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The Paradox of Agriculture and its Impact on China and Western Civilization

The Oldest Paradox

The use of agriculture created the first cultural paradox in world history, in that it both enabled the development and rise of the first civilizations and continuously threatened to undermine them and lead to their fall. This is because in the ancient era, they unintentionally created an artificial relationship with domesticated plants (and later animals) that was not permanently sustainable.

The first groups of people working in agriculture created a relationship with plants that proved to be quite unnatural. The circumstances that created this bond combined the warmth of a new climatic era at the end of the last Ice Age (around 18,000 years ago) with the appearance of an abundance of seed-bearing grasses that promised a bounty of new foods. In this new setting of melting ice, exposed new lands, and seed producing plants, hunters and gatherers began a new economy called foraging. These foragers collected seeds in different locations around the world by studying such plants as wild wheat, barley, rice, corn, lentils, chickpeas, peas, flax, rye, millets, sorghum, and so on, to learn their life cycles. These foragers learned that wild varieties of these plants produced pods that spontaneously opened to scatter their seeds on the wind and spread throughout the landscape. Studying the life cycle of these wild varieties taught these foragers when to approach clusters of these seed-bearing plants and harvest their kernels of food before they dispersed in the wind. Learning so much about the wild plants, these foragers noticed that every once in a while a rare genetic mutant appeared that did not scatter its seeds. This rare plant

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(one mutant in every two to four million wild plants) stood out because its pod did not open, its seeds grew to an unusually large size, and these seeds remained trapped with the parent plant.[1] The large seeds in these unopened pods promised to provide a very rich diet if more of these plants could be found. But these plants did not reproduce.

Having learned a great deal about wild seed producing grasses, these foragers collected these mutant seeds whenever they appeared and sowed them rather than ate them. Very quickly, the number of mutant plants increased each year, changing fields of wild, seed-bearing plants into this rare mutant variety. By eating some of the large seeds, and planting the rest, these foragers unintentionally became farmers and rapidly began raising fields of mutant plants that could not reproduce on their own. A new bond had been forged: the first farmers in world history perpetuated the existence of plants that could not generate their numbers without human intervention.

Not surprisingly, this artificial bond between humans and their mutant plants led to a dramatic increase in the population of both. In a relatively short time this mutually beneficial relationship, which biologists call a "symbiosis," changed the landscape. Wild varieties of seed-producing grasses gave way to human cultivators planting their mutant food sources. But this new symbiosis was not a natural relationship because these ancient farmers had sowed the seeds of plants that should have disappeared after one growing season.

Biologists refer to individual organisms that do not reproduce in the wild as *omegas*. The mutant plants that ancient farmers chose to cultivate certainly belonged to this category of life form. In contrast, biologists call successful organisms that do reproduce in the wild *alphas*. The wild variety of seed-producing grasses that scatter their seeds, sending them flying on the wind far away from the parent plant certainly belong to this category. These proved the most successful in the process Charles Darwin called "Natural Selection," while planting mutant *omega* grasses required human intervention, or what biologists called "artificial selection." All agricultural communities used artificial selection.

By selecting *omega* plants, the first farmers secured a reliable food source. The predictability of producing seeds from single *omega* parent plants provided offspring that matured at the same time and at the same rate. Also, since grasses are hermaphrodites, the male and female sex organs on the same mutant parent plant produced seeds with a very stable DNA. Such an abundance of food from a stable gene pool fed growing numbers of people and soon ancient farmers and their *omega* plants thrived together. The result was the rapid increase in the number of

omega plants, as well as the number of those groups of people who had turned to agriculture (and by extension a sedentary lifestyle). As the number of humans and *omega* plants linked in the symbiotic relationship we know as agriculture continued to increase, these groups began to move aside the once widespread *alpha* plants, changed the physical landscape, and (unintentionally) narrowed the range of food sources available for human consumption. Soon thereafter, unintended consequences followed.

