

▲ 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.

KEY ISSUE 2

Why Do People Consume Different Foods?

- Diet
- Nutrition and Hunger

Learning Outcome 10.2.1

Explain differences between developed and developing countries in food consumption.

When you buy food in a supermarket, are you reminded of a farm? Not likely. The meat is carved into pieces that no longer resemble an animal and is wrapped in paper or plastic film. Often the vegetables are canned or frozen. The milk and eggs are in cartons.

The food industry in the United States and Canada is vast, but only a few people are full-time farmers, and they may be more familiar with the operation of computers and advanced machinery than the typical factory or office worker. The mechanized, highly productive American or Canadian farm contrasts with the subsistence farm found in much of the world. The most “typical” human—if there is such a person—is an Asian farmer who grows enough food to survive, with little surplus. This sharp contrast in agricultural practices constitutes one of the most fundamental differences between the more developed and less developed countries of the world.

Diet

Everyone needs food to survive. Consumption of food varies around the world, both in total amount and source of nutrients. The variation results from a combination of:

- **Level of development.** People in developed countries tend to consume more food and from different sources than do people in developing countries.
- **Physical conditions.** Climate is important in influencing what can be most easily grown and therefore consumed in developing countries. In developed countries, though, food is shipped long distances to locations with different climates.

- **Cultural preferences.** Some food preferences and avoidances are expressed without regard for physical and economic factors, as discussed in Chapter 4.

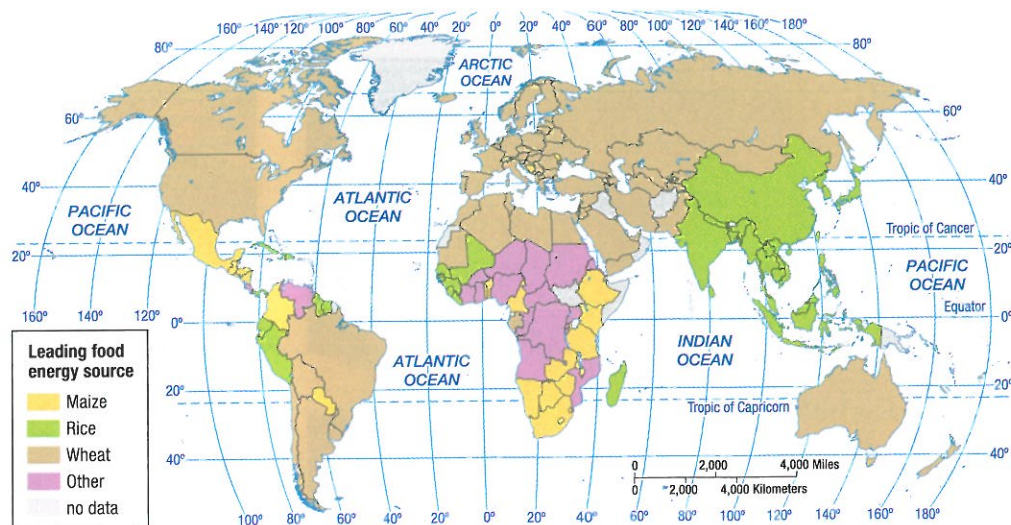
TOTAL CONSUMPTION OF FOOD

Dietary energy consumption is the amount of food that an individual consumes. The unit of measurement of dietary energy is the kilocalorie (kcal), or Calorie in the United States. One gram (or ounce) of each food source delivers a kilocalorie level that nutritionists can measure.

Most humans derive most of their kilocalories through consumption of **cereal grain**, or simply **cereal**, which is a grass that yields grain for food. **Grain** is the seed from a cereal grass. The three leading cereal grains—wheat, rice, and maize (corn in North America)—together account for nearly 90 percent of all grain production and more than 40 percent of all dietary energy consumed worldwide:

- **Wheat.** The principal cereal grain consumed in the developed regions of Europe and North America is wheat, which is consumed in bread, pasta, cake, and many other forms. It is also the most consumed grain in the developing regions of Central and Southwest Asia, where relatively dry conditions are more suitable for growing wheat than other grains (Figure 10-9).
- **Rice.** The principal cereal grain consumed in the developing regions of East, South, and Southeast Asia is rice. It is the most suitable crop for production in tropical climates.
- **Maize.** The leading crop in the world is maize (called corn in North America), though much of it is grown for purposes other than direct human consumption, especially as animal feed. It is the leading crop in some countries of sub-Saharan Africa.
- **Other crops.** A handful of countries obtain the largest share of dietary energy from other crops, especially in sub-Saharan Africa (Figure 10-10). These include cassava, sorghum, millet, plantains, sweet potatoes, and

▼ FIGURE 10-9 DIETARY ENERGY BY SOURCE Wheat, rice, and maize are the three main sources of kilocalories.





