

Chapter 10

Food and Agriculture



What food is this African girl carrying? Page 353



Why is this field deliberately flooded? Page 363

KEY ISSUE 1

Where Did
Agriculture
Originate?

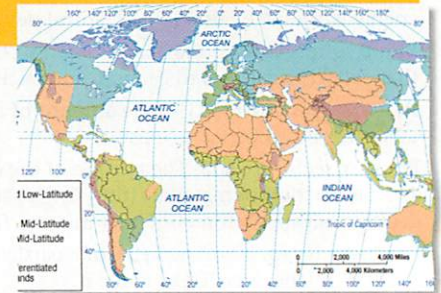


Inventing Agriculture p. 347

Agriculture was invented around 10,000 years ago in multiple hearths.

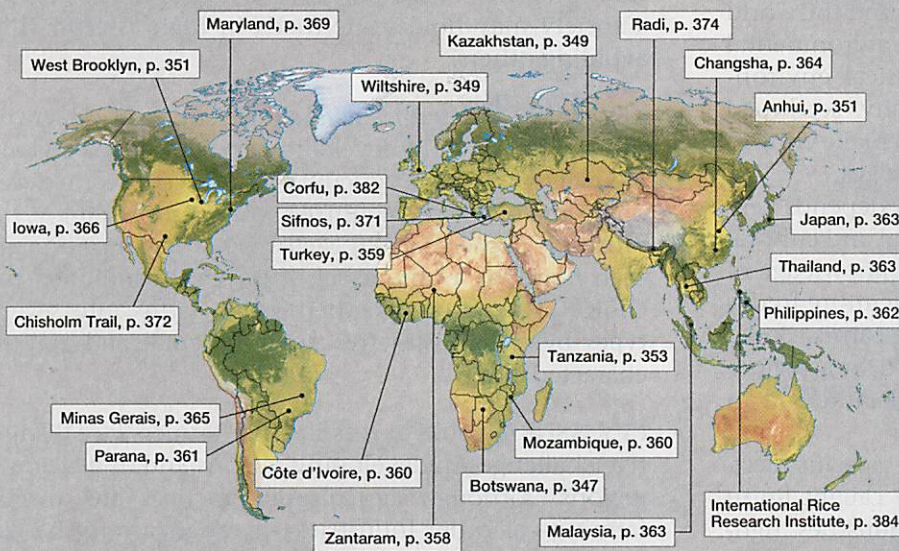
KEY ISSUE 2

Why Do People
Consume
Different Foods?



The Foods We Consume p. 352

Humans consume most of their calories through grains.



▲ These farmers in northwestern India are harvesting wheat seeds by beating the stalks by hand. The farm produces about 1,500 kilograms (3,300 pounds) of wheat per year—enough to feed a family. In contrast, the average farmer in Kansas produces 175,000 kilograms (400,000 pounds) of wheat a year. In a developed country, the work of separating the seeds from the stalks is done by a machine, whereas in developing countries, most farmers can't afford machinery, so they must do the work by hand.

KEY ISSUE 3

Where Is Agriculture Distributed?



Agricultural Regions p. 360

Eleven major agricultural regions approach agriculture differently.

KEY ISSUE 4

Why Do Farmers Face Economic Difficulties?



Challenges for Farmers p. 374

Farmers have trouble making ends meet in both developing and developed regions.

Introducing Food and Agriculture

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.

Geographers study where agriculture is distributed across Earth. The most important distinction is what happens to farm products. In developing *regions*, the farm products are most often consumed on or near the farm where they are produced, whereas in developed countries, farmers sell what they produce.

Geographers observe a wide variety of agricultural practices. The reason why farming varies around the world relates to the distribution of cultural and environmental factors across *space*. 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.

Farming is an economic activity that still depends very much on the local diversity of environmental and cultural conditions in each *place*. Despite increased knowledge of alternatives, farmers practice distinctive agriculture in different regions and, in fact, on neighboring farms. Broad climate patterns influence the crops planted in a region, and local soil conditions influence the crops planted on an individual farm.

