The First Farmers
What could be more American than McDonald’s, hamburgers, hot dogs, or apple pie? More American, in other words, than a now global fast-food chain, a sandwich and sausage named for German cities, or a fruit first grown in the Middle East baked in a pastry crust from wheat, domesticated there as well. What we think of as truly American usually has foreign roots. Consider just McDonald’s Big Mac as a world system in miniature. It consists of two all-beef patties (from cattle, an Old World domesticate), special sauce (similar to mayonnaise, invented in France), lettuce (Egypt), cheese (from cow’s milk—Old World), pickles (India), onions (Iran and West Pakistan), and it comes on a sesame-seed (India) bun (wheat—Middle East). The breakfast Egg McMuffin is only slightly less cosmopolitan. Eggs are from chickens, domesticated in Southeast Asia. Cheese comes from cow’s milk (cows were domesticated in India, the Middle East, and Africa’s eastern Sahara). Canadian bacon is from pork (western Asia), and the muffin is made of wheat (Middle East). If you crave “real American,” i.e., New World origin, food, have some turkey or beans on a taco or tortilla (from maize or corn) and chocolate for dessert.

The domestication of plants and animals for food occurred, independently, in both the Old World and in the Americas around 11,000 years ago. Animals and crops thrived together in the Middle East, Africa, Europe, and Asia. Not so in the Americas, where wild oxen, horses, pigs, and camels went extinct long before crops were ever cultivated. Key differences in early food production between the hemispheres help us to understand their subsequent histories. A mutually supportive relationship developed between farming and herding in the Old World, where crops sustained sheep, goats, and eventually cattle, pigs, horses, and donkeys.

What, again deceptively, could be more American than the habit of using your own wheels to get you to your favorite restaurant? Wheels? Only in Old World prehistory were animals harnessed to pull wheeled vehicles. Ancient Mexicans did also invent the wheel, but only for toys. Their homeland lacked the appropriate animals to pull plows, oxcarts, chariots, and carriages. How could a dog, turkey, or duck match a horse, donkey, or ox as a beast of burden? The absence of large animal domestication in ancient Mexico is a key factor in world history, helping us understand the divergent development of societies on different sides of the oceans. Wheels fueled the growth of transport, trade, and travel in the Old World. Thousands of years after the origin of food production, advantages in transport would fuel an “age of discovery” and enable the European conquest of the Americas. Again, a key feature of contemporary American life turns out to have foreign roots.

In Chapter 10, we considered some of the economic implications of the end of the Ice Age in Europe. With glacial retreat, foragers pursued a more generalized economy, focusing less on large animals. This was the beginning of what Kent Flannery (1969) has called the broad-spectrum revolution. This refers to the period beginning around 15,000 B.P. in the Middle East and 12,000 B.P. in Europe, during which a wider range,
hunting and fishing were important in Europe, Big-game hunting and, thereafter, Mesolithic chisels, and gouges. Tools used by Mesolithic carpenters appear in the archaeological record: new kinds of axes, rope. Tools used by Mesolithic carpenters appear in the archaeological record: new kinds of axes, delicately shaped stone tools can tell us about the total economy and way of life of the people who made them.

By 12,000 B.P., subarctic animals no longer lived in southwestern Europe. By 10,000 B.P. the glaciers had retreated to such a point that the range of hunting, gathering, and fishing populations in Europe extended to the formerly glaciated British Isles and Scandinavia. The reindeer herds had gradually retreated to the far north, with some human groups following (and ultimately domesticating) them. Europe around 10,000 B.P. was forest rather than treeless steppe and tundra—as it had been during the Upper Paleolithic. Europeans were exploiting a wider variety of resources and gearing their lives to the seasonal appearance of particular plants and animals.

People still hunted, but their prey were solitary forest animals, such as the roe deer, the wild ox, and the wild pig, rather than herd species. This led to new hunting techniques: solitary stalking and trapping. The coasts and lakes of Europe and the Middle East were fished intensively. Some important Mesolithic sites are Scandinavian shell mounds—the garbage dumps of prehistoric oyster collectors. Microliths were used as fishhooks and in harpoons. Dugout canoes were used for fishing and travel. The process of preserving meat and fish by smoking and salting grew increasingly important. Meat preservation had been less of a problem in a subarctic environment since winter snow and ice, often on the ground nine months of the year, offered convenient refrigeration.) The bow and arrow became essential for hunting water fowl in swamps and marshes. Dogs were domesticated as retrievers by Mesolithic people (Champion and Gamble 1984). Woodworking was important in the forested environment of northern and Western Europe. Tools used by Mesolithic carpenters appear in the archaeological record: new kinds of axes, chisels, and gouges.

Big-game hunting and, thereafter, Mesolithic hunting and fishing were important in Europe, but other foraging strategies were used by prehistoric humans in Africa and Asia. Among contemporary foragers in the tropics, gathering is the dietary mainstay (Lee 1968/1974). Although herds of big game animals were more abundant in the tropics in prehistory than they are today, gathering probably always has been at least as important as hunting for tropical foragers (Draper 1975).

Generalized, broad-spectrum economies lasted about 5,000 years longer in Europe than in the Middle East. Whereas Middle Easterners had begun to cultivate plants and breed animals by 10,000 B.P., food production reached Western Europe only around 5000 B.P. (3000 B.C.E.) and northern Europe 500 years later.

After 15,000 B.P., throughout the inhabited world, as the big-game supply diminished, foragers had to pursue new resources. Human attention shifted from large-bodied, slow reproducers (such as mammoths) to species such as fish, mollusks, and rabbits that reproduce quickly and prolifically (Hayden 1981). This happened with the European Mesolithic. It also happened at the Japanese site of Nittano (Akazawa 1980), located on an inlet near Tokyo. Nittano was occupied several times between 6000 and 5000 B.P. by members of the Jomon culture, for which 30,000 sites are known in Japan. These broad-spectrum foragers hunted deer, pigs, bears, and antelope. They also ate fish, shellfish, and plants. Jomon sites have yielded the remains of 300 species of shellfish and 180 species of edible plants (including berries, nuts, and tubers) (Akazawa and Aikens 1986).
THE NEOLITHIC

The archaeologist V. Gordon Childe (1951) used the term Neolithic Revolution to describe the origin and impact of food production—plant cultivation and animal domestication. Neolithic was coined to refer to new techniques of grinding and polishing stone tools. However, the primary significance of the Neolithic was the new total economy rather than just its characteristic artifacts, which also included pottery.

The transition from Mesolithic to Neolithic occurs when groups become dependent on domesticated foods (more than 50 percent of the diet). Usually this happens after a very long period of experimenting with and using domesticates as supplements to broad-spectrum foraging. The archaeological signature of Neolithic cultures (which are called Formative in the Americas) includes dependence on cultivation, sedentary (settled) life, and the use of ceramic vessels.

Neolithic economies based on food production were associated with substantial changes in human lifestyles. By 12,000 B.P., the shift toward the Neolithic was under way in the Middle East (Turkey, Iraq, Iran, Syria, Jordan, and Israel). People started intervening in the reproductive cycles of plants and animals. No longer simply harvesting nature’s bounty, they grew their own food and modified the biological characteristics of the plants and animals in their diet. By 10,000 B.P., domesticated plants and animals were part of the broad spectrum of resources used by Middle Easterners. By 7500 B.P., most Middle Easterners had moved away from the broad-spectrum foraging pattern toward more specialized, Neolithic, economies based on fewer species, which were domesticates.

They had become committed farmers and herders. Kent Flannery (1969) has proposed a series of eras during which the Middle Eastern transition to farming and herding took place. The era of seminomadic hunting and gathering (12,000–10,000 B.P.) encompasses the last stages of broad-spectrum foraging. This was the period just before the first domesticated plants (wheat and barley) and animals (goats and sheep) were added to the diet. Next came the era of early dry farming (of wheat and barley) and caprine domestication (10,000–7500 B.P.). Dry farming refers to farming without irrigation; such farming depended on rainfall. Caprine (from capra, Latin for “goat”) refers to goats and sheep, which were domesticated during this era.