▲ FIGURE 10-10 AFRICAN FOOD The girl is carrying cassavas in Tanzania. At home, these roots will be pounded to break up the fibrous texture and cooked into a porridge.

yams. Sugar is the leading source of dietary energy in Venezuela.

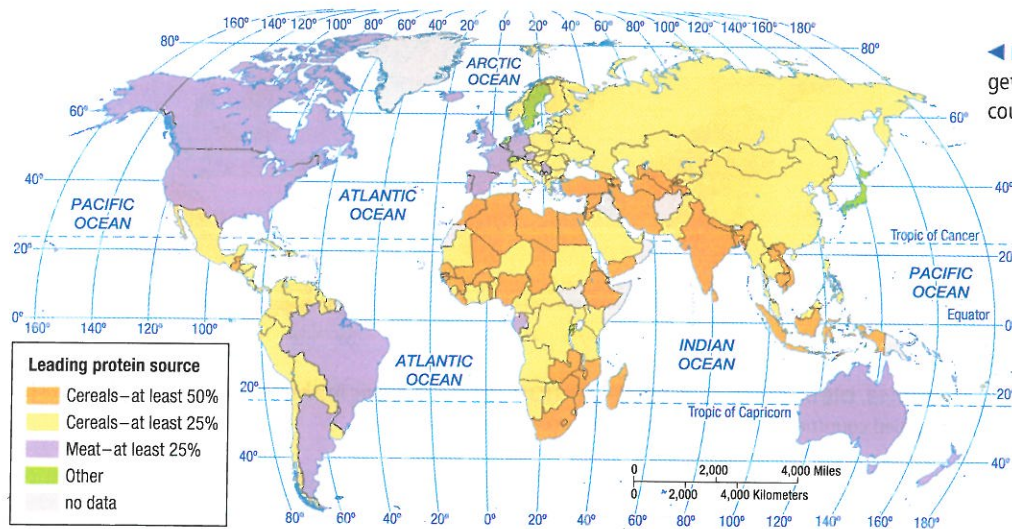
Pause and Reflect 10.2.1

Which of the three main cereal grains is most prevalent in your diet?

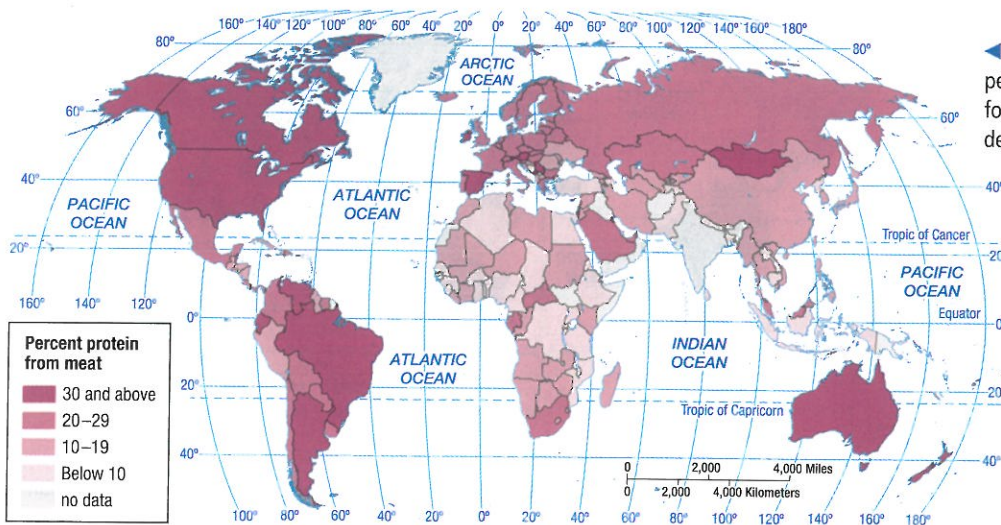
SOURCE OF NUTRIENTS

Protein is a nutrient needed for growth and maintenance of the human body. Many food sources provide protein of varying quantity and quality. One of the most fundamental differences between developed and developing regions is the primary source of protein (Figure 10-11).

