

## Chapter 10. Agriculture

Providing food in the United States and Canada is a vast industry. The mechanized, highly productive American or Canadian farm contrasts with the subsistence farm found in much of the world. This sharp contrast in agricultural practices constitutes one of the most fundamental differences between the more developed and less developed countries of the world.

### Key Issues

1. Where did agriculture originate?
2. Where are agricultural regions in less developed countries?
3. Where are agricultural regions in more developed countries?
4. Why do farmers face economic difficulties?

(333)

The previous chapter divided economic activities into primary, secondary, and tertiary sectors. This chapter is concerned with the principal form of primary-sector economic activity—agriculture. The next two chapters look at the secondary and tertiary sectors. In less developed *regions*, the farm products are most often consumed on or near the farm, whereas in more developed countries farmers sell what they produce. The reason *why* farming varies around the world relates to distribution across *space* of cultural and environmental factors. Elements of the physical environment, such as climate, soil, and topography, set broad limits on agricultural practices, and farmers make choices to modify the environment in a variety of ways. Broad climate patterns influence the crops planted in a region, and local soil conditions influence the crops planted on an individual farm. Farmers choose from a variety of agricultural practices, based on their perception of the value of each alternative. These values are partly economic and partly cultural. How farmers deal with their physical environment varies according to dietary preferences, availability of technology, and other cultural traditions. At a global *scale*, farmers increasingly pursue the most profitable agriculture. After examining the origins and diffusion of agriculture, we will consider the agricultural practices used in less developed and more developed regions.

### Key Issue 1. Where Did Agriculture Originate?

- **Origins of agriculture**
- **Location of agricultural hearths**
- **Classifying agricultural regions**

The origins of agriculture cannot be documented with certainty, because it began before recorded history. Scholars try to reconstruct a logical sequence of events based on fragments. Improvements in cultivating plants and domesticating animals evolved over thousands of years.

### Origins of Agriculture

Determining the origin of agriculture first requires a definition of what it is—and agriculture is not easily defined. We will use this definition: **Agriculture** is deliberate modification of Earth's surface through cultivation of plants and rearing of animals to obtain sustenance or economic gain.

### Hunters and Gatherers

Before the invention of agriculture, all humans probably obtained the food they needed for survival through hunting for animals, fishing, or gathering. Hunters and gatherers lived in small groups. The men hunted game or fished, and the women collected berries, nuts, and roots. This division of labor sounds like a stereotype but is based on evidence from archaeology and anthropology. The group traveled frequently, establishing new home bases or camps. The direction and frequency of migration depended on the movement of game and the seasonal growth of plants at various locations.

(334)

**Contemporary Hunting and Gathering.** Today perhaps a quarter-million people, or less than 0.005 percent of the world's population, still survive by hunting and gathering. Contemporary hunting and

gathering societies are isolated groups living on the periphery of world settlement, but they provide insight into human customs that prevailed in prehistoric times, before the invention of agriculture.

### **Invention of Agriculture**

Why did nomadic groups convert from hunting, gathering, and fishing to agriculture? Over thousands of years, plant cultivation apparently evolved from a combination of accident and deliberate experiment.

**Two Types of Cultivation.** The earliest form of plant cultivation, according to . . . Carl Sauer, was **vegetative planting**, direct cloning from existing plants, such as cutting stems and dividing roots. Coming later, according to Sauer, was **seed agriculture**. Seed agriculture is practiced by most farmers today.

### **Location of Agricultural Hearths**

Agriculture probably did not originate in one location, but began in multiple, independent hearths.

### **Location of First Vegetative Planting**

Sauer believes that vegetative planting probably originated in Southeast Asia. The region's diversity of climate and topography . . . encouraged . . . plants suitable for dividing. Also, the people obtained food primarily by fishing rather than by hunting and gathering, so they may have been more sedentary and therefore able to devote more attention to growing plants. The first plants domesticated in Southeast Asia . . . probably included roots such as the taro and yam, and tree crops such as the banana and palm. The dog, pig, and chicken probably were domesticated first in Southeast Asia. Other early hearths of vegetative planting also may have emerged independently in West Africa and northwestern South America.

### **Location of First Seed Agriculture**

Seed agriculture also originated in more than one hearth. Sauer identified three hearths in the Eastern Hemisphere: western India, northern China, and Ethiopia. Seed agriculture diffused quickly from western India to Southwest Asia, where important early advances were made, including the domestication of wheat and barley.

(335)

Apparently, inhabitants of Southwest Asia also were first to integrate seed agriculture with domestication of herd animals such as cattle, sheep, and goats. This integration of plants and animals is a fundamental element of modern agriculture.

**Diffusion of Seed Agriculture.** Seed agriculture diffused from Southwest Asia across Europe and through North Africa. Greece, Crete, and Cyprus display the earliest evidence of seed agriculture in Europe.

Seed agriculture also diffused eastward from Southwest Asia to northwestern India and the Indus River plain. Again, various domesticated plants and animals were brought from Southwest Asia, although other plants, such as cotton and rice, arrived in India from different hearths. From the northern China hearth, millet diffused to South Asia and Southeast Asia. Rice . . . has an unknown hearth. Sauer identified a third independent hearth in Ethiopia, where millet and sorghum were domesticated early. However, he argued that agricultural advances in Ethiopia did not diffuse widely to other locations.

