



AGRICULTURE

The Geography of the Global Food System

Every one of us depends, either directly or indirectly, on agriculture for our survival. It is easy to forget that urban-industrial society relies on the food surplus generated by farmers and herders and that, without agriculture, there would be no cities, universities, factories, or offices.

agriculture
The cultivation of domesticated crops and the raising of domesticated animals.

Agriculture, the tilling of crops and rearing of domesticated animals to produce food, feed, drink, and fiber, has been the principal enterprise of humankind throughout recorded history. Even today, agriculture remains by far the most important economic activity in the world, using more land than any other activity and employing about 40 percent of the working population. In some parts of Asia and Africa, more than 75 percent of the labor force is devoted to agriculture. North Americans, on the other hand, live in an urban society in which less than 2 percent of the population work as agriculturists. Likewise, Europe's labor force is as thoroughly nonagricultural as North America's. Nearly half of the world's population, however, continues to live in farm villages.

Region

How is the theme of region relevant to agriculture? For thousands of years, farmers have found ways to cope with a range of environmental conditions,

creating in the process an array of different types of food-producing systems. Collectively, these farming practices

have constructed formal **agricultural regions**. During the past 500 years, colonialism, industrialization, and globalization have greatly altered existing practices and created new types of agricultural regions, such as plantations. Increasingly, large-scale, energy-intensive agriculture overcomes local environmental constraints through irrigation; land reclamation; and the use of synthetic fertilizers, chemical pesticides, herbicides, and genetic engineering. Consequently, in order to understand agricultural regions, we need to consider the role of the environment, cultural factors, and the political and economic forces that influence a region.

agricultural region

A geographic region defined by a distinctive combination of physical and environmental conditions; crop type; settlement patterns; and labor, cultivation, and harvesting practices.

Swidden Cultivation

Many of the peoples of tropical lowlands and hills in the Americas, Africa, and Southeast Asia practice a land-rotation agricultural system known as **swidden cultivation**. The term *swidden* is derived from an old English term meaning "burned clearing." Using machetes, axes, and chainsaws, swidden cultivators chop away the undergrowth from small patches of land and kill the trees by removing a strip of bark completely around the trunk. After the dead vegetation dries out, the farmers set it on fire to clear the land. Because of these clearing techniques, swidden cultivation is also called slash-and-burn agriculture. Working with digging sticks or hoes, the farmers then plant a variety of crops in the ash-covered clearings, varying from the maize (corn), beans, bananas, and manioc of Native Americans to the yams and nonirrigated rice grown by hill tribes in Southeast Asia (Figure 8.1, page 276). Different crops typically share the same clearing, a practice called **intercropping**. This technique allows taller, stronger crops to shelter lower,

swidden cultivation

A type of agriculture characterized by land rotation in which temporary clearings are used for several years and then abandoned to be replaced by new clearings; also known as slash-and-burn agriculture.

intercropping

The practice of growing two or more different types of crops in the same field at the same time.





FIGURE 8.1 A farmer in Tojo, central Sulawesi, surveys the results of clearing and burning a patch of forest for planting. What looks like destruction is actually part of a cycle that begins and ends in forest when swidden cultivation is practiced sustainably. (Reuters/Yusuf Ahmad/Landov.)

more fragile ones; reduces the chance of total crop losses from disease or pests; and provides the farmer with a varied diet. The complexity of many intercropping systems reveals the depth of knowledge acquired by swidden cultivators over many centuries. Relatively little tending of the plants is necessary until harvest time, and no fertilizer is applied to the fields because the ashes from the fire are a sufficient source of nutrients.

The planting and harvesting cycle is repeated in the same clearings for perhaps three to five years, until soil fertility begins to decline as nutrients are taken up by crops and not replaced. Subsequently, crop yields decline. These fields then are temporarily left fallow, and new clearings are prepared to replace them. Because the farmers periodically shift their cultivation plots, another commonly used term for the system is *shifting cultivation*. The abandoned cropland lies fallow for 10 to 20 years before farmers return to clear it and start the cycle again. Swidden

subsistence agriculture
Farming to supply the minimum food and materials necessary to survive.

cultivation represents one form of **subsistence agriculture**: food production mainly for the family and local community rather than for market.

Although the technology of swidden may be simple, it has proved to be an efficient and adaptive strategy. Swidden farming, unlike some modern systems, is ecologically sustainable and has endured for millennia. Indeed, contemporary studies suggest that some swidden systems have actually enhanced biodiversity. Furthermore, swidden returns more calories of food for the calories spent on cul-

tivation than does modern mechanized agriculture. In many tropical forest regions, swidden cultivation, unlike Western plantations, has left most of the forest intact over centuries of continuous use.

Nonetheless, swidden cultivation can be environmentally destructive under certain conditions. In poor countries with large landless populations, one often finds a front of pioneer swidden farmers advancing on the forests. In such situations, a range of institutional, economic, political, and demographic factors restrict poor farmers' abilities to employ the methods of swidden agriculture in a sustainable way. In many tropical countries, for example, a small proportion of the population owns most of the best agricultural land, forcing the majority of farmers to clear forests to gain access to land. Another condition that may diminish the sustainability of swidden cultivation occurs when a population experiences a sudden increase in its rate of growth and political or social conditions restrict its mobility. Swidden cultivation, still widely practiced throughout the tropics, is thus a highly variable system, occurring in both sustainable and unsustainable forms.

Paddy Rice Farming

Peasant farmers in the humid tropical and subtropical parts of Asia practice a highly distinctive type of agriculture called **paddy rice farming**. Rice, the dominant paddy crop,

paddy rice farming
The cultivation of rice on a paddy, or small flooded field enclosed by mud dikes, practiced in the humid areas of the Far East.

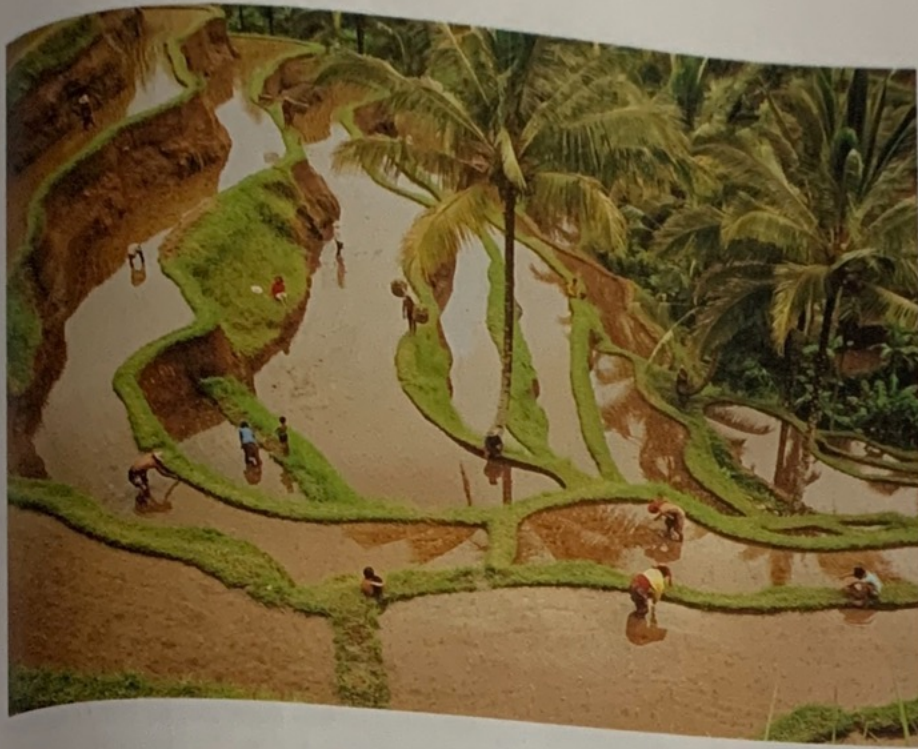


FIGURE 8.2 Cultivation of rice on the island of Bali, Indonesia. Paddy rice farming traditionally entails enormous amounts of human labor and yields very high productivity per unit of land.

What are the disadvantages of such a system?

(Denis Waugh/Tony Stone Images.)

forms the basis of civilizations in which almost all the caloric intake is of plant origin. From the monsoon coasts of India through the hills of southeastern China and on to the warmer parts of Korea and Japan stretches a broad region of diked, flooded rice fields, or paddies, many of which are perched on terraced hillsides (Figure 8.2). The terraced paddy fields form a striking cultural landscape (see Figure 1.16, page 23).

A paddy rice farm of only 3 acres (1 hectare = 2.47 acres) is usually adequate to support a family because irrigated rice provides a very large output of food per unit of land. Still, paddy farmers must till their small patches intensively to harvest enough food. A system of irrigation that can deliver water when and where it is needed is key to success. In addition, large amounts of fertilizer must be applied to the land. Paddy farmers often plant and harvest the same parcel

double-cropping of land twice per year, a practice known as **double-cropping**. These systems are extremely productive, yielding more food per acre than many forms of industrialized agriculture in the United States.

The modern era has witnessed a restructuring of paddy rice farming in more developed countries, such as Japan, Korea, and Taiwan. In some cases, the terrace structure has been reengineered to produce larger fields that can be worked with machines. In addition, dams, electric pumps, and reservoirs now provide a more reliable water supply, and high-yielding seeds, pesticides, and synthetic fertilizers boost production further. Most paddy rice farmers now produce mainly for urban markets.

Peasant Grain, Root, and Livestock Farming

In colder, drier Asian farming regions that are climatically unsuited to paddy rice farming—as well as in the river valleys of the Middle East, in parts of Europe, in Africa, and in the mountain highlands of Latin America and New Guinea—farmers practice a diverse system of agriculture based on bread grains, root crops, and herd livestock (Figures 8.3 and 8.4, page 278). Many geographers refer to these farmers as **peasants**, recognizing that they often represent a distinctive **folk culture** strongly rooted in the land. Peasants generally are small-scale farmers who own their fields and produce both for their own subsistence and for sale in the market. The dominant grain crops in these regions are wheat, barley, sorghum, millet, oats, and maize. Common cash crops—some of them raised for export—include cotton, flax, hemp, coffee, and tobacco.

These farmers also raise herds of cattle, pigs, sheep, and, in South America, llamas and alpacas. The livestock pull the plow; provide milk, meat, and wool; serve as beasts of burden; and produce manure for the fields. They also consume a portion of the grain harvest. In some areas, such as the Middle Eastern river valleys, the use of irrigation helps support this peasant system. In general,

peasant

A farmer belonging to a folk culture and practicing a traditional system of agriculture.

folk culture

A small, cohesive, stable, isolated, nearly self-sufficient group that is homogenous in custom and race; characterized by a strong family or clan structure, order maintained through sanctions based in the religion or family, little division of labor other than between the sexes, frequent and strong interpersonal relationships, and a material culture consisting mainly of handmade goods.

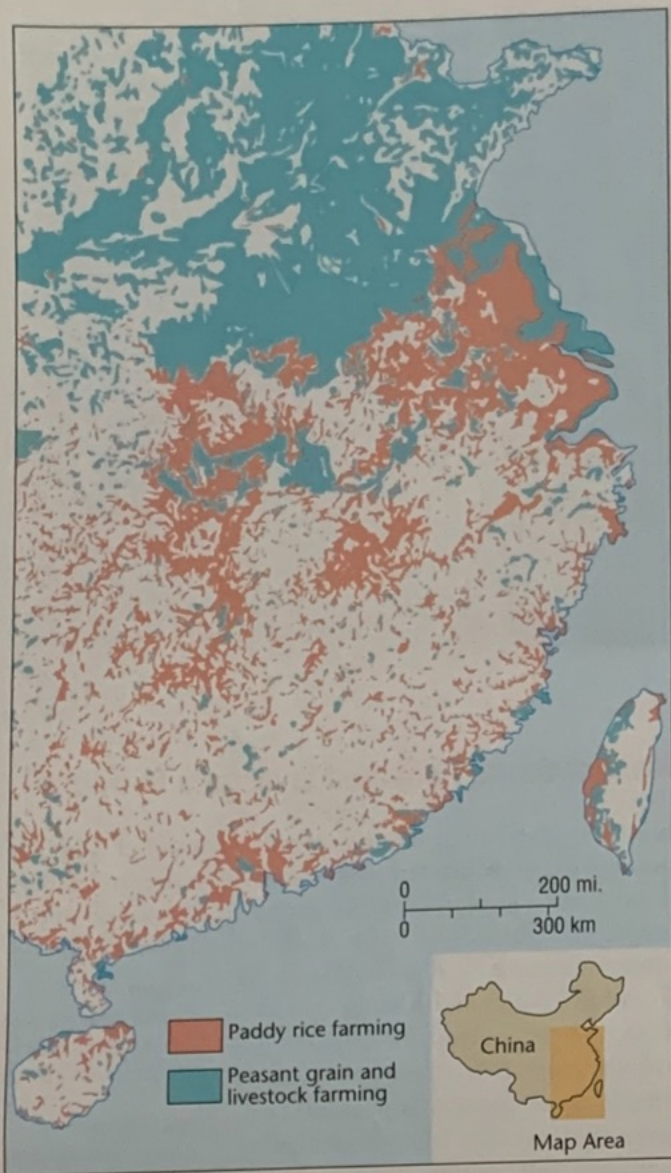


FIGURE 8.3 Two agricultural regions in China. The intricacies of culture region boundaries are suggested by the distribution of two types of agriculture in Taiwan and the eastern part of China. All such cultural-geographical borders are difficult to draw. *What might account for the more fragmented distribution of paddy rice farming, as contrasted with peasant grain, root, and livestock farming? Where would you draw the cultural boundary between the two types of agriculture?* (Source: Chuan-jun, 1979.)

however, most modern agricultural technologies are beyond the financial reach of most peasants.

Plantation Agriculture

In certain tropical and subtropical areas, Europeans and Americans introduced a commercial agricultural system called **plantation agriculture**. A **plantation** is a landholding



FIGURE 8.4 Peasant grain, root, and livestock agriculture in highland New Guinea. Distinctive “raised fields” with sweet potato mounds are found here among the farmers of highland New Guinea. These people raise diverse crops but give the greatest importance to sweet potatoes, together with pigs. *Why might they go to the trouble of creating these small mounds?* (Courtesy of Terry G. Jordan-Bychkov.)

devoted to capital-intensive, large-scale, specialized production of one tropical or subtropical crop for the global market. Each plantation district in the tropical and subtropical zones tends to specialize in one crop. Plantation agriculture has long relied on large amounts of manual labor, initially in the form of slave labor and later as wage labor. The plantation system originated in the 1400s on Portuguese-owned sugarcane-producing islands off the coast of tropical West Africa—São Tomé and Príncipe—but the greatest concentrations are now in the American tropics, Southeast Asia, and tropical South Asia. Most plantations lie near the sea-coast, close to the shipping lanes that carry their produce to nontropical lands such as Europe, the United States, and Japan.

Workers usually live right on the plantation, where a rigid social and economic segregation of labor and management produces a two-class society of the wealthy and the poor. As a result of the concentration of ownership and production, a handful of multinational corporations, such as Chiquita and Dole, control the largest share of plantations globally. Tension between labor and management is not uncommon, and the societal ills of the plantation system remain far from cured (**Figure 8.5**).

Plantations provided the base for European and American economic expansion into tropical Asia, Africa, and Latin America. They maximize the production of luxury crops for

plantation agriculture
A system of monoculture for producing export crops requiring relatively large amounts of land and capital, originally dependent on slave labor.

plantation
A large landholding devoted to specialized production of a tropical cash crop.



FIGURE 8.5 Plantation agriculture. This sign was erected by the management at the entrance to a banana plantation in Costa Rica. "Welcome to Freehold Plantation, a workplace where labor harmony reigns; in mutual respect and understanding, we united workers produce and export quality goods in peace and harmony." *How does this message suggest that, in fact, not all is harmonious here and that the tension of the two-class plantation system might simmer below the surface?* (Courtesy of Terry G. Jordan-Bychkov.)

Europeans and Americans, such as sugarcane, bananas, coffee, coconuts, spices, tea, cacao, pineapples, rubber, and tobacco (Figure 8.6). Similarly, textile factories require cotton, sisal, jute, hemp, and other fiber crops from the plantation areas. Much of the profit from these plantations is exported, along with the crops themselves, to Europe and North America, another source of political friction between countries of the global North and South.