In developed countries, the leading source of protein is meat products, including beef, pork, and poultry (Figure 10-12). Meat accounts for approximately one-third of all protein intake in developed countries, compared to approximately one-tenth in developing ones. In most developing countries, cereal grains provide the largest share of protein.



◀ FIGURE 10-11 PROTEIN BY SOURCE People get most of their protein from meat in developed countries and from cereals in developing countries.



◀ FIGURE 10-12 PROTEIN FROM MEAT The percentage of protein from meat is much higher for people in developed countries than for those in developing countries.

Nutrition and Hunger

Learning Outcome 10.2.2

Explain the global distribution of undernourishment.

The United Nations defines **food security** as physical, social, and economic access at all times to safe and nutritious food sufficient to meet dietary needs and food preferences for an active and healthy life. By this definition, roughly one-eighth of the world's inhabitants do not have food security.

DIETARY ENERGY NEEDS

To maintain a moderate level of physical activity, an average individual needs to consume at least 1,800 kcal per day, according to the UN Food and Agricultural Organization. The figure must be adjusted for age, sex, and region of the world.

Average consumption worldwide is approximately 2,800 kcal per day, or roughly 50 percent more than the recommended minimum. Thus, most people are getting enough food to eat. People in developed countries are consuming on average twice the recommended minimum, approximately 3,600 kcal per day (Figure 10-13). Austria and the United States have the world's highest consumption, approximately 3,800 kcal per day per person. The consumption of so much food is one reason that obesity is more prevalent than hunger in developed countries.

In developing regions, average daily consumption is approximately 2,600 kcal, still above the recommended minimum. However, the average in sub-Saharan Africa is only 2,400 kcal, an indication that a large percentage of Africans are not getting enough to eat. Diets are more likely to be deficient in countries where people have to spend a high percentage of their income to obtain food (Figure 10-14).

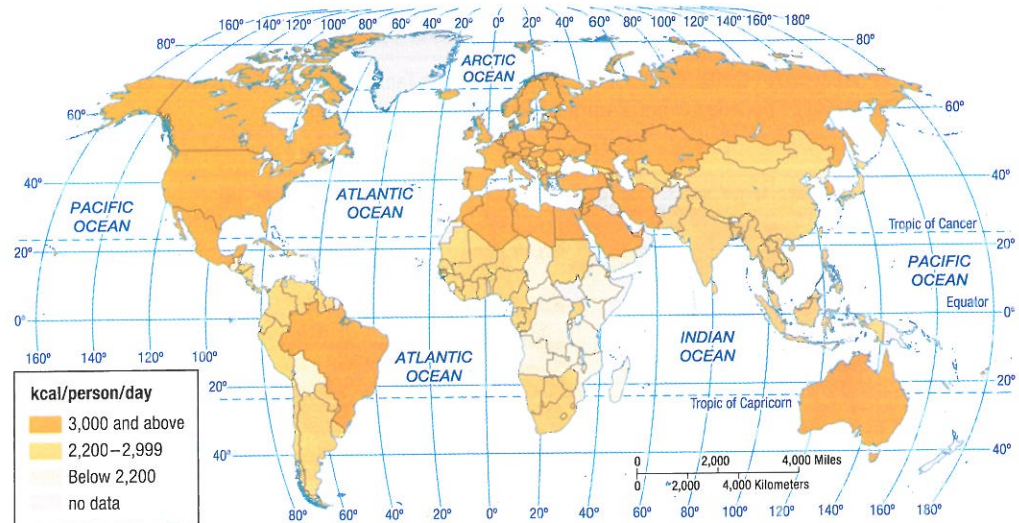
Pause and Reflect 10.2.2

How many kilocalories are in a Big Mac? You can use Google to find the answer. How does one Big Mac compare to the daily caloric intake of the average African?