Two independent seed agriculture hearths originated in the Western Hemisphere: southern Mexico and northern Peru. Agricultural practices diffused to other parts of the Western Hemisphere. That agriculture had multiple origins means that, from earliest times, people have produced food in distinctive ways in different regions. This diversity derives from a unique legacy of wild plants, climatic conditions, and cultural preferences in each region. Improved communications in recent centuries have encouraged the diffusion of some plants to varied locations around the world.

### **Classifying Agricultural Regions**

The most fundamental differences in agricultural practices are between those in less developed countries and those in more developed countries.

### **Differences between Subsistence and Commercial Agriculture**

**Subsistence agriculture** . . . is the production of food primarily for consumption by the farmer's family. **Commercial agriculture** . . . is the production of food primarily for sale off the farm. Five principal features distinguish commercial . . . from subsistence agriculture: purpose of farming; percentage of farmers in the labor force; use of machinery; farm size; (and) relationship of farming to other businesses.

(336)

**Purpose of Farming.** In LDCs most people produce food for their own consumption. Some surplus may be sold . . . but . . . may not even exist some years. In commercial farming, farmers grow crops and raise animals primarily for sale. Agricultural products are . . . sold . . . to food-processing companies.

**Percentage of Farmers in the Labor Force.** In more developed countries less than 5 percent of the workers are engaged directly in farming, compared to 55 percent in less developed countries. The percentage of farmers is even lower in the United States and Canada, at only 2 percent. The number of farmers has declined dramatically in more developed societies during the twentieth century. Both push and pull migration factors have been responsible.

**Use of Machinery.** A small number of farmers in more developed societies can feed many people because they rely on machinery to perform work. Traditionally, the farmer or local craftspeople made equipment from wood, but beginning in the late eighteenth century, factories produced farm machinery. The first all-iron plow was made in the 1770s. Factory-made farm machines have replaced or supplemented manual labor.

Transportation improvements also aid commercial farmers. Railroads in the nineteenth century, and highways and trucks in the twentieth century, have enabled farmers to transport crops and livestock farther and faster. Commercial farmers use scientific advances to increase productivity.

(337)

Some farmers conduct their own on-farm research. Electronics also aid commercial farmers. Global Positioning Systems units determine precise coordinates for spreading different types and amounts of fertilizers. Both satellite imagery and yield monitors attached to combines monitor production yields.

**Farm Size.** The average farm size is relatively large in commercial agriculture, especially in the United States and Canada. Commercial agriculture is increasingly dominated by a handful of large farms. In the United States the largest 4 percent of farms . . . account for more than one half of the country's total output. One half of U.S. farms generate less than \$10,000 a year in sales. Large size is partly a consequence of mechanization. As a result of the large size and the high level of mechanization, commercial agriculture is an expensive business.

(338)

This money is frequently borrowed from a bank and repaid after the output is sold. Although the United States currently has fewer farms and farmers than in 1900, the amount of land devoted to agriculture has increased. However, the amount of U.S. farmland has declined from an all-time peak around 1960. A . . . serious problem in the United States has been the loss of the most productive farmland, known as **prime agricultural land**, as urban areas sprawl into the surrounding countryside.

**Relationship of Farming to Other Businesses.** Commercial farming is closely tied to other businesses. Commercial farming . . . has been called **agribusiness**, . . . integrated into a large food-production industry.

(339)

Although farmers are less than 2 percent of the U.S. labor force, more than 20 percent of U.S. labor works in food production related to agribusiness: food processing, packaging, storing, distributing, and retailing.

### **Mapping Agricultural Regions**

Several attempts have been made to outline the major types of subsistence and commercial agriculture currently practiced in the world, but few of these classifications include maps that show regional distributions. The most widely used map of world agricultural regions was prepared by geographer Derwent Whittlesey in 1936. Whittlesey identified 11 main agricultural regions, plus an area where agriculture was nonexistent. Whittlesey sorted out agricultural practices primarily by climate. Agriculture varies between the drylands and the tropics within LDCs—as well as between the drylands of less developed and more developed countries.

Because of the problems with environmental determinism discussed in Chapter 1, geographers are wary of placing too much emphasis on the role of climate. Cultural preferences, discussed in Chapter 4, explain some agricultural differences in areas of similar climate.

### **Key Issue 2. Where Are Agricultural Regions in Less Developed Countries?**

- **Shifting cultivation**
- **Pastoral nomadism**
- **Intensive subsistence agriculture**

This section considers four of the five agricultural types characteristic of LDCs: shifting cultivation, pastoral nomadism, and two types of intensive subsistence. The fifth type of LDC agriculture, plantation, is discussed in the third key issue along with agriculture in more developed countries.

### **Shifting Cultivation**

Shifting cultivation is practiced in much of the world's Humid Low-Latitude, or A, climate regions, which have relatively high temperatures and abundant rainfall. It is called shifting cultivation rather than shifting agriculture because "agriculture" implies greater use of tools and animals and more sophisticated modification of the landscape.