Although individual farmers may make specific decisions on a very local *scale*, agriculture is as caught up in the globalization of the economy as other industries. Agriculture is big business in developed countries and a major

component of international trade *connections* in developing countries (Figure 10-1).

After examining the origins and diffusion of agriculture, we will consider the agricultural practices used in developing and developed countries. We will also examine the problems farmers face in each type of region. Although each farm has a unique set of physical conditions and choice of crops, geographers group farms into several types by their distinctive environmental and cultural characteristics.

- **KEY ISSUE 1** examines the origin and diffusion of agriculture. In each society, farmers possess very specific knowledge of their environmental conditions and certain technology for modifying the landscape. Within the limits of their technology, farmers choose from a variety of agricultural practices, based on their perception of the value of each alternative.
- **KEY ISSUE 2** looks at *local diversity* in the consumption of food and nutrition, as well as the distribution of global hunger. Values underlying the consumption of food are influenced by culture. Farmers select agricultural practices based on cultural perceptions, because a society may hold some foods in high esteem while avoiding others.
- **KEY ISSUE 3** describes *where* different types of agriculture are practiced in developing and developed regions. We will consider the agricultural practices used in developing and developed countries. We will also examine the problems farmers face in each type of region. Although each farm has a unique set of physical conditions and choice of crops, geographers group farms into several types by their distinctive environmental and cultural characteristics.
- **KEY ISSUE 4** looks at reasons *why* farmers face distinctive challenges in developing regions and in developed regions. Although agricultural practices are diverse, farming—as other industries—is caught up in the *globalization* of the economy.

▼ **FIGURE 10-1 U.S. WHEAT FARM** Two combine machines on a U.S. farm empty grain into a truck.



KEY ISSUE 1

Where Did Agriculture Originate?

- Invention of Agriculture
- Comparing Subsistence and Commercial Agriculture

Agriculture is deliberate modification of Earth's surface through cultivation of plants and rearing of animals to obtain sustenance or economic gain. Agriculture originated when humans domesticated plants and animals for their use. The word *cultivate* means "to care for," and a **crop** is any plant cultivated by people.

Approximately one-half of the people in less developed countries are farmers. The overwhelming majority of them grow enough food to feed themselves, but little more. Developing countries are home to 97 percent of the world's farmers. In contrast, fewer than 2 percent of the people in the United States are farmers. Yet the advanced technology used by U.S. farmers allows them to produce enough food for people in the United States at a very high standard, as well as food for many people elsewhere in the world.

In each society, farmers possess very specific knowledge of their environmental conditions and certain technology for modifying the landscape. Within the limits of their technology, 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. Farmers select agricultural practices based on cultural perceptions because a society may hold some foods in high esteem while avoiding others.

Invention of Agriculture

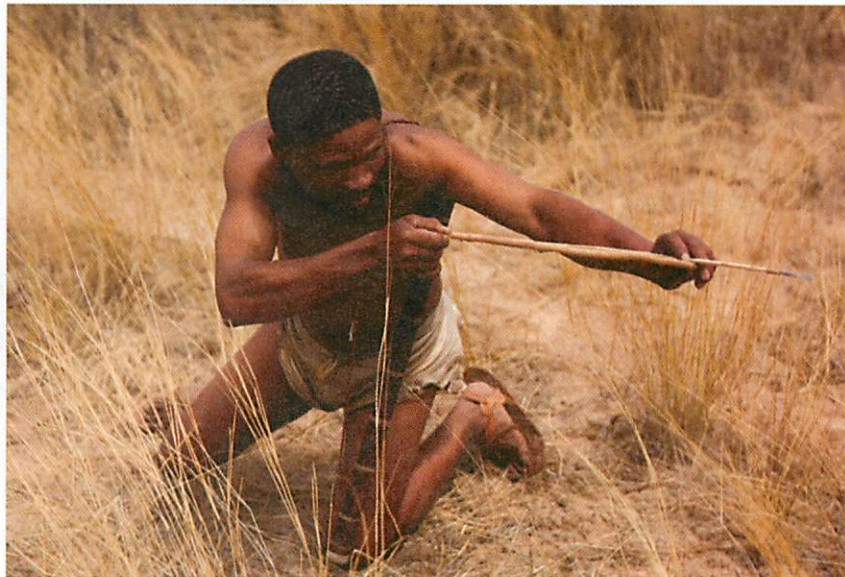
The origins of agriculture cannot be documented with certainty because it began before recorded history. Scholars try to reconstruct a logical sequence of events based on fragments of information about ancient agricultural practices and historical environmental conditions. Improvements in cultivating plants and domesticating animals evolved over thousands of years. This section offers an explanation for the origin and diffusion of agriculture.

