves brought from Africa performed most of the labor until the abolition of slavery and the defeat of the South in the Civil War. Thereafter, plantations declined in the United States; they were subdivided and either sold to individual farmers or worked by tenant farmers.

**Mixed Crop and Livestock Farming**

Mixed crop and livestock farming is the most common form of commercial agriculture in the United States west of the Appalachians and east of 98° west longitude and in much of Europe from France to Russia (refer to Figure 10-4).

**Characteristics of Mixed Crop and Livestock Farming**

The most distinctive characteristic of mixed crop and livestock farming is its integration of crops and livestock (Figure 10-14). Most of the crops are fed to animals rather than consumed directly by humans. In turn, the livestock supply manure to improve soil fertility to grow more crops. A typical mixed crop and livestock farm devotes nearly all land area to growing crops but derives more than three-fourths of its income from the sale of animal products, such as beef, milk, and eggs. In the United States pigs are often bred directly on the farms, whereas cattle may be brought in to be fattened on corn. Mixing crops and livestock permits farmers to distribute the workload more evenly through the year. Fields require less attention in the winter than in the spring, when crops are planted, and in the fall, when they are harvested. Meanwhile, livestock require year-long attention. A mix of crops and livestock also reduces seasonal variations in income; most income from crops comes during the harvest season, but livestock products can be sold throughout the year.

In the United States, corn (maize) is the crop most frequently planted in the mixed crop and livestock region because it generates higher yields per area than other crops (Figure 10-13). Some of the corn is consumed by people as oil, margarine, and other food products, but most is fed to pigs and cattle. The most important mixed crop and livestock farming region in the United States—extending from Ohio to the Dakotas, with its center in Iowa—is frequently called the Corn Belt, because around half of the cropland is planted in corn. Soybeans have become the second most important crop in the U.S. mixed commercial farming region. Like corn, soybeans are mostly used to make animal feed. Tofu (made from soybean milk) is a major food source, especially for people in China and Japan. Soybean oil is widely used in U.S. foods, but as a hidden ingredient.

**Crop Rotation**

Mixed crop and livestock farming typically involves crop rotation. The farm is divided into a number of fields, and each field is planted on a planned cycle, often of several years. The crop planted changes from one year to the next, typically going through a cycle of two or more crops, and perhaps a year of fallow before the cycle is repeated. Crop rotation helps maintain the fertility of a field because various crops deplete the soil of certain nutrients but restore others. Crop rotation contrasts with shifting cultivation, in which nutrients depleted from a field are restored only by leaving the field fallow (uncropped) for many years. In any given year, crops cannot be planted in

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**KEY ISSUE 3**

**Where Are Agricultural Regions in MDCs?**

- Mixed Crop and Livestock Farming
- Dairy Farming
- Grain Farming
- Livestock Ranching
- Mediterranean Agriculture
- Commercial Gardening and Fruit Farming

Commercial agriculture in MDCs can be divided into six main types, as listed above. Each type is predominant in distinctive regions within MDCs, depending largely on climate.
most of an area’s fields, so overall production in shifting cultivation is much lower than in mixed commercial farming.

A two-field crop-rotation system was developed in Northern Europe as early as the fifth century. A cereal grain, such as oats, wheat, rye, or barley, was planted in Field A one year, while Field B was left fallow. The following year Field B was planted but A left fallow, and so forth. Beginning in the eighth century, a three-field system was introduced. The first field was planted with a winter cereal, the second with a spring cereal, and the third was left fallow. As a result, each field yielded four harvests every 6 years, compared to three every 6 years under the two-field system.

A four-field system was introduced in Europe during the eighteenth century. The first year, the farmer could plant a root crop (such as turnips) in Field A, a cereal in Field B, a “rest” crop (such as clover, which helps restore the field) in Field C, and a cereal in Field D. The second year, the farmer might select a cereal for Field A, a rest crop for Field B, a cereal for Field C, and a root for Field D. The rotation would continue for two more years before the cycle would start again. Each field thus passed through a cycle of four crops—root, cereal, rest crop, and another cereal.