### **Characteristics of Shifting Cultivation**

**Shifting cultivation** has two distinguishing hallmarks: farmers clear land for planting by slashing vegetation and burning the debris; and farmers grow crops on a cleared field for only a few years. People who practice shifting cultivation generally live in small villages and grow food on the surrounding land, which the village controls.

(341)

**The Process of Shifting Cultivation.** Each year villagers designate (an area) for planting. They must remove the dense vegetation that typically covers tropical land. Using axes, they cut most of the trees, sparing only those that are economically useful. The debris is burned under carefully controlled conditions. Rains wash the fresh ashes into the soil, providing needed nutrients. The cleared area is known by a variety of names in different regions, including *swidden*, *ladang*, *milpa*, *chena*, and *kaingin*. The cleared land can support crops only briefly, usually three years or less. Villagers . . . leave the old site uncropped for many years. The villagers will return to the site, . . . perhaps as few as 6 years or as many as 20 years later, to begin the process of clearing the land again. In the meantime, they may still care for fruit-bearing trees on the site.

(342)

**Crops of Shifting Cultivation.** The precise crops grown by each village vary by local custom and taste. The predominant crops include upland rice in Southeast Asia, maize (corn) and manioc (cassava) in South America, and millet and sorghum in Africa. Yams, sugarcane, plantain, and

vegetables also are grown in some regions. The Kayapo people of Brazil's Amazon tropical rain forest . . . plant in concentric rings. Plants that require more nutrients are located in the outer ring. It is here that the leafy crowns of cut trees fall when the field is cleared. Most families grow only for their own needs, so one swidden may contain a large variety of intermingled crops. Families may specialize in a few crops and trade with villagers who have a surplus of others.

**Ownership and Use of Land in Shifting Cultivation.** Traditionally, land is owned by the village as a whole rather than separately by each resident. Private individuals now own the land in some communities, especially in Latin America. Shifting cultivation occupies approximately one fourth of the world's land area, a higher percentage than any other type of agriculture. However, only 5 percent of the world's population engages in shifting cultivation.

### **Future of Shifting Cultivation**

The percentage of land devoted to shifting cultivation is declining in the tropics at the rate of about 100,000 square kilometers (40,000 square miles), or 1 percent per year. The amount of Earth's surface allocated to tropical rain forests has already been reduced to less than half of its original area. Shifting cultivation is being replaced by logging, cattle ranching, and cultivation of cash crops. Until recent years the World Bank supported deforestation with loans to finance development schemes that required clearing forests.

(343)

To its critics, shifting cultivation is at best a preliminary step in economic development. Critics say it then should be replaced by more sophisticated agriculture that yields more per land area.

But defenders of shifting cultivation consider it the most environmentally sound approach for the tropics. Practices used in other forms of agriculture . . . may damage the soil, cause severe erosion, and upset balanced ecosystems. Large-scale destruction of the rain forests also may contribute to global warming. When large numbers of trees are cut, their burning and decay release large volumes of carbon dioxide. Elimination of shifting cultivation could also upset the traditional local diversity of cultures in the tropics. The activities of shifting cultivation are intertwined with other social, religious, political, and various folk customs.

As the importance of tropical rain forests to the global environment has become recognized, LDCs have been pressured to restrict further destruction of them. In Brazil's Amazon rain forest, deforestation is increasing. A 1997 U.S. government study placed deforestation . . . at 58,000 square kilometers (22,000 square miles) per year.

### **Pastoral Nomadism**

**Pastoral nomadism** is a form of subsistence agriculture based on the herding of domesticated animals. The word *pastoral* refers to sheep herding. It is adapted to dry climates, where planting crops is impossible. Only about 15 million people are pastoral nomads, but they sparsely occupy about 20 percent of Earth's land area.

### **Characteristics of Pastoral Nomadism**

Pastoral nomads depend primarily on animals rather than crops for survival. The animals provide milk, and their skins and hair are used for clothing and tents. Like other subsistence farmers, though, pastoral nomads consume mostly grain rather than meat. Some pastoral nomads obtain grain from sedentary subsistence farmers in exchange for animal products. More often, part of a nomadic group—perhaps the women and children—may plant crops at a fixed location while the rest of the group wanders with the herd. Other nomads might sow grain in recently flooded areas and return later in the year to harvest the crop.

**Choice of Animals.** Nomads select the type and number of animals for the herd according to local cultural and physical characteristics. The choice depends on the relative prestige of animals and the ability of species to adapt to a particular climate and vegetation.

(344)

**Movements of Pastoral Nomads.** Pastoral nomads do not wander randomly across the landscape but have a strong sense of territoriality. Every group controls a piece of territory and will invade another group's territory only in an emergency or if war is declared. The precise migration patterns evolve from intimate knowledge of the area's physical and cultural characteristics. The selection of routes varies in unusually wet or dry years and is influenced by the condition of their animals and the area's political stability. Some pastoral nomads practice **transhumance**, which is seasonal migration of livestock between mountains and lowland pasture areas.