During the era of increased specialization in food production (7500–5500 B.P.), new crops were added to the diet, along with more productive varieties of wheat and barley. Cattle and pigs were domesticated. By 5500 B.P., agriculture extended to the alluvial plain of the Tigris and Euphrates rivers (Figure 11.1), where early Mesopotamians lived in walled towns, some of which grew into cities. (Recap 11.1 highlights these stages or eras in the transition to food production in the ancient Middle East.) After two million years of stone-tool making, H. sapiens was living in the Bronze Age, when metallurgy and the wheel were invented.

RECAP 11.1 The Transition to Food Production in the Middle East

<table>
<thead>
<tr>
<th>ERA</th>
<th>DATES (B.P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin of state (Sumer)</td>
<td>5500 B.P.</td>
</tr>
<tr>
<td>Increased specialization in food production</td>
<td>7500–5500 B.P.</td>
</tr>
</tbody>
</table>
THE FIRST FARMERS AND HERDERS IN THE MIDDLE EAST

Middle Eastern food production arose in the context of four environmental zones. From highest to lowest, they are high plateau (5,000 feet, or 1,500 meters), Hilly Flanks, piedmont steppe (treeless plain), and alluvial desert—the area watered by the Tigris and Euphrates rivers (100–500 feet, or 30–150 meters). The Hilly Flanks is a subtropical woodland zone that flanks those rivers to the north (Figure 11.1).

It was once thought that food production began in oases in the alluvial desert. (Alluvial describes rich, fertile soil deposited by rivers and streams.) This arid region was where Mesopotamian civilization arose later. Today, we know that although the world’s first civilization (Mesopotamian) did indeed develop in this zone, irrigation, a late (7000 B.P.) invention, was necessary to farm the alluvial desert. Plant cultivation and animal domestication started not in the dry river zone but in areas with reliable rainfall.

The archaeologist Robert J. Braidwood (1975) proposed instead that food production started in the Hilly Flanks, or subtropical woodland zone, where wild wheat and barley would have been most abundant (see Figure 11.1). In 1948, a team headed by Braidwood started excavations at Jarmo, an early food-producing village inhabited between 9000 and 8500 B.P., located in the Hilly Flanks. We now know, however, that there were farming villages earlier than Jarmo in zones adjacent to the Hilly Flanks. One example is Ali Kosh (Figure 11.1), a village in the foothills (piedmont steppe) of the Zagros mountains. By 9000 B.P., the people of Ali Kosh were herding goats, intensively collecting various wild plants, and harvesting wheat during the late winter and early spring (Hole, Flannery, and Neely 1969).

Climate change played a role in the origin of food production (Smith 1995). The end of the Ice Age brought greater regional and local variation in climatic conditions. Lewis Binford (1968) proposed that in certain areas of the Middle East (such as the Hilly Flanks), local environments were so rich in resources that foragers could adopt sedentism—sedentary (settled) life in villages. Binford’s prime example is the widespread Natufian culture (12,500–10,500 B.P.), based on broad-spectrum foraging. The Natufians, who collected wild cereals and hunted gazelles, had year-round villages. They were able to stay in the same place (early villages) because they could harvest nearby wild cereals for six months.

Donald Henry (1989, 1995) documented a climate change toward warmer, more humid conditions just before the Natufian period. This expanded the altitude range of wild wheat and barley, thus enlarging the available foraging area and allowing a longer harvest season. Wheat and barley ripened in the spring at low altitudes, in the summer at middle altitudes, and in the fall at high altitudes. As locations for their villages, the Natufians chose central places where they could harvest wild cereals in all three zones.

Around 11,000 B.P., this favorable foraging pattern was threatened by a second climate change—to drier conditions. As many wild cereal habitats dried up, the optimal zone for foraging shrank. Natufian villages were now restricted to areas with permanent water. As population continued to grow, some Natufians attempted to maintain productivity by transplanting wild cereals to well-watered areas, where they started cultivating.

In the view of many scholars, the people most likely to adopt a new subsistence strategy, such as food production, would be those having the most trouble in following their traditional subsistence strategy (Binford 1968; Flannery 1973; Wenke 1996).
Thus, those ancient Middle Easterners living outside the area where wild foods were most abundant would be the most likely to experiment and to adopt new subsistence strategies. This would have been especially true as the climate dried up. Recent archaeological finds support this hypothesis that food production began in marginal areas, such as the piedmont steppe, rather than in the optimal zones, such as the Hilly Flanks, where traditional foods were most abundant.

Even today, wild wheat grows so densely in the Hilly Flanks that one person working just an hour with Neolithic tools can easily harvest a kilogram of wheat (Harlan and Zohary 1966). People would have had no reason to invent cultivation when wild grain was ample to feed them. Wild wheat ripens rapidly and can be harvested over a three-week period. According to Flannery, over that time period, a family of experienced plant collectors could harvest enough grain—2,200 pounds (1,000 kilograms)—to feed themselves for a year. But after harvesting all that wheat, they’d need a place to put it. They could no longer maintain a nomadic lifestyle, since they’d need to stay close to their wheat.

Sedentary village life thus developed before farming and herding in the Middle East. The Natufians and other Hilly Flanks foragers had no choice but to build villages near the densest stands of wild grains. They needed a place to keep their grain. Furthermore, sheep and goats came to graze on the stubble that remained after humans had harvested the grain. The fact that basic plants and animals were available in the same area also favored village life. Hilly Flanks foragers built houses, dug storage pits for grain, and made ovens to roast it.

Natufian settlements, occupied year-round, show permanent architectural features and evidence for the processing and storage of wild grains. One such site is Abu Hureyra, Syria (see Figure 11.1), which was initially occupied by Natufian foragers around 11,000 to 10,500 B.P. Then it was abandoned—to be reoccupied later by food producers, between 9500 and 8000 B.P. From the Natufian period, Abu Hureyra has yielded the remains of grinding stones, wild plants, and 50,000 gazelle bones, which represent 80 percent of all the bones recovered at the site (Jolly and White 1995).

Prior to domestication, the favored Hilly Flanks zone had the densest human population. Eventually, its excess population started to spill over into adjacent areas. Colonists from the Flanks tried to maintain their traditional broad-spectrum foraging in these marginal zones. But with sparser wild foods available, they had to experiment with new subsistence strategies. Eventually, population pressure on more limited resources forced people in the marginal zones to become the first food producers (Binford 1968; Flannery 1969). Early cultivation began as an attempt to copy, in a less favorable environment, the dense stands of wheat and barley that grew wild in the Hilly Flanks.

The Middle East, along with certain other world areas where food production originated, is a region that for thousands of years has had a vertical economy. (Other examples include Peru and Mesoamerica—Middle America, including Mexico, Guatemala, and Belize.) A vertical economy exploits environmental zones that, although close together in space, contrast with one another in altitude, rainfall, overall climate, and vegetation (Figure 11.1). Such a close juxtaposition of varied environments allowed broad-spectrum foragers to use different resources in different seasons.

Early seminomadic foragers in the Middle East had followed game from zone to zone. In winter they hunted in the piedmont steppe region, which had winter rains rather than snow and provided winter pasture for game animals 12,000 years ago. (Indeed it is still used for winter grazing by herders today.) When winter ended, the steppe dried up. Game moved up to the Hilly Flanks and high plateau country as the snow melted. Pastureland became available at higher elevations. Foragers gathered as they climbed, harvesting wild grains that ripened later at higher altitudes. Sheep and goats followed the stubble in the wheat and barley fields after people had harvested the grain.
The four Middle Eastern environmental zones shown in Figure 11.1 also were tied together through trade. Certain resources were confined to specific zones. Asphalt, used as an adhesive in the manufacture of sickles, came from the steppe. Copper and turquoise sources were located in the high plateau. Contrasting environments were linked in two ways: by foragers’ seasonal migration and by trade.

The movement of people, animals, and products between zones—plus population increase supported by highly productive broad-spectrum foraging—was a precondition for the emergence of food production. As they traveled between zones, people carried seeds into new habitats. Mutations, genetic recombinations, and human selection led to new kinds of wheat and barley. Some of the new varieties were better adapted to the steppe and, eventually, the alluvial desert than the wild forms had been.