Market Gardening

The growth of urban markets in the last few centuries also gave rise to other commercial forms of agriculture, including **market gardening**, also known as truck farming. Unlike plantations, truck farms are located in developed countries and specialize in intensively cultivated nontropical fruits, vegetables, and vines. They raise no livestock. Many districts concentrate on a single product, such as wine, table grapes, raisins, olives, oranges, apples, lettuce, or potatoes, and the entire farm output is raised for sale rather than for consumption on the farm. Many truck farmers participate in cooperative marketing arrangements and depend on migratory seasonal farm laborers to harvest their crops. Market garden districts appear in most industrialized countries. In the United States, a broken belt of market gardens extends from California eastward through the Gulf and Atlantic coast states, with scattered districts in other parts of the country. The lands around the Mediterranean Sea are dominated by market gardens. In regions with mild climates, such as California, Florida, and the Mediterranean region, winter vegetables are a common market crop raised for sale in colder regions of the higher latitudes.

market gardening
Farming devoted to specialized fruit, vegetable, or vine crops for sale rather than consumption.

Livestock Fattening

In **livestock fattening**, farmers raise and fatten cattle and hogs for slaughter. One of the most highly developed fattening areas is the famous Corn Belt of the U.S. Midwest, where farmers raise corn and soybeans

livestock fattening
A commercial type of agriculture that produces fattened cattle and hogs for meat.



FIGURE 8.6 Tea plantation in the highlands of Papua New Guinea. Although profitable for the owners and providing employment for a small labor force, the plantation recently displaced a much larger population of peasant grain, root, and livestock farmers. This is one result of globalization. *Should the government have prevented such a displacement?* (Courtesy of Terry G. Jordan-Bychkov.)



FIGURE 8.7 Cattle feedlot for beef production. This feedlot, in Colorado, is reputedly the world's largest. *What ecological problems might such an enterprise cause?* (William Strode/Woodfin Camp.)

to feed cattle and hogs. Typically, slaughterhouses are located close to feedlots, creating a new meat-producing region, which is often dependent on mobile populations of cheap immigrant labor. A similar system prevails over much of western and central Europe, though the feed crops there more commonly are oats and potatoes. Other zones of commercial livestock fattening appear in overseas European settlement zones such as southern Brazil and South Africa.

One of the central traditional characteristics of livestock fattening is the combination of crops and animal husbandry. Farmers breed many of the animals they fatten, especially hogs. In the last half of the twentieth century, livestock fatteners began to specialize their activities; some concentrated on breeding animals, others on preparing them for market.

feedlot

A factorylike farm devoted to either livestock fattening or dairying; all feed is imported and no crops are grown on the farm.

In the factorylike **feedlot**, farmers raise imported cattle and hogs on purchased feed (**Figure 8.7**). Increases in the amount of land and crop harvest dedicated to beef production have

accompanied the growth in feedlot size and number. In the United States, across Europe, and in European settlement zones around the globe, 51 to 75 percent of all grain raised goes to livestock fattening.

The livestock fattening and slaughtering industry has become increasingly concentrated, on both the national and global scales. In 1980 in the United States, the top four companies accounted for 41 percent of all slaughtered cattle. By 2000, the top four companies were slaughtering 81 percent of all feedlot cattle. One company alone

accounted for 35 percent. Corporate conglomerates such as ConAgra and Cargill control much of the beef supply through their domination of the grain market and ownership of feedlots and slaughterhouses. The concentration of the industry has extended north and south across the border, primarily spurred by the 1994 North American Free Trade Agreement (NAFTA). By 1999, two U.S.-based companies accounted for 50 percent of Canada's slaughtered cattle. Cargill owns beef operations in more than 60 countries. One industry observer concludes that three multinational companies control the entire global beef industry.

Grain Farming

Grain farming is a type of specialized agriculture in which farmers grow primarily wheat, rice, or corn for commercial markets. The United States is the world's leading wheat and corn exporter. The United States, Canada, Australia, the European Union (EU), and Argentina together account for more than 85 percent of all wheat exports, while the United States alone accounts for about 70 percent of world corn exports. Wheat belts stretch through Australia, the Great Plains of interior North America, the steppes of Russia and Ukraine, and the pampas of Argentina. Farms in these areas generally are very large, ranging from family-run wheat farms to giant corporate operations (**Figure 8.8**).

Widespread use of machinery, synthetic fertilizers, pesticides, and genetically engineered seed varieties enables grain farmers to operate on this large scale. The



FIGURE 8.8 A "wheat landscape" in the Palouse, a grain farming region on the borders of Washington and Oregon. Grain elevators are a typical part of such agricultural landscapes. The raising of one crop such as wheat over entire regions is called *monoculture*. **What problems might be linked to monoculture?** (Courtesy of Terry G. Jordan-Bychkov.)

planting and harvesting of grain is more completely mechanized than any other form of agriculture. Commercial rice farmers employ such techniques as sowing grain from airplanes. Harvesting is usually done by hired migratory crews operating corporation-owned machines (**Figure 8.9**). Perhaps grain farming's ultimate development is the **suitcase farm**, which is found

suitcase farm
In American commercial grain agriculture, a farm on which no one lives; planting and harvesting are done by hired migratory crews.

in the Wheat Belt of the northern Great Plains of the United States. The people who own and operate these farms do not live on the land. Most of them own several suitcase farms, lined up in a south-to-north row through the Plains states. They keep fleets of farm machinery, which they send north with crews of laborers along the string of suitcase farms to plant, fertilize, and harvest the wheat. The progressively later ripening of the grain as one moves north allows these farmers to maintain and harvest crops



FIGURE 8.9 Mechanized wheat harvest on the Great Plains of the United States. North American grain farmers operate in a capital-intensive manner, investing in machines, chemical fertilizers, and pesticides. **What long-term problems might such methods cause? What benefits are realized in such a system?** (Roger Du Buisson/The Stock Market.)

on all their farms with the same crew and the same machinery. Except for visits by migratory crews, the suitcase farms are uninhabited.

Such highly mechanized, absentee-owned, large-scale operations, or *agribusinesses*, have mostly replaced the small, husband- and wife-operated American family farm, an important part of the U.S. rural heritage. Geographer Ingolf Vogeler documented the decline of small family farms in the American countryside and argued that U.S. governmental policies, prompted by the forces of globalization, have consistently favored the interests of agribusiness, thereby hastening the decline. Family-owned farms continue to play an important role, but they now operate mostly as large agribusinesses that own or lease many far-flung grain fields.

Dairying

In many ways, the specialized production of dairy goods closely resembles livestock fattening. In the large dairy belts of the northern United States from New England to the upper Midwest, western and northern Europe, southeastern Australia, and northern New Zealand, the keeping of dairy cows depends on the large-scale use of pastures. In colder areas, some acreage must be devoted to winter feed crops, especially hay. Dairy products vary from region to region, depending in part on how close the farmers are to their markets. Dairy belts near large urban centers usually produce milk, which is more perishable, while those farther away specialize in butter, cheese, or processed milk. An extreme case is New Zealand, which, because of its remote location from world markets, produces much butter.

Reflecting on Geography

Why is dairying confined to northern Europe and the overseas lands settled by northern Europeans?

As with livestock fattening, in recent decades a rapidly increasing number of dairy farmers have adopted the feedlot system and now raise their cattle on feed purchased from other sources. Often situated on the suburban fringes of large cities for quick access to market, the dairy feedlots operate like factories. Like industrial factory owners, feedlot dairy owners rely on hired laborers to help maintain their herds. Dairy feedlots are another indicator of the rise of globalization-induced agribusiness and the decline of the family farm. By easing trade barriers, globalization compels U.S. dairy farmers to compete with producers in other parts of the world. Huge feedlots, a factory-style organization of production, automation, the concentration of ownership, and the increasing size of dairy farms are responses to this intense competition.

Nomadic Herding

In the dry or cold lands of the Eastern Hemisphere, particularly in the deserts, prairies, and savannas of Africa, the Arabian Peninsula, and the interior of Eurasia, **nomadic livestock herders** graze cattle, sheep, goats, and camels. North of the tree line in Eurasia, the cold tundra forms a zone of nomadic herders who raise reindeer. The common characteristic of all nomadic herding is mobility. Herders move with their livestock in search of forage for the animals as seasons and range conditions change. Some nomads migrate from lowlands in winter to mountains in summer; others shift from desert areas during the rainy season to adjacent semiarid plains in the dry season or from tundra in summer to nearby forests in winter. Some nomads herd while mounted on horses, such as the Mongols of East Asia, or on camels, such as the Bedouin of the Arabian Peninsula. Others, such as the Rendile of East Africa, herd cattle, goats, and sheep on foot.

Their need for mobility dictates that the nomads' few material possessions be portable, including the tents used for housing (**Figure 8.10**). Their mobile lifestyle also affects how wealth is measured. Typically, in nomadic cultures wealth is based on the size of livestock holdings rather than on the accumulation of property and personal possessions. Usually, the nomads obtain nearly all of life's necessities from livestock products or by bartering with the farmers of adjacent river valleys and oases.

For a number of different reasons, nomadic herding has been in decline since the early twentieth century. Some national governments established policies encouraging nomads to practice **sedentary cultivation** of the land. This practice was begun in the nineteenth century by British and French colonial administrators in North Africa because it allowed greater control of the people by the central governments. Today, many nomads are voluntarily abandoning their traditional life to seek jobs in urban areas or in the Middle Eastern oil fields. Recent severe drought in sub-Saharan Africa's Sahel region, which decimated nomadic livestock herds, was a further impetus to abandon nomadic life.

In recent decades, research conducted by geographers and anthropologists in Africa's semiarid environments has revealed the sound logic of nomadic herding practices. These studies demonstrate that nomadic cultures' pasture and livestock management strategies are rational responses to an erratic and unpredictable environment. Rainfall is highly irregular in time and space, and herding practices must adjust. The most important nomadic strategy is mobility, which allows herders to take fullest advantage of the resulting variations in range productivity. These findings

nomadic livestock herder
A member of a group that continually moves with its livestock in search of forage for its animals.

sedentary cultivation
Farming in fixed and permanent fields.



FIGURE 8.10 Nomadic pastoralists in West Africa. This Fulbe-Waila pastoralist household in Chad is moving their livestock to new pastures. Mobility is key to their successful use of the variable and unpredictable environment of this region of Africa. They are taking with them all of their possessions, including their shelter—a hut, which they have packed on top of one of their cows. (Frank Kroenke/Peter Arnold, Inc.)

have led to a new appreciation of nomadic herding cultures and may cause governments to reconsider sedentarization programs, thus postponing the demise of herding cultures.

Livestock Ranching

ranching
The commercial raising of herd livestock on a large landholding.

Superficially, **ranching** might seem similar to nomadic herding. It is, however, a fundamentally different livestock-raising system. Although both nomadic herders and livestock ranchers specialize in animal husbandry to the exclusion of crop raising and both live in arid or semiarid regions, livestock ranchers have fixed places of residence and operate as individuals rather than within a communal or tribal organization. In addition, ranchers raise livestock on a large scale for market, not for their own subsistence.

Livestock ranchers are found worldwide in areas with environmental conditions that are too harsh for crop production. They raise only two kinds of animals in large numbers: cattle and sheep. Ranchers in the United States, Canada, tropical and subtropical Latin America, and the warmer parts of Australia specialize in cattle raising. Midlatitude ranchers in cooler and wetter climates specialize in sheep. Sheep production is geographically concentrated to such a degree that only three countries—Australia, China, and New Zealand—account for 56 percent of the world's export wool.

Urban Agriculture

The United Nations (UN) calculated that in 2008 the human species passed a milestone. For the first time in history, more

people live in cities than in the countryside. As this global-scale rural-to-urban migration gained momentum, a distinct form of agriculture rose in significance.

We might best call this **urban agriculture**. Millions of city dwellers, especially in Third World countries, now produce enough vegetables, fruit, meat, and milk from tiny urban or suburban plots to provide most of their food, often with a surplus to sell. In China, urban agriculture now provides 90 percent or more of all the vegetables consumed in the cities. In the African metropolises of Kampala and Dar es Salaam, 70 percent of the poultry and 90 percent of the leafy vegetables consumed in the cities, respectively, come from urban lands. In 2010, the UN Food and Agriculture Organization convened the first symposium on urban agriculture in Africa in recognition of the important role it will play in feeding the continent's twenty-first-century urban residents.

urban agriculture

The raising of food, including fruit, vegetables, meat, and milk, inside cities, especially common in the Third World.

Geographer Susanne Freidberg has conducted research demonstrating the importance of urban agriculture to family income and food security in West Africa. Focusing on the city of Bobo-Dioulasso in Burkina Faso, Freidberg showed that though plots were small, urban agriculture offered residents “a culturally meaningful way to fulfill their roles as food producers and family providers.” In its heyday in the 1970s and 1980s, urban farming provided substantial incomes from vegetable sales in both the domestic and export markets. Since then, collapsing demand and the deterioration of environmental conditions have threatened the enterprise and undermined cooperation and trust within Bobo-Dioulasso's urban agricultural communities.

In the developed world, urban agriculture is becoming more prevalent despite, or perhaps in reaction to, the fact that food sourcing is increasingly globalized. The reasons for the boom in urban agriculture in cities such as Vancouver, Canada, and London are complex. However, almost everywhere it is seen as a partial solution to the problems of food insecurity and lack of access to nutritious foods in cities. The work of geographer Nik Heynen has shown that solving food insecurity is integral to improving urban social justice in the United States. It tends to be poorer residents, often members of marginalized minority groups, who lack access to a healthy diet. Similarly in Europe, the World Health Organization (WHO) has identified the poor availability of and inequitable access to nutritious vegetables and fruits in cities, especially for vulnerable groups, as a major twenty-first-century problem for the region. According to the WHO, the promotion of local food production in European cities will aid in reducing urban poverty and inequalities.

Reflecting on Geography

What types of agriculture occur in the three most densely populated areas of the world? Are these two characteristics—type of agriculture and population density—linked?

Farming the Waters

Most of us don't think of the ocean when discussing agriculture. In fact, however, every year more and more of our

aquaculture

The cultivation, under controlled conditions, of aquatic organisms, primarily for food but also for scientific and aquarium uses.

mariculture

A branch of aquaculture specific to the cultivation of marine organisms, often involving the transformation of coastal environments and the production of distinctive new landscapes.

animal protein is produced through **aquaculture**: the cultivation and harvesting of aquatic organisms under controlled conditions. Aquaculture includes **mariculture**, shrimp farming, oyster farming, fish farming, pearl cultivation, and more. In the heart of Brooklyn, New York, urban aquaculture thrives in a laboratory, where fish bound for New York City restaurants are harvested from indoor tanks. Aquaculture has its own distinctive cultural landscapes of containment

ponds, rafts, nets, tanks, and buoys (Figure 8.11). Like terrestrial agriculture, there is a marked regional character to aquacultural production.

Aquaculture is an ancient practice, dating back at least 4500 years. Older local practices, sometimes referred to as traditional aquaculture, involve simple techniques such as constructing retention ponds to trap fish or "seeding" flooded rice fields with shrimp. Commercial aquaculture, the industrialized, large-scale protein factories that are driving today's production growth, is a contemporary phenomenon. The greatest leaps in technology and production have occurred mostly since the 1970s.



FIGURE 8.11 Emerging mariculture landscapes. As mariculture expands, coastal landscapes and ecosystems are transformed, as in the case of marine fish farming off Langkawi Island, Malaysia. (© age fotostock/SuperStock.)

At the turn of the twenty-first century, aquaculture was experiencing phenomenal growth worldwide, growing nearly four times faster than all terrestrial animal food-producing sectors combined. Aquaculture is a key reason that per capita protein availability has mostly kept pace with population growth in recent decades. For example, China's per capita protein supply derived from aquaculture went from 1 kilogram in 1970 to nearly 24 kilograms in 2004. By 2008, aquaculture was producing nearly one-half of all fish and seafood consumed worldwide, compared with only 4 percent in 1970. Aquaculture's share of production is projected to continue growing as demand for seafood increases and wild fish stocks decline.

The extraordinary expansion of food production by aquaculture has come with high costs to the environment and human health. As with industrialized agriculture, most commercial aquaculture relies on large energy and chemical inputs, including antibiotics and artificial feeds made from the wastes of poultry and hog processing. Such production practices tend to concentrate toxins in farmed fish, creating a potential health threat to consumers. The discharge from fish farms, which can be equivalent to the sewage from a small city, can pollute nearby natural aquatic ecosystems. Around the tropics, especially tropical Asia, the expansion of commercial shrimp farms is contributing to the loss of highly biodiverse coastal mangrove forests.