#### **The Future of Pastoral Nomadism**

Agricultural experts once regarded pastoral nomadism as a stage in the evolution of agriculture. Because they had domesticated animals but not plants, pastoral nomads were considered more advanced than hunters and gatherers but less advanced than settled farmers. Pastoral nomadism is now generally recognized as an offshoot of sedentary agriculture, not as a primitive precursor of it. It is simply a practical way of surviving on land that receives too little rain for cultivation of crops. Today pastoral nomadism is a declining form of agriculture, partly a victim of modern technology. Nomads used to be the most powerful inhabitants of the drylands, but now, with modern weapons, national governments can control the nomadic population more effectively. Government efforts to resettle nomads have been particularly vigorous in China, Kazakhstan, and several Middle Eastern countries, including Egypt, Israel, Saudi Arabia, and Syria. Governments force groups to give up pastoral nomadism because they want the land for other uses. In the future, pastoral nomadism will be increasingly confined to areas that cannot be irrigated or that lack valuable raw materials.

#### **Intensive Subsistence Agriculture**

Shifting cultivation and pastoral nomadism are . . . found in regions of low (population) density.

(345)

But three-fourths of the world's people live in LDCs, and another form of subsistence agriculture is needed to feed most of them: **intensive subsistence agriculture**. In densely populated East, South, and Southeast Asia, most farmers practice intensive subsistence agriculture. The typical farm . . . is much smaller than elsewhere in the world. Because the agricultural density—the ratio of farmers to arable land—is so high in parts of East and South Asia, families must produce enough food for their survival from a very small area of land. They do this through careful agricultural practices, refined over thousands of years in response to local environmental and cultural patterns. Intensive subsistence farmers waste virtually no land. Paths and roads are kept as narrow as possible to minimize the loss of arable land. Little grain is grown to feed the animals.

#### **Intensive Subsistence with Wet Rice Dominant**

Wet rice occupies a relatively small percentage of Asia's agricultural land but is the region's most important source of food. Intensive wet-rice farming is the dominant type of agriculture in Southeast China, East India, and much of Southeast Asia.

Successful production of large yields of rice is an elaborate process, time-consuming and done mostly by hand. Growing rice involves several steps: First, a farmer prepares the field for planting, using a plow drawn by water buffalo or oxen. The use of a plow and animal power is one characteristic that distinguishes subsistence agriculture from shifting cultivation. Then the plowed land is flooded with water . . . from rainfall, river overflow, or irrigation. The flooded field is called a **sawah** in the Austronesian language widely spoken in Indonesia, including Java. Europeans and North Americans frequently, but incorrectly, call it a **paddy**, the Malay word for wet rice. Wet rice is most easily grown on flat land, because the plants are submerged in water much of the time. One method of developing additional land suitable for growing rice is to terrace the hillsides of river valleys.

Land is used even more intensively in parts of Asia by obtaining two harvests per year from one field, a process known as **double cropping**. Double cropping is common in places having warm winters . . . but is relatively rare in India, where most areas have dry winters. Normally, double cropping involves alternating between wet rice . . . and wheat, barley, or another dry crop, grown in the drier winter season.

#### **Intensive Subsistence with Wet Rice Not Dominant**

Climate prevents . . . growing wet rice in portions of Asia, especially where summer precipitation levels are too low and winters are too harsh. This region shares most of the characteristics of intensive subsistence agriculture with the wet-rice region. Wheat is the most important crop, followed by barley. Other grains and legumes are grown for household consumption (and) . . . some crops sold for cash, such as cotton, flax, hemp, and tobacco.

(346)

In milder parts of the region, more than one harvest can be obtained some years through skilled use of **crop rotation**.

Since the (Chinese) Communist Revolution in 1949, . . . the . . . government organized agricultural producer communes. By combining several small fields into a single large unit, the government hoped to promote agricultural efficiency.

(347)

China has dismantled the agricultural communes. The communes still hold legal title to agricultural land, but villagers sign contracts entitling them to farm portions of the land as private individuals. Reorganization has been difficult because . . . infrastructure was developed to serve large communal farms rather than small, individually managed ones.

#### **Key Issue 3. Where Are Agricultural Regions in More Developed Countries?**

- **Mixed crop and livestock farming**
- **Dairy farming**
- **Grain farming**
- **Livestock ranching**
- **Mediterranean agriculture**
- **Commercial gardening and fruit farming**
- **Plantation agriculture**

Commercial agriculture in more developed countries can be divided into six main types. Each type is predominant in distinctive regions within MDCs, depending largely on climate. The end of this section examines plantation farming, a form of commercial agriculture in LDCs.

#### **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.

#### **Characteristics of Mixed Crop and Livestock Farming**

The most distinctive characteristic of mixed crop and livestock farming is its integration of crops and livestock. Most of the crops are fed to animals rather than consumed directly by humans. Mixed crop and livestock farming permits farmers to distribute the workload more evenly through the year . . . (and) reduces seasonal variations in income.

**Crop Rotation Systems.** Mixed crop and livestock farming typically involves crop rotation. 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. A two-field crop-rotation system was developed in Northern Europe as early as the fifth century A.D. Beginning in the eighth century, a three-field system

was introduced. Each field yielded four harvests every six years, compared to three every six years under the two-field system. A four-field system was used in Northwest Europe by the eighteenth century.

(348)

Each field thus passed through a cycle of four crops: root, cereal, rest crop, and another cereal. Cereals . . . were sold for flour and beer production, and straw . . . was retained for animal bedding. Root crops . . . 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.