Genetic Changes and Domestication

What are the main differences between wild and domesticated plants? The seeds of domesticated cereals, and often the entire plant, are larger. Compared with wild plants, crops produce a higher yield per unit of area. Domesticated plants also lose their natural seed dispersal mechanisms. Cultivated beans, for example, have pods that hold together, rather than shattering as they do in the wild. Domesticated cereals have tougher connective tissue holding the seedpods to the stem.

Grains of wheat, barley, and other cereals occur in bunches at the end of a stalk (Figure 11.2). The grains are attached to the stalk by an axis, plural axes. In wild cereals, this axis is brittle. Sections of the axis break off one by one, and a seed attached to each section falls to the ground. This is how wild cereals spread their seeds and propagate their species. But a brittle axis is a problem for people. Imagine the annoyance experienced by broad-spectrum foragers as they tried to harvest wild wheat, only to have the grain fall off or be blown away.

In very dry weather, wild wheat and barley ripen—their axes totally disintegrating—in just three days (Flannery 1973). The brittle axis must have been even more irritating to people who planted the seeds and waited for the harvest. But fortunately, certain stalks of wild wheat and barley happened to have tough axes. These were the ones whose seeds people saved to plant the following year.

Another problem with wild cereals is that the edible portion is enclosed in a tough husk. This husk was too tough to remove with a pounding stone. Foragers had to roast the grain to make the husk brittle enough to come off. However, some wild plants happened to have genes for brittle husks. Humans chose the seeds of these plants (which would have germinated prematurely in nature) because they could be more effectively prepared for eating.

People also selected certain features in animals (Smith 1995). Some time after sheep were domesticated, advantageous new phenotypes arose. Wild sheep aren’t woolly; wool coats were products of domestication. Although it’s hard to imagine, a wool coat offers protection against extreme heat. Skin temperatures of sheep living in very hot areas are much lower than temperatures on the surface of their wool. Woolly sheep, but not their wild ancestors, could survive in hot, dry alluvial lowlands. Wool had an additional advantage: its use for clothing.

What are some of the differences between wild and domesticated animals? Plants got larger with domestication, while animals got smaller, probably because smaller animals are easier to control. Middle Eastern sites document changes in the horns of domesticated goats. Such change may have been genetically linked to some other desirable trait that has left no skeletal evidence behind.

We’ve seen that sheep and goats were the first animals to be domesticated in the ancient Middle East, where the domestication of cattle, pigs, and other animals came later. Domestication was an ongoing process, as people kept refining and
changing the traits they considered desirable in plants and animals—as they still do today through bioengineering. Different animals were domesticated at different times and in different regions. The factors that govern animal domestication are discussed further in the section “Explaining the Neolithic” later in this chapter.

**Food Production and the State**

The shift from foraging to food production was gradual. The knowledge of how to grow crops and breed livestock didn’t immediately convert Middle Easterners into full-time farmers and herders. Domesticated plants and animals began as minor parts of a broad-spectrum economy. Foraging for fruits, nuts, grasses, grains, snails, and insects continued.

Over time, Middle Eastern economies grew more specialized, geared more exclusively toward crops and herds. The former marginal zones became centers of the new economy and of population increase and emigration. Some of the increasing population spilled back into the Hilly Flanks, where people eventually had to intensify production by cultivating. Domesticated crops could now provide a bigger harvest than could the grains that grew wild there. Thus, in the Hilly Flanks, too, farming eventually replaced foraging as the economic mainstay.

Farming colonies spread down into drier areas. By 7000 B.P., simple irrigation systems had developed, tapping springs in the foothills. By 6000 B.P., more complex irrigation techniques made agriculture possible in the arid lowlands of southern Mesopotamia. In the alluvial desert plain of the Tigris and Euphrates rivers, a new economy based on irrigation and trade fueled the growth of an entirely new form of society. This was the state, a social and political unit featuring a central government, extreme contrasts of wealth, and social classes. The process of state formation is examined in the next chapter.

We now understand why the first farmers lived neither in the alluvial lowlands, where the Mesopotamian state arose around 5500 B.P., nor in the Hilly Flanks, where wild plants and animals abounded. Food production began in marginal zones, such as the piedmont steppe, where people experimented at reproducing, artificially, the dense grain stands that grew wild in the Hilly Flanks. As seeds were taken to new environments, new phenotypes were favored by a combination of natural and human selection. The spread of cereal grains outside their natural habitats was part of a system of migration and trade between zones, which had developed in the Middle East during the broad-spectrum period. Food production also owed its origin to the need to intensify production to feed an increasing human population—the legacy of thousands of years of productive foraging.

**OTHER OLD WORLD FOOD PRODUCERS**

The path from foraging to food production was one that people followed independently in at least seven world areas. As we’ll see later in this chapter, at least three were in the Americas. At least four were in the Old World. In each of these centers, people independently invented domestication, although of different sets of crops and animals.

As we’ll see in more detail later in this chapter, food production also spread from the Middle East. This happened through trade; through diffusion of plants, animals, products, and information; and through the actual migration of farmers. Middle Eastern domesticates spread westward to northern Africa, including Egypt’s Nile Valley, and into Europe (Price 2000). Trade also extended eastward from the Middle East to India and Pakistan. In Egypt, an agricultural economy based on plants and animals originally domesticated in the Middle East led to a pharaonic civilization.

**The African Neolithic**

Excavations in southern Egypt have revealed considerable complexity in its Neolithic economy.
and social system, along with very early pottery and cattle, which may have been domesticated locally rather than imported from the Fertile Crescent. Located in the eastern Sahara and southern Egypt, Nabta Playa is a basin that, during prehistoric summers, filled with water. Over several millennia this temporary lake attracted people who used it for social and ceremonial activities (Wendorf and Schild 2000). Nabta Playa was first occupied around 12,000 B.P., as Africa’s summer rains moved northward, providing moisture for grasses, trees, bushes, hares, and gazelle, along with humans. The earliest settlements (11,000–9300 B.P.) at Nabta were small seasonal camps of herders of domesticated cattle. (Note the very early, and perhaps independent, domestication of cattle here.) According to Wendorf and Schild (2000), Nabta Playa provides early evidence for what anthropologists have called the “African cattle complex,” in which cattle are used economically for their milk and blood, rather than killed for their meat (except on ceremonial occasions). Nabta was occupied only seasonally, as people came over from the Nile or from better-watered areas to the south. They returned to those areas in the fall.

By 9000 B.P. people were living at Nabta Playa year-round. To survive in the desert, they dug large, deep wells and lived in well-organized villages, with small huts arranged in straight lines. Plant remains show they collected sorghum, millet, legumes (peas and beans), tubers, and fruits. These were wild plants, and so the economy was not fully Neolithic. By 8800 B.P. these people were making their own pottery, possibly the earliest Neolithic. By 8100 B.P. sheep and goats had diffused in from the Middle East.

Around 7500 B.P. new settlers occupied Nabta, whose previous inhabitants had been forced away by a major drought. The newcomers brought a more sophisticated social and ceremonial system. They sacrificed young cattle, which they buried in clay-lined and roofed chambers covered with rough stone slabs. They lined up large, unshaped stones. They also built Egypt’s earliest astronomical measuring device: a “calendar circle” used to mark the summer solstice. Nabta Playa had become a regional ceremonial center: a place where various groups gathered seasonally or occasionally to conduct ceremonies and to socialize. The existence of such centers, as well as their religious, political, and social functions, is familiar to ethnographers who have worked in Africa. Nabta seems to have been such a center for prehistoric herders who lived in southern Egypt. It probably began to function as a regional ceremonial center around 8100–7600 B.P., when various groups gathered there for ceremonial and other purposes during the summer wet season.

Gathering on the northwestern shores of the summer lake, those ancient people left debris, including numerous cattle bones. At other African Neolithic sites (Edwards 2004), cattle bones are rarely numerous, which suggests that the cattle were being tapped “on the hoof” for their milk and blood, rather than being slaughtered and eaten. The numerous cattle bones at Nabta Playa, however, suggest that its people killed cattle seasonally for ceremonial purposes. Among modern African herders, cattle, which represent wealth and political power, are rarely killed except on important ceremonial or social occasions.

Nabta’s role as a regional ceremonial center is also suggested by an alignment of nine large upright stone slabs near the place where people gathered, along the northwest margin of the seasonal lake. This formation, probably dating between 7500 and 5500 B.P., recalls similarly dated large stone alignments found in Western Europe, which were built during the late Neolithic and early Bronze Age.

