several waves of people. One group that arrived were once thought to have
wily melting ice sheet over
and the smaller ice sheet
the earliest reliably dated
them modern-day Chilen),
almost at the opposite
of arrival of people that
was based on fish, the
t down the Pacific coast

is were home to rich and
mous pulse of extinction
genera of large mammals
now gone extinct includes:
lo, the giant short-faced
ground sloth, the saber
beaver, one kind of tapi,
kinds of llama, one kind
olf, and the Glyptodont

pulse of extinctions was
the combination of rap
as of the land and chilled
ers farther south caused
concentrations. Many sci-
is same combination of
 glaciations, yet none of
sters of extinctions (see

n: Why would the cli-
be so completely differ-
to this question, some
ir growing skills at
This idea that humans
s known as the overkill
the pulse of extinction

occurred at least a few thousand years after the earliest human
arrivals. Possible responses to this criticism counter that human
populations took time to build to the levels needed to completely
cinate so many mammal species, or that the introduction of some
kind of new hunting technology soon after human arrival may have
been crucial.

The new arrivals from Asia were hunter-gatherers (and fishers)
lacking bronze or iron tools. Yet several American cultures had begun
to work copper by the time of European entry, and two of them (Aztecs
Mexico and Incas in Peru) had become massive empires. Also, as
noted above, American peoples had become among the world’s great-
est agriculturalists (see Table 6-1). But because of geographic isolation
(create by barriers of mountains and deserts) combined with very
different climate zones and natural vegetation, many agricultural in-
2sions remained localized, and agricultural patterns differed greatly
from region to region.

Mesoamerica (Mexico and Central America)

Mesoamerica spans a range of climatic and vegetation zones (Figure 6-2,
and see Figure 6-1). The region most relevant to the spread of agriculture
includes the semi-arid central Mexican highlands, with dry tropical forests
and runoff from mountain rains and snows, and wet tropical forests

![Map of Mesoamerica](image)

**FIGURE 6-2** Centers of early agriculture in Central America. [Adapted from map
by C. C. Mann, W. Doulllta, and P. Dana, in C. C. Mann, 1491 (New York: Random House, 2006);
courtesy of C. C. Mann.]
along the lowlands on the coast of the Pacific Ocean and Gulf of Mexico. These regions were the center of domestication of an amazing variety of foods, including maize, squash, tomatoes, avocados, and several types of beans (Figures 6-3 and 6-4). The wild ancestors of tomatoes grew naturally in the areas now known as Peru and Ecuador, and small plants with tiny berries that were smaller than modern-day peas, but the slow domestication of these wild varieties to larger forms apparently occurred in what is now western Mexico.

The first agriculture in this region dates to 10,000 years ago or earlier, when several kinds of squash were first domesticated and grown in tropical lowlands. This date rivals the earliest agriculture in China and lags not far behind the earliest agriculture in the Fertile Crescent. By 8,700 years ago, evidence of early domestication of maize—one of the three major modern-day grain crops in the world—appears in the Central Baja River valley in southwest present-day Mexico. Stone grinding tools of this era still have traces of maize on them, and DNA analyses suggest that initial domestication occurred at about the same time.

The natural ancestor of maize was debated for decades, because nothing similar to it grows wild in the region today. Careful archeological work and DNA analyses have shown that maize comes from a natural wild grass called teosinte, although the reason for its domestication remains something of a mystery. Wild wheat and rice have large grains that look like their domesticated successors, but teosinte has a dozen or so tiny “kernels” encased in a very hard outer casing (Figure 6-5). Why ear farmers found teosinte worth their attention is difficult to understand. One interested in the sugar-rich stalks of hays they didn’t actually pay much for it as a minor supplement to other seeds, farmers may have chosen grains that had open husks and didn’t exhibit the shattering behavior in any case, some how, over many the farmers ended up selecting for larger, more easily harvested ears.