These consequences played out following a long and tortuous scenario, one repeated in more or less the same order in all long-lasting agricultural communities:

1 The earliest form of agriculture, known as "slash and burn," involved the killing of large forests of trees by stripping off their bark, burning the dead trees, and using the ash as fertilizer to grow *omega* plants.
2 The human-*omega* plant symbiosis supported by slash and burn agriculture increased the total population of both groups of organisms.
3 Continuous growth in the populations of sedentary human farmers and *omega* plants resulted in deforestation and altered the local landscape.
4 Deforestation exposed the land under cultivation to soil depletion and erosion, making it particularly vulnerable to changes in climate, which could in turn lead to great ecological damage and even the collapse of the local ecosystem, the latter known as ecocide.
5 Great ecological damage forced farmers to abandon exhausted fields and seek new locations in which they could settle and grow the crops upon which they had grown dependent for sustenance.
6 The most desirable locations for permanent fields in which to grow crops were near rivers that could provide season after season of fresh soil and water thanks to annual floods of the river valleys and their nearby floodplains.
7 In order to avoid drowning during these annual floods, local farmers began irrigation projects in attempt to both bring the water of the river closer to their fields and regulate the impact of the floods.
8 Long periods of successful growing seasons and increased human numbers soon required farmers to devise methods to count their seeds, store them, and ration their supply in order to ensure a continuous supply of food to eat from harvest to harvest, year after year.
9 The need to count seeds, measure time, and ration food supplies led to the development of mathematics, writing, and calendars by the people living in the successful farming communities.

10 Those individuals who developed numbers, letters, characters, and concepts of time held specialized occupations, did not spend their days farming, and lived near one another in towns. These were near but separate from the fields and those individuals who remained tied to the land and had to tend to the crops on a daily basis.
11 As human numbers continued to grow, towns became cities and the urban centers became the foundations of civilizations.
12 As a civilization expanded, more and more of the surrounding local landscape fell under human control, causing nature to continue to retreat.

Eventually, however, nature always seemed to rebel. The increasingly large human imprint on the local ecology upset the delicate balance between ancient farmers, their *omega* plants, and the conditions that both needed to exist. This apparent natural rebellion could take the form of droughts, soil exhaustion, increased local aridity, violent floods, the sudden eruption of epidemic disease (whether in the human, or domesticated plant, or domesticated animal populations), or, most destructive of all, complete ecocide, or collapse of the power of the ecosystem to sustain life. Any and all of the unpleasant consequences of agriculture that inflicted damage on the natural environment could and usually did disrupt the human organization needed to continue to cultivate the local landscape. Such disruptions could cause a very high death rate among farmers and threaten the very foundations of a given civilization. Sometimes the inhabitants of the ancient farming community would find a way to recover from the disruption and continue to develop; sometimes the community would unravel and simply cease to exist. In either case, any surviving farmers found themselves still caught up in the incessant struggle to exist, but now sustenance by agricultural was the only way they knew how to feed themselves, so all who could do so moved to a new location, inevitably altering the landscape wherever they settled.

As agriculture developed in the ancient world, two very successful human communities that followed the above-mentioned scenario of humanity's struggle with food production, its ecological impact, and its mounting population pressures, were China and the Western world. Within Chinese and Western civilizations' long histories, Han China and Imperial Rome managed to produce the richest empires of the world's ancient era and maintain a remarkably long period of command over their respective domains. Han China rose to power in 202 BCE and fell in CE 220. The Roman Republic began in 509 BCE, with the Roman Empire officially coming to an end in CE 476. During these long periods of rule, and within their respective parts of Eurasia, these civilizations were unrivaled

in the number of people they could feed, the size of the geographic area they commanded, the amount of wealth that they produced and amassed, and the length of time they managed to secure their borders from nomadic raiders.

To understand the conditions that underpinned such major imperial successes requires an analysis of two central themes of world history: cultural diffusion and geographic isolation. The history of Eurasia, and the adjacent lands of North Africa, is one of frequent intercultural contacts, or much cultural diffusion. This is because an east-west land axis dominates the geography of Eurasia and North Africa, a physical alignment that allowed the many different peoples of Europe, North Africa, and Asia to range far and wide and engage in considerable cultural interaction. Frequent cultural exchanges resulted in the transference of all manner of domesticated plants and animals, tools, ideas, and commercial goods, from one end of this large portion of the world to the other. It also accelerated the development of civilizations throughout the entire geographic zone. For this reason, the ancient civilizations of Eurasia and North Africa developed more quickly than did those of sub-Saharan Africa or the Americas. Still, of all the ancient civilizations of Eurasia, none achieved as great a material success as did Han China and the Roman Empire.