### **Choice of Crops**

In the United States, mixed crop and livestock farmers select corn most frequently because of higher yields per area than other crops. Some of the corn is consumed by people . . . but most is fed to pigs and cattle. Soybeans have become the second most important crop in the U.S. mixed commercial farming region . . . mostly to make animal feed.

### **Dairy Farming**

Dairy farming is the most important type of commercial agriculture practiced on farms near the large urban areas of the Northeast United States, Southeast Canada, and Northwest Europe. Russia, Australia, and New Zealand also have extensive areas devoted to dairy farming. Nearly 60 percent of the world's supply of milk is produced and consumed in these developed regions. Traditionally, fresh milk was rarely consumed except directly on the farm or in nearby villages. 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.

### **Why Dairy Farms Locate Near Urban Areas**

Dairying has become the most important type of commercial agriculture in the first ring outside large cities because of transportation factors.

(349)

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. As a result, nearly every farm in the U.S. Northeast and Northwest Europe is within the milkshed of at least one urban area.

Some dairy farms specialize in products other than milk. Originally, butter and cheese were made directly on the farm, primarily from the excess milk produced in the summer, before modern agricultural methods evened the flow of milk through the year.

### **Regional Differences in Dairy Products**

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. Farms located farther from consumers are more likely to sell their output to processors. In the East, virtually all milk is sold to consumers living in . . . large urban areas. Farther west, most milk is processed into cheese and butter. Countries likewise tend to specialize in certain products. New Zealand, the world's largest producer of dairy products, devotes about 5 percent to liquid milk, compared to over 50 percent in the United Kingdom. Dairy farmers, like other commercial farmers, usually do not sell their products directly to consumers.

### **Problems for Dairy Farmers**

Like other commercial farmers, dairy farmers face economic problems because of declining revenues and rising costs. Dairy farming is labor-intensive.

(350)

Dairy farmers also face the expense of feeding the cows in the winter, when they may be unable to graze on grass. The number of farms with milk cows declined in the United States by two-thirds



between 1980 and 2000. The number of dairy cows declined by only one-eighth, and production actually increased by one-fourth—yields per cow increased substantially.

### **Grain Farming**

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. Wheat generally can be sold for a higher price than other grains . . . and it has more uses as human food. Because wheat has a relatively high value per unit weight, it can be shipped profitably from remote farms to markets.

### **Grain-farming Regions**

The United States is by far the largest commercial producer of grain. 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 first is the **winter wheat belt** that extends through Kansas, Colorado, and Oklahoma. The second important grain-producing region in North America is the **spring wheat belt** of the Dakotas, Montana, and southern Saskatchewan in Canada. A third important grain-growing region is the Palouse region of Washington State.

Large-scale grain production, like other commercial farming ventures in more developed countries, is heavily mechanized, conducted on large farms, and oriented to consumer preferences. 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.

(351)

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.

### **Importance of Wheat**

Wheat is grown to a considerable extent for international trade and is the world's leading export crop. The ability to provide food for many people elsewhere in the world is a major source of economic and political strength for the United States and Canada.

### **Livestock Ranching.**

**Ranching** is the commercial grazing of livestock over an extensive area, . . . practiced in more developed countries, where the vegetation is too sparse and the soil too poor to support crops.

### **Cattle Ranching in U.S. Popular Culture**

The importance of ranching in the United States extends beyond the number of people who choose this form of commercial farming because of its prominence in popular culture. Cattle ranching in Texas, though, as glamorized in popular culture, actually dominated commercial agriculture for a short period—from 1867 to 1885.

**Beginning of U.S. Cattle Ranching.** Cattle were first brought to the Americas by Columbus on his second voyage. Living in the wild, the cattle multiplied and thrived on abundant grazing lands on the frontiers of North and South America. Immigrants from Spain and Portugal—the only European countries with a tradition of cattle ranching—began ranching in the Americas. Cattle ranching in the United States expanded because of demand for beef in the East Coast cities during the 1860s. Ranchers who could get their cattle to Chicago were paid \$30 to \$40 per head, compared to only \$3 or \$4 per head in Texas.

(352)

**Transporting Cattle to Market.** To reach Chicago, cattle were driven on hoof by cowboys over trails from Texas to the nearest railhead. The western terminus of the rail line reached Abilene, Kansas, in 1867. The number of cattle brought into Abilene increased from 1,000 in 1867 to 35,000 in 1868 and 150,000 in 1869. After a few years the terminus of the railroad moved farther west. The most famous route from Texas northward to the rail line was the Chisholm Trail. Today U.S. Route 81 roughly follows the course of the Chisholm Trail.

#### **Fixed Location Ranching**

Cattle ranching declined in importance during the 1880s after it came in conflict with sedentary agriculture. The early cattle ranchers in the West owned little land, only cattle.

(353)

**Range Wars.** The U.S. government, which owned most of the land used for open grazing, began to sell it to farmers to grow crops. For a few years the ranchers tried to drive out the farmers. The farmers' most potent weapon proved to be barbed wire, first commercially produced in 1873. Ranchers were compelled to buy or lease land to accommodate their cattle. Sixty percent of cattle grazing today are on land leased from the U.S. government.