As this process continued, maize of Mesoamericans for more than 4,000 years ago, of domestication had occurred by 8,700 years ago, too small to be relied on as a major food source along with wild food sources along with it not yet reached the point of providing enough people needed.

By 4,300 years ago, ears of maize became sufficiently productive to sustain agricultural use. Combining maize with beans, tomatoes, avocados (and later), people in what is now Centrally Nutritious had relatively large quantities of crops that are the result of its nutritional benefit, high in protein and other nutrients that can extract nitrogen from soil, allowed land to remain fertile. Eventually, maize and the other maize-producing regions of the Amazon Basin and lower forests of...
along the lowlands on the coasts of the Pacific Ocean and Gulf of Mexico. These regions were the center of domestication of an amazing variety of foods, including maize, squash, tomatoes, avocados, and several types of beans (Figures 6-3 and 6-4). The wild ancestors of tomatoes grew naturally in the areas now known as Peru and Ecuador as plants with tiny berries that, but the slow domestication of these only occurred in what is now western region dates to 10,000 years ago or were first domesticated and grown as the earliest agriculture in China. Agriculture in the Fertile Crescent.

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As this process continued, maize remained a minor item in the diet of Mesoamericans for more than 4,000 years. Even though some degree of domestication had occurred by 8,700 years ago, the ears (cobs) were too small to be relied on as a major food source, and people continued to eat wild food sources along with crops like squash. Agriculture had not yet reached the point of providing the complete nutritional base that people needed.

By 4,300 years ago, ears of maize had become large enough for the crop to become sufficiently productive for greater, more widespread agricultural use. Combining maize with squash (domesticated earlier) and with beans, tomatoes, avocados, and melons (all domesticated later), people in what is now Central Mexico gradually developed a fully nutritional package of crops planted together in plots called milpa. Aside from its nutritional benefit, this combination of crops (particularly beans that can extract nitrogen from the air and store it in the soil) allowed land to remain fertile for relatively long periods of time. Eventually, maize and the other milpa crops spread south into the Amazon Basin and lower forests of the Andes and then north into...
North America (Figure 6-6). Compared to Europe, however, the transition from a hunting and gathering life to a fully agricultural one was slow, in part because of the gradual pace of maize domestication, but also because wild animals suitable for domestication were not widely available for use in field labor.

In Mesoamerica, the success of milpa farming eventually made possible a sedentary life and the early emergence of several major civilizations based on agriculture (recall Figure 6-2). Between 3,500 and 2,500 years ago, the Olmec people on the Gulf Coast of Mexico formed one of the first technologically sophisticated cities, colossal stone statues, spread to many other regions. So Olmec art. Between 3,000 and 2,500 years ago, the Toltec and the Zapotecs followed by the Aztecs along the Pacific coast.

On the Yucatan Peninsula, between 4,000 and 3,000 years ago forests to cultivate maize. Mayan terracing higher terrain to direct water to fields in waterlogged terraced fields that supplied vegetation. Mayan populations in the frequent deforestation between 3,000 and 2,500.

The archeologist Arlen Chase of the Large Mayan city of Caracol in the LIDAR (Light Detection And Ranging) through the jungle canopies and the dense forested areas. Previously, twenty-five years of archeological fieldwork at this site created a map of the city’s layout. The survey thoroughly mapped an area a kilometer at the scale of features such as extensive agricultural terraces. Many more such revelations about this LIDAR survey, we know that Caracol had a population of all the land for miles around in

![Figure 6-6](image1.png) Dispersal of agriculture from centers in Mexico and the Andes. Numbers are thousands of years ago. (Adapted from P. Bellwood, First Farmers: The Origins of Agriculture (Oxford: Blackwell, 2004); and from M. D. Purugganan and D. O. Fuller, "The Nature of Selection During Plant Domestication," Nature 457 (2009): 843–848. doi:10.1038/nature07895.)