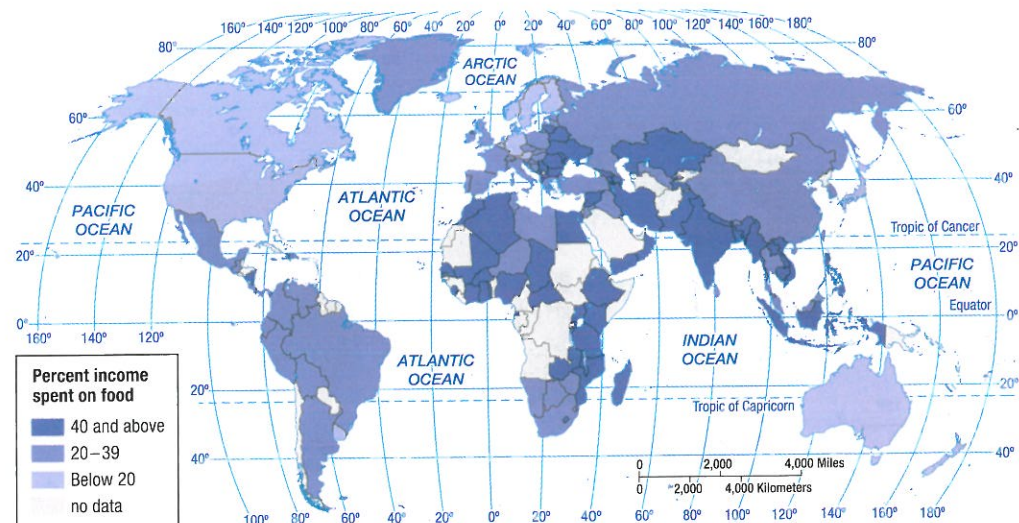
UNDERNOURISHMENT

Undernourishment is dietary energy consumption that is continuously below the minimum requirement for maintaining a healthy life and carrying out light physical activity. The UN estimates that 870 million people in the world are undernourished; 99 percent of the world's undernourished people are in developing countries. India has by far the largest the number of undernourished people, 225 million, followed by China, with 130 million (Figure 10-15). One-fourth of the population in sub-Saharan Africa, one-fifth in South Asia, and one-sixth in all developing countries are classified as undernourished (Figure 10-16).

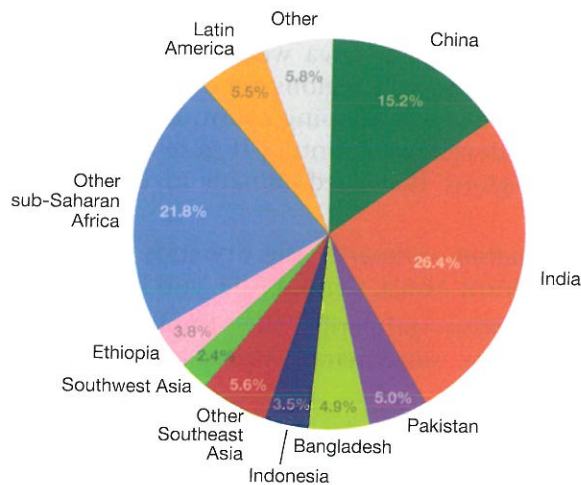
Worldwide, the total number of undernourished people has not changed much in several decades (Figure 10-17). With population growth, though, the percentage of undernourished people has decreased. Among developing regions, East Asia, led by China, has had by far the largest decrease in number undernourished, and South Asia and



▲ **FIGURE 10-13 DIETARY ENERGY CONSUMPTION** Per capita caloric intake is approximately 3,600 kcal per day in developed countries and 2,600 in developing countries.



▲ **FIGURE 10-14 INCOME SPENT ON FOOD** People spend on average less than 20 percent of income for food in developed countries compared to more than 40 percent in developing countries.



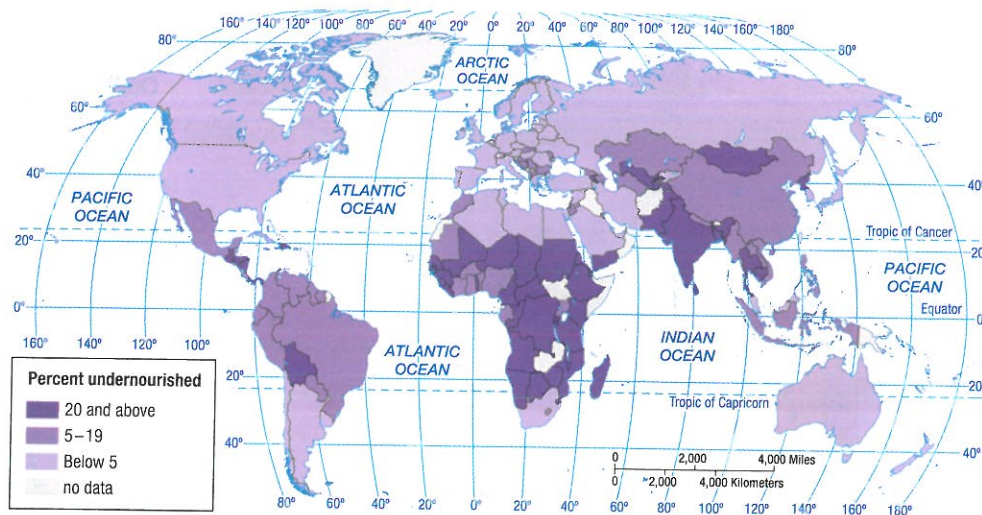
▲ FIGURE 10-15 DISTRIBUTION OF UNDERNOURISHMENT More than half of the world's undernourished people are in South Asia and East Asia.