**Changes in Cattle Breeding.** Ranchers were also induced to switch from cattle drives to fixed-location ranching by a change in the predominant breed of cattle. Longhorns . . . were hardy animals . . . but . . . the meat of longhorns was of poor quality. New cattle breeds introduced from Europe, such as the Hereford, offered superior meat but were not adapted to the old ranching system. These breeds thrived once open grazing was replaced by fixed ranching, and long-distance trail drives and rail journeys to Chicago gave way to short rail or truck trips to nearby meat packers. With the spread of irrigation techniques and hardier crops, land in the United States has been converted from ranching to crop growing. Cattle are still raised on ranches but are frequently sent for fattening to farms or to local feed lots.

#### **Ranching outside the United States**

Commercial ranching is conducted in other more developed regions of the world.

(354)

Ranching is rare in Europe, except in Spain and Portugal. In South America a large portion of the pampas . . . are devoted to grazing cattle and sheep. The relatively humid climate on the pampas provides more shoots and shrubs on a given area of land than in the U.S. West. Land was divided into large holdings in the nineteenth century, in contrast to the U.S. practice. Ranching has declined in Argentina . . . because growing crops is more profitable except on very dry lands. The interior of Australia was opened for grazing in the nineteenth century, although sheep are more common than cattle. Ranches in the Middle East, New Zealand, and South Africa are also more likely to have sheep.

Ranching has followed similar stages around the world: first, . . . herding . . . over open ranges, then . . . transformed into fixed farming by dividing the open land. Many of the farms converted to growing crops, and ranching was confined to the drier lands. Ranching (later) became part of the meat-processing industry rather than an economic activity carried out on isolated farms.

#### **Mediterranean Agriculture**

Mediterranean agriculture exists primarily in the lands that border the Mediterranean Sea. Farmers in California, central Chile, the southwestern part of South Africa, and southwestern Australia practice Mediterranean agriculture as well. Every Mediterranean area borders a sea. Prevailing sea winds provide moisture and moderate the winter temperatures. Summers are hot and dry. The land is very hilly. Farmers derive a smaller percentage of income from animal products in the Mediterranean region than in the mixed crop and livestock region. Some farmers living along the Mediterranean Sea traditionally used transhumance to raise animals, although the practice is now less common.

### **Mediterranean Crops**

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 the Mediterranean farming. A combination of local physical and cultural characteristics determines which crops are grown in each area. In the lands bordering the Mediterranean Sea, the two most important cash crops are olives and grapes.

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.

(355)

Cereals occupy a much lower percentage of the cultivated land in California than in other Mediterranean climates. Instead, much of California farmland is devoted to fruit and vegetable horticulture. The rapid growth of urban areas in California, especially Los Angeles, has converted high-quality agricultural land into housing developments. The loss of farmland has been offset by expansion of agriculture into arid lands. However, farming in drylands requires massive irrigation to provide water.

### **Commercial Gardening and Fruit Farming**

Commercial gardening and fruit farming is the predominant type of agriculture in the U.S. Southeast, . . . frequently called **truck farming**, because “truck” was a Middle English word meaning bartering or the exchange of commodities. Truck farms grow . . . fruits and vegetables. Some of these fruits and vegetables are sold fresh to consumers, but most are sold to large processors. Truck farms are highly efficient large-scale operations that take full advantage of machines at every stage of the growing process. Labor costs are kept down by hiring migrant farm workers. 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, . . . growing crops that have limited but increasing demand among affluent consumers.

### **Plantation Farming**

The plantation is a form of commercial agriculture found in the tropics and subtropics, especially in Latin America, Africa, and Asia. Plantations are often owned or operated by Europeans or North Americans and grow crops for sale primarily in more developed countries. A **plantation** is a large farm that specializes in one or two crops. Among the most important crops . . . are cotton, sugarcane, coffee, rubber, and tobacco, . . . cocoa, jute, bananas, tea, coconuts, and palm oil.

Because plantations are usually situated in sparsely settled locations, they must import workers. Managers try to spread the work . . . throughout the year to make full use of the large labor force. 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. Crops are normally processed at the plantation. Processed goods are less bulky and therefore cheaper to ship. Until the Civil War, plantations were important in the U.S. South, where the principal crop was cotton, followed by tobacco and sugarcane. Slaves brought from Africa performed most of the labor until . . . the defeat of the South in the Civil War. Thereafter, plantations . . . were subdivided and either sold to individual farmers or worked by tenant farmers.

### **Key Issue 4. Why Do Farmers Face Economic Difficulties?**

- **Issues for commercial farmers**
- **Issues for subsistence farmers**
- **Strategies to increase food supply**

(356)

#### **Issues for Commercial Farmers**

Two economic factors influence the choice of crops (or livestock) by commercial farmers: access to markets and overproduction.

### **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.

**Von Thünen's Model.** The von Thünen model was first proposed in 1826 by Johann Heinrich von Thünen, a farmer in northern Germany, in a book titled *The Isolated State*. In choosing an enterprise, a commercial farmer compares two costs: the cost of the land versus the cost of transporting products to market. First, a farmer identifies a crop that can be sold for more than the land cost. A farmer will not necessarily plant the crop that sells for the highest price per hectare. Distance to market is critical because the cost of transporting each product is different.