Although aquaculture can take place just about anywhere that water is found, strong regional patterns do exist. Mariculture is prevalent along tropical coasts, particularly in the mangrove forest zone. Marine coastal zones in general, especially in protected gulfs and estuaries, have high

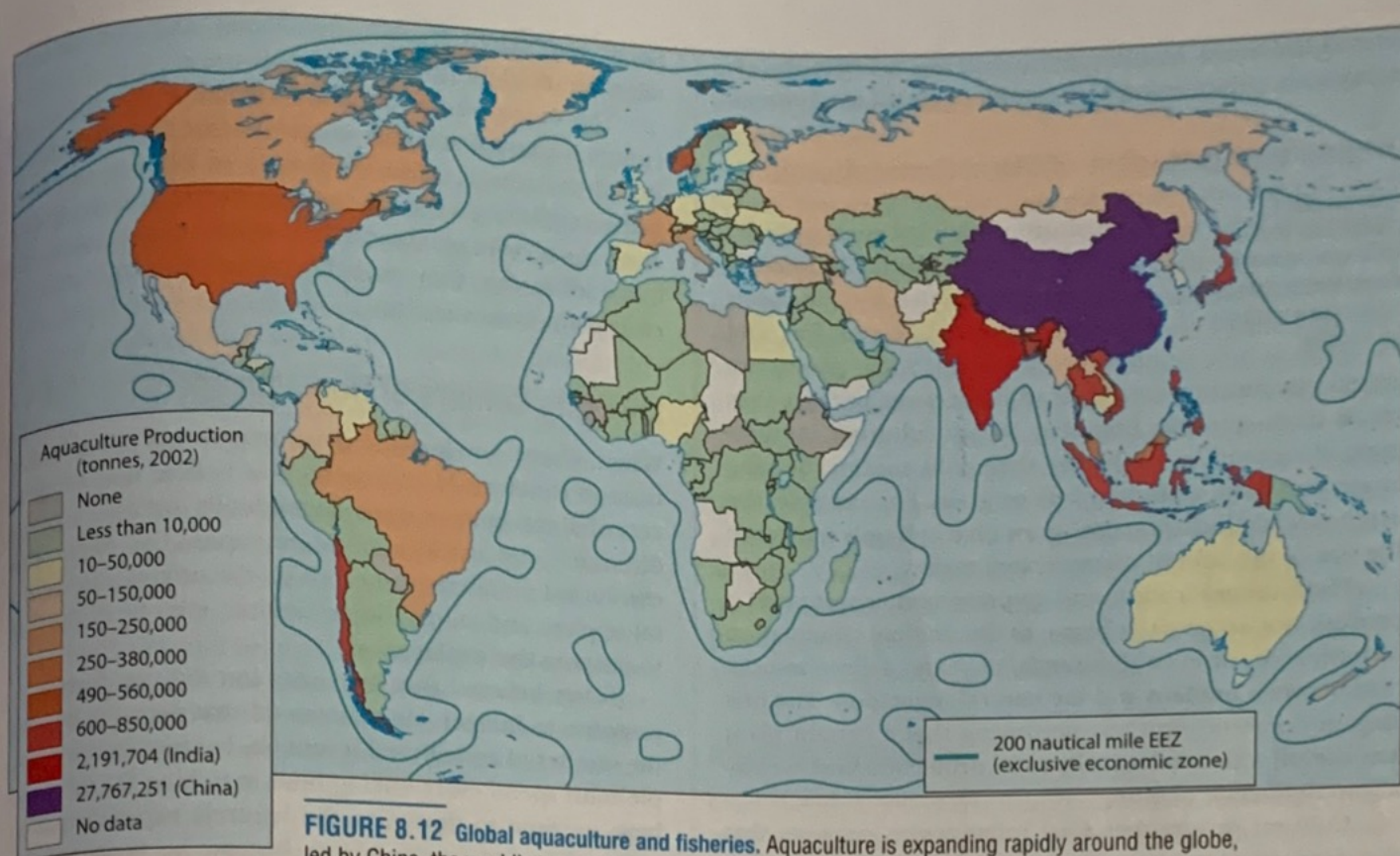


FIGURE 8.12 Global aquaculture and fisheries. Aquaculture is expanding rapidly around the globe, led by China, the world's top producer. Virtually all mariculture takes place within countries' 200-mile coastal territory known as the EEZ (exclusive economic zone). The EEZ is also the site of most commercial fishing, which has greatly depleted wild fish stocks and raised the need for increased mariculture production. (Source: *The Global Education Project, Fishing and Aquaculture.*)

concentrations of mariculture. On a global scale, China dwarfs all other regions, producing over two-thirds of the world's farmed seafood (Figure 8.12). Asia and Pacific regions combined produce over 90 percent of the world's total.

If you order shrimp, trout, or salmon for dinner at any of the myriad restaurant chains, you will almost certainly be eating farmed protein. As the populations of wild species decline and the price of capture fish increases, farmed seafood will increasingly move into the breach. If trends continue, we may be among the last generations to enjoy affordable fresh-caught wild fish.

Nonagricultural Areas

Areas of extreme climate, particularly deserts and subarctic forests, do not support any form of agriculture. Such lands are found predominantly in much of Canada and Siberia.

Often these areas are inhabited by **hunting-and-gathering** groups of native peoples, such as the Inuit, who gain a livelihood by hunting game, fishing where possible, and

hunting and gathering
The killing of wild game and the harvesting of wild plants to provide food in traditional cultures.

gathering edible and medicinal wild plants. At one time, all humans lived as hunter-gatherers. Today, fewer than 1 percent of humans do. Given the various inroads of the modern world, even these people rarely depend entirely on hunting and gathering. In most hunting-and-gathering societies, a division of labor by gender occurs. Males perform most of the hunting and fishing, whereas females carry out the equally important task of gathering harvests from wild plants. Hunter-gatherers generally rely on a great variety of animals and plants for their food.



Mobility

How does the theme of mobility help us understand the spatial and cultural patterns of agricultural production and food consumption? Some of the varia-

tion among the agriculture regions we've discussed results from **cultural diffusion**. Agriculture and its many components are inventions; they arose as innovations in certain source areas and diffused to other

cultural diffusion
The spread of elements of culture from the point of origin over an area.

parts of the world. Mobility, as we shall see, is key in the expansion and functioning of the modern global food system.

Origins and Diffusion of Plant Domestication

domesticated plant

A plant deliberately planted and tended by humans that is genetically distinct from its wild ancestors as a result of selective breeding.

Agriculture probably began with the domestication of plants. A **domesticated plant** is one that is deliberately planted, protected, cared for, and used by humans. Such plants are

genetically distinct from their wild ancestors because they result from selective breeding by agriculturists. Accordingly, they tend to be bigger than wild species, bearing larger and more abundant fruit or grain. For example, the original wild “Indian maize” grew on a cob only one-tenth the size of the cobs of domesticated maize.

Plant domestication and improvement constituted a process, not an event. It began as the gradual culmination of hundreds, or even thousands, of years of close association between humans and the natural vegetation. The first step in domestication was perceiving that a certain plant was useful, which led initially to its protection and eventually to deliberate planting.

Cultural geographer Carl Johannessen suggests that the domestication process can still be observed. He believes that by studying current techniques used by native subsistence farmers in places such as Central America, we can gain insight into the methods of the first farmers of prehistoric antiquity. Johannessen’s study of the present-day cultivation of the *pejibaye* palm tree in Costa Rica revealed that native cultivators actively engage in seed selection. All choose the seed of fresh fruit from superior trees, ones that bear particularly desirable fruit, as determined by size, flavor, texture, and color. Superior seed stocks are built up gradually over the years, with the result that elderly farmers generally have the best selections.

Seeds are shared freely within family and clan groups, allowing rapid diffusion of desirable traits.

The widespread association of female deities with agriculture suggests that it was women who first worked the land. Recall the almost universal division of labor in hunting-gathering-fishing societies. Because women had day-to-day contact with wild plants and their mobility was constrained by childbearing, they probably played the larger role in early plant domestication.

Locating Centers of Domestication

When, where, and how did these processes of plant domestication develop? Most experts now believe that the process of domestication was independently invented at many different times and locations. Geographer Carl Sauer, who conducted pioneering research on the origins and dispersal of plant and animal domestication, was one of the first to propose this explanation.

Sauer believed that domestication did not develop in response to hunger. He maintained that necessity was not the mother of agricultural invention, because starving people must spend every waking hour searching for food and have no time to devote to the leisurely experimentation required to domesticate plants. Instead, he suggested this invention was accomplished by peoples who had enough food to remain settled in one place and devote considerable time to plant care. The first farmers were probably sedentary folk rather than migratory hunter-gatherers. He reasoned that domestication did not occur in grasslands or large river floodplains, because primitive cultures would have had difficulty coping with the thick sod and periodic floodwaters. Sauer also believed that the hearth areas of domestication must have been in regions of great biodiversity where many different kinds of wild plants grew, thus providing abundant vegetative raw material for experimen-

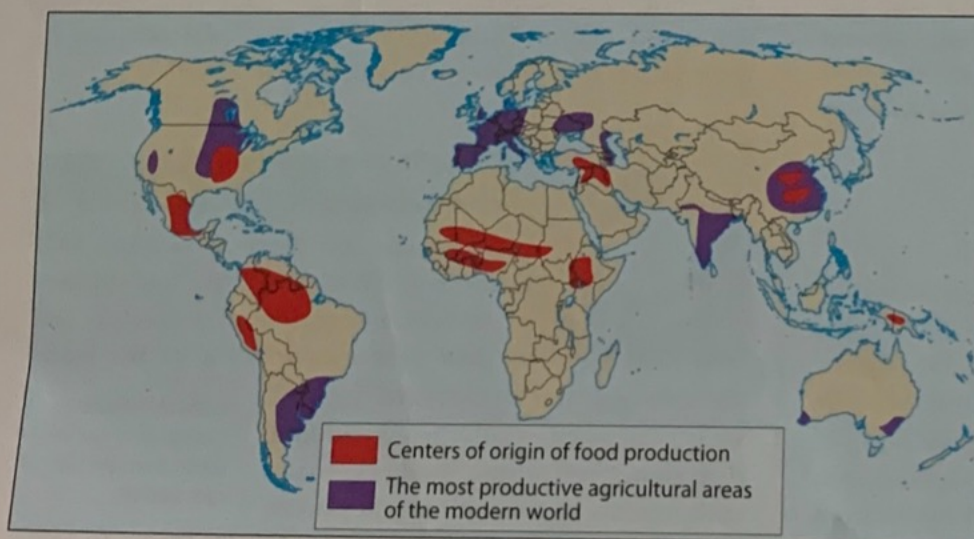


FIGURE 8.13 Ancient centers of plant domestication. New archaeological discoveries and new technologies such as genetic science are changing our understanding of the geography and history of domestication. This map represents a synthesis of the latest findings. (Source: Diamond, 2002.)

tation and crossbreeding. Such areas typically occur in hilly districts, where climates change with differing sun exposure and elevation above sea level.

Geographers, archaeologists, and, increasingly, genetic scientists continue to investigate the geographic origins of domestication. Because the conditions conducive to culture arose independently in at most nine regions (Figure 8.13). All of these have made significant contributions to the modern global food system. For example, the Fertile Crescent in the Middle East is the origin of the great bread grains of wheat, barley, rye, and oats that are so key to our modern diets. This region is also home to the first domesticated grapes, apples, and olives. China and New Guinea provided rice, bananas, and sugarcane, while the African centers gave us peanuts, yams, and coffee. Native Americans in Mesoamerica created another important center of domestication, from which came crops such as maize (corn), tomatoes, and beans. Farmers in the Andes domesticated the potato. While crop diffusions out of these nine regions have occurred over the millennia, the forces of globalization have now made even the rarest of local domesticates available around the world.

The dates of earliest domestication are continually being updated by new research findings. Until recently, archaeological evidence suggested that the oldest center is the Fertile Crescent, where crops were first domesticated roughly 10,000 years ago. However, domestication dates for other regions are constantly being pushed back by new discoveries. Most dramatically, in the Peruvian Andes archaeologists recently excavated domesticated seeds of squash and other crops that they dated to 9240 years before the present. These seeds were associated with permanent dwellings, irrigation canals, and storage structures, suggesting that farming societies were established in the Americas 10,000 years ago, similar to the Fertile Crescent date.

Pets or Meat? Tracing Animal Domestication

domesticated animal

An animal kept for some utilitarian purpose whose breeding is controlled by humans and whose survival is dependent on humans; domesticated animals differ genetically and behaviorally from wild animals.

A **domesticated animal** is one that depends on people for food and shelter and that differs from wild species in physical appearance and behavior as a result of controlled breeding and frequent contact with humans. Animal domestication apparently occurred later in prehistory than did

the first planting of crops—with the probable exception of the dog, whose companionship with humans appears to be much more ancient. Typically, people value domesticated animals and take care of them for some utilitarian purpose. Certain domesticated animals, such as the pig and the dog, probably attached themselves voluntarily to human settle-

ments to feast on garbage. At first, perhaps, humans merely tolerated these animals, later adopting them as pets or as sources of meat.

The early farmers in the Fertile Crescent deserve credit for the first great animal domestications, most notably that of herd animals. The wild ancestors of major herd animals—such as cattle, pigs, horses, sheep, and goats—lived primarily in a belt running from Syria and southeastern Turkey eastward across Iraq and Iran to central Asia. Farmers in the Middle East were also the first to combine domesticated plants and animals in an integrated system, the antecedent of the peasant grain, root, and livestock farming described earlier. These people began using cattle to pull the plow, a revolutionary invention that greatly increased the acreage under cultivation. In other regions, such as southern Asia and the Americas, far fewer domestications took place, in part because suitable wild animals were less numerous. The llama, alpaca, guinea pig, Muscovy duck, and turkey were among the few American domesticates.

Modern Mobilities

Over the past 500 years, European exploration and colonialism were instrumental in redistributing a wide variety of crops on a global scale: maize and potatoes from North America to Eurasia and Africa, wheat and grapes from the Fertile Crescent to the Americas, and West African rice to the Carolinas and Brazil.

The diffusion of specific crops continues, extending the process begun many millennia ago. The introduction of the lemon, orange, grape, and date palm by Spanish missionaries in eighteenth-century California, where no agriculture existed in the Native American era, is a recent example of **relocation diffusion**. This was part of a larger process of multidirectional diffusion. Eastern Hemisphere crops were introduced to the Americas, Australia, New Zealand, and South Africa through the mass emigrations from Europe over the past 500 years. Crops from the Americas diffused in the opposite direction. For example, chili peppers and maize, carried by the Portuguese to their colonies in South Asia, became staples of diets all across that region (Figure 8.14, page 288).

In cultural geography, our understanding of agricultural diffusion focuses on more than just the crops; it also includes an analysis of the cultures and **indigenous technical knowledge** systems in which they are embedded. For example, geographer Judith Carney's study of the diffusion of African rice (*Oryza glaberrima*), which was domesticated independently in the inland delta area of West Africa's Niger River, shows the

relocation diffusion

The spread of an innovation or other element of culture that occurs with the bodily relocation (migration) of the individual or group responsible for the innovation.

indigenous technical knowledge

Highly localized knowledge about environmental conditions and sustainable land-use practices.



FIGURE 8.14 Chili peppers in Nepal and Korea. A Tharu tribal woman of lowland Nepal prepares a condiment made of chili peppers from her garden, and in South Korea chili peppers dry under a plastic-roofed shed. This crop comes from the Indians of Mexico. *How might it have diffused so far and become so important in Asia?* For the answer, see Andrews, 1993. (Courtesy of Terry G. Jordan-Bychkov.)

importance of indigenous knowledge. European planters and slave owners carried more than seeds across the Atlantic from Africa to cultivate in the Americas. The Africans taken into slavery, particularly women from the Gambia River region, had the knowledge and skill to cultivate rice. Slave owners actively sought slaves from specific ethnic groups and geographic locations in the West African rice-producing zone, suggesting that they knew about and needed Africans' skills and knowledge. Carney argues that the "association of agricultural skills with certain African ethnicities within a specific geographic region" means that research on agricultural diffusion must address the relation of culture to technology and the environment.

green revolution

The recent introduction of high-yield hybrid crops and chemical fertilizers and pesticides into traditional Asian agricultural systems, most notably paddy rice farming, with attendant increases in production and ecological damage.

Not all innovations involve expansion diffusion and spread wavelike across the land; less orderly patterns are more typical. The **green revolution** in Asia provides an example. The green revolution is a product of modern agricultural science that involves the development of high-yield hybrid

varieties of crops, increasingly genetically engineered, coupled with extensive use of chemical fertilizers. The high-yield crops of the green revolution tend to be less resistant to insects and diseases, necessitating the widespread use of

pesticides. The green revolution, then, promises larger harvests but ties the farmer to greatly increased expenditures for seed, fertilizer, and pesticides. It enmeshes the farmer in the global corporate economy. In some countries, most notably India, the green revolution diffused rapidly in the latter half of the twentieth century. By contrast, countries such as Myanmar resisted the revolution, favoring traditional methods. An uneven pattern of acceptance still characterizes the paddy rice areas today.