Construction of large, complex megalithic structures requires well-organized work parties and a major effort. This suggests that some authority (religious or civil) may have been managing resources and human labor over time. The findings at Nabta Playa represent an elaborate and previously unsuspected ceremonialism, as well as social complexity, during the African Neolithic.

The Neolithic in Europe and Asia

Around 8000 B.P., communities on Europe’s Mediterranean shores, in Greece, Italy, and France, started shifting from foraging to farming, using imported species. By 7000 B.P., there were fully sedentary farming villages in Greece and Italy. By 6000 B.P., there were thousands of farming villages as far east as Russia and as far west as northern France (see Bogaard 2004).

Domestication and Neolithic economies spread rapidly across Eurasia. Archaeological research confirms the early (8000 B.P.) presence of domesticated goats, sheep, cattle, wheat, and barley in Pakistan (Meadow 1991). In that country’s Indus River Valley, ancient cities (Harappa and Mohenjodaro) emerged slightly later than did the first Mesopotamian city-states. Domestication and state formation in the Indus Valley were influenced by developments in, and trade with, the Middle East.

China was also one of the first world areas to develop farming, based on millet and rice. Millet is a tall, coarse cereal grass still grown in northern China. This grain, which today feeds a third of the world’s population, is used in contemporary North America mainly as birdseed. By 7500 B.P., two varieties of millet supported early farming
communities in northern China, along the Yellow River. Millet cultivation paved the way for widespread village life and eventually for Shang dynasty civilization, based on irrigated agriculture, between 3600 and 3100 B.P. (See Chapter 12.) The northern Chinese also had domesticated dogs, pigs, and possibly cattle, goats, and sheep by 7000 B.P. (Chang 1977).

Discoveries by Chinese archaeologists suggest that rice was domesticated in the Yangtze River corridor of southern China as early as 8400 B.P. (Smith 1995). Other early rice comes from the 7,000-year-old site Hemudu, on Lake Dongting in southern China. The people of Hemudu used both wild and domesticated rice, along with domesticated water buffalo, dogs, and pigs. They also hunted wild game (Jolly and White 1995).

China seems to have been the scene of two independent transitions to food production, based on different crops grown in strikingly different climates. Southern Chinese farming was rice aquaculture in rich subtropical wetlands. Southern winters were mild; and summer rains, reliable. Northern China, by contrast, had harsh winters, with unreliable rainfall during the summer growing season. This was an area of grasslands and temperate forests. Still, in both areas by 7500 B.P., food production supported large and stable villages. Based on the archaeological evidence, early Chinese villagers had architectural expertise. They lived in substantial houses, made elaborate ceramic vessels, and had rich burials.

At Nok Nok Tha in central Thailand, pottery made more than 5,000 years ago has imprints of husks and grains of domesticated rice (Solheim 1972/1976). Animal bones show that the people of Nok Nok Tha also had humped zebu cattle similar to those of contemporary India. Rice might have been cultivated at about the same time in the Indus River Valley of Pakistan and adjacent western India.

It appears that food production arose independently at least seven times in different world areas. Figure 11.3 is a map highlighting those seven areas: the Middle East, northern China, southern China, sub-Saharan Africa, central Mexico, the south central Andes, and the eastern United States. A different set of major foods was domesticated, at different times, in each area, as is shown in Recap 11.2. Some grains, such as millet and rice, were domesticated more than once. Millet grows wild in China and Africa, where it became an important food crop, as well as in Mexico, where it did not. Indigenous African rice, grown only in West Africa, belongs to the same genus as Asian rice. Pigs and probably cattle were independently domesticated in the Middle East, China, and sub-Saharan Africa. Independent domestication of the dog was virtually a worldwide phenomenon, including the Western Hemisphere. We turn now to archaeological sequences in the Americas.
As hunters benefiting from the abundance of big game, bands of foragers gradually spread through the Americas. As they moved, these early Americans learned to cope with a great diversity of environments. Eventually their descendants would independently invent food production, paving the way for the emergence of states based on agriculture and trade in Mexico and Peru.

The most significant contrast between Old and New World food production involved animal domestication, which was much more important in the Old World than in the New World. The animals that had been hunted during the early American big-game tradition either became extinct before people could domesticate them or were not domesticae. The largest animal ever domesticated in the New World (in Peru, around 4500 B.P.) was the llama. Early Peruvians and Bolivians ate llama meat and used that animal as a beast of burden (Flannery, Marcus, and Reynolds 1989). They

**FIGURE 11.3** Seven World Areas Where Food Production Was Independently Invented.

Do any of these areas surprise you?

**SOURCE:** Bruce D. Smith, The Emergence of Agriculture (New York: Scientific American Library, 1995), p. 12. Reprinted by permission of the author. smith.bruce@nmnh.si.edu

**RECAP 11.2** Seven World Areas Where Food Production Was Independently Invented

<table>
<thead>
<tr>
<th>WORLD AREA</th>
<th>MAJOR DOMESTICATED PLANTS/ANIMALS</th>
<th>EARLIEST DATE (B.P.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle East</td>
<td>Wheat, barley, sheep, goats, cattle, pigs</td>
<td>10,000</td>
</tr>
<tr>
<td>Andean region</td>
<td>Squash, potato, quinoa, beans, camelids (llama, alpaca), guinea pigs</td>
<td>10,000–5000</td>
</tr>
<tr>
<td>Southern China (Yangtze River corridor)</td>
<td>Rice, water buffalo, dogs, pigs</td>
<td>8500–6500</td>
</tr>
<tr>
<td>Mesoamerica</td>
<td>Maize, beans, squash, dogs, turkeys</td>
<td>8000–4700</td>
</tr>
<tr>
<td>Northern China (Yellow River)</td>
<td>Millet, pearl millet, African rice, dogs, pigs, chickens</td>
<td>7500</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>Sorghum, pearl millet, African rice, dogs, chickens</td>
<td>4000</td>
</tr>
<tr>
<td>Eastern United States</td>
<td>Goosefoot, marsh elder, sunflower, squash</td>
<td>4500</td>
</tr>
</tbody>
</table>

**SOURCE:** Data compiled from Bruce D. Smith, The Emergence of Agriculture (New York: Scientific American Library, W. H. Freeman, 1995).
Early Peruvians and Bolivians ate llama meat, harnessed llamas as beasts of burden, and used llama dung to fertilize their fields. What was the largest animal domesticated in the New World?

By diffusion, manioc or cassava, originally domesticated in lowland South America, has become a caloric staple in the tropics worldwide. This young Thai farmer displays his manioc crop.

**maize**
Corn, first domesticated in tropical southwestern Mexico around 8000 B.C.

**manioc**
Cassava; tuber domesticated in the South American lowlands.

...bred the llama’s relative, the alpaca, for its wool. Peruvians also added animal protein to their diet by raising and eating guinea pigs and ducks.

The turkey was domesticated in Mesoamerica and in the southwestern United States. Lowland South Americans domesticated a type of duck. The dog is the only animal that was domesticated throughout the New World. There were no cattle, sheep, or goats in the areas where food production arose. As a result, neither herding nor the kinds of relationships that developed between herders and farmers in many parts of the Middle East, Europe, Asia, and Africa emerged in the precolonial Americas. The New World crops were different, although staples as nutritious as those of the Old World were domesticated from native wild plants.