sub-Saharan Africa have had the largest increases. Southeast Asia, led by Myanmar and Vietnam, has also had a large decrease.

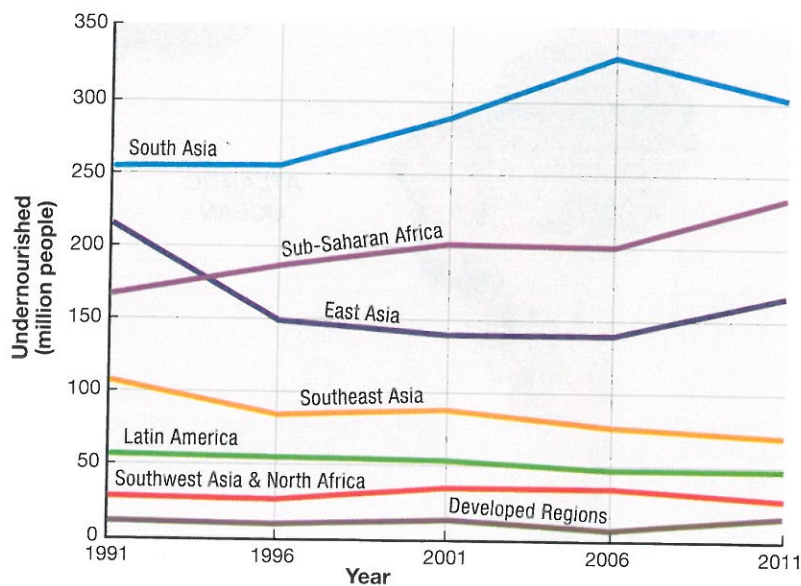
CHECK-IN: KEY ISSUE 2

Why Do People Consume Different Foods?

- ✓ Most food is consumed in the form of cereal grains, especially wheat, rice, and maize.
- ✓ People in developed countries consume more total calories and a higher percentage through animal products.
- ✓ Most humans consume more than the recommended minimum calories, but undernourishment is widespread in Asia and sub-Saharan Africa.



◀ FIGURE 10-16 EXTENT OF UNDERNOURISHMENT Less than 5 percent of the population is undernourished in developed countries compared to 15 percent in developing countries.



◀ FIGURE 10-17 CHANGE IN UNDERNOURISHMENT South Asia has seen the largest increase in number of undernourished people.

KEY ISSUE 3

Where Is Agriculture Distributed?

- Agriculture in Developing Regions
- Agriculture in Developed Regions

Learning Outcome 10.3.1

Identify the 11 major agricultural regions.

People have been able to practice agriculture in a wide variety of places. The most widely used map of world agricultural regions is based on work done by geographer

Derwent Whittlesey in 1936. Whittlesey identified 11 main agricultural regions, plus an area where agriculture was nonexistent. Whittlesey's 11 regions are divided between 5 that are important in developing countries and 6 that are important in developed countries (Figure 10-18). The 5 agricultural regions that predominate in developing countries are:

- *Pastoral nomadism*—primarily the drylands of Southwest Asia & North Africa, Central Asia, and East Asia
- *Shifting cultivation*—primarily the tropical regions of Latin America, sub-Saharan Africa, and Southeast Asia
- *Intensive subsistence, wet rice dominant*—primarily the large population concentrations of East Asia and South Asia
- *Intensive subsistence, crops other than rice dominant*—primarily the large population concentrations of East Asia and South Asia, where growing rice is difficult

► FIGURE 10-18 AGRICULTURE AND CLIMATE REGIONS

(right) The major agricultural practices of the world can be divided into those that are prevalent in developing countries and those that are prevalent in developed countries (upper right). Climate plays a large role in the practice of agriculture. Figure 1-40 is a more detailed version of the climate map shown here.