The green revolution illustrates how cultural and economic factors influence patterns of diffusion. In India, for example, new hybrid rice and wheat seeds first appeared in 1966. These crops required chemical fertilizers and protection by pesticides, but with the new hybrids India's 1970 grain production output was double its 1950 level. However, poorer farmers—the great majority of India's agriculturists—could not afford the capital expenditures for chemical fertilizer and pesticides, and the gap between rich and poor farmers widened. Many of the poor became displaced from the land and flocked to the overcrowded cities of India, aggravating urban problems. To make matters worse, the use of chemicals and poisons on the land heightened environmental damage.

The widespread adoption of hybrid seeds has created another problem: the loss of plant diversity or genetic vari-

ety. Before hybrid seeds diffused around the world, each farm developed its own distinctive seed types through the annual harvest-time practice of saving seeds from the better plants for the next season's sowing. Enormous genetic diversity vanished almost instantly when farmers began purchasing hybrids rather than saving seed from the last harvest. "Gene banks" have belatedly been set up to preserve what remains of domesticated plant variety, not just in the areas affected by the green revolution but also in the American Corn Belt and many other agricultural regions where hybrids are now dominant. In sum, the green revolution has been a mixed blessing.

Labor Mobility

Agriculture, more than any other modern economic endeavor, is constrained by the rhythms of nature. Biological cycles associated with planting and harvesting are reflected in cycles of labor demand. Seeds must be planted at the right moment to take advantage of seasonal conditions. When crops ripen, they must be harvested, often in a matter of days or weeks. In between, labor demand is minimal, so farmers face a dilemma. They need to mobilize a large labor force for harvesting crops, but keeping a year-round work force raises farm production costs. One solution has been to rely on migratory labor.

migrant workers

Most broadly, this term refers to people working outside of their home country. Migrant workers are particularly critical to large-scale commercial agriculture.

In the United States, the use of **migrant workers** has been central to the growth and profitability of farming. In his study of labor and landscape in California, geographer Don Mitchell found that the mechanization and intensification of farming created ever greater extremes in seasonal labor demand, lessening the demand for labor during nonharvest periods while still requiring manual labor for the increased harvests. Farmers thus developed an agricultural industry based on migratory labor, employing cultural and racial stereotypes to depress farm wages and tighten employers' control over farmworkers. Mitchell noted that through much of the twentieth century, California growers surmised that "hispanic, black, or Asian workers . . . were 'naturally' better suited to agricultural tasks," and prevailing racist attitudes allowed them to "pay nonwhite workers a lower wage than white workers." Ultimately, the federal government provided the legal mechanism, called the *Bracero* Program, by which contract workers were brought from Mexico to California during periods of peak labor demand. Migrant workers lived in substandard housing, were paid less than a living wage, and were deported back to Mexico if they complained.

The case of California's migrant workers is not unusual. Geographer Gail Hollander has documented the use of migratory labor in the development of Florida's sugarcane

region. Florida produces 20 percent of the U.S. sugar supply, which until the 1990s was harvested entirely by hand by migrant workers imported seasonally from "former slave plantation economies of the Caribbean." Like their California counterparts, growers relied on racial stereotypes to argue that only blacks were suitable for cutting cane in Florida. The federal government also established a special federal immigration program like *Bracero* to import Caribbean migrant workers for the Florida harvest and repatriate them afterwards. Migrant farmworkers remain ubiquitous today in other regions, too, such as the EU. A recent agricultural boom in Mediterranean coastal Spain relies heavily on North African migrant workers, many of them undocumented immigrants, who are subject to persistent racial prejudices (**Figure 8.15**).



FIGURE 8.15 Migrant farmworkers: a global phenomenon.

International migrant farmworkers, such as these African immigrants harvesting lettuce in southern Spain, are critical to production in the global food system. (Mark Eveleigh/Alamy.)



Globalization

How have the processes of globalization altered the geography of agriculture? How does globalization affect the availability and variety of food in specific places?

For most of human history, people obtained their provisions locally and had locally distinct dietary cultures. The development of global markets over the past 500 years has shifted cultural food preferences and altered the ecology of vast areas of the planet.

Local-Global Food Provisioning

As European maritime explorers brought far-flung cultures into contact, a multitude of crops were diffused around the globe. The processes of exploration, colonization, and globalization created new regional cuisines (imagine Italian cuisine without tomatoes from the Americas) and at the same time simplified the global diet to a disproportionate reliance on only three grains: wheat, rice, and maize.

The expansion of European empires in the seventeenth and eighteenth centuries was inseparable from the expansion of tropical plantation agriculture. Plantations in warm climates produced what were then luxury foods for markets in the global North, which had developed seemingly insatiable appetites for sugar, tea, coffee, and other tropical crops. The expansion of plantation agriculture had profound effects on local ecology, all but obliterating,

for example, the forests of the Caribbean and the tropical coasts of the Americas (Figure 8.16).

In short, we have witnessed the development of a global food system that, for better or worse, has freed consumers in the affluent regions of the world from the constraints of local ecologies. Fresh strawberries, bananas, pears, avocados, pineapples, and many, many other types of temperate, subtropical, and tropical produce are available in our urban supermarkets any day, any time of the year. On the other hand, the emphasis on a relatively small number of staple crops desired by northern consumers can mean the abandonment of local crop varieties and a decline in the associated biological diversity. Imported refined wheat from the global North enters poor tropical countries by the shipload, altering local dietary cultures and undercutting the ability of local farmers to sell their crops at a profitable price.

These are the general patterns, but the globalization of food and agriculture has complex effects on culture and ecology that vary by location and spatial scale. These complexities are best illustrated by a case study from the Peruvian Andes. Geographer Karl Zimmerer (see *Practicing Geography*; also see Rod's Notebook, page 292, for a different look at the globalization of food and agriculture) conducted extensive fieldwork among Quichua peasant farmers in the Paucartambo Andes to determine the effects of economic change on indigenous agricultural practices and the genetic diversity of local crops. He wanted to test the general hypothesis that as globalization and national economic policies integrate indigenous farmers into market production,



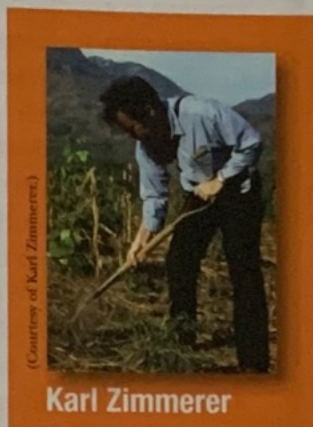
FIGURE 8.16 An oil palm plantation in Malaysia. Plantation agriculture continues to expand in many Third World countries. While plantation-grown export commodities can be important to national economies, the accompanying destruction of tropical rain forests is a high ecological price to pay. (Stuart Franklin/Magnum.)

PRACTICING GEOGRAPHY

Penn State University geography professor Karl Zimmerer discovered the discipline of geography through his interests in agriculture. As an undergraduate, he was a student intern at the Land Institute in Salina, Kansas, where research was focused on developing alternatives to conventional agriculture and on the food supply. As Zimmerer recalls, "Its director, Wes Jackson, suggested that I consider the field of geography for graduate school. I read books, visited departments, talked to students and listened to faculty lectures, and recognized that this was the discipline for me." Geography offered him the ideal disciplinary setting for pursuing his broad interests in agriculture and food, which range from environmental to political issues.

Professor Zimmerer finds three aspects of practicing geography particularly compelling and exciting. "First is the challenge of understanding the multifaceted changes of agriculture in Latin America and the United States. . . . Part of my interest is the fusion of the human world and the natural world that takes place in agriculture." In particular, he is interested in the new changes in the areas of biotechnology and corporate agribusiness.

"Second is the excitement and intellectual engagement of fieldwork [and] working closely with the diverse people in farming sites. When in the Andean countries, most often Bolivia and Peru, I speak Quechua as well as Spanish. Using these languages is not only exciting and engaging, but it also continually reinforces for me the importance of languages in addition to English."



Karl Zimmerer

The third area of practicing geography that appeals to Professor Zimmerer is communicating his knowledge through teaching, speaking, and writing. "Often I find myself faced with new and welcome challenges in understanding, interpreting, and telling the stories of the changes in agriculture." As an example, through the feedback that he has received from his teaching and public speaking, Zimmerer "became increasingly aware of this diverse, expanding, and possibly hopeful (although potentially explosive) interface of agriculture and conservation." The agriculture-conservation interface subsequently has become an important part of his research and writing.

His work in the field typically involves a variety of methods and techniques, including a lot of interviewing and related qualitative ethnographic methods. "I also do a fair amount of archival research," he explains, "since many of my projects on agriculture have a historical dimension and since they are often located in places where archival research is the main way of gaining information and awareness about the past." Professor Zimmerer is no stranger to quantitative methods, which are important for studying the environmental aspects of agriculture, such as biodiversity and soil properties. "In the latter sort of research I often use biogeography and ecology field methods and have also used laboratory techniques." Most recently his research has taken a historical turn, focusing on ideas of sustainable land use in the Americas over a 500-year period.

the diversity of crops declines, ultimately resulting in genetic erosion (i.e., a decline in the genetic diversity of cultivars).

Zimmerer's study produced surprising findings on the complex relationships among culture, economy, and the environment. On the question of whether farmers must abandon crop diversity in order to adopt new, commercially oriented high-yielding varieties, he found there was no simple answer. In fact, it was the more well-off peasants, heavily involved in commercial farming, who had the resources and land to cultivate diverse crops and "enjoy their agronomic, culinary, cultural, and ritual values." Among these values was the use of diverse, noncommercial potato varieties in local bartering. The ability to use noncommercial varieties in this way is valued in the local culture because it is a traditional

way to cement interpersonal bonds. Such uses emphasize the cultural importance of crop diversity. Zimmerer discovered that the cultural relevance of crops was a strong motivation for planting by well-off farmers. At least 90 percent of the genetically diverse crops had been conserved, even as the Quichua were further integrated into commercial production for the market.

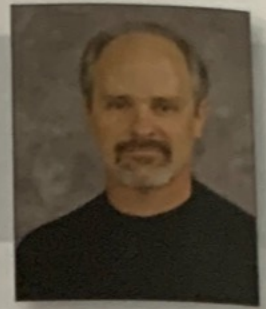
A number of lessons can be drawn from Zimmerer's study, chief among them the need to carefully examine the effects of globalization on culture and environment, rather than simply assuming that local agricultural practices will give way to the demands of the marketplace. The Quichua farmers who benefited most from their participation in the market were those best able to cultivate traditional

Rod's Notebook

The Importance of Place in the Global Food System



Olive growers large and small deliver their harvests for milling into oil at the Sierra de Cazorla Olive Growers' Cooperative in Andalusia, Spain. Such local co-ops are critical in place-based marketing of global agricultural commodities such as olive oil. (Courtesy of Roderick Neumann.)



Roderick Neumann

December is olive harvest season in southern Spain, when farmers large and small bring their crops to nearby mills for processing. On a recent research trip to Jaén Province in southern Spain, my colleague Gail Hollander and I observed the process at the mill of the Sierra de Cazorla Olive Growers' Cooperative. We watched as families with 5-foot tow trailers lined up next to huge corporate-owned dumptrucks to unload their harvests onto 150-foot conveyor belts leading to the oil presses. We were witnessing a centuries-old harvest ritual refitted to agroindustrial mass production.

Olives and olive oil are staple foods in the Mediterranean diet. Thus, people in the region are sensitized to varying tastes, colors, and consistencies of olive oils to which most North Americans are oblivious. Approach most North Americans about olive oil and they are likely to respond with something like, "Italian food." In one sense this is correct, since Italy is indeed the largest exporter of processed olive oil. But Spain is the world's largest producer of olives, the greatest share coming from Jaén Province. Most of Spain's harvest, however, is sent to Italy for repackaging and export under Italian brand names that are more familiar to North American shoppers.

This system of mass production of olive oil for Italian export firms worked well for Spanish farmers until recent years. The forces of globalization are now challenging Spain's dominance of the market. North African countries, such as Tunisia, are expanding olive production and competing with Spain for access to the global mass market of undifferentiated oil. In interviews with farmers in Jaén, we discovered that they are looking for ways to differentiate their product from mass-produced oils. Similar to the way fine wines are marketed, they seek to emphasize the unique qualities of oils that are produced in specific places with particular climate and soil characteristics. The idea is to find a niche market of high-end consumers who are appreciative of the distinct qualities and characteristics of local olive varieties.

Jaén farmers have responded to the challenges of globalization by creating new place-based products. Olive oil is being bottled with the "*denominación de origen*" labeling, a third-party certification system that guarantees consumers that the product originates from a specific place. We discovered that the number of marketing cooperatives using the *denominación de origen* designation has exploded across Jaén. Each co-op offers an array of olive-based products. We are still enjoying, for example, our bottle of extra-virgin Royal Aniversario 10 olive oil from the Sierra de Cazorla *denominación de origen*, a product that many Spaniards consider to be of the highest quality anywhere. Currently *denominación de origen* olive oil is sold mostly to an appreciative domestic Spanish market. Farmers are eyeing North America and East Asia as future export markets as affluent consumers learn of the complexities of olive oil quality and seek new culinary experiences. We were reminded that place matters in the global food system.

varieties, which functioned as an expression of cultural identity and their sense of place. Cultural values, not merely a strict economic or ecological calculus, critically influenced farming decisions.

The von Thünen Model

Geographers and others have long tried to understand the distribution and intensity of agriculture based on transportation costs to market. Long before globalization took hold, the nineteenth-century German scholar-farmer Johann Heinrich von Thünen developed a **core-periphery** model to address the problem. In his model, von Thünen proposed an "isolated state" that had no trade connections with the outside world; possessed only one market, located centrally in the state; had uniform soil and climate; and had level terrain throughout. He further assumed that all farmers located the same distance from the market had

core-periphery

A concept based on the tendency of both formal and functional culture regions to consist of a core or node, in which defining traits are purest or functions are headquartered, and a periphery that is tributary and displays fewer of the defining traits.

equal access to it and that all farmers sought to maximize their profits and produced solely for market. Von Thünen created this model to study the influence of distance from market and the concurrent transport costs on the type and intensity of agriculture.

Figure 8.17 presents a modified version of von Thünen's isolated-state model, which reflects the effects of improvements in transportation since the 1820s, when von Thünen proposed his theory. The model's fundamental feature is a series of concentric zones, each occupied by a different type of agriculture, located at progressively greater distances from the central market.

Reflecting on Geography

Why should we study spatial models, such as von Thünen's, when they do not depict reality?