Three key caloric staples, major sources of carbohydrates, were domesticated by Native American farmers. **Maize**, or corn, first domesticated in the tropical lowlands of southwestern Mexico, became the caloric staple in Mesoamerica and Central America and eventually reached coastal Peru. The other two staples were root crops: white (“Irish”) potatoes, first domesticated in the Andes, and **manioc**, or cassava, a tuber first cultivated in the South American lowlands, where other root crops such as yams and sweet potatoes also were important. Other crops added variety to New World diets and made them nutritious. Beans and squash provided essential proteins, vitamins, and minerals. Maize, beans, and squash were the basis of the Mesoamerican diet. This chapter’s “Appreciating Anthropology” discusses how anthropologists recently have confirmed that the earliest domesticates, including squash, in the Americas are about as old as the first Old World domesticates.
Food production was independently invented in at least three areas of the Americas: Mesoamerica, the eastern United States, and the south central Andes. Mesoamerica is discussed in detail below. Food plants known as goosefoot and marsh elder, along with the sunflower and a species of squash, were domesticated by Native Americans in the eastern United States by 4500 B.P. Those crops supplemented a diet based mainly on hunting and gathering. They never became caloric staples like maize, wheat, rice, millet, manioc, and potatoes. Eventually, maize diffused from Mesoamerica into what is now the United States, reaching both the Southwest and the eastern area just mentioned. Maize provided a more reliable caloric staple for native North American farming. Domestication of several species was under way in the south central Andes of Peru and Bolivia by 5,000 B.P. They were the potato, quinoa (a cereal grain), beans, llamas, alpacas, and guinea pigs (Smith 1995). This chapter’s “Appreciating Anthropology” discusses how anthropologists recently have confirmed the very early domestication of squash, cotton, and peanuts in Peru.

The Tropical Origins of New World Domestication

Based on microscopic evidence from early cultivated plants, New World farming began in the lowlands of South America and then spread to Central America, Mexico, and the Caribbean islands. In Chapter 4 we learned about new techniques that allow archaeologists and botanists to recover and analyze microscopic evidence from pollens, starch grains, and phytoliths (plant crystals) (Bryant 2003, 2007). This evidence has forced revision of old assumptions, most prominently the idea that New World farming originated in upland areas, such as the highlands of Mexico and Peru. This chapter’s “Appreciating Anthropology” reports that domesticated squash seeds from Peru date back 10,000 years. Although found in the highlands (western Andes), those seeds, along with other domesticates from that site, were not domesticated there originally. This means that domestication must have occurred even earlier, most probably in South America’s tropical lowlands.

Dolores Piperno and Karen Stothert (2003) found that phytoliths from cultivated squashes and gourds are substantially larger than those from wild species. They then used phytolith size to confirm that domesticated squash and gourds (Cucurbita) were grown in coastal Ecuador between 9,000 and 10,000 years ago. According to Piperno and Deborah Pearsall (1998), farming in the tropical lowlands of Central and South America began at about the same time as food production arose in the Middle East—around 10,000 years ago. By that time, cultural groups in Panama, Peru, Ecuador, and Colombia were cultivating plants in garden plots near their homes. Between 9000 and 8000 B.P., changes in seed form and phytolith size suggest that farmers were selecting certain characteristics in their cultivated plants. By 7,000 years ago, farmers had expanded their plots into nearby forests, which they cleared using slash-and-burn techniques. By that time also, early farming ideas and techniques were diffusing from tropical lowlands into drier regions at higher elevations (Piperno and Pearsall 1998; Bryant 1999, 2003).

What about maize (corn), a major New World crop, long thought to have been domesticated in the Mexican highlands? Recent molecular and genetic studies indicate that maize domestication actually took place in the lowlands of southwestern Mexico. The wild ancestor of maize is a species of teosinte (a wild grain) native to the Rio Balsas watershed of tropical southwestern Mexico (Holst, Moreno, and Piperno 2007). Evidence for the evolution of maize from its wild ancestor has yet to be found in that poorly studied region. Still, we can infer some of the likely steps in maize domestication.

Such a process would have included increases in the number of kernels per cob, cob size, and the number of cobs per stalk (Flannery 1973). These changes would make it increasingly profitable to collect wild teosinte and eventually to plant...
The Early Origin of New World Domestication

New dating techniques applied to plant remains found in northern Peru have pushed back the origin of domestication in the New World to about the same time that food production arose in the Old World. Previously anthropologists had believed that Old World (Middle Eastern) farming predated the earliest cultivation in the Americas by three or four millennia. Peruvian squash seeds dating back 10,000 years show there was no such time lag between the first farming in the New World and in the Old. Other sites and dates discussed in this chapter support this finding.

Seeds of domesticated squash found by scientists on the western slopes of the Andes in northern Peru are almost 10,000 years old, about twice the age of previously discovered cultivated crops in the region, new, more precise dating techniques have revealed.

The findings about Peru and recent research in Mexico, anthropologists say, are evidence that some farming developed in parts of the Americas nearly as early as in the Middle East, which is considered the birthplace of the earliest agriculture.

Digging under house floors and grinding stones and in stone-lined storage bins, the archaeologist Tom D. Dillehay of Vanderbilt University, in Nashville, uncovered the squash seeds at several places in the Ñanchoc Valley, near the Pacific coast about 400 miles north of Lima. The excavations also yielded peanut hulls and cotton fibers—about 8,500 and 6,000 years old, respectively.

The new, more precise dating of the plant remains, some of which were collected two decades ago, is being reported by Dr. Dillehay and colleagues in today’s issue of the journal Science.

Their research also turned up traces of other domesticated plants, including a grain, manioc and unidentified fruits, and stone hoes, furrowed garden plots and small-scale irrigation canals from approximately the same period of time.

The researchers concluded that these beginnings in plant domestication “served as catalysts for rapid social changes that eventually contributed to the development of intensified agriculture, institutionalized political power and towns in both the Andean highlands and on the coast between 5,000 and 4,000 years ago.”

The evidence at Ñanchoc, Dr. Dillehay’s team wrote, indicated that “agriculture played a more important and earlier role in the development of Andean civilization than previously understood.”

In an accompanying article on early agriculture, Eve Emshwiller, an ethnobotanist at the University of Wisconsin, Madison, was quoted as saying that the reports of early dates for plant domestication in the New World were remarkable because this appeared to have occurred not long after humans colonized the Americas, now thought to be at least 13,000 years ago.

The article also noted that 10,000-year-old cultivated squash seeds had recently been reported in Mexico, along with evidence of domesticated corn there by 9,000 years ago . . .

In the Fertile Crescent of the Middle East, an arc from modern-day Israel through Syria and Turkey to Iraq, wheat and barley were domesticated by 10,000 years ago, and possibly rye by 13,000 years ago . . .

Dr. Dillehay has devoted several decades of research to ancient cultures in South America. His most notable previous achievement was the discovery of a campsite of hunter-gatherers at Monte Verde, in Chile, which dates to 13,000 years ago. Most anthropologists recognize this as the earliest

maize. Undoubtedly, some of the mutations necessary for domesticated maize had occurred in wild teosinte before people started growing it. However, since teosinte was well adapted to its natural niche, the mutations offered no advantage and didn’t spread. But once people started harvesting wild maize intensively, they became selective agents, taking back to camp a greater proportion of plants with tough axes and cobs. These were the plants most likely to hold together during harvesting and least likely to disintegrate on the way back home. Eventually, teosinte became dependent on humans for its survival because maize lacks a natural means of dispersal—a brittle axis or cob. If humans chose plants with tough axes inadvertently, their selection of plants with soft husks must have been intentional, as was their selection of larger cobs, more kernels per cob, and more cobs per plant.

A phytolith analysis of sediments from San Andrés, in the Mexican state of Tabasco, confirms the spread of maize cultivation eastward to the tropical Mexican Gulf Coast by 7300 b.p. Data from many sites now confirm that maize spread rapidly from its domestication cradle in tropical southwestern Mexico during the eighth millennium b.p. (8000–7001) (Bryant 2007b; Piperno 2001; Pohl et al. 2007). For example, analysis of starch grains from stone tools in Panama’s tropical lowlands confirms that maize was grown there by 7800–7000 b.p. (Dickau, Ranere, and Cooke 2007).
The distribution of building structures, canals and furrowed fields, Dr. Dillehay said, indicated that the Andean culture was moving beyond cultivation limited to individual households toward an organized agricultural society. Botanists studying the squash, peanut, and cotton remains determined that the specific strains did not grow naturally in the Ñanchoc area. The peanut, in particular, was thought to be better suited to cultivation in tropical forests and savannas elsewhere in South America.