**Example of Von Thünen's Model.** The example shows that a farmer would make a profit growing wheat on land located less than 4 kilometers from the market. Beyond 4 kilometers, wheat is not profitable, because the cost of transporting it exceeds the gross profit. More distant farms are more likely to select crops that can be transported less expensively.

**Application of Von Thünen's Model.** 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. Von Thünen did not consider site or human factors in his model, . . . although he recognized that the model could vary according to topography and other distinctive physical conditions. The model also failed to understand that social customs and government policies influence the attractiveness of plants and animals for a commercial farmer. Although von Thünen developed the model for a small region with a single market center, it also applies to a national or global scale.

(357)

### **Overproduction in Commercial Farming**

Commercial farmers suffer from low incomes because they produce too much food rather than too little. A surplus of food has been produced in part because of widespread adoption of efficient agricultural practices. Commercial farmers have dramatically increased the capacity of the land to produce food. While the food supply has increased in more developed countries, demand has remained constant, because the market for most products is already saturated. Demand is also stagnant for most agricultural products in more developed countries because of low population growth.

**U.S. Government Policies.** The U.S. government has three policies to attack the problem of excess productive capacity. First, farmers are encouraged to avoid producing crops that are in excess supply. The government encourages planting fallow crops. Second, the government pays farmers when certain commodity prices are low. Third, the government buys surplus production and sells or donates it to foreign governments. In addition, low-income Americans receive food stamps in part to stimulate their purchase of additional food. The United States spends about \$10 billion a year on farm subsidies. Annual spending varies considerably from one year to the next. Government policies point out a fundamental irony in worldwide agricultural patterns. In a more developed country such as the United States, farmers are encouraged to grow less food, while less developed countries struggle to increase food production to match the rate of the growth in population.

### **Sustainable Agriculture**

Some commercial farmers are converting their operations to sustainable agriculture, an agricultural practice that preserves and enhances environmental quality. Farmers practicing sustainable agriculture typically generate lower revenues than do conventional farmers, but they also have lower costs. Two principal practices distinguish sustainable agriculture from conventional agriculture:

1. More sensitive land management
2. Better integration of crops and livestock

**Sensitive Land Management.** Sustainable agriculture protects soil in part through ridge tillage and limited use of chemicals. **Ridge tillage** is a system of planting crops on 4-to 8-inch ridges that are formed during cultivation or after harvest. Ridge tillage is attractive for two main reasons: lower production costs and greater soil conservation. Production costs are lower with ridge tillage in part because it requires less investment in tractors and other machinery than conventional planting.

(358)

Ridge tillage features a minimum of soil disturbance from harvest to the next planting. Over several years the soil will tend to have increased organic matter, greater water holding capacity and more earthworms. The channels left by earthworms and decaying roots enhance drainage. Under sustainable agriculture, farmers control weeds with cultivation and minimal use of herbicides.

**Integrated Crop and Livestock.** Sustainable agriculture attempts to integrate the growing of crops and the raising of livestock as much as possible at the level of the individual farm. Animals consume crops grown on the farm and are not confined to small pens.

### **Issues for Subsistence Farmers**

Two economic issues discussed in earlier chapters influence the choice of crops planted by subsistence farmers: first, . . . rapid population growth, (and) second, . . . adopting the international trade approach to development.

### **Subsistence Farming and Population Growth**

According to Ester Boserup, population growth compels subsistence farmers to consider new farming. For hundreds if not thousands of years, subsistence farming . . . yielded enough food. Suddenly in the late twentieth century, the LDCs needed to provide enough food for a rapidly increasing population.

According to the Boserup thesis, subsistence farmers increase the supply of food through intensification of production, achieved in two ways. First, land is left fallow for shorter periods. Boserup identified five basic stages in the intensification of farmland: Forest Fallow; Bush Fallow; Short Fallow; Annual Cropping; and Multicropping. Eventually, farmers achieve the very intensive use of farmland characteristic of areas of high population density. The second way that subsistence farmers intensify production, according to the Boserup thesis, is through adopting new farming methods. The additional labor needed to perform these operations comes from the population growth.

(359)

### **Subsistence Farming and International Trade**

To expand production, subsistence farmers need higher-yield seeds, fertilizer, pesticides, and machinery. For many African and Asian countries . . . the main source of agricultural supplies is importing. To generate the funds they need to buy agricultural supplies, less developed countries must produce something they can sell in more developed countries. In a less developed country such as Kenya, families may divide by gender between traditional subsistence agriculture and contributing to international trade. The more land that is devoted to growing export crops, the less that is available to grow crops for domestic consumption. Rather than helping to increase productivity, the funds generated through the sale of export crops may be needed to feed the people who switched from subsistence farming to growing export crops.

**Drug Crops.** The export crops chosen in some LDCs, especially in Latin America and Asia, are those that can be converted to drugs. Various drugs, such as coca leaf, marijuana, opium, and hashish, have distinctive geographic distributions.

### **Strategies to Increase Food Supply**

Four strategies can increase the food supply:

1. Expand the land area used for agriculture
2. Increase the productivity of land now used for agriculture
3. Identify new food sources
4. Increase exports from other countries

**Increase Food Supply by Expanding Agricultural Land.** Historically, world food production increased primarily by expanding the amount of land devoted to agriculture. Today few scientists believe that further expansion of agricultural land can feed the growing world population. Beginning about 1950, the human population has increased faster than the expansion of agricultural land. Prospects for expanding the percentage of cultivated land are poor in much of Europe, Asia, and Africa.