For any given crop, the intensity of cultivation declines with increasing distance from the market. Farmers near the market have minimal transportation costs and can invest most of their resources in labor, equipment, and supplies to

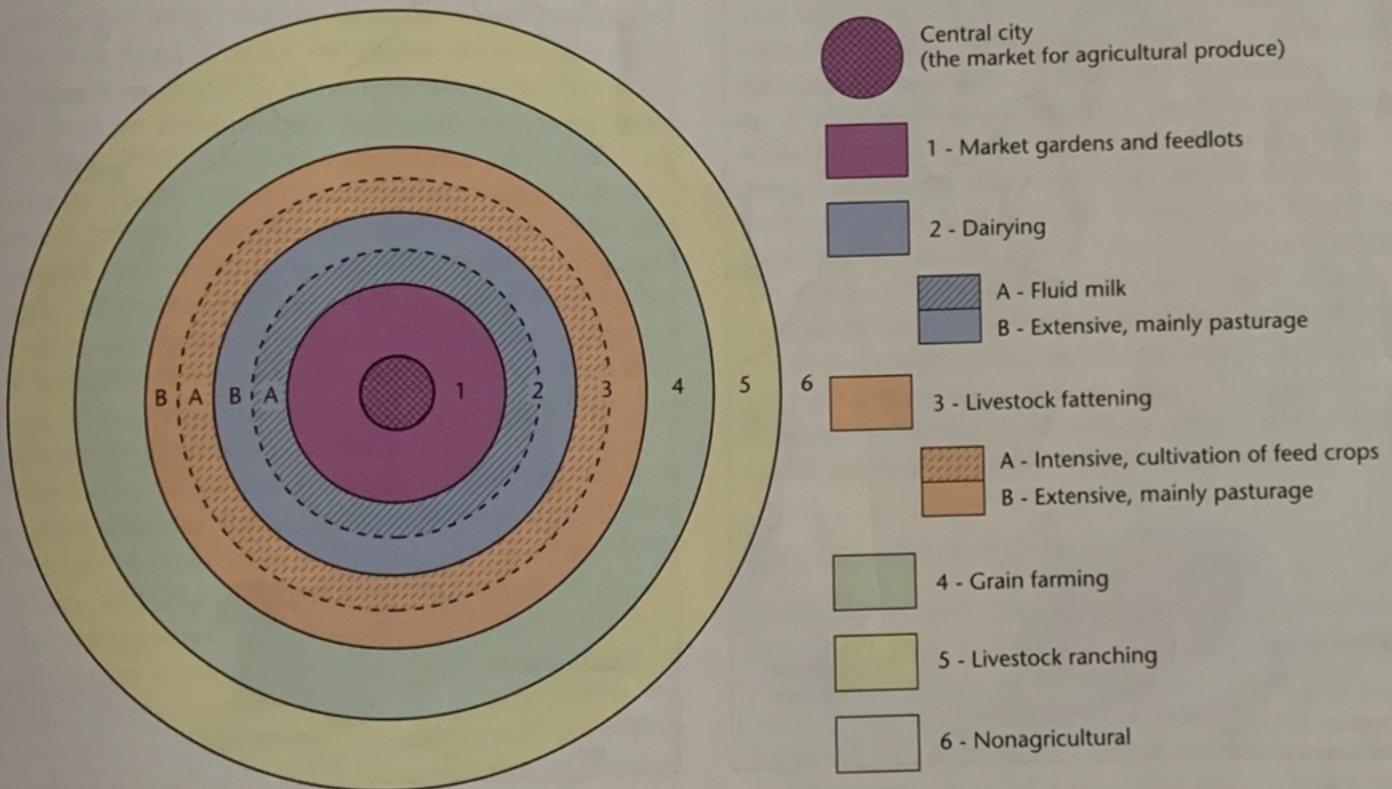


FIGURE 8.17 Von Thünen's isolated-state model. The model is modified to fit the modern world better, showing the hypothetical distribution of types of commercial agriculture. Other causal factors are held constant to illustrate the effect of transportation costs and differing distances from the market. The more intensive forms of agriculture, such as market gardening, are located nearest the market, whereas the least intensive form (livestock ranching) is most remote. Compare this model to the real-world pattern of agricultural types in Uruguay, South America, shown in Figure 8.18, page 294. **Why does the model have the configuration of concentric circles?**

augment production. Indeed, because their land is more valuable and subject to higher taxes, they have to farm intensively to make a bigger profit. With increasing distance from the market, farmers invest progressively less in production per unit of land because they have to spend progressively more on transporting produce to market. The effect of distance means that highly perishable products such as milk, fresh fruit, and garden vegetables need to be produced near the market, whereas peripheral farmers have to produce nonperishable products or convert perishable items into a more durable form, such as cheese or dried fruit.

The concentric-zone model describes a situation in which highly capital-intensive forms of commercial agriculture, such as market gardening and feedlots, lie nearest to market. The increasingly distant, successive concentric belts are occupied by progressively less intensive types of agriculture, represented by dairying, livestock fattening, grain farming, and ranching.

How well does this modified model describe reality? As we would expect, the real world is far more complicated. For example, the emergence of **cool chains** for agricultural commodities—the refrigeration and transport technologies that bring fresh produce from fields around the globe to our dinner tables—have collapsed distance. Still, on a world scale, we can see that intensive commercial types of agriculture tend to occur most commonly near the huge urban markets of northwestern Europe and the eastern United States. An even closer match can be observed in smaller areas, such as in the South American nation of Uruguay (**Figure 8.18**).

cool chain
The refrigeration and transport technologies that allow for the distribution of perishables.

The value of von Thünen's model can also be seen in the underdeveloped countries of the world. Geographer Ronald Horvath made a detailed study of the African region centering on the Ethiopian capital city of Addis Ababa. Although noting disruptions caused by ethnic and environmental differences, Horvath found "remarkable

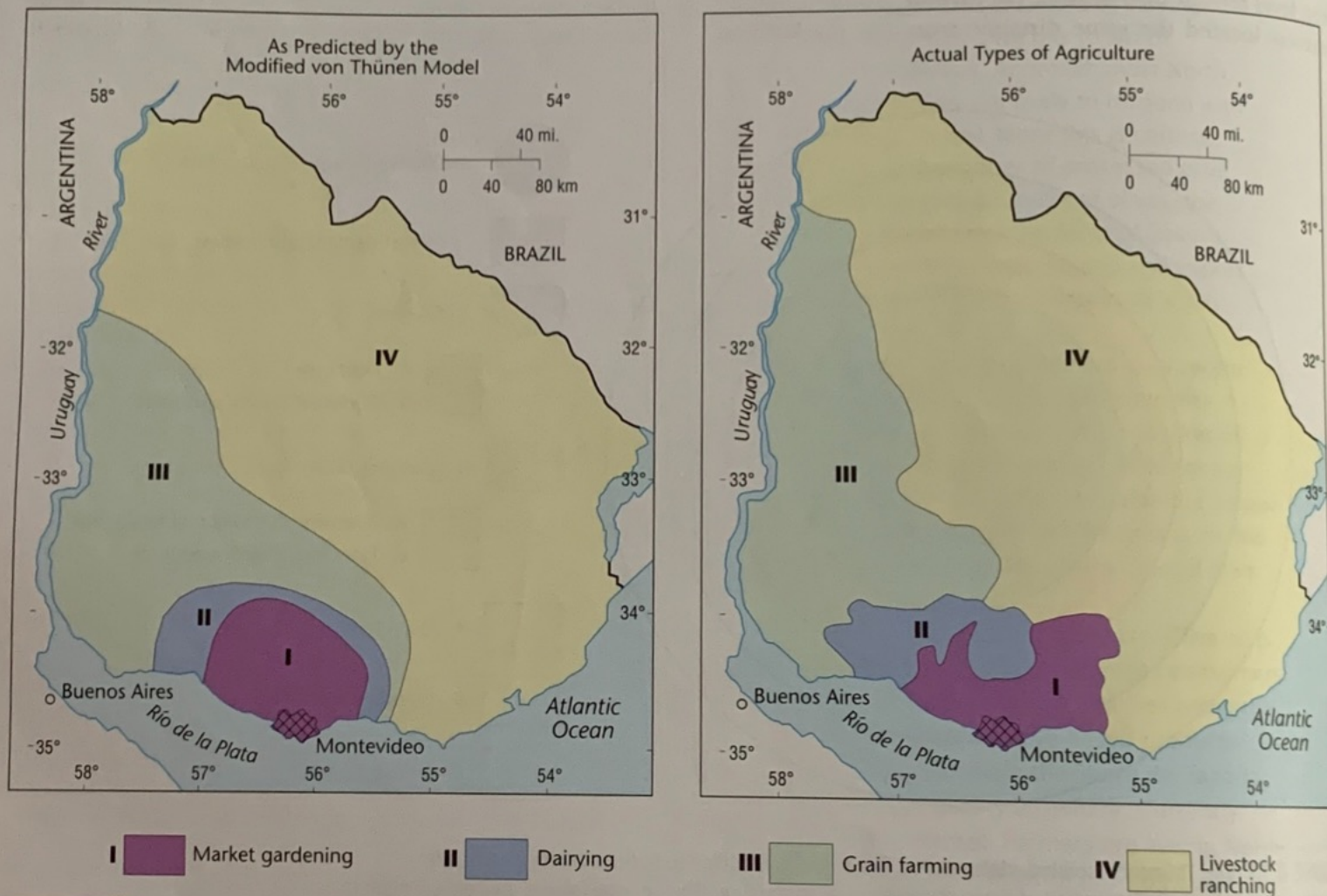


FIGURE 8.18 Ideal and actual distribution of types of agriculture in Uruguay. This South American country possesses some attributes of von Thünen's isolated state, in that it is largely a plains area dominated by one city. *In what ways does the spatial pattern of Uruguayan agriculture conform to von Thünen's model? How is it different? What might cause the anomalies?* (For the answers, see Griffin, 1973.)

parallels between von Thünen's crop theory and the agriculture around Addis Ababa." Similarly, German geographer Ursula Ewald applied the model to the farming patterns of colonial Mexico during the period of Spanish rule, concluding that even this culturally and environmentally diverse land provided "an excellent illustration of von Thünen's principles on spatial zonation in agriculture."

Will the World Be Fed?

Are famine and starvation inevitable as the world's population grows, as Thomas Malthus predicted (see Chapter 3)? Or will our agricultural systems successfully feed nearly 7 billion people? In trying to answer these questions, we face a paradox. Today, nearly 1 billion people are malnourished, some to the point of starvation. Almost every year, we read of food shortages occurring somewhere in the world. In 2008, there were food riots in 30 countries around the world when food prices shot beyond the reach of hundreds of thousands of the urban poor. Between 1990 and 2010, the number of hungry people in western and southern Asia and sub-Saharan Africa increased by tens of millions (Figure 8.19, pages 296–297).

Yet—and this would astound Malthus—food production has grown more rapidly than the world population over the past 40 or 50 years. Per capita, more food is available today than in 1950, when only about half as many people lived on Earth. Production continues to increase. From 1996 to 2006, world food production increased at an annual rate of 2.2 percent, and hunger was reduced by 30 percent in more than 30 countries. Thus, paradoxically, on a global scale there is enough food produced to feed everyone, while famines and malnutrition prevail. If the world food supply is sufficient to feed everyone and yet hunger afflicts one of every six or seven persons, then Malthus was wrong about the limits on population growth but right about the persistence of deprivation.

What explains this paradox of dearth amidst plenty? As geographer Thomas Bassett and economist Alex Winter-Nelson show in their *Atlas of World Hunger*, one must ask both where and why people are hungry. We see in Figure 8.19 where people are going hungry on a global scale. Why they are hungry is complex and varies geographically and historically. For example, Bassett and Winter-Nelson explain that the crisis of HIV/AIDS in southern Africa affects mostly 15- to 49-year-olds, the most productive segment of the population. The epidemic thus negatively affects food production and raises the level of food insecurity, especially in rural areas.

To a great extent international political economics, not global food shortages, causes hunger and starvation. International trade favors the farmers of wealthier countries through systems of government subsidies that make the prices of their agricultural exports artificially

low. Third World farmers find it difficult to compete. Many Third World countries do not grow enough food to feed their populations, and they cannot afford to purchase enough imported food to make up the difference. As a result, famines can occur even when plenty of food is available. Millions of Irish people starved in the 1840s while adjacent Britain possessed enough surplus food to have prevented this catastrophe. Bangladesh suffered a major famine in 1974, a year of record agricultural surpluses in the world.

Internal government policies are also an important cause of famine. The roots of the largest famine of the twentieth century lie in the agricultural policies of the Chinese government's 1958–1961 Great Leap Forward. The Chinese government required peasants to abandon their individual fields and work collectively on large, state-run farms. This policy of collectivization succeeded in boosting food production in some cases but failed in most. Thirty million rural Chinese died of starvation during the Great Leap Forward. Misguided government policies triggered one of the first famines of the twenty-first century as well. In the early 2000s, Zimbabwe's President Robert Mugabe clung to power by demonizing white commercial farmers. In 2002, he threatened Zimbabwe's commercial farmers with imprisonment if they continued to farm. Other government policies discouraged planting and cultivation, thus producing another human-caused famine.

Even when major efforts are made to send food from wealthy countries to famine-stricken areas, the poor transportation infrastructure of Third World countries often prevents effective distribution. Political instability can disrupt food shipments, and the donated food often falls into the hands of corrupt local officials. Such was the case in Somalia in the 1990s, where warring factions in the capital city of Mogadishu prevented food aid from getting to starving populations. So while the trigger for famine may be environmental, there are deep-seated political and economic problems that conspire to block famine relief.

The Growth of Agribusiness

Globalization and its impact on agriculture have been referred to throughout this chapter. Globalization, you will recall, involves the restructuring of the world economy by multinational corporations thriving in an era of free-trade capitalism, rapid communications, improved transport, and computer-based information systems. When applied to agriculture, globalization tends to produce **agribusiness**: a modern farming system that is totally commercial, large-scale, mechanized, and dependent upon chemicals,

globalization

The binding together of all the lands and peoples of the world into an integrated system driven by capitalistic free markets, in which cultural diffusion is rapid, independent states are weakened, and cultural homogenization is encouraged.

agribusiness

Highly mechanized, large-scale farming, usually under corporate ownership.

Mapping Hunger

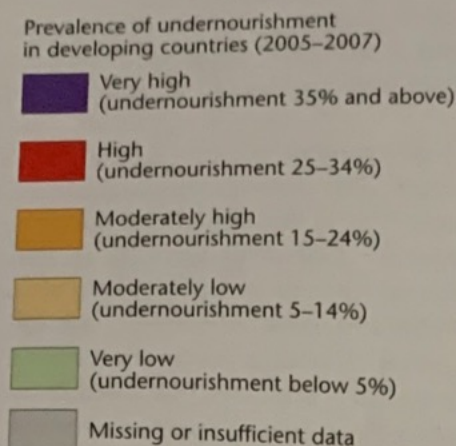


FIGURE 8.19 Mapping hunger worldwide.

While food supply has outpaced population growth on a global scale, many world regions continue to suffer from malnutrition. *What geographic patterns does this map reveal? How might we explain them?* (Source: UNFAO.)

monoculture

The raising of only one crop on a huge tract of land in agribusiness.

hybrid seeds, genetic engineering, and the practice of **monoculture** (raising a single specialty crop on vast tracts of land). Furthermore, agribusinesses are often vertically integrated; that is, corporations own the land as well as the processing and marketing facilities. Vertical integration takes a variety of forms depending on the nature of production processes and markets. The case of the “global chicken” provides a useful illustration of vertically integrated agribusiness as well as the interconnections of changing cultural values and global food production.

The origins of the “global chicken” can be found in the shift from beef to poultry as the preferred protein source in American dietary culture, which underwent fundamental changes during the post–World War II period.

From 1945 to 1995, per capita consumption of chicken in the United States rose from 5 to 70 pounds (2.25 to 31.5 kilograms) and by 1990 surpassed that of beef. This was a startling development in American culture, where the myth of the cowboy herding cattle on the open range has been so central to an imagined national identity. Since the 1990s, the per capita consumption of chicken has continued to grow as that of beef continues to decline, especially since the publicity about mad cow disease.

Advances in U.S. agrotechnologies for the breeding, nutrition, housing, and processing of chickens largely account for increases in production efficiency (Figure 8.20, page 298). This has allowed the U.S. poultry industry, largely centered in the South, to become the world’s single largest supplier of broilers. As the taste for chicken spreads world-



wide, U.S. producers have been positioned to gain increasing shares of an expanding market. From 1980 to 2002, world trade in broilers grew nearly 500 percent, while the U.S. share of that trade rose from 22.2 to 46.1 percent. China has been the hottest import market, because rising affluence there has led to increasing per capita consumption. At the same time, China is increasing its production and its exports of poultry. It is likely to become a major competitor with the United States for access to other Asian markets.

Farmers who produce a single commodity, such as poultry, must produce far more than the local market can consume in order to be profitable. Thus, they must sell in both national and global markets, access to which requires a dependence on multinational agribusinesses. So pervasive is the reach of agribusiness that many poultry farmers

no longer own the chickens they produce; multinational corporations do. Farmers contract with multinationals to receive farm inputs such as chicks and feed and to cover other expenses related to marketing and transport. When the chickens mature, they are trucked to the contracting corporation's processing plant where they are weighed and corporate expenditures are deducted from the farmer's shares. The farmers take their earnings to pay the mortgages on their lands and buildings, and the chickens are processed for the global food system.

The Ongoing Green Revolution

The green revolution generally refers to the transfer of agro-industrial technological packages to Third World countries.



FIGURE 8.20 The “global chicken.” Poultry consumption has skyrocketed worldwide, propelled by new industrialized systems of meat production and changing food preferences. *How might cultural differences influence the structure of international trade in poultry products?* (Robert Nickelsburg/Time Life Pictures/Getty Images.)

It can also be seen as one component of agricultural globalization, along with countless “rural development” projects in Third World countries, usually funded by the World Bank or the International Monetary Fund. These projects often displace small-scale peasant farmers to make way for larger enterprises and even multinational agribusinesses. The green revolution is thus a continuation and geographic expansion of the industrialization of agriculture. Key to the industrialization process are seeds, which are the foundation of cultivation. Whoever controls seeds controls access to the next crop harvest.