During the last century, for reasons enumerated by Vaughn Bryant (2003), archaeologists tended to seek evidence for early New World farming in the highlands of Mexico and Peru. These upland areas were easy to reach and had caves and rock shelters with preserved plant remains. They also were in the vicinity of the centers of major civilizations that would eventually develop in the Mexican highlands (see Chapter 12). Decades ago, excavations in the Mexican Valleys of Tehuacan and Oaxaca (see the next section) yielded well-preserved seeds and fruits, maize kernels and cobs, fibers, and rinds. Few archaeologists sought the origin of domestication in lowland and jungle regions, which were wrongly assumed to be infertile and where plants did not preserve well (Bryant 2003). Today, the microscopic evidence says otherwise and reveals the key role of tropical lowland regions in early New World farming.

**The Mexican Highlands**

Long before Mexican highlanders developed a taste for maize, beans, and squash, they hunted as part of a pattern of broad-spectrum foraging. Mammoth remains dated to 11,000 B.P. have been found along with spear points in the basin that surrounds Mexico City. However, small animals were more important than big game, as were the grains, pods, fruits, and leaves of wild plants.
In the Valley of Oaxaca, in Mexico’s southern highlands, between 10,000 and 4000 B.P., foragers concentrated on certain wild animals—deer and rabbits—and plants—cactus leaves and fruits, and tree pods, especially mesquite (Flannery 1986). Those early Oaxacans dispersed to hunt and gather in fall and winter. But they came together in late spring and summer, forming larger groups to harvest seasonally available plants. Cactus fruits appeared in the spring. Since summer rains would reduce the fruits to mush and since birds, bats, and rodents competed for them, cactus collection required hard work by large groups of people. The edible pods of the mesquite, available in June, also required intensive gathering.

Eventually, people started planting maize in the alluvial soils of valley floors. This was the zone where foragers traditionally had congregated for the annual spring/summer harvest of cactus fruits and mesquite pods. By 4000 B.P., a type of maize was available that provided more food than the mesquite pods did. Once that happened, people started cutting down mesquite trees and replacing them with corn fields.

By 3500 B.P. in the Valley of Oaxaca, where winter frosts are absent, simple irrigation permitted the establishment of permanent villages based on maize farming. Water close to the surface allowed early farmers to dig wells right in their corn fields. Using pots, they dipped water out of these wells and poured it on their growing plants, a technique known as pot irrigation. Early permanent villages supported by farming appeared in areas of Mesoamerica where there was reliable rainfall, pot irrigation, or access to humid river bottomlands.

The spread of maize farming resulted in further genetic changes, higher yields, higher human populations, and more intensive farming. Pressures to intensify cultivation led to improvements in water-control systems. New varieties of fast-growing maize eventually appeared, expanding the range of areas that could be cultivated. Increasing population and irrigation also helped spread maize farming. The advent of intensive cultivation laid the foundation for the emergence of the state in Mesoamerica—some 3,000 years later than in the Middle East, a process examined in the next chapter.

EXPLAINING THE NEOLITHIC

This section focuses on the factors that influenced the origin and spread of Neolithic economies in various world areas. (Much of this section is based on observations in Chapters 8 through 10 of Jared Diamond’s influential book Guns, Germs, and Steel: The Fates of Human Societies [1997]).

Several factors had to converge to make domestication happen and to promote its spread. Most plants, and especially animals, aren’t easy—or particularly valuable—to domesticate. Thus, of some 148 large animal species that seem potentially domesticable, only 14 actually have been domesticated. And a mere dozen among 200,000 known plant species account for 80 percent of the world’s farm production. Those 12 caloric staples are wheat, corn (maize), rice, barley, sorghum (millet), soybeans, potatoes, cassava (manioc), sweet potatoes, sugarcane, sugar beets, and bananas.

Domestication rested on a combination of conditions and resources that had not come together previously. The development of a full-fledged Neolithic economy required settling down. Sedentism, such as that adopted by ancient Natufian hunter-gatherers, was especially attractive when several species of plants and animals were available locally for foraging and eventual domestication. The Fertile Crescent area of the Middle East had such species, along with a Mediterranean climate favorable to the origin and spread of the Neolithic economy. Among those species were several self-pollinating plants, the easiest wild plants to domesticate, including wheat, which required few genetic changes for domestication. We’ve seen that the Natufians adopted sedentism prior to farming. They lived off abundant wild grain and the animals attracted to the stubble left after the harvest. Eventually, with climate change, population growth, and the need for people to sustain themselves in the marginal zones, hunter-gatherers started cultivating.

Compared with other world areas, the Fertile Crescent region had the largest area with a...
Mediterranean climate, with the highest species diversity. As we saw previously, this was an area of vertical economy and closely packed microenvironments. Such diverse terrains and habitats concentrated in a limited area offered a multiplicity of plant species, as well as goats, sheep, pigs, and cattle. The first farmers eventually domesticated several crops: two kinds of wheat, barley, lentils, peas, and chickpeas (garbanzo beans). As in Mesoamerica, where corn (supplying carbohydrate) was supplemented by squash and beans (supplying protein), the Neolithic diet of the Middle East combined caloric staples such as wheat and barley with protein-rich pulses such as lentils, peas, and chickpeas.

Anthropologists once thought, erroneously, that domestication would happen almost automatically once people gained sufficient knowledge of plants and animals and their reproductive habits to figure out how to make domestication work. Anthropologists now realize that foragers have an excellent knowledge of plants, animals, and their reproductive characteristics, and that some other trigger is needed to start and sustain the process of domestication. A full-fledged Neolithic economy requires a minimal set of nutritious domesticates. Some world areas, for example, North America (north of Mesoamerica), managed independently to invent domestication, but the inventory of available plants and animals was too meager to maintain a Neolithic economy.

The early domesticates—squash, sunflower, marsh elder, and goosefoot—had to be supplemented by hunting and gathering. A full Neolithic economy and sedentism did not develop in the east, southeast, and southwest of what is now the United States until maize diffused in from Mesoamerica—more than 3,000 years after the first domestication in the eastern United States.

We’ve seen how the presence or absence of domesticable animals helps explain the divergent trajectories of the Eastern and Western hemispheres in that the mixed economies that developed in Eurasia and Africa never emerged in Mesoamerica. Of the world’s 14 large (over 100 pounds) successful domesticated animal species, 13 are from Eurasia, and only 1 (the llama) is from South America. Ancient Mexicans domesticated dogs and turkeys and created toy wheels, but they lacked sheep, goats, and pigs as well as the oxen or horses needed to make the wheel a viable transport option. Once the big five Eurasian animal domesticates (cow, sheep, goat, pig, horse) were introduced into Africa and the Americas, they spread rapidly.

We’ve seen that detailed knowledge of plants and their reproduction is not a sufficient condition for domestication to occur. Similarly, the knowledge that animals can be tamed or kept as pets isn’t enough to produce animal domestication, because not all tamed animals can be domesticated. Just as some plants (e.g., self-pollinating annuals) are easier to domesticate than others are, so are some animals. Cattle, dogs, and pigs were so easy to domesticate that they were domesticated independently in multiple world areas.

Consider some reasons why most large animal species (134 out of 148 big species) have not been domesticated. Some are finicky eaters (e.g., koalas). Others refuse to breed in captivity (e.g., vicunas). Some animals are just too nasty to domesticate (e.g., grizzly bears), and others have a tendency to panic (e.g., deer and gazelles).

Perhaps the key factor in domestication is animal social structure. The easiest wild animals to domesticate live in hierarchical herds. Accustomed to dominance relations, they allow humans to assume superior positions in the hierarchy. Herd animals are easier to domesticate than solitary ones are. Among the latter, only cats and ferrets have been domesticated, and there’s some question about the completeness of domestication of those animals (hence the expression “It’s like herding cats”). A final factor in ease of domestication is whether a wild animal typically shares its range with others. Animals with exclusive territories (e.g., rhinoceros, African antelope) are harder to pen up with others than are animals that share their territories with other species.

Geography and the Spread of Food Production

As Jared Diamond (1997, Chapter 10) observes convincingly, the geography of the Old World facilitated the diffusion of plants, animals, technology (e.g., wheels and vehicles), and information (e.g., writing). Most crops in Eurasia were domesticated just once and spread rapidly in an east-west direction. The first domesticates spread from the Middle East to Egypt, Northern Africa, Europe, India, and eventually China (which, however, also had its own domesticates, as we have seen). By contrast, there was less diffusion of American domesticates.