Cereals such as wheat and barley were sold for flour and beer production, and straw (the stalks remaining after the heads of wheat are threshed) was retained for animal bedding. Root crops such as turnips were fed to the animals during the winter. Clover and other “rest” crops were used for cattle grazing and restoration of nitrogen to the soil.

**Dairy Farming**

Dairy farming is the most important commercial agriculture practiced on farms near the large urban areas of the Northeast United States, Southeast Canada, and Northwest Europe (Figure 10-16). Dairying has also become an important type...
of farming in South and East Asia. Traditionally, fresh milk was rarely consumed except directly on the farm or in nearby villages. With the rapid growth of cities in MDCs during the nineteenth century, demand for the sale of milk to urban residents increased. Rising incomes permitted urban residents to buy milk products, which were once considered luxuries.

**Regional Distribution of Dairying**

For most of the twentieth century, the world’s milk production was clustered in a handful of MDCs (Figure 10-17). However, the share of the world’s dairy farming conducted in LDCs has risen dramatically, from 26 percent in 1980 to 51 percent in 2007. In the twenty-first century, India has become the world’s largest milk producer, ahead of the United States, the traditional leader, and China and Pakistan have passed Russia as third and fourth largest.

In MDCs, dairying is the most important type of commercial agriculture in the first ring outside large cities because of transportation factors. Dairy farms must be closer to their market than other types of farms because their products are highly perishable. The ring surrounding a city from which milk can be supplied without spoiling is known as the milkshed. Improvements in transportation have permitted dairying to be undertaken farther from the market. Until the 1840s, when railroads were first used for transporting dairy products, milksheds rarely had a radius beyond 50 kilometers (30 miles). Today, refrigerated railcars and trucks enable farmers to ship milk more than 500 kilometers (300 miles). As a result, nearly every farm in the U.S. Northeast and Northwest Europe is within the milkshed of at least one urban area.
Dairy farmers, like other commercial farmers, usually do not sell their products directly to consumers. Instead, they generally sell milk to wholesalers, who distribute it in turn to retailers. Retailers then sell milk to consumers in shops or at home. Farmers also sell milk to butter and cheese manufacturers. The choice of product varies within the U.S. dairy region, depending on whether the farms are within the milkshed of a large urban area. In general, the farther the farm is from large urban concentrations, the smaller is the percentage of output devoted to fresh milk. Farms located farther from consumers are more likely to sell their output to processors who make butter, cheese, or dried, evaporated, and condensed milk. The reason is that these products keep fresh longer than milk does and therefore can be safely shipped from remote farms.

In the East, virtually all milk is sold to consumers living in New York, Philadelphia, Boston, and the other large urban areas. Farther west, most milk is processed into cheese and butter. Most of the milk in Wisconsin is processed, for example, compared to only 5 percent in Pennsylvania. The proximity of northeastern farmers to several large markets accounts for these regional differences.

Countries likewise tend to specialize in certain products. New Zealand, the world's largest per capita producer of dairy products, devotes about 5 percent to liquid milk, compared to more than 50 percent in the United Kingdom. New Zealand farmers do not sell much liquid milk, because the country is too far from North America and Northwest Europe, the two largest relatively wealthy population concentrations.

Challenges for Dairy Farmers
Like other commercial farmers, dairy farmers face economic difficulties because of declining revenues and rising costs. Dairy farmers who have quit most often cite lack of profitability and excessive workload as reasons for getting out of the business. Distinctive features of dairy farming have exacerbated the economic difficulties:

- **Labor-intensive.** Cows must be milked twice a day, every day; although the actual milking can be done by machines, dairy farming nonetheless requires constant attention throughout the year.
- **Winter Feed.** Dairy farmers face the expense of feeding the cows in the winter, when they may be unable to graze on grass. In Northwest Europe and in the Northeastern United States, farmers generally purchase hay or grain for winter feed. In the western part of the U.S. dairy region, crops are more likely to be grown in the summer and stored for winter feed on the same farm.

Grain Farming
Some form of grain is the major crop on most farms. Grain is the seed from various grasses, like wheat, corn, oats, barley, rice, millet, and others. Commercial grain agriculture is distinguished from mixed crop and livestock farming because crops on a grain farm are grown primarily for consumption by humans rather than by livestock (Figure 10-18). Farms in

LDCs also grow crops for human consumption, but the output is directly consumed by the farmers. Commercial grain farms sell their output to manufacturers of food products, such as breakfast cereals and snack-food makers.