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 plants (including berries, nuts, fruits, and roots). Hunters and gatherers lived in small groups of usually fewer than 50 persons because a larger number would quickly exhaust the available resources within walking distance (Figure 10-2). 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. They collected food often, perhaps daily. The food search might have taken only a short time or much of the day, depending on local conditions.

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. We can assume that groups communicated with each other concerning hunting rights, intermarriage, and other specific subjects. For the most part, they kept the peace by steering clear of each other's territory.

Today, perhaps a quarter-million people, or less than 0.005 percent of the world's population, still survive by hunting and gathering rather than by agriculture. Examples include the Spinifex (also known as Pila Nguru) people, who live in Australia's Great Victorian Desert; the Sentinelese people, who live in India's Andaman Islands; and the Bushmen, who live in Botswana and Namibia. Contemporary hunting and gathering societies are isolated groups that live on the periphery of world settlement, but they provide insight into human customs that prevailed in prehistoric times, before the invention of agriculture.



▲ **FIGURE 10-2 HUNTING AND GATHERING** A Bushman in Botswana prepares his bow and arrow for hunting.

AGRICULTURAL REVOLUTION

Learning Outcome 10.1.1

Identify the major crop and livestock hearths.

The **agricultural revolution** was the time when human beings first domesticated plants and animals and no longer relied entirely on hunting and gathering. When did the agricultural revolution occur? About the year 8000 B.C., the world's population began to grow at a more rapid rate than it had in the past. Geographers and other scientists believe that the reason for the sudden population increase was the agricultural revolution. By growing plants and raising animals, human beings created larger and more stable sources of food, so more people could survive.

Scientists do not agree on whether the agricultural revolution originated primarily because of environmental factors or cultural factors. Probably a combination of both factors contributed:

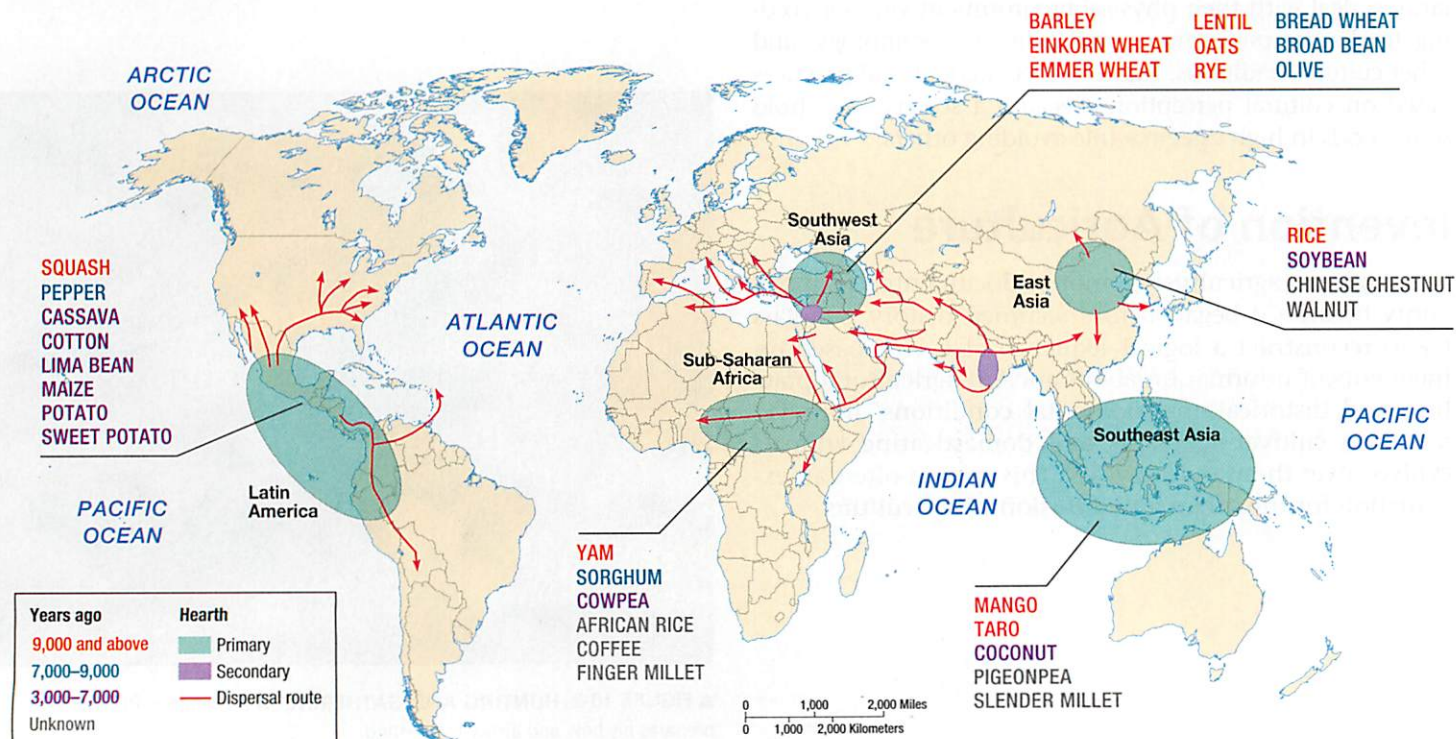
- **Environmental factors.** Those favoring environmental reasons point to the coinciding of the first domestication of crops and animals with climate change around 10,000 years ago. This marked the end of the last ice age, when permanent ice cover receded from Earth's mid-latitudes to polar regions, resulting in a massive redistribution of humans, other animals, and plants at that time.
- **Cultural factors.** Human behavior may be primarily responsible for the origin of agriculture. A preference for

living in a fixed place rather than as nomads may have led hunters and gatherers to build permanent settlements and to store surplus vegetation there. In gathering wild vegetation, people inevitably cut plants and dropped berries, fruits, and seeds. These hunters probably observed that, over time, damaged or discarded food produced new plants. They may have deliberately cut plants or dropped berries on the ground to see if they would produce new plants. Subsequent generations learned to pour water over the site and to introduce manure and other soil improvements. Over thousands of years, plant cultivation apparently evolved from a combination of accident and deliberate experiment.

CROP HEARTHES. Scientists also do not agree on how agriculture diffused or why most nomadic groups convert from hunting, gathering, and fishing to agriculture. They do agree that agriculture originated in multiple hearths around the world:

- **Southwest Asia.** The earliest crops domesticated in Southwest Asia are thought to have been barley and wheat, around 10,000 years ago (Figure 10-3). Lentil and olive were also early domestications in Southwest Asia. From this hearth, cultivation diffused west to Europe and east to Central Asia.
- **East Asia.** Rice is now thought to have been domesticated in East Asia more than 10,000 years ago, along the Yangtze River in eastern China. Millet was cultivated at an early date along the Yellow River.
- **Sub-Saharan Africa.** Sorghum was domesticated in central Africa around 8,000 years ago. Yams may have

▼ **FIGURE 10-3 CROP HEARTHES** Agriculture originated in multiple hearths. Domestication of some crops can be dated back more than 10,000 years.