Look at Figure 11.4 to see that Eurasia has a much broader east–west spread than does Africa or does either of the Americas, which are arranged north–south. This is important because climates are more likely to be similar moving across thousands of miles east–west than north–south because of common day lengths and similar seasonal variations. More radical climatic contrasts have hindered north–south diffusion. In the Americas, for example, although the distance between the cool Mexican highlands and the South American highlands is just 1,200 miles, those two similar zones are separated by a low, hot, tropical region, which supports very different plant species than the highlands. Such environmental barriers to diffusion kept the
Neolithic societies of Mesoamerica and South America more separate and independent in the Americas than they were in Eurasia. It took some 3,000 years for maize to reach what is now the United States, where productive Neolithic economies eventually did develop. They were based on the cultivation of new varieties of maize adapted to a colder climate and different day lengths.

In the Old World, the spread of Middle Eastern crops southward into Africa eventually was halted by climatic contrasts as well. Certain tropical crops did spread west–east in Africa, but they did not reach Southern Africa because of climatic barriers. Again and again, the geographic and climatic barriers posed by high mountains and broad deserts have slowed the spread of domesticates. In what is now the United States, for example, the east–west spread of farming from the southeast to the southwest was slowed by the dry climates of Texas and the southern great plains.

This section has examined the factors that favored and retarded the origin and spread of Neolithic economies in various world areas. Several factors combined to promote early domestication in the ancient Middle East. The first domesticates spread rapidly across Eurasia, facilitated by climatic similarities across a broad territorial expanse. In the Americas, food production spread less rapidly because of north–south contrasts. Another factor that slowed the Neolithic transition in the Americas was the lack of large animals suitable for domestication. Factors that explain the origin and diffusion of food production involve climate, economic adaptation, demography, and the specific attributes of plants and animals.

COSTS AND BENEFITS

Food production brought advantages and disadvantages. Among the advantages were discoveries and inventions. People eventually learned to spin and weave; to make pottery, bricks, and arched masonry; and to smelt and cast metals. They developed trade and commerce by land and sea. By 5500 B.P., Middle Easterners were living in vibrant cities with markets, streets, temples, and palaces. They created sculpture, mural art, writing systems, weights, measures, mathematics, and new forms of political and social organization (Jolly and White 1995).

Because it increased economic production and led to new social, scientific, and creative forms, food production is often considered an evolutionary advance. But the new economy also brought hardships. For example, food producers typically...
work harder than foragers do—and for a less adequate diet. Because of their extensive leisure time, foragers have been characterized as living in “the original affluent society” (Sahlins 1972). Certain foragers have survived into recent times and have been studied by anthropologists. Among foragers living in the Kalahari Desert of southern Africa, for example, only part of the group needed to hunt and gather, maybe 20 hours a week, to provide an adequate diet for the entire group. Women gathered, and adult men hunted. Their labor supported older people and children. Early retirement from the food quest was possible, and forced child labor was unknown.

With food production, yields are more reliable, but people work much harder. Herds, fields, and irrigation systems need care. Weeding can require hours of arduous bending. No one has to worry about where to keep a giraffe or a gazelle, but pens and corrals are built and maintained for livestock. Trade takes men, and sometimes women, away from home, leaving burdens for those who stay behind. For several reasons, food producers tend to have more children than foragers do. This means greater child care demands, but child labor also tends to be more needed and valued than it is among foragers. Many tasks in farming and herding can be done by children. The division of economic labor grows more complex, so that children and older people have assigned economic roles.

And public health declines. Diets based on crops and dairy products tend to be less varied, less nutritious, and less healthful than foragers’ diets, which are usually higher in proteins and lower in fats and carbohydrates. With the shift to food production, the physical well-being of the population often declines. Communicable diseases, protein deficiency, and dental caries increase (Cohen and Armelagos 1984). Greater exposure to pathogens comes with food production.

Compared with a seminomadic foraging band, food producers tend to be sedentary. Their populations are denser, which makes it easier to transmit and maintain diseases. We saw in Chapter 5 that malaria and sickle-cell anemia spread along with food production. Population concentrations, especially cities, are breeding grounds for epidemic diseases. People live nearer to other people and animals and their wastes, which also affect public health (Diamond 1997). Compared with farmers, herders, and city dwellers, foragers were relatively disease-free, stress-free, and well nourished.

Other hardships and stresses accompanied food production and the state. Social inequality and poverty increased. Elaborate systems of social stratification eventually replaced the egalitarianism of the past. Resources were no longer common goods, open to all, as they tend to be among foragers. Property distinctions proliferated. Slavery and other forms of human bondage eventually were invented. Crime, war, and human sacrifice became widespread.

The rate at which human beings degraded their environments also increased with food production. The environmental degradation in today’s world, including air and water pollution and deforestation, is on a much larger scale, compared with early villages and cities, but modern trends are foreshadowed. After food production, population increase and the need to expand farming led to deforestation in the Middle East. Even today, many farmers think of trees as giant weeds to be cut down to make way for productive fields. Previously, we saw how early Mesoamerican farmers cut down mesquite trees for maize cultivation in the Valley of Oaxaca.

Many farmers and herders burn trees, brush, and pasture. Farmers burn to remove weeds; they also use the ashes for fertilizer. Herders burn to promote the growth of new tender shoots for their livestock. But such practices do have environmental costs, including air pollution. Smelting and other chemical processes basic to the manufacture of metal tools also have environmental costs. As modern industrial pollution has harmful effluents, early chemical processes had by-products that polluted air, soils, and waters. Salts,
chemicals, and microorganisms accumulate in irrigated fields. These and other pathogens and pollutants, which were by and large nonissues during the Paleolithic, endanger growing human populations. To be sure, food production had benefits. But its costs are just as evident. Recap 11.3 summarizes the costs and benefits of food production. We see that progress is much too optimistic a word to describe food production, the state, and many other aspects of the evolution of society.

1. By 10,000 B.P., people were pursuing broad-spectrum economies in the British Isles and Scandinavia. Tool kits adapted to a forested environment included small, delicately shaped stone tools called microliths. The Mesolithic had begun. The broad-spectrum revolution, based on a wide variety of dietary resources, began in the Middle East somewhat earlier than in Europe. It culminated in the first food-producing economies in the Middle East around 10,000 B.P.

2. After 15,000 B.P., as the big-game supply diminished, foragers sought out new foods. By 10,000 B.P., domesticated plants and animals were part of a broad spectrum of resources used by Middle Easterners. By 7500 B.P., most Middle Easterners were moving away from broad-spectrum foraging toward more specialized food-producing economies. Neolithic refers to the period when the first signs of domestication appeared.

3. Braidwood proposed that food production started in the Hilly Flanks zone, where wheat and barley grew wild. Others questioned this: The wild grain supply in that zone already provided an excellent diet for the Natufians and other ancient Middle Easterners. There would have been no incentive to domesticate. Other scholars view the origin of food production in the context of increasing population and climate changes.

### RECAP 11.3 The Benefits and Costs of Food Production (Compared with Foraging)

<table>
<thead>
<tr>
<th>BENEFITS</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discoveries and inventions</td>
<td>Harder work</td>
</tr>
<tr>
<td>New social, political, scientific, and creative forms (e.g., spinning,</td>
<td>Less nutritious diets</td>
</tr>
<tr>
<td>weaving, pottery, bricks, metallurgy)</td>
<td>Child labor and child care demands</td>
</tr>
<tr>
<td>Monumental architecture, arched masonry, sculpture</td>
<td>Taxes and military drafts</td>
</tr>
<tr>
<td>Writing</td>
<td>Public health declines (e.g., more exposure to pathogens,</td>
</tr>
<tr>
<td></td>
<td>including communicable and epidemic diseases)</td>
</tr>
<tr>
<td>Mathematics, weights, and measures</td>
<td>Rise in protein deficiency and dental caries</td>
</tr>
<tr>
<td>Trade and markets</td>
<td>Greater stress</td>
</tr>
<tr>
<td>Urban life</td>
<td>Social inequality and poverty</td>
</tr>
<tr>
<td>Increased economic production</td>
<td>Slavery and other forms of human bondage</td>
</tr>
<tr>
<td>More reliable crop yields</td>
<td>Rise in crime, war, and human sacrifice</td>
</tr>
<tr>
<td></td>
<td>Increased environmental degradation (e.g., air and water</td>
</tr>
<tr>
<td></td>
<td>pollution, deforestation)</td>
</tr>
</tbody>
</table>
4. Ancient Middle Eastern foragers migrated seasonally in pursuit of game. They also collected wild plant foods as the plants ripened at different altitudes. As they moved about, these foragers took grains from the Hilly Flanks zone, where they grew wild, to adjacent areas. Population spilled over from the Hilly Flanks into areas like the piedmont steppe. In such marginal zones, people started cultivating plants. They were trying to duplicate the dense wild grains of the Hilly Flanks.