The most important crop grown is wheat, used to make bread flour. Wheat generally can be sold for a higher price than other grains, such as rye, oats, and barley, and it has more uses as human food. It can be stored relatively easily without spoiling and can be transported a long distance. Because wheat has a relatively high value per unit weight, it can be shipped profitably from remote farms to markets.

Wheat's significance extends beyond the amount of land or number of people involved in growing it. Unlike other agricultural products, wheat is grown to a considerable extent for international trade and is the world's leading export crop. The United States and Canada account for about half of the world's wheat exports; consequently, the North American prairies are accurately labeled the world's "breadbasket." The ability to provide food for many people elsewhere in the world is a major source of economic and political strength for these two countries.

The largest commercial producer of grain by far is the United States (Figure 10-19). Large-scale commercial grain production is found in only a few other countries, including Canada, Argentina, Australia, France, and the United Kingdom. Commercial grain farms are generally located in regions that are too dry for mixed crop and livestock agriculture. Within North America, large-scale grain production is concentrated in three areas:

- The **winter-wheat** belt through Kansas, Colorado, and Oklahoma. The crop is planted in the autumn and develops a strong root system before growth stops for the winter. The wheat survives the winter, especially if it is insulated beneath a snow blanket, and is ripe by the beginning of summer.
- The **spring-wheat** belt through the Dakotas, Montana, and southern Saskatchewan in Canada. Winters are usually too

FIGURE 10-18 Wheat farmer, Palouse, Washington. Eastern Washington is one of three major wheat-growing regions in the United States, along with the winter-wheat belt of Kansas, Colorado, and Oklahoma, and the spring-wheat belt of the Dakotas and Montana.
severe for winter wheat in this region, so spring wheat is planted in the spring and harvested in the late summer.

- The Palouse region of Washington State.

Large-scale grain production, like other commercial farming ventures in MDCs, is heavily mechanized, conducted on large farms, and oriented to consumer preferences. The McCormick reaper (a machine that cuts grain standing in the field), invented in the 1830s, first permitted large-scale wheat production. Today the combine machine performs in one operation the three tasks of reaping, threshing, and cleaning.

Unlike work on a mixed crop and livestock farm, the effort required to grow wheat is not uniform throughout the year. Some individuals or firms may therefore have two sets of fields—one in the spring-wheat belt and one in the winter-wheat belt. Because the planting and harvesting in the two regions occur at different times of the year, the workload can be distributed throughout the year. In addition, the same machinery can be used in the two regions, thus spreading the cost of the expensive equipment. Combine companies start working in Oklahoma in early summer and work their way northward.

**Livestock Ranching**

Ranching is the commercial grazing of livestock over an extensive area (Figure 10-20). This form of agriculture is adapted to semiarid or arid land and is practiced in MDCs where the vegetation is too sparse and the soil too poor to support crops.

The importance of ranching in the United States extends beyond the people who choose this form of commercial farming. Its prominence in popular culture, especially in Hollywood films and television, has not only helped to draw attention to this form of commercial farming but has also served to illustrate, albeit in sometimes romanticized ways, the crucial role that ranching played in the history and settlement of areas of the United States. Cattle ranching in Texas, as glamorized in popular culture, did actually dominate commercial agriculture, but only for a short period—from 1867 to 1885.

Cattle ranching expanded in the United States during the 1860s because of the demand for beef in the East Coast cities. If they could get their cattle to Chicago, ranchers were paid $30 to $40 per head, compared to only $3 or $4 per head in Texas. Once in Chicago, the cattle could be slaughtered and processed by meat-packing companies and shipped in packages to consumers in the East. To reach Chicago, cattle were driven on hoof by cowboys over trails from Texas to the nearest railhead. There the cattle were driven into cattle cars for the rest of their journey. The western terminus of the rail line reached Abilene, Kansas, in 1867. Wichita, Caldwell, Dodge City, and other towns in Kansas took their turns as the main destination for cattle driven north on trails from Texas. The most famous route from Texas northward to the rail line was the Chisholm Trail, which began near Brownsville at the Mexican border and extended northward through Texas.