![Figure 6-7](image2.png) LIDAR-based reconstructions of Caracol and nearby area. (Courtesy of...
pared to Europe, however, the transition from a fully agricultural one was more gradual. The pace of maize domestication, while not widely known, eventually made possible the emergence of several major civilizations (Figure 6-2). Between 3,500 and 2,500 BCE, the Gulf Coast of Mexico formed one of the first technologically sophisticated American societies, with towns, great ceremonial sites, colossal stone statues, and a cultural influence that gradually spread to many other regions. Stalks of maize featured prominently in early art. Between 3,000 and 2,000 years ago, a series of regional empires developed, including the Toltecs in the central northern highlands, the Zapotecs followed by the Mixtecs in the southern highlands and in the Pacific coast.

On the Yucatan Peninsula farther south, Mayan cultures emerged around 5,000 and 3,000 years ago, as people began cutting the coastal forests to cultivate maize. Mayan farmers planted two crops a year by harvesting higher terrain to direct runoff from rains, and by constructing raised fields in waterlogged terrain separated by submerged ditches and canals that supplied vegetation for use as fertilizer. An increase in Mayan populations in the frequently warring city-states caused heavy deforestation between 3,000 and 1,000 years ago.

The archaeologist Arlen Chase and colleagues recently studied the Mayan city of Caracol in the modern-day country of Belize, using LIDAR (Light Detection And Ranging), a technology that can peer through the jungle canopies and reveal structures lying below them (Figure 6-7). Previously, twenty-five years of painstaking ground-based archaeological fieldwork at this site had identified several major buildings, connecting roads, and terraced areas. In just four days, this new LIDAR survey thoroughly mapped an area more than seven times larger, down to the scale of features such as small buildings, causeways, and very extensive agricultural terraces. Future use of this technique may bring many more such revelations about other tropical rain forest areas. Based on this LIDAR survey, we know that at its peak, between the years 500 and 900, Caracol had a population of more than 100,000 people, with the land for miles around in use, mainly for agriculture. Caracol was
but one of dozens of cities packed into this densely inhabited region. Sometime between the years 800 and 1000, the classic Mayan cultures collapsed because of some combination of droughts, environmental degradation, resource depletion, and strife among different groups.

Northeast of present-day Mexico City, a powerful culture centered on the city of Teotihuacan appeared 2,000 years ago. At the height of its power between 400 and 600, Teotihuacan boasted the third-largest stone structure in the world, the Pyramid of the Sun. Teotihuacan fell in the 700s.

By the time of European arrival, the region was under the control of an alliance of city-states headed by the Aztecs. Their capital city of Tenochtitlan was a complex of artificial islands and intervening canals that had been constructed in Lake Texcoco at the site of present-day Mexico City (Figure 6-8). Tenochtitlan was bigger than most European cities, with fresh water brought in from nearby springs, thriving wetland agriculture, and streets swept clean every night.

In summary, land clearance for agriculture was already widespread by 4,000 to 3,000 years ago in Mesoamerica because of early crop domestication. As clearance continued in most regions during subsequent millennia, and maize was domesticated, major cultures prospered. At the eve of European conquest, some fifteen million people were living in Mesoamerica. The forest clearance needed to cultivate enough land to feed fifteen million people would have emitted a substantial amount of CO$_2$ to the atmosphere during the interval when atmospheric CO$_2$ concentrations were rising (recall Chapter 3, Figure 3-7).

The Andes

The second area in the Americas with a long history of early agricultural innovation spans diverse environments in western South America—from the hyper-arid Pacific coast, across the heights of the Andes, and eastward to the warm, humid low (Figure 6-9).

Local forms of squash and bear years ago in the northern Andes technologically sophisticated culture years ago at an urban center called of modern-day Lima. Because there is no rain, it seems an unlikely place support an advanced civilization, but of fish and shellfish, and the native vegetables by diverting water Andes into terraces piled with soil.