Control of seeds has been consolidated in fewer and fewer companies. The five biggest hybrid vegetable seed suppliers control 75 percent of the global market, and the ten largest agrochemical manufacturers command 85 percent of the world supply. Four corporations supply more than two-thirds of the U.S. consumption of hybrid seed maize. Sometimes single companies—Monsanto, for example—both supply the seeds and manufacture the pesticides. What’s more, the genetic engineering of seeds is often done in-house. This arrangement allows Monsanto to genetically engineer “Roundup Ready” seed varieties. Roundup is an herbicide manufactured by Monsanto, and its Roundup Ready gene builds in greater tolerance to higher doses. The seeds essentially became vehicles to sell more herbicide.

Genetically modified (GM) crops, the products of biotechnology, are seen by many as another aspect of globalization. Genetic engineering produces new organisms through gene splicing. Pieces of DNA can be recombined

with the DNA of other organisms to produce new properties, such as pesticide tolerance or disease resistance. DNA can be transferred not only between species but also between plants and animals, which makes this technology truly revolutionary and unlike any other development since the beginning of domestication. Agribusinesses are often able to patent the processes and resulting genetically engineered organisms and, thus, claim legal ownership of new life-forms.

genetically modified (GM) crops
Plants whose genetic characteristics have been altered through recombinant DNA technology.

Political, economic, and environmental problems resulting from the concentration of ownership of seeds and the production of pesticide-resistant GM seeds are beginning to emerge in the United States. The Department of Justice began an antitrust investigation of Monsanto’s activities in the seed market. One reason for the investigation was the sharp rise in corn and soybean seed prices, which have more than doubled since 2001. The use of Roundup Ready seeds has resulted in the emergence and spread of so-called superweeds, weeds that have evolved resistance to increasing doses of Roundup herbicide. Thus, the gains in yield that were initially produced by Roundup Ready seeds are starting to decline, suggesting the environmental limitations of GM seeds that promote the use of pesticides.

Commercial production of GM crops began in the United States in 1996. The technology has now spread around the globe, but the United States still dominates, accounting for two-thirds of the world’s acreage (Figure 8.21). Two crops, soybeans and corn, account for the rapid growth of GM food production in the United States. By 2010, 93 percent of all soybeans and 86 percent of all corn produced in the United States were genetically modified. Their genetically engineered resistance to disease and drought are an important reason for the spread of GM crops, but that’s only part of the story. For example, all of the GM soybean seeds in the United States are engineered to tolerate greater doses of synthetic herbicides produced by agrochemical companies.

If you provision your household from a U.S. supermarket, you have undoubtedly ingested GM foods. Whether or not one finds this troubling is closely related to the strength of certain cultural norms and values that vary from region to region and country to country. In England and western Europe, where national identities are strongly linked to the countryside, agrarian culture, and regional cuisines, there has been a lot of opposition to biotechnology in agriculture. In response to public pressure, major supermarket chains, such as Sainsbury’s in England, have refused since 1998 to sell GM foods. In the United States, the response has been far more muted, so much so that the expansion of GM crop planting has proceeded virtually without public debate.



FIGURE 8.21 Worldwide use of genetically altered crop plants, especially maize and soybeans. This diffusion has occurred despite the concerns of health scientists, environmentalists, and consumers. **What problems might arise?** (Source: ISAAA.)

These cultural differences are now coming to the fore of globalization debates as the EU challenges the United States over international trade in GM seeds and foods.

Food Fears

A globalized food system is vulnerable to events that threaten food safety. Recent events, such as outbreaks of mad cow disease in Great Britain and the contamination of imported produce by *Salmonella* or the virus that causes hepatitis A in the United States, have raised anxiety levels among consumers about eating food transported from distant lands. Responses to such crises in the global food system vary culturally and individually and may be based more on the perception of risk than on the probability of illness or death. The way in which national governments and consumers respond to a particular food safety problem can fundamentally reshape geographic patterns of agricultural production on a global scale. Conversely, the idea that a culturally symbolic food may be tainted and life-threatening can shake the strongest of cultural identities.

The case of mad cow disease in Great Britain—where beef and dairy consumption has long been associated with British cultural identity—provides a good illustration. Mad cow disease is the vernacular term for bovine spongiform encephalopathy (BSE), a disease that attacks the central nervous system of cattle. The disease has an incubation period of several years, and there is no cure or vaccine. It was first discovered in Great Britain in 1986. While 95 percent of the cases have been in the United Kingdom (U.K.), new cases were documented in Austria, Finland, Slovenia, and Canada in 2001 and in the United States in 2003.

In 1996, the British government announced a link between BSE and a variant of Creutzfeldt-Jakob disease (vCJD), which causes a progressive deterioration of brain tissue in humans. The precise link between BSE and vCJD is unknown, but scientists think that vCJD is caused when people ingest contaminated brain, spinal cord, and other organs from BSE-infected cattle. Such organ matter is typically contained in ground beef. By 2002, doctors had attributed 115 deaths in the United Kingdom to vCJD, and deaths were also reported in France, Ireland, and elsewhere.

The fallout from the BSE and vCJD scares altered the geography of beef production, consumption, and trade in complex ways. The cattle production processes that led to the BSE crisis resulted from the growing industrialization and intensification of livestock fattening. High-protein cattle feed was produced from infected sheep and cow bones and organs. Cows that ate the feed contracted BSE, thus spreading the epidemic. These beef production practices have now been banned. In addition, most countries banned the import of cattle and beef from countries where BSE was discovered and shifted their trade to other regions, such as South America. The U.K. industry suffered three BSE crises (1988, 1996, and 2000) that had the net result of reducing its exports of live cows to zero (Figure 8.22). Since U.K. cattle were entering the EU export market, EU beef and live cattle exports also suffered and have yet to regain their old markets.

Consumers' fears of contaminated beef initially reduced demand for cattle worldwide, though the downward trend has been reversed, mostly because of new demand in middle-income countries. In the United Kingdom and the EU, the BSE scares have reinforced a long-term pattern of declining demand for beef. Similarly, Japanese consumers continue to be wary of imported beef; demand has yet to recover. In 2003, when BSE was discovered in a single cow in the United States, all exports were temporarily curtailed and the industry's global competitiveness suffered long-term damage.



FIGURE 8.22 Vulnerabilities in the global food system. The industrialization and globalization of agriculture have heightened the possibilities for and consequences of food contamination, most sensationally illustrated by the case of mad cow disease. The mad cow crisis led to the destruction of tens of thousands of cattle in the United Kingdom, demoralizing many farming communities and crippling a major export industry. (© P. Ashton/South West News Service.)

The case of mad cow disease demonstrates the global interconnectivity of food-producing and food-consuming regions, the vulnerability of the global food system, and the role of cultural norms and values surrounding questions of food safety.



Nature-Culture

How are nature-culture relations expressed through the production and consumption of food? Agriculture has been the fundamental encounter between

nature and culture for more than 10,000 years, as human labor is mixed with nature's bounty to produce our sustenance. What we eat and how we eat it is a basic source of cultural identity. At the same time, thousands of years of agricultural use of the land have led to massive alterations in our natural environment.

Technology over Nature?

Historically, climate and the physical environment have exerted the greatest influence on shaping agriculture. People have had to adjust their subsistence strategies and techniques to the prevailing regional climate conditions. In addition, soils have played an influential role in both agricultural practices and food provisioning. Swidden cultivation, in part, reflects an adaptation to poor tropical soils, which rapidly lose their fertility when farmed. Peasant agriculture, by contrast, often owes its high productivity to the long-lived fertility of local volcanic soils. Terrain has also influenced agriculture, as farmers tended to cultivate relatively level areas (Figure 8.23). In sum, the constraints of climate, soil, and terrain have historically limited the types of crops that could be grown and the cultivation methods that could be practiced.

In recent centuries, markets, technology, and capital investment have greatly altered the spatial patterns of agriculture that climate and soils had historically shaped. Expanding global-scale markets for agricultural commodities such as sugar, coffee, and edible oils have reduced millions of acres of biologically diverse tropical forests to monocrop plantations. Synthetic fertilizers and petroleum-based insecticides and herbicides, widely available in developed countries after World War II, helped boost agricultural productivity to unimagined levels. Massive dams and large-scale irrigation systems have caused the desert to bloom from central Asia to the Americas, converting, for example, the semiarid Central Valley of California into the world's most productive agricultural region.

The ecological price of such technological miracles is high. Drainage and land reclamation destroy wetlands and associated biodiversity. The application of synthetic fertil-

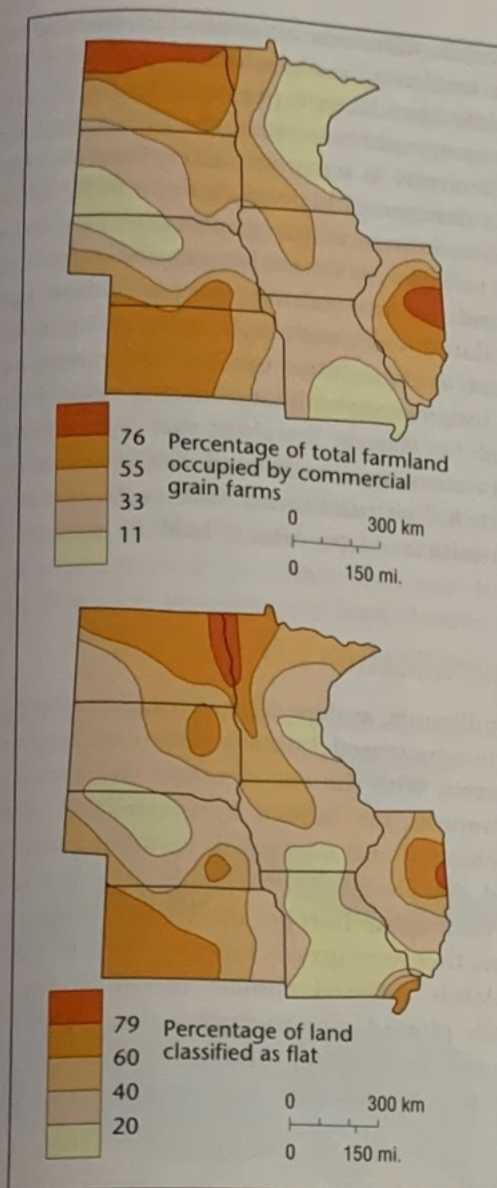


FIGURE 8.23 The influence of terrain on agriculture. The spatial relationship of commercial grain farming and flat terrain appears in the American Midwest, about 1960. "Flat" terrain is defined as any land with a slope of 3 degrees or less. Commercial grain farming is completely mechanized, and flat land permits more efficient machine operation. The result is this striking correlation between a type of agriculture and a type of terrain. **What other factors might attract mechanized grain farming to level land?** (After Hidore, 1963: 86, 87.)

izers results in nutrient-rich runoff from farms that enters freshwater systems as pollution, lowering water quality, destroying aquatic habitat, and reducing biodiversity. Agrochemicals also enter the environment as runoff, as residue on food crops, and in the tissues of livestock. These chemicals ultimately reduce biodiversity, pollute water systems, and cause increases in the rates of cancer and birth defects in humans and animals.

In the context of global climate change, great concern exists about the long-term sustainability of modern agricultural practices. In many parts of the world, groundwater is being pumped to the surface faster than it can be replenished and reservoirs are approaching the end of their life spans. Well-and-pump irrigation has drastically lowered the water table in parts of the American Great Plains, particularly Texas, causing ancient springs to go dry. Climate change data from the distant past and computer models of future climate conditions suggest that the U.S. Southwest is likely entering a drier climate regime. Lake Mead, the giant reservoir in Arizona and Nevada that helps supply water to California's cities and farms, was only 49 percent full in 2006 and is unlikely ever to be full again. This region, the most agriculturally productive in the world, will face increasingly difficult questions regarding the viability of current farming and land-use practices.

Another area where arid land irrigation has had severe ecological consequences lies on the borderland between Kazakhstan and Uzbekistan in central Asia. The once-huge Aral Sea has become so diminished by the diversion of irrigation water from the rivers flowing into it that large areas of dry lakebed now lie exposed. Not only was the local fishing industry destroyed, but noxious, chemical-laden dust storms now blow from the barren lakebed onto nearby settlements, causing assorted health problems. Irrigation water diverted to huge cotton fields, then, destroyed an ecosystem and produced another desert.

Sustainable Agriculture

As cultural geography studies by Zimmerer and many others have shown, local and indigenous knowledge about ecological conditions can be a foundation for sustainable agriculture (refer to Practicing

Geography on page 291). **Sustainability**—the survival of a land-use system for centuries or millennia without destruction of the environmental base—is the central ecological issue confronting agriculture today. The case of the Quichua peasants offers an optimistic assessment of indigenous knowledge as the basis for long-term sustainability. Their response to contemporary market pressures suggests that development and conservation can be compatible. Their knowledge of complex and variable ecological conditions in the Andes has allowed them to farm highly diverse crop varieties, a practice that in some cases has been strengthened by economic development.

Another example of sustainable indigenous agriculture is the paddy rice farming that occurs near the margins of the Asian wet-rice region, where unreliable rainfall causes harvests to vary greatly from one year to the next. Farmers have developed complex cultivation strategies to

sustainability

The survival of a land-use system for centuries or millennia without destruction of the environmental base, allowing generation after generation to continue to live there.

avert periodic famine, including growing many varieties of rice. These farmers, including those in parts of Thailand, almost universally rejected the green revolution. The simplistic advice given to them by agricultural experts working for the Thai government was inappropriate for their marginal lands. Based on generations of experimentation, the local farmers knew that their traditional adaptive strategy of diversification was superior. In West Africa, peasant grain, root, and livestock farmers have also developed adaptations to local environmental influences. They raise a multiplicity of crops on the more humid lands near the coast. Moving inland toward the drier interior, farmers plant fewer kinds of crops but grow more drought-resistant varieties. Having observed many cases like these in which local practices have proved effective and sustainable, most geographers now agree that agricultural experts need to consider indigenous knowledge when devising development plans.

Intensity of Land Use

intensive agriculture

The expenditure of much labor and capital on a piece of land to increase its productivity. In contrast, *extensive* agriculture involves less labor and capital.

Great spatial variation exists in the intensity of rural land use. In **intensive agriculture**, a large amount of human labor or investment capital, or both, is put into each acre or hectare of land,

with the goal of obtaining the greatest output. Intensity can be calculated by measuring either energy input or level of productivity. In much of the world, especially the paddy rice areas of Asia, high intensity is achieved through prodigious use of human labor, which results in a rice output per unit of land that is the highest in the world. In Western countries, high intensity is achieved

through the use of massive amounts of investment capital for machines, fertilizers, and pesticides, resulting in the highest agricultural productivity per capita found anywhere.

Many geographers support the theory that increased land-use intensity is a common response to population growth. As demographic pressure mounts, farmers systematically discard the more geographically extensive adaptive strategies to focus on those that provide greater yield per unit of land. In this manner, the population increase is accommodated. The resultant farming system may be riskier, because it offers fewer options and possesses greater potential for environmental modification, but it does yield more food—at least in the short run. Other geographers reject this theory, arguing instead that increases in population density follow innovations, such as the introduction of new high-calorie crops, which lead to greater land-use intensity.

The Desertification Debate

Over the millennia, as dependence on agriculture grew and as population increased, humans made ever larger demands on the forests. With the rise of urban civilization and conquering empires, the human transformation of forests to fields accelerated and expanded. In many parts of China, India, and the Mediterranean lands, forests virtually vanished. In transalpine Europe, the United States, and some other areas, they were greatly reduced (**Figure 8.24**).