Cattle ranching declined in importance during the 1880s after it came into conflict with sedentary agriculture. Most early U.S. ranchers adhered to “the Code of the West,” although the system had no official legal status. Under the code, ranchers had range rights—that is, their cattle could graze on any open land and had access to scarce water sources and grasslands. The early cattle ranchers in the West owned little land, only cattle. The U.S. government, which owned most of the land used for open grazing, began to sell it to farmers to grow crops, leaving cattle ranchers with no legal claim to it. For a few years the ranchers tried to drive out the farmers by cutting fences and then illegally
erecting their own fences on public land, and “range wars” flared. The farmers’ most potent weapon proved to be barbed wire, first commercially produced in 1873. The farmers eventually won the battle, and ranchers were compelled to buy or lease land to accommodate their cattle. Large cattle ranches were established, primarily on land that was too dry to support crops. Ironically, 60 percent of cattle grazing today takes place on land leased from the U.S. government.

With the spread of irrigation techniques and hardier crops, land in the United States has been converted from ranching to crop growing. Ranching generates lower income per area of land, although it has lower operating costs. Cattle are still raised on ranches but are frequently sent for fattening to farms or to local feed lots along major railroad and highway routes rather than directly to meat processors.

Commercial ranching is conducted in several other MDCs (Figure 10-21). The interior of Australia was opened for grazing in the nineteenth century, although sheep are more common than cattle. Ranching is rare in Europe, except in Spain and Portugal. In South America, a large portion of the pampas of Argentina, southern Brazil, and Uruguay are devoted to grazing cattle and sheep. The cattle industry grew rapidly in Argentina in part because the land devoted to ranching was relatively accessible to the ocean, making it possible for meat to be transported to overseas markets.

Ranching has followed similar stages around the world. First was the herding of animals over open ranges, in a seminomadic style. Then ranching was transformed into fixed farming by dividing the open land into ranches. When many of the farms converted to growing crops, ranching was confined to the drier lands. To survive, the remaining ranches experimented with new methods of breeding and sources of water and feed. Ranching has become part of the meat-processing industry rather than an economic activity carried out on isolated farms. In this way,
commercial ranching differs from pastoral nomadism, the form of animal herding practiced in less developed regions.

**Mediterranean Agriculture**

Mediterranean agriculture exists primarily on the lands that border the Mediterranean Sea in Southern Europe, North Africa, and western Asia (Figure 10-22). Farmers in California, central Chile, the southwestern part of South Africa, and southwestern Australia practice Mediterranean agriculture as well.

These Mediterranean areas share a similar physical environment (refer to Figure 10-4). Every Mediterranean area borders a sea and most are on west coasts of continents (except for some lands surrounding the Mediterranean Sea). Prevailing sea winds provide moisture and moderate the winter temperatures. Summers are hot and dry, but sea breezes provide some relief. The land is very hilly, and mountains frequently plunge directly to the sea, leaving very narrow strips of flat land along the coast.

Farmers derive a smaller percentage of income from animal products in the Mediterranean region than in the mixed crop and livestock region. Livestock production is hindered during the summer by the lack of water and good grazing land. Some farmers living along the Mediterranean Sea traditionally used transhumance to raise animals, although the practice is now less common. Under transhumance, animals—primarily sheep and goats—are kept on the coastal plains in the winter and transferred to the hills in the summer.

Most crops in Mediterranean lands are grown for human consumption rather than for animal feed. **Horticulture**—which is the growing of fruits, vegetables, and flowers—and tree crops form the commercial base of Mediterranean farming. A combination of local physical and cultural characteristics determines which crops are grown in each area. The hilly landscape encourages farmers to plant a variety of crops within one farming area.

In the lands bordering the Mediterranean Sea, the two most important cash crops are olives and grapes. Two-thirds of the world's wine is produced in countries that border the Mediterranean, especially Italy, France, and Spain. Mediterranean agricultural regions elsewhere in the world produce most of the remaining one-third. The lands near the Mediterranean Sea are also responsible for a large percentage of the world's supply of olives, an important source of cooking oil. Despite the importance of olives and grapes to commercial farms bordering the Mediterranean Sea, approximately half of the land is devoted to growing cereals, especially wheat for pasta and bread. As in the U.S. winter-wheat belt, the seeds are sown in the fall and harvested in early summer. After cultivation, cash crops are planted on some of the land, whereas the remainder is left fallow for a year or two to conserve moisture in the soil.