Especially in semiarid regions, human actions are causing land to deteriorate to a desertlike condition, a process called desertification (more precisely, semiarid land degradation). The United Nations estimates that desertification removes 27 million hectares (104,000 square miles) of land from agricultural production each year, an area roughly equivalent to Colorado.

Excessive water threatens other agricultural areas, especially drier lands that receive water from human-built irrigation systems. The United Nations estimates that 10 percent of all irrigated land is waterlogged, mostly in Asia and South America.

(360)

As urban areas grow in population and land area, farms on the periphery are replaced by homes, roads, shops, and other urban land uses.

**Increase Food Supply through Higher Productivity.** The invention and rapid diffusion of more productive agricultural techniques during the 1970s and 1980s is called the green revolution. The green revolution involves two main practices: the introduction of new higher-yield seeds and the expanded use of fertilizers.

The new high yield wheat, rice and maize seeds were diffused rapidly around the world. India's wheat production, for example, more than doubled in five years. Other Asian and Latin American countries recorded similar productivity increases.

To take full advantage of the new miracle seeds, farmers must use more fertilizer and machinery. The problem is that the cheapest way to produce both types of nitrogen-based fertilizers is to obtain hydrogen from natural gas or petroleum. As fossil-fuel prices increase, so do the prices for nitrogen-based fertilizers, which then become too expensive for many farmers in LDCs.

(361)

Farmers need tractors, irrigation pumps, and other machinery to make the most effective use of the new miracle seeds. In LDCs, farmers cannot afford such equipment, nor, in view of high energy costs, can they buy fuel to operate the equipment.

Scientists have continued to create higher-yield hybrids that are adapted to environmental conditions in specific regions. The green revolution was largely responsible for preventing a food crisis in these regions during the 1970s and 1980s, but will these scientific breakthroughs continue in the twenty-first century?

**Increase Food Supply by Identifying New Food Sources.** The third alternative for increasing the world's food supply is to develop new food sources. Three strategies being considered are to cultivate the oceans, to develop higher-protein cereals, and to improve palatability of rarely consumed foods.

(362)

**Increase Food Supply by Increasing Exports from Other Countries.** The fourth alternative for increasing the world's food supply is to export more food from countries that produce surpluses. The three top export grains are wheat, maize (corn), and rice. Few countries are major exporters of food, but increased production in these countries could cover the gap elsewhere.

The United States remains by far the largest grain exporter, accounting for one-half of global corn exports and one-fourth of wheat. However, the United States has decreased its grain exports in the past quarter century, whereas other countries have increased theirs.

(363)

Japan is by far the world's leading grain importer, especially of corn and wheat. South Korea and Mexico are major importers of corn, Egypt and Italy of wheat. World volume of trade in rice is much lower, with Bangladesh, Iran, and the Philippines the leading importers.

### **Africa's Food-Supply Crisis**

Some countries that previously depended on imported grain have become self-sufficient in recent years. Higher productivity generated by the green revolution is primarily responsible for reducing dependency on imports, especially in Asia.

In contrast, sub-Saharan Africa is losing the race to keep food production ahead of population growth. By all estimates, the problems will grow worse. Production of most food crops is lower today in Africa than in the 1960s. Agriculture in sub-Saharan Africa can feed little more than half of the region's population.

The problem is particularly severe in the Horn of Africa, and in the Sahel region.

(364)

With rapid population growth, pastoral nomad herd size increased beyond the capacity of the land to support them. Farmers overplanted, exhausting soil nutrients, and reduced fallow time, during which unplanted fields can recover. Soil erosion increased after most of the remaining trees were cut for wood and charcoal, used for urban cooking and heating.

Government policies have aggravated the food-shortage crisis. To make food affordable for urban residents, governments keep agricultural prices low. Constrained by price controls, farmers are unable to sell their commodities at a profit and therefore have little incentive to increase productivity.

### **Key Terms**

Agribusiness (p.338)

Agriculture (p.333)

Cereal grain (p.347)

Chaff (p.345)

Combine (p.350)

Commercial agriculture (p.335)

Crop (p.333)

Crop rotation (p.346)

Desertification (p.359)

Double cropping (p.345)

Grain (p.350)

Green revolution (p.360)

Horticulture (p.354)

Hull (p.345)

Intensive subsistence agriculture (p.345)

Milkshed (p.349)

Paddy (p.345)

Pastoral nomadism (p.343)

Pasture (p.344)

Plantation (p.355)

Prime agricultural land (p.338)

Ranching (p.351)

Reaper (p.350)

Ridge tillage (p.357)

Sawah (p.345)

Seed agriculture (p.334)

Slash-and-burn agriculture (p.339)

Shifting cultivation (p.339)

Spring wheat (p.350)

Subsistence agriculture (p.335)

Sustainable agriculture (p.357)

Swidden (p.341)

Thresh (p.345)

Transhumance (p.344)

Truck farming (p.355)

Vegetative planting (p.334)

Wet rice (p.345)

Winnow (p.345)

Winter wheat (p.350)