In contrast, geographic isolation, which of course limits cultural diffusion, dominated the history of the Americas and sub-Saharan Africa. In the Americas, the land axis runs north to south, which precludes the easy movement of domesticated plants and animals due to dramatic changes in climatic zones and habitats as one moves farther north or south of the equator. In addition, the Atlantic and the Pacific Oceans virtually quarantined the peoples of the Americas from those of Eurasia and Africa, effectively denying almost all forms of cultural and even biological contact.

Finally, and unlike the Americas or Eurasia, the land axis of sub-Saharan Africa runs both north and south and east and west. The Sahara Desert, however, dominates most of the east-to-west axis. This means that this massive desert, one of the largest in the world, undid most of the advantages an east-west land axis might otherwise have afforded the peoples who inhabited the zone. Climate and habitat remained similar along this east-west axis, but sand dominates much of the landscape. The only area where humans could thrive was the grasslands just below the Sahara, but until the arrival of the camel, an animal not native to the area, foreigners had no way to reach the grasslands. Therefore, the grasslands of sub-Saharan Africa would go undeveloped until the rise of Islam and the use of the Arabian camel to cross the Sahara in large numbers and open trade routes during the Middle Ages (CE 500–1500). The only exception to this

condition of severe isolation was sub-Saharan cultures situated on or near the Nile River. Ancient Kush (1700 BCE– CE 350) had a history anchored in its contact with Egypt situated to the north, and along the Red Sea coast a later civilization called Axum (CE 100–700) thrived after the beginning of the Common Era. But south of Kush and Axum, climate denied further cultural penetration into sub-Saharan Africa because summer rains drowned Egypt winter grass crops.[2] This helps explain why no civilization in the Americas or sub-Saharan Africa ever matched the material successes found in Eurasia and North Africa during the ancient era.

Even though both Han China and the Roman Empire were unrivaled in the ancient world, neither was immune to the trappings of the paradox of agriculture. The strain on the local ecology of increasing human and *omega* plant numbers resulted in periods of decay in both. In addition, the success of China and Western civilization increased the distance between their human populations and the natural setting in which these people lived. Ultimately, the more both cultures succeeded, the more population pressures they created. And the more population pressures they created, the more likely they were to face massive failures. These continuous issues of human numbers and the spread of *omega* plants required constant adjustments to maintain order in both civilizations. Finally, the Han Dynasty and the Roman Empire represent the most complex cultural developments of ancient Chinese and Western civilizations.

This chapter explores the paradox of agriculture, ties it to the biology and geography of cultivation in these two cultures, and considers the developmental adaptations of both. Below is the history of this paradox as it unfolded in the ancient era in both China and Western civilization. Each responded by continually adjusting institutions to the organizational needs of food production as they teetered between order and chaos.

Chinese Agriculture

For much of world history, China maintained the globe's most dynamic culture. Chinese wealth and power enjoyed pre-eminence from the Han Dynasty (202 BCE– CE 220) to the beginning of the modern age (*c.* CE 1500). Each ruling dynasty, or imperial family, that governed China, did so with absolute power. That power, however, was tempered by the necessity to delegate authority to highly trained bureaucrats who administered the emperor's will. Chinese emperors selected these officials from individuals who had passed the rigorous Confucian examination system, which promoted the most talented men of each generation. These Chinese

scholar-bureaucrats then rose in rank, based on their interpersonal skills and bureaucratic cunning. This system of centralized authority allowed each imperial family to rule China for centuries. The end result was the creation of the Chinese dynastic cycle: the ability of traditional China to regenerate its political organization century after century despite the fact that each ruling family eventually fell from power.

Through their dynastic cycle, the Chinese developed and maintained a highly successful political organization. Despite periodic disruptions due to internal rebellions or nomadic invasions, the Chinese managed to return to their well-tested system. In short, China exhibited an ancient form of internal coherence that the cultures of India, Europe, the Middle East, the Americas, and Africa never equaled. A critical underpinning of this successful rule lay in the Chinese system of agriculture.