Cereals occupy a much lower percentage of the cultivated land in California than in other Mediterranean climates. Instead, a large portion of California farmland is devoted to fruit and vegetable horticulture, which supplies much of the citrus fruits, tree nuts, and deciduous fruits consumed in the United States. Horticulture is practiced in other Mediterranean climates, but not to the extent found in California. The rapid growth of urban areas in California, especially Los Angeles, has converted high-quality agricultural land into housing developments. Thus far, the loss of farmland has been offset by the expansion of agriculture into arid lands. However, farming in dry lands requires massive irrigation to provide water. In the future, agriculture may face stiffer competition for the Southwest's increasingly scarce water supply.

**Commercial Gardening and Fruit Farming**

Commercial gardening and fruit farming is the predominant type of agriculture in the U.S. Southeast (Figure 10-23). The region has a long growing season and humid climate and is accessible to the large markets of New York, Philadelphia, Washington, and other eastern U.S. urban areas. The type of agriculture practiced in this region is frequently called **truck farming**, from the Middle English word **truck**, meaning bartering or the exchange of commodities. Truck farms grow many of the fruits and vegetables that consumers in more developed societies demand, such as apples, asparagus, cherries, lettuce, mushrooms, and tomatoes. Some of these fruits and vegetables are
sold fresh to consumers, but most are sold to large processors for canning or freezing.

Truck farms are highly efficient large-scale operations that take full advantage of machines at every stage of the growing process. Truck farmers are willing to experiment with new varieties, seeds, fertilizers, and other inputs to maximize efficiency. Labor costs are kept down by hiring migrant farm workers, some of whom are undocumented immigrants from Mexico who work for very low wages. Farms tend to specialize in a few crops, and a handful of farms may dominate national output of some fruits and vegetables.

A form of truck farming called specialty farming has spread to New England. Farmers are profitably growing crops that have limited but increasing demand among affluent consumers, such as asparagus, peppers, mushrooms, strawberries, and nursery plants. Specialty farming represents a profitable alternative for New England farmers, at a time when dairy farming is declining because of relatively high operating costs and low milk prices.

KEY ISSUE 4
Why Do Farmers Face Economic Difficulties?

- Challenges for Commercial Farmers
- Challenges for Subsistence Farmers
- Strategies to Increase Food Supply

Commercial and subsistence farmers face comparable challenges. Both commercial and subsistence farmers have difficulty generating enough income to continue farming. The underlying reasons, though, are different. Commercial farmers can produce a surplus of food, whereas many subsistence farmers are barely able to produce enough food to survive.

Challenges for Commercial Farmers

Commercial farmers are in some ways victims of their own success. Having figured out how to produce large quantities of food, they face low prices for their output. Government subsidies help prop up farm income, but many believe that the future health of commercial farming rests with embracing more sustainable practices.

Importance of Access to Markets

Because the purpose of commercial farming is to sell produce off the farm, the distance from the farm to the market influences the farmer’s choice of crop to plant. Geographers use the von Thünen model to help explain the importance of proximity to market in the choice of crops on commercial farms.

Johann Heinrich von Thünen, an estate owner in northern Germany, first proposed the model in 1826 in a book titled The Isolated State (Figure 10-24). According to the model, which was later modified by geographers, a commercial farmer initially considers which crops to cultivate and which animals to raise based on market location. In choosing an enterprise, the farmer compares two costs—the cost of the land versus the cost of transporting products to market.

Von Thünen based his general model of the spatial arrangement of different crops on his experiences as owner of a large estate in northern Germany during the early nineteenth century. He found that specific crops were grown in different rings around the cities in the area. Market-oriented gardens and milk producers were located in the first ring out from the cities. These products are expensive to deliver and must reach the market quickly because they are perishable. The next ring out from the cities contained wood lots, where timber was cut for construction and fuel; closeness to market is important for this commodity because of its weight. The