◀ **FIGURE 10-4 ANIMAL HEARTHS** Animal domestication also originated in multiple hearths.

been domesticated even earlier. Millet and rice may have been domesticated in sub-Saharan Africa independently of the hearth in East Asia. From central Africa, domestication of crops probably diffused further south in Africa.

- **Latin America.** Two important hearths of crop domestication are thought to have emerged in Mexico and Peru around 4,000 to 5,000 years ago. Mexico is considered a hearth for beans and cotton, and Peru for potato. The most important contribution of the Americas to crop domestication, maize (corn), may have emerged in the two hearths independently around the same time. From these two hearths, cultivation of maize and other crops diffused northward into North America and southward into tropical South America. Some researchers place the origin of squash in the southeastern present-day United States.

Inhabitants of Southwest Asia may have been the first to integrate cultivation of crops with domestication of herd animals such as cattle, sheep, and goats. These animals were used to prepare the land before planting seeds and, in turn, were fed part of the harvested crop. Other animal products, such as milk, meat, and skins, may have been exploited at a later date. This integration of plants and animals is a fundamental element of modern agriculture.

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. Many plants and animals thrive across a wide portion of Earth's surface, not just in their place of original domestication. Only after 1500, for example, were wheat, oats, and barley introduced to the Western Hemisphere and maize to the Eastern Hemisphere.

Pause and Reflect 10.1.1

Which crops appear to have reached the present-day United States first, according to Figure 10-3?

ANIMAL HEARTHS. Animals were also domesticated in multiple hearths at various dates. Southwest Asia is thought to have been the hearth for the domestication of the largest number of animals that would prove to be most important for agriculture, including cattle, goats, pigs, and sheep, between 8,000 and 9,000 years ago (Figure 10-4). Domestication of the dog is thought to date from around 12,000 years ago or possibly earlier in Southwest Asia, East Asia, and/or Europe. The horse is considered to have been domesticated in Central Asia; diffusion of the domesticated horse is thought to be associated with the diffusion of the Indo-European language, as discussed in Chapter 5 (Figure 10-5).

▼ **FIGURE 10-5 HORSES IN KAZAKHSTAN** The horse is thought to have been domesticated in this region roughly 6,000 years ago.



Comparing Subsistence and Commercial Agriculture

Learning Outcome 10.1.2

Describe the major differences between subsistence and commercial agriculture.

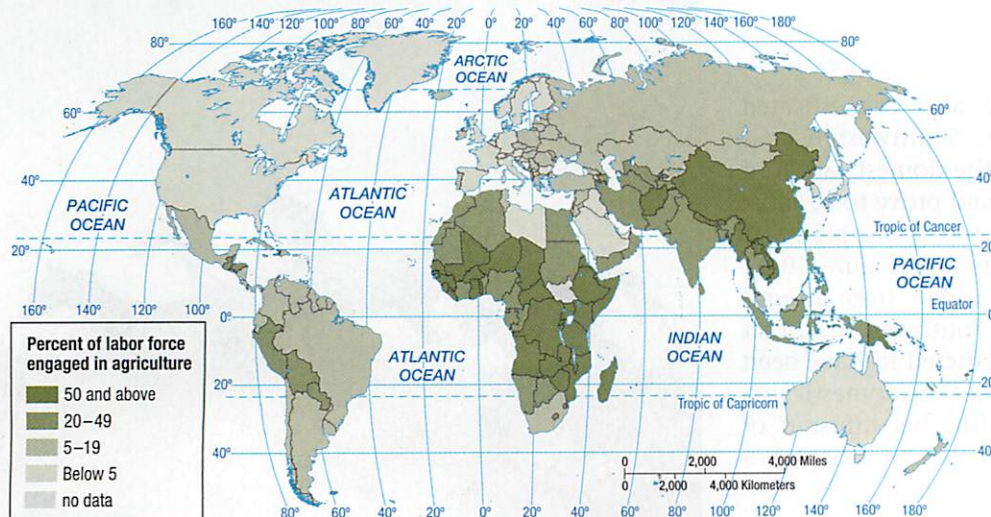
The most fundamental differences in agricultural practices are between those in developing countries and those in developed countries. Farmers in developing countries generally practice subsistence agriculture, whereas farmers in developed countries practice commercial agriculture. **Subsistence agriculture**, found in developing countries, is the production of food primarily for consumption by the farmer's family. **Commercial agriculture**, found in developed countries, is the production of food primarily for sale off the farm. The main features that distinguish commercial agriculture from subsistence agriculture include the percentage of farmers in the labor force, the use of machinery, and farm size.