Grasslands suffered similar modifications. Farmers occasionally plowed grasslands that were too dry for sustainable crop production, and herders sometimes damaged semiarid pastures through overgrazing. The result

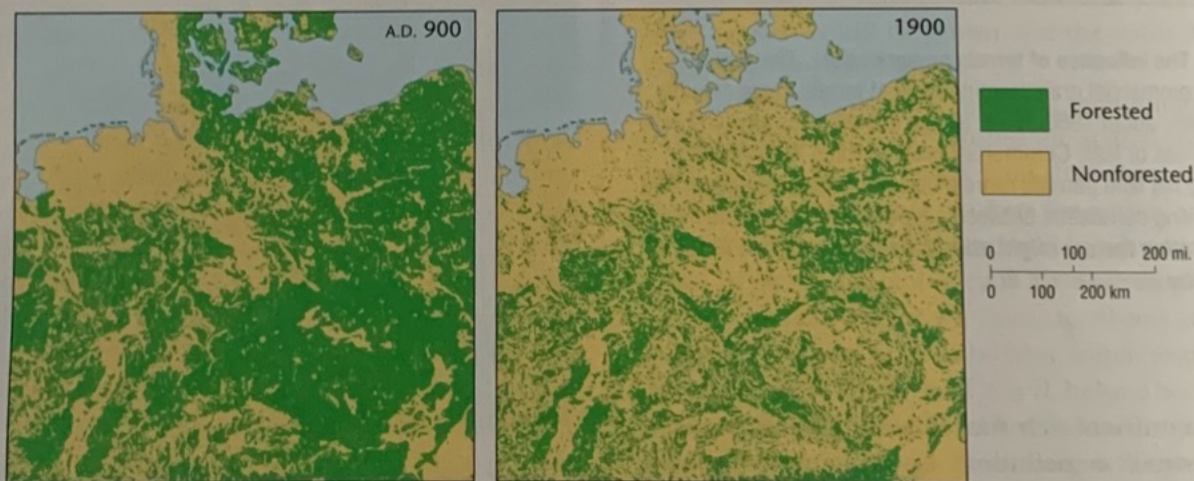


FIGURE 8.24 The agricultural impact on the forest cover of central Europe from A.D. 900 to 1900. Extensive clearing of the forests, mostly before 1350, was tied largely to expansion of farmland. The distribution of forests in 1900 closely resembles that of hills and mountain ranges. *Why might this pattern have developed?*

(Redrawn from Darby, 1956: 202–203.)

Desertification
A process whereby human actions unintentionally turn productive lands into deserts through agricultural and pastoral misuse, destroying vegetation and soil to the point where they cannot regenerate.

Desert. He noted the catastrophic decline of countries such as Libya and Tunisia in the 1500 years since the time of Roman rule, when North Africa served as the "granary of the Empire," yielding huge wheat harvests.

More recent research on desertification has centered on the Sahel, a semiarid tropical savanna region just south of the Sahara Desert in Africa (Figure 8.25). A series of droughts in the 1970s and 1980s raised concern that the Sahel was becoming desertified. This was a focal point of discussion at the 1977 UN Conference on Desertification. One theory advanced at the conference was that farmers and pastoralists were overusing the land, destroying vegeta-

tion to such an extent that the plant life could not regenerate. Lands that had been covered with pastures and fields could become permanently joined with the adjacent Sahara. In sum, researchers theorized that Africans were overgrazing rangelands and using poor cultivation practices, both of which practices were causing the desert to spread southward.

In the intervening years, substantial evidence, much of it obtained through satellite images, has raised questions about this theorized link between land use and the advancing Sahara Desert. Satellite imagery suggests to many researchers that the semiarid lands possess more resiliency than was once thought. They claim that, since 1960, the Sahara-Sahel boundary has not migrated steadily south but fluctuated as it always has, responding to wetter and drier years. New research by geographers and anthropologists also challenges the generalized claim that Africans were misusing the land. These findings suggest that African

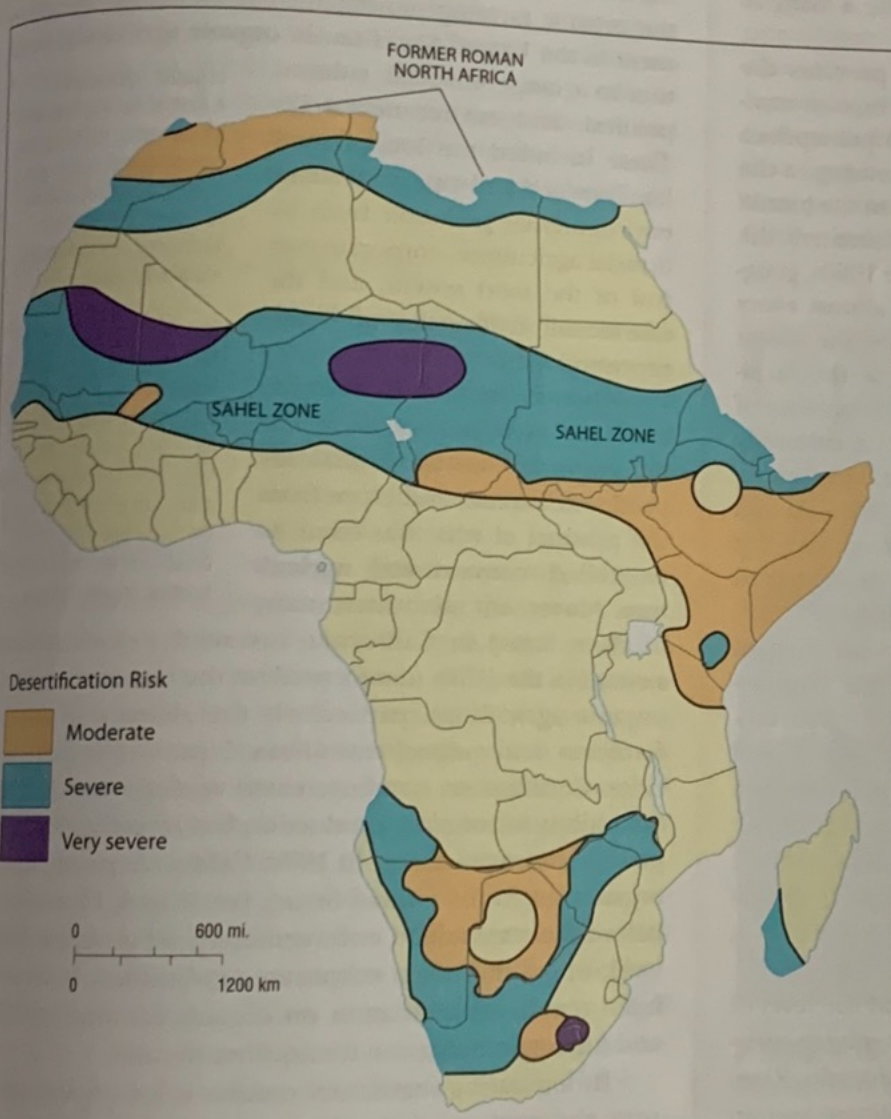


FIGURE 8.25 Risk of desertification in Africa. Are the deserts of the world expanding because of agricultural land use? Or do desert boundaries advance and retreat primarily in response to climate fluctuations? Geographer Rhoads Murphey began this debate half a century ago, and it still rages. Africa has been at the center of the debate. (Murphey, 1951; Thomas, 1993: 320.)

land-use practices in the region are highly adapted to the variable and unpredictable environments of the Sahel. A great deal of careful research is needed to distinguish the fluctuations caused by climate variability from permanent ecological damage caused by human misuse. For now, the debate continues over the extent and sources of desertification in the Sahel.

Reflecting on Geography

What might be some ecological consequences of expanding cropland to meet the world's rising food needs?

Environmental Perception by Agriculturists

People perceive the physical environment through the lenses of their culture. Each person's agricultural heritage can be influential in shaping these perceptions. This is not surprising, because human survival depends on how successfully people can adjust their ways of making a living to environmental conditions.

The Great Plains of the United States provides the setting for how an agricultural experience in one environment influenced farmers' environmental perceptions and subsequent behavior when they began farming in the Great Plains. The Plains farmers who came from the humid eastern United States consistently underestimated the problem of drought in their new home. In the 1960s, geographer Thomas Saarinen pointed out that almost every

Great Plains farmer, even the oldest and most experienced of the farmers, underestimated the frequency of the dry periods. By contrast, **culturally preadapted** German-speaking immigrants from the steppes of Russia and Ukraine, an area very much like the

culturally preadapted

A complex of adaptive traits and skills possessed in advance of migration by a group, giving it survival ability and competitive advantage in occupying the new environment.

American Great Plains, accurately perceived the new land and experienced fewer problems due to drought.

Farmers rely on climatic stability. A sudden spell of unusual weather events can change agriculturists' environmental perceptions. Geographer John Cross studied Wisconsin agriculture following a series of floods, droughts, and other anomalies. He found that two-thirds of all Wisconsin dairy farmers now believe the climate is changing for the worse, and fully one-third told him that continued climatic variability threatened their operations. Perhaps they perceive the environmental hazard to be greater than it really is, but they make decisions based on their perceptions.

Environmental perceptions also operate at the level of society. Such is the case in the U.S. Southwest, where early-twentieth-century dam building on the Colorado River allowed for the expansion of irrigated agriculture and an urban population boom that is still going strong. The wide-

spread perception that water is abundant, however, has been based on a misreading of the climate. The early 1920s, when the Colorado River flow was divided among western states, marked an unusually wet period in the region's climate. Officials greatly overestimated average river flow when allocating water rights, thus creating a perception of water abundance. The region is now entering a drier phase, partly associated with global warming, which is bound to put agriculture in increasing conflict with urban demands. Since migration into the Southwest—where urban growth outpaces that of the rest of the country—continues, we can conclude that perceptions have yet to catch up with the reality of water scarcity.

Don't Panic, It's Organic

Alarmed by the ecological and health hazards of chemical-dependent, industrialized agriculture, a small counterculture movement emerged in the United States and Europe in the 1960s and 1970s. Geographer Julie Guthman labels this the organic farming movement. For Guthman, the movement in the United States saw in **organic agriculture** a solution to a range of social, cultural, political, and environmental ills. These included the loss of small family-owned and -operated farms, environmental pollution from industrial agriculture, corporate control of the food system, and the nutritional deficiencies of highly processed foods.

When the organic food movement was in its infancy, there was no way to differentiate organically produced animals and crops from the product of what has come to be called **conventional agriculture**. Movement advocates, many of them based in California, invented new certification systems in the 1970s that focused on the technical aspects of organic agriculture, particularly the absence of artificial fertilizers and petrochemical-based pesticides and herbicides. Certification systems created uniform standards and definitions for organic production but lacked enforcement powers to control fraud. In 1979, California passed the first organic law in the United States, but it took 11 more years before the state added enforcement powers. At the federal level, opposition from corporate agribusiness interests delayed regulatory legislation on organic farming until 1990 and full implementation for another decade.

By legislating regulatory standards for organic agriculture, the state and federal governments provided organic farmers the basis for differentiating their product in the

organic agriculture

A form of farming that relies on manuring, mulching, and biological pest control and rejects the use of synthetic fertilizers, insecticides, herbicides, and genetically modified crops.

conventional agriculture

The widely adopted commercial, industrialized form of farming that uses a range of synthetic fertilizers, insecticides, and herbicides to control pests and maximize productivity; a term that emerged following the creation of alternative forms, such as organic farming.

marketplace. This in turn allowed producers and retailers to charge consumers a premium. Premium pricing has encouraged many producers to switch to organic agriculture. The organic food market is now the most rapidly growing (and most profitable) agricultural sector. Affluent consumer demand for organics in First World countries, while only 1 to 3 percent of national retail sales, is growing at the phenomenal pace of 20 to 25 percent annually. Land-use practices reflect this growing demand. In the United States, organic crop acreage increased 11 percent between 2001 and 2003, with larger increases in vegetables and fruits, which now account for 4 and 2 percent, respectively, of total U.S. farm acreage.

In Guthman's assessment, the organic farming movement, because it focused solely on the technical aspects of organic production, fell short of addressing many of the social and political ills it sought to correct. Her study of California organic agriculture demonstrated that organic farming is readily incorporated into large-scale agribusiness enterprises. Indeed, some existing agribusinesses merely purchased existing organic farms as a means of diversifying their operations and tapping the profits from premium pricing. While organic agriculture has produced environmental and health benefits (for farm laborers and consumers), its effect on the historic decline of family farms and their rural communities has been minimal.

Green Fuels from Agriculture

biofuel

Broadly, this term refers to any form of energy derived from biological matter, increasingly used in reference to replacements for fossil fuels in internal combustion engines, industrial processes, and the heating and cooling of buildings.

dependent on fossil fuels to produce everything that we eat, wear, listen to, read, and live in. Now fossil fuels, particularly oil, have become scarce, causing prices and political uncertainties to increase. In addition, fossil-fuel combustion is a source of atmospheric greenhouse gases, which are partly responsible for global warming. Thus, an urgent search is under way to find alternative, renewable fuel supplies, and agriculture has become one of the main sources.

How can agriculture be a source of energy for industry? By tapping the simple process of fermentation, many plant materials can be converted to a combustible alcohol, ethanol. In the United States, corn is the main source of ethanol, and new ethanol plants are springing up across the Corn Belt in the midwestern United States. The U.S. Department of Agriculture planned for ethanol production to double from 2005 to 2009 and then continue to expand. This shift in corn production from food to fuel

Henry Ford fueled his first car with alcohol, and Rudolf Diesel ran his engine on fuel made from peanut oil. They soon abandoned these **biofuels**, however, for nonrenewable fossil fuels derived from "rock oil," and the rest is history. The modern global economy is dependent

affects nearly every aspect of the field crop sector, as well as livestock production, habitat protection, and the global grain trade. For example, corn acreage in the midwestern United States is projected to increase nearly 15 percent, replacing crops such as soybeans and taking over pastures and land set aside for conservation.

Brazil, which is the closest international rival of the United States in ethanol production, grows and ferments sugarcane, which yields twice as many gallons of ethanol per acre as does corn. The policies of the Brazilian government have encouraged the creation of a delivery infrastructure (plants, tanks, and pumps) and the manufacture and sale of "flex" cars that can run on either gasoline or ethanol. By 2006 the country had freed itself from a dependence on imported oil, an achievement that many countries dream of emulating.

Will biofuels from agriculture produce a sustainable, environmentally friendly alternative to fossil fuels? Biofuels appear to offer tremendous promise, but many problems remain, such as shifting crops from food to fuel production (**Figure 8.26**). The environmental benefits of biofuels also may be reduced by some of the associated costs of increasing ethanol and biodiesel production. Biodiesel, fuel made from vegetable oils, takes less energy to produce than crop-based ethanol, but it is typically more expensive than petroleum-derived diesel. These issues are explored further in Subject to Debate (page 306).



FIGURE 8.26 Corn Belt ethanol plant. Plants such as this one in Colorado have been springing up in cornfields across the midwestern United States as demand for alternative fuel sources increases. Corn is the main ingredient in making ethanol as a gasoline additive in the United States. (Rick Wilking/Reuters/Corbis.)



Subject to Debate

Can Biofuels Save the Planet?

In 2005, in response to diminishing oil reserves and global warming, the U.S. government mandated that biofuels be added to gasoline. Governments around the world have implemented similar initiatives to increase renewable fuel use. Globally, the most promising environmental outcome of increased biofuel use is a decrease in greenhouse gasses. Growing plants consume atmospheric carbon dioxide. Using them for fuel thus recycles an important greenhouse gas, in contrast with fossil fuels, which release stored carbon into the atmosphere when combusted.

Biofuel demand is transforming agriculture around the world, but the energy and environmental benefits are uncertain. Because U.S. corn cultivation is so thoroughly industrialized, ethanol production consumes as much fossil fuel as it replaces. By some estimates, corn ethanol production *uses more* energy than it supplies. Brazil's sugarcane ethanol industry has a far better energy balance of 1 unit of fossil fuel input to 8 units of biofuel output. These energy gains may be offset by other environmental costs. Sugarcane cultivation has created a monocultural desert that is expected to double in acreage by 2014. Many fear this will contribute to deforestation. Likewise, in the United States, 35 million acres of land now set aside for soil and wildlife conservation may be plowed to grow corn for ethanol.

The increase in biofuel production raises social and ethical questions. For example, the world grain trade is controlled by giant multinational corporations that stand to gain the most from government subsidies and rising fuel prices. On the other hand, farmers are receiving near-record prices for their corn. Using cropland to produce fuel is already raising food prices for consumers and threatening food security in the poorest countries. The emerging food-fuel battle could pit 800 million affluent motorists against the world's 2 billion poorest people.

Continuing the Debate

Think about the future role biofuels will play in addressing the linked crises of energy supply and global warming and consider these questions:

- What do you think can be done to make biofuels more promising environmentally?
- How can food security for the poor be assured as biofuel use increases?
- Who do you think will benefit the most from the expansion of biofuel use? Small farmers or agribusiness? High-income countries or low-income countries? Consumers or corporations?

The biofuel controversy. Many U.S. politicians and farm lobbyists promote ethanol from corn as an alternative fuel source for cars. Many scientists and environmentalists argue otherwise. (Pat LaCroix/Photographer's Choice/Getty Images.)



CULTURAL LANDSCAPE

What is the agricultural component of the cultural landscape? What might we learn about agriculture by examining

its unique landscape? According to the UN Food and Agriculture Organization, 37.3 percent of the world's land area is cultivated or pastured. In this huge area, the visible

imprint of humankind might best be called the **agricultural landscape**. The agricultural landscape

often varies even over short distances, telling us much about local cultures and subcul-

tures. Moreover, it remains in many respects a window on the past, and archaic features abound. For this reason, the traditional rural landscape can teach us a great deal about the cultural heritage of its occupants.