5. After the harvest, sheep and goats fed off the stubble of these wild plants. Animal domestication occurred as people started selecting certain features and behavior and guiding the reproduction of goats, sheep, cattle, and pigs. Gradually, food production spread into the Hilly Flanks. Later, with irrigation it spread down into Mesopotamia's alluvial desert, where the first cities, states, and civilizations developed by 3500 B.C.E. Food production then spread west from the Middle East into North Africa and Europe and east to India and Pakistan.

6. There were at least seven independent inventions of food production: in the Middle East, sub-Saharan Africa, northern and southern China, Mesoamerica, the south central Andes, and the eastern United States. Millet was domesticated by 7000 B.C.E. in northern China; and rice, by 8000 B.C.E. in southern China.

7. In the New World the most important domesticates were maize, potatoes, and manioc. The llama of the central Andes was the largest animal domesticated in the New World, where herding traditions analogous to those of the Old World did not develop. Economic similarities between the hemispheres must be sought in foraging and farming.

8. New World farming started in the lowlands of South America, then spread to Central America, Mexico, and the Caribbean islands. Tropical lowland cultivation in Central and South America began at about the same time as food production arose in the Middle East—around 10,000 years ago. By 7000 B.C.E., farming was diffusing from tropical lowlands into drier regions at higher elevations. The specific ancestor of maize, teosinte, grows wild in tropical southwestern Mexico, where maize probably was domesticated around 8000 B.C.E. At Oaxaca, in Mexico’s southern highlands, maize was gradually added to a broad-spectrum diet by 4000 B.C.E. Permanent villages supported by maize cultivation arose in the lowlands and in a few frost-free areas of the highlands.

9. Several factors, including a diversity of useful plant and animal species and early sedentism, combined to promote domestication in the ancient Middle East. Domesticates spread rapidly across Eurasia, facilitated by climatic similarities across a broad territorial expanse. In the Americas, food production spread less rapidly because of north–south contrasts. Another factor that slowed the Neolithic transition in the Americas was the lack of large animals suitable for domestication. Factors that explain the origin and diffusion of food production involve climate, economic adaptation, demography, and the specific attributes of plants and animals.

10. Food production and the social and political system it supported brought advantages and disadvantages. The advantages included discoveries and inventions. The disadvantages included harder work, poorer health, crime, war, social inequality, and environmental degradation.
3. Why were the Natufians able to live in year-
round villages prior to the emergence of
domestication?
   a. Because their diet became hyperspecialized
to the locally grown foods.
   b. Because they could exploit their rich local
environment with broad-spectrum foraging.
   c. Because they had a low-calorie diet relative
to the average caloric intake of foragers.
   d. Because they traded with nearby populations
that did develop domestication.
   e. Because they reduced the population size
of their villages.

4. Early cultivation in the Middle East began as an
attempt to
   a. improve, in a more favorable environment,
the foraging techniques of villagers living
in the Hilly Flanks.
   b. improve the supply of animal feed for the
already domesticated cattle.
   c. win a war against nomads encroaching on
Natufian territory.
   d. copy, in a less favorable environment, the
dense stands of wheat and barley that grew
wild in the Hilly Flanks.
   e. impose a social hierarchy among the Natu-
fi an commoners.

5. Why do most domesticated grains (such as
wheat and barley) have a tougher axis and
more brittle husk than wild grains?
   a. Grains with a weak axis and husk could
not survive in the wild.
   b. They get better nutrients through being
domesticated.
   c. The practices of harvesting and processing
grain gradually selected for these features.
   d. The first domesticated grains were from
the alluvial plains, where caprine infl-
ences strengthened the axis and husk.
   e. B and D only

6. In the alluvial desert plain of the Tigris and Eu-
phrates rivers, a new economy based on irrigation
and trade fueled the growth of an entirely
new form of society:
   a. the Jomon, a social and political unit with
roots in East Asia.
   b. the state, a social and political unit featur-
ing a central government, extreme con-
trasts of wealth, and social classes.
   c. the city-state, a social and political unit
featuring egalitarianism.
   d. the state, featuring what Marshall Sahlins
called “the original affluent society.”
   e. the village.

7. Food production spread out from the Middle
East through trade, diffusion of domesticated
species, and actual migration of farmers, to
northern Africa, Europe, India, and Pakistan.
However, archeological evidence suggests that
   a. in southern Egypt, cattle may have been
domesticated locally rather than imported
from the Fertile Crescent.
   b. in Oaxaca, llama may have been domesti-
cated locally rather than imported from the
Fertile Crescent.
   c. in certain regions of Pakistan sheep may
have been domesticated independently.
   d. in southern France barley may have been
domesticated locally rather than imported
from the Fertile Crescent.
   e. in northern India wheat may have been
domesticated earlier than in the Fertile
Crescent.

8. The findings of Nabta Playa, located in the east-
ern Sahara and southern Egypt,
   a. represent an elaborate and previously un-
suspected ceremonialism, as well as social
complexity during the African Neolithic.
   b. suggest that it was a ceremonial site
where the economy was fully Neolithic
by 10,000 B.P.
   c. provide evidence for the “African sheep
complex.”
   d. suggest it was entirely isolated from Mid-
le Eastern influence until 5,000 B.P.
   e. represent a case of sheep and goat domesti-
cation unlike the one that occurred in the
Middle East.

9. Which of the following statements about life in
the Valley of Oaxaca prior to cultivation is not
true?
   a. People ate maguey, cactus, tree pods, deer,
and rabbit.
   b. The populations shifted seasonally
between bands and microbands.
   c. People lived in sedentary villages.
   d. The people periodically harvested the wild
grass, teosinte.
   e. The inhabitants were foragers.

10. Which of the following is correct about the
food-producing traditions of Mesopotamia and
Mesoamerica?
   a. Food production occurred as a gradual
process in Mesoamerica but was revolu-
tionary in Mesopotamia.
   b. In Mesoamerica, goats, sheep, and pigs
were domesticated; while in Mesopotamia,
only dogs were domesticated.
   c. Food production emerged in Mesoamerica
thousands of years prior to Mesopotamia.
   d. Maize was the staple grain in Mesopotama-
while the primary grain in Mesoamer-
ica was wheat.
   e. Large domesticated animals played an im-
portant role Mesopotamia, but were absent
from Mesoamerica.
FILL IN THE BLANK

1. _______ refers to the first cultural period in a given region in which the first signs of domestication are present.

2. A _______ is a system that exploits environmental zones that contrast with one another in altitude, rainfall, overall climate, and vegetation.

3. The practice of using cattle for their milk and blood rather than killing them for their meat (except on ceremonial occasions) is called _______.

4. In contrast to the sequence of events in Mesopotamia, food production _______ to the early village farming community (around 3500 B.C.) in _______.

5. Recent evidence has forced the revision of old assumptions in archaeology, most prominently the idea that New World farming originated in upland areas, such as the highlands of Mexico and Peru. Researchers now suggest that farming in the tropical lowlands of Central and South America began around _______ years ago, about the same time as food production in _______.

CRITICAL THINKING

1. What is revolutionary about what Kent Flannery (1969) called the “broad-spectrum revolution”? What other more recent events in history do you consider revolutionary? Why?

2. Why is the lack of animal domestication in Mesoamerica considered a key factor in world history?

3. Previously anthropologists had believed that Old World (Middle Eastern) farming predated the earliest cultivation in the Americas by three or four millennia. How have new dating techniques pushed back the origin or domestication in the New World?

4. In this chapter, what are some examples of the role geography plays in key events in human history? Geography also affects how we come to know about the past. How so?

5. Was the origin of food production good or bad. Why?