PERCENTAGE OF FARMERS IN THE LABOR FORCE

A priority for all people is to secure the food they need to survive. In developing countries most people are subsistence farmers who work in agriculture to produce the food they and their families require. In developed countries the relatively few people engaged in farming are commercial farmers, and most people buy food with money earned by working in factories or offices or by performing other services.

In developed countries, around 5 percent of workers are engaged directly in farming, compared to around 44 percent in developing countries (Figure 10-6). The percentage of farmers is even lower in North America—only around 2 percent. Yet the small percentage of farmers in the United States and Canada produces not only enough food

▼ **FIGURE 10-6 AGRICULTURAL WORKERS** The percentage of the workforce engaged in agriculture is higher in developing countries than in developed countries.



for themselves and the rest of the region but also a surplus to feed people elsewhere.

The number of farmers declined dramatically in developed countries during the twentieth century. The United States had about 60 percent fewer farms and 85 percent fewer farmers in 2000 than in 1900. The number of farms in the United States declined from about 6 million in 1940 to 4 million in 1960 and 2 million in 1980. Both push and pull migration factors have been responsible for the decline: People were pushed away from farms by lack of opportunity to earn a decent income, and at the same time they were pulled to higher-paying jobs in urban areas. The number of U.S. farmers has stabilized since 1980 at around 2 million.

USE OF MACHINERY

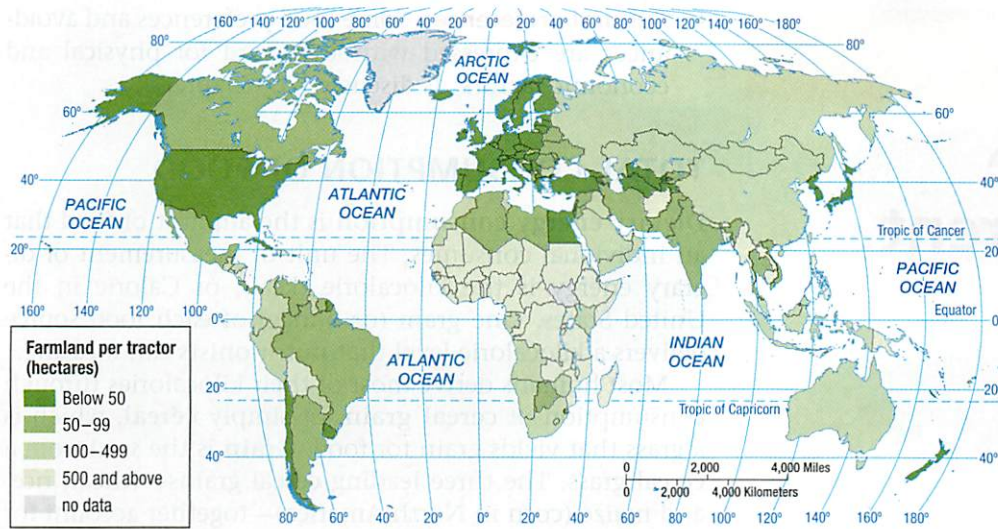
In developed countries, a small number of commercial farmers can feed many people because they rely on machinery to perform work rather than on people or animals (Figure 10-7). In developing countries, subsistence farmers do much of the work with hand tools and animal power.