In Chapter 3, we discussed some aspects of the agricultural landscape, in particular the rural settlement forms. We saw the different ways in which farming people situate their dwellings in various cultures. In Chapter 2, we considered traditional rural architecture, another element in the agricultural landscape. In this chapter, we attend to a third aspect of the rural landscape: the patterns of fields and property ownership created as people occupy land for the purpose of farming.

Survey, Cadastral, and Field Patterns

A **cadastral pattern** is one that describes property ownership lines, whereas a field pattern reflects the way that a

cadastral pattern

The shapes formed by property borders; the pattern of land ownership.

survey pattern

A pattern of original land survey in an area.

hamlet

A small rural settlement, smaller than a village.

farmer subdivides land for agricultural use. Both can be greatly influenced by **survey patterns**, the lines laid out by surveyors prior to the settlement of an area. Major regional contrasts exist in survey, cadastral, and field patterns, for example, unit-block versus fragmented landholding and regular, geometric survey lines versus irregular or unsurveyed property lines.

Fragmented farms are the rule in the Eastern Hemisphere. Under this system, farmers live in farm villages or smaller **hamlets**. Their landholdings lie splintered into many separate fields situated at varying distances and lying in various directions from the settlement. One farm can consist of 100 or more separate, tiny parcels of land (Figure 8.27). The individual plots may be roughly rectangular in shape, as in Asia and southern Europe, or they may lie in narrow strips.



Buildings of the village
Holdings of one farmer

FIGURE 8.27 Fragmented landholdings surround a French farm village. The numerous fields and plots belonging to one individual farmer are shaded. Such fragmented farms remain common in many parts of Europe and Asia. **What are the advantages and disadvantages of this system?** (After Demangeon, 1946.)

The latter pattern is most common in Europe, where farmers traditionally worked with a bulky plow that was difficult to turn. The origins of the fragmented farm system go back to an early period of peasant communalism. One of its initial justifications was a desire for peasant equality. Each farmer in the village needed land of varying soil composition and terrain. Travel distance from the village was to be equalized. From the rice paddies of Japan and India to the fields of western Europe, the fragmented holding remains a prominent feature of the cultural landscape.

Unit-block farms, by contrast, are those in which all of the farmer's property is contained in a single, contiguous piece of land. Such forms are found mainly in the overseas area of European settlement, particularly the Americas, Australia, New Zealand, and South Africa. Most often, they reveal a regular, geometric land survey. The checkerboard of farm fields in the rectangular survey areas of the United States provides a good example of this cadastral pattern (Figure 8.28, page 308).

The American township and range system, discussed in Chapter 6, first appeared after the Revolutionary War as an orderly method for parceling out federally owned land for sale to pioneers. It imposed a rigid, square, graph-paper pattern on much of the American countryside; geometry triumphed over physical geography (Figure 8.29, page 308). Similarly, roads follow section and township lines, adding to the checkerboard character of the



FIGURE 8.28 American township and range survey creates a checkerboard, illustrated well by irrigated agriculture in the desert of California's Imperial Valley. (Glowimages/Getty Images.)

American agricultural landscape. Canada adopted an almost identical survey system, which is particularly evident in the Prairie Provinces.

Reflecting on Geography

What advantages does the checkerboarded North American rural landscape offer? What disadvantages?

Equally striking in appearance are long-lot farms, where the landholding consists of a long, narrow unit-block stretching back from a road, river, or canal (**Figure 8.30**). Long-lots lie grouped in rows, allowing this cadastral survey pattern to dominate entire districts. Long-lots occur widely

in the hills and marshes of central and western Europe, in parts of Brazil and Argentina, along the rivers of French-settled Québec and southern Louisiana, and in parts of Texas and northern New Mexico. These unit-block farms are elongated because such a layout provides each farmer with fertile valley land, water, and access to transportation facilities, either roads or rivers. In French America, long-lots appear in rows along streams, because waterways provided the chief means of transport in colonial times. In the hill lands of central Europe, a road along the valley floor provides the focus, and long-lots reach back from the road to the adjacent ridge crests.

Some unit-block farms have irregular shapes rather than the rectangular or long-lot patterns. Most of these

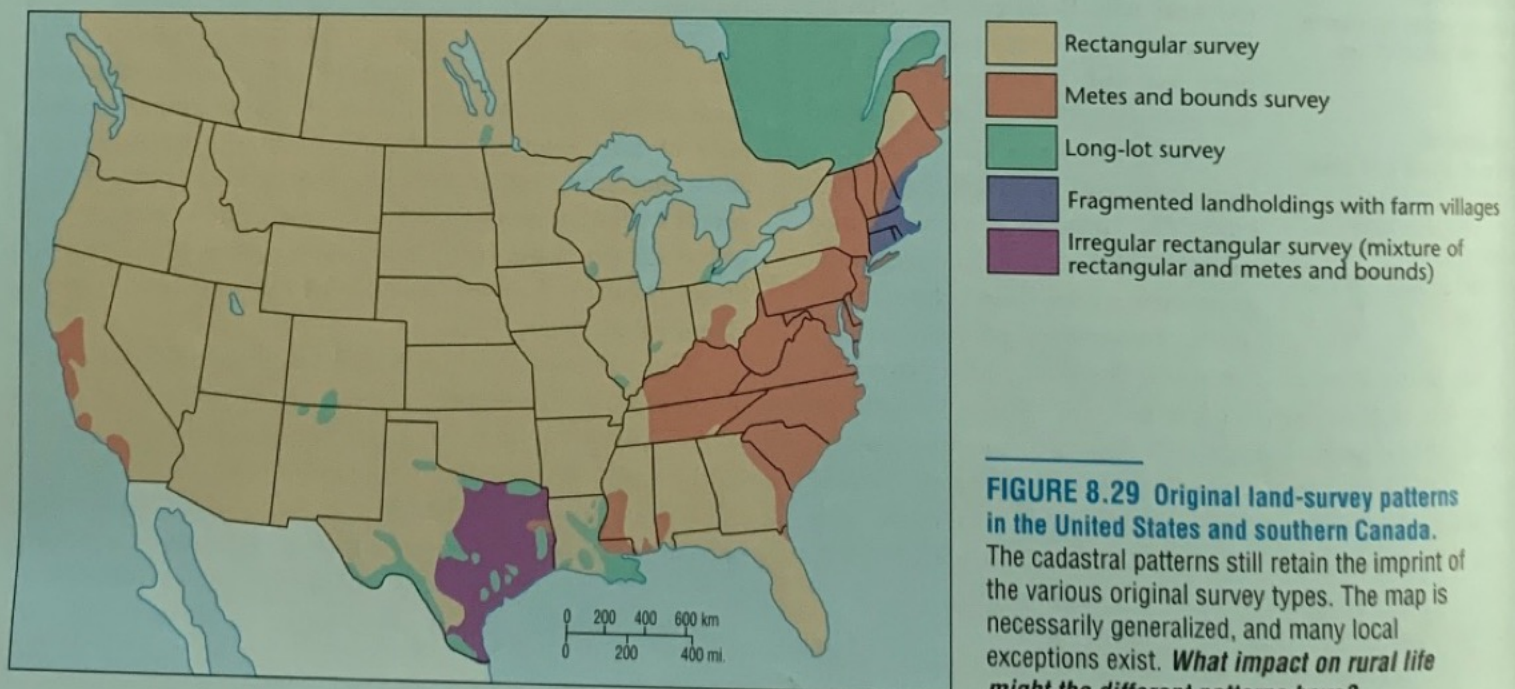


FIGURE 8.29 Original land-survey patterns in the United States and southern Canada. The cadastral patterns still retain the imprint of the various original survey types. The map is necessarily generalized, and many local exceptions exist. *What impact on rural life might the different patterns have?*

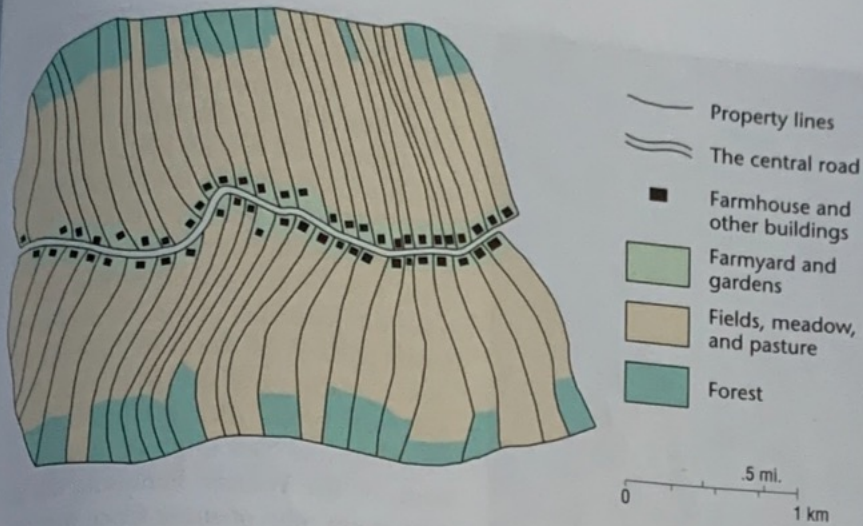
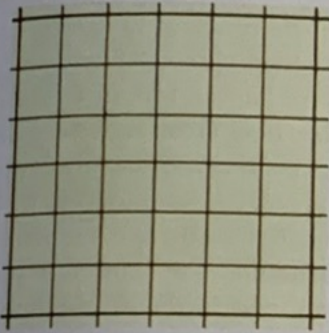


FIGURE 8.30 A long-lot settlement in the hills of central Germany. Each property consists of an elongated unit-block of land stretching back from the road in the valley to an adjacent ridgecrest, part of which remains wooded.

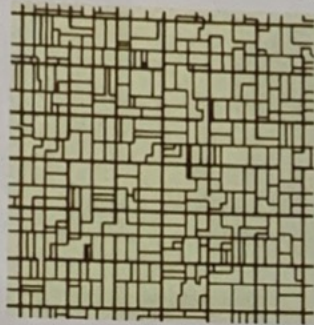
result from metes and bounds surveying, which makes much use of natural features such as trees, boulders, and streams. Parts of the eastern United States were surveyed

under the metes and bounds system, with the result that farms there are much less regular in outline than those where rectangular surveying was used (Figure 8.31).

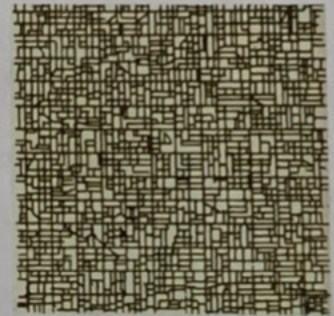
Original Survey Lines



Property Lines, About 1955
(Those that follow original survey lines are shown by thicker lines.)



Field and Woodlot Borders, About 1955



U.S. RECTANGULAR SURVEY, HANCOCK AND HARDIN COUNTIES, OHIO



METES AND BOUNDS SURVEY, UNION AND MADISON COUNTIES, OHIO

FIGURE 8.31 Two contrasting land-survey patterns, rectangular and metes and bounds. Both types were used in an area of west-central Ohio. Note the impact these survey patterns had on modern cadastral and field patterns. *What other features of the cultural landscape might be influenced by these patterns?* (After Thorner, 1966: 40, 63, 84.)



FIGURE 8.32 Traditional fence in the mountains of Papua New Guinea. The fence is designed to keep pigs out of sweet potato gardens. The modern age has had an impact, as revealed in the use of tin cans to decorate and stabilize the fence. Each culture has its own fence types, adding another distinctive element to the agricultural landscape. (Courtesy of Terry G. Jordan-Bychkov.)

Fencing and Hedging

Property and field borders are often marked by fences or hedges, heightening the visibility of these lines in the agricultural landscape. Open-field areas, where the dominance of crop raising and the careful tending of livestock make fences unnecessary, still prevail in much of western



Europe, India, Japan, and some other parts of the Eastern Hemisphere, but much of the remainder of the world's agricultural land is enclosed.

Fences and hedges add a distinctive touch to the cultural landscape (Figure 8.32). Because different cultures have their own methods and ways of enclosing land, types of fences and hedges can be linked to particular groups. Fences in different parts of the world are made of substances as diverse as steel wire, logs, poles, split rails, brush, rock, and earth. Those who visit rural New England, western Ireland, or the Yucatán Peninsula will see mile upon mile of stone fence that typifies those landscapes. Barbed-wire fences swept across the American countryside a century ago, but remnants of older styles can still be seen. In Appalachia, the traditional split-rail zig-zag fence of pioneer times survives here and there. As do most visible features of culture, fence types can serve as indicators of cultural diffusion.

The hedge is a living fence. In Brittany and Normandy in France and in large areas of Great Britain and Ireland, hedgerows are a major aspect of the rural landscape (Figure 8.33). To walk or drive the roads of hedgerow country is to experience a unique feeling of confinement quite different from the openness of barbed wire or unenclosed landscapes. In recent decades, hedgerows have been disappearing as landholdings have been consolidated and grown larger. The removal of hedgerows means not only the loss of a defining feature of the rural landscape but also a decline in habitat for many rare plants, mammals, and birds. In response, the U.K. government passed regulations in 1997 to protect hedgerows in England and Wales; these regulations appear to have slowed their removal.

FIGURE 8.33 Hedgerows in England.

Archetypical hedgerow landscapes, such as the one in Shropshire, England, historically common throughout western Europe, are now disappearing as land-ownership has become increasingly concentrated. **How might agricultural landscapes with hedgerows support greater biodiversity than those without?**

(David Paterson/Picade.)

CONCLUSION

We have seen that the ancient human endeavor called agriculture varies markedly from region to region and is reflected in formal agricultural regions; we have also seen that we can better understand this complicated pattern through the themes of mobility, the global food system, nature-culture interactions, and agricultural landscape. Once again, we have seen the interwoven character of the five themes of cultural geography. In many fundamental ways, the agricultural revolution changed humankind. In equally dramatic fashion, the industrial revolution sparked further changes. We will use the five themes to guide an exploration of the industrial world in the next chapter.

DOING GEOGRAPHY

The Global Geography of Food

Until recently, people throughout history obtained the food they needed either by growing it themselves or procuring it directly from nearby farmers. The choice and availability of food were limited and changed seasonally. About 100 years ago, this situation began to change dramatically as the pace of urbanization and industrialization accelerated. Today, very few people in developed countries grow their own food or even know where the food they eat was produced or who produced it. Where does our food come from? Who produces and sells it? Your task for this exercise is to find out.

This exercise can be organized as a group or individual project. As a group project, people can be assigned to research particular categories of food, such as meat and poultry, cereals and grains, fruits and vegetables, and dairy products. As an individual project, you should begin with a typical day's meals and identify all the ingredients (don't forget the seasonings and cooking oils used in preparation).

Steps to Tracing the Global Geography of Food

Step 1: The project starts at the food markets where you usually shop. For much of the information you will need, you can refer to the labels on the food items. For some items, such as fish, poultry, and meat, you may need to speak to the butcher or store manager. Find out, as specifically as possible, where the food item was produced. Find out the name of the company that marketed the product and, if available, the name of the parent company.

Step 2: After collecting this basic information, you will need to head to the library and perhaps log on to the Internet to do further research (the web sites listed in this chapter should be helpful). Organize a list of companies and the food products

they market; then locate the geographic origins of each food product.

Step 3: Now look for patterns.

- Which and how many companies are involved and what proportion of the food supply does each control?
- What proportion and which kinds of food are produced in other countries? Do certain kinds of foods tend to be produced closer to the market than others?
- Do certain kinds of food tend to be marketed by large corporations more than others?
- Can you think of explanations for the patterns you identify?

You may wish to take this investigation to a greater depth.

- Can you determine from your research what the conditions are where the food is produced? For example, what landscape changes occur when regions begin producing for the global food system?
- How is production structured? Is it organized into large corporate plantations or small peasant farm plots?
- What are the ethical and social justice dimensions of food production?
- What are the conditions for workers?
- Have concerns over the treatment of animals been raised?
- Have environmental or human health concerns been raised?



A bountiful produce display, common in U.S. supermarkets. *Where does the bounty come from, who grows it, and how is it made available for our tables no matter what the season?* (Associated Press.)

Key Terms

agribusiness	p. 295
agricultural landscape	p. 307
agricultural region	p. 275
agriculture	p. 275
aquaculture	p. 284
biofuel	p. 305