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 and was followed in the nineteenth and twentieth centuries by inventions that made farming less dependent on human or animal power. Tractors, combines, corn pickers, planters, and other factory-made farm machines have replaced or supplemented manual labor.

Transportation improvements have also aided commercial farmers. The building of railroads in the nineteenth century and highways and trucks in the twentieth century have enabled farmers to transport crops and livestock farther and faster. Cattle arrive at market heavier and in better condition when transported by truck or train than when driven on hoof. Crops reach markets without spoiling.

Commercial farmers use scientific advances to increase productivity. Experiments conducted in university laboratories, industry, and research organizations generate new fertilizers, herbicides, hybrid plants, animal breeds, and farming practices, which produce higher crop yields and healthier animals. Access to other scientific information has enabled farmers to make more intelligent decisions concerning proper agricultural practices. Some farmers conduct their own on-farm research.

Electronics also help commercial farmers. Farmers use Global Positioning System (GPS) devices to determine the precise coordinates for spreading different types and amounts of fertilizers. On large ranches, they also use GPS devices to monitor the location



▲ FIGURE 10-7 AREA OF FARMLAND PER TRACTOR Farmers in developing countries have more hectares or acres of land per tractor than do farmers in developed countries. The machinery makes it possible for commercial farmers to farm extensive areas, a practice necessary to pay for the expensive machinery.

of cattle. They use satellite imagery to measure crop progress and yield monitors attached to combines to determine the precise number of bushels being harvested.

Pause and Reflect 10.1.2

What other electronics, in addition to GPS devices, might help a farmer on a very large farm?

FARM SIZE

The average farm is relatively large in commercial agriculture. Farms average 161 hectares (418 acres) in the United States, compared to about 1 hectare (2.5 acres) in China (Figure 10-8). Large size partly depends on mechanization. Combines, pickers, and other machinery perform most efficiently at very large scales, and their considerable expense cannot be justified on a small farm. As a result of the large size and the high level of mechanization, commercial agriculture is an expensive business. Farmers spend hundreds of thousands of dollars to buy or rent land and machinery before

▼ FIGURE 10-8 FARM SIZE The average size of a family farm in China is much smaller than in the United States. (left) Family farm in Anhui Province, China. (right) Family farm in West Brooklyn, Illinois.



(a)



(b)

beginning operations. This money is frequently borrowed from a bank and repaid after output is sold.

Commercial agriculture is increasingly dominated by a handful of large farms. In the United States, the largest 5 percent of farms produce 75 percent of the country's total agriculture. Despite their size, most commercial farms in developed countries—90 percent in the United States—are family owned and operated. Commercial farmers frequently expand their holdings by renting nearby fields.

Although the United States had fewer farms and farmers in 2000 than in 1900, the amount of land devoted to agriculture increased by 13 percent, primarily due to irrigation and reclamation. However, in the twenty-first century, the United States has been losing 1.2 million hectares (3 million acres) per year of its 400 million hectares (1 billion acres) of farmland, primarily because of the expansion of urban areas.

CHECK-IN: KEY ISSUE 1

Where Did Agriculture Originate?

- ✓ Before the invention of agriculture, most humans were hunters and gatherers.
- ✓ Agriculture was invented in multiple hearths beginning approximately 10,000 years ago.
- ✓ Modern agriculture is divided between subsistence agriculture in developing countries and commercial agriculture in developed countries. They differ according to the percentage of farmers, use of machinery, and farm size.