The history of Chinese civilization began on the northern plain, situated around the massive Huang He (Yellow River). This is an area rich in a fine-grained yellow soil called loess, a wind-deposited dust comprised of lime derived from the decomposition of tiny organisms. The fertility of loess is without equal, and it served to support a style of cultivation that was distinctly Chinese.[3] In short, the Yellow River carried loess to its floodplain and thereby offered rich rewards to ancient Chinese farmers. This offering, however, came at a big price. Due to periodic and often violent flooding, the Yellow River also bears another name: "China's sorrow."[4] The Yellow River gained this second name because it drew Chinese farmers to its rich soils, and regularly drowned them with disastrous floods. The Chinese soon learned to work together in specialized tasks and on a large scale to develop systems of irrigation to produce their crops and prevent these ruinous floods.[5]

Most of China is unproductive agriculturally. Only relatively thin bands of land support crops. These thin bands are concentrated in river valleys, or across acreage found on local floodplains, and along coastal plains. These few areas attracted the Chinese, who figured out how to use them by building an irrigation system that permitted the development of ever-wider bands of arable acreage than those offered by nature.[6] At the dawn of Chinese civilization, during the Xia Dynasty (*c.* 2207–1766 BCE), the Chinese mastered the techniques of irrigation necessary to harness the waters of the Yellow River to increase food production, indeed to create food surpluses, and see their culture expand. The entire length of the Yellow River came under human control by the start of the Han Dynasty (202 BCE– CE 220). But the Chinese never fully mastered the continued violent flooding of the Yellow River. This river produced such disastrous floods because it was a waterway that carried more silt than the Amazon,

the Mississippi, and the Nile combined. This silt fell in the Yellow River's riverbed, forcing the Chinese continually to build up their irrigation levees, the embankments they used to prevent the water from inundating the surrounding land. Eventually, the silt in the Yellow River raised the riverbed until it towered as high as 50 feet above the floodplain in several locations. At those locations where the river levees reached their greatest height, weaknesses in the irrigation system led to massive breeches in the levees. This led to massive floods that spread across the landscape and swept across the North China Plain. Sometimes this extended hundreds of miles from the river's banks, killing all the farmers in its path. Such colossal disasters reminded the Chinese people time and again that they needed a strong centralized political system, one that could marshal the resources of capital and labor necessary to build projects to manage the water supply of the great Yellow River and try to keep its murderous waters at bay. These reminders led to the central theses of Chinese history: political unity, highly organized divisions of labor, specialized tasks, and numerous large-scale enterprises worked best to produce food.

Origins of Chinese Agriculture

The earliest Chinese farmers who used their domesticated plants as food unwittingly unleashed population pressures, but had taken the first steps toward the process of a developing a civilization. In so doing China followed the common historical scenario laid out above, taking on increased institutional complexity as more and more people came to depend on agriculture for food. In China's case, ancient cultivation began when a set of farmers domesticated millets on the loess plains along the Yellow River. This domestication occurred sometime around 5000 BCE. These farmers, situated in northern China, were the first to begin to change China's countryside in order to meet their needs and provided the staple crop that gave life to the first Chinese dynasties. Attributing social order to Hou Ji ("Lord Millets," a Chinese name praising the value of millets), the agricultural sites these farmers founded laid a foundation for the first Chinese cities. But long before any cities appeared, the early Chinese farmers practiced slash and burn agriculture to clear forests for crops, secure ash to enrich the soil, and plant their millet seeds. Whenever soil exhaustion reduced their crop yields, the farmers, who belonged to the prehistoric Yangshao culture (*c.*5100–2950 BCE), were forced to relocate and clear land for new fields.

Archaeologists have uncovered several hundred Yangshao culture village sites widely scattered across the central Yellow River basin, from Henan to

Shaanxi and Shanxi. Collectively, the artifacts unearthed at these sites provide evidence that these peoples lived a semi-sedentary lifestyle common to all those who practiced slash and burn agriculture. It also tells us that they had domesticated different varieties of millets, supplementing the grains these plants yielded by hunting and fishing. The evidence does not, however, indicate any sort of central government that would have united the many villages.

Following the peoples of the Yangshao culture, were the Dawenkou people (*c.*4700–3600 BCE). This new culture, which also cultivated millets, developed later than the Yangshao and lived in village sites farther to the east, on the Shandong Peninsula on the north-eastern coast of China. Exploiting the resources of the mouth of the Yellow River, Dawenkou farmers left evidence that suggests that they had abandoned slash and burn cultivation. They built semi-permanent villages, taking advantage of the rich loess soils deposits of the Yellow River's delta to grow their crops. It also appears that they engaged in small-scale irrigation projects. The artifacts left by these semi-permanent agricultural villages suggest a more highly developed culture, one on the verge of city building. Typically, archaeologists have found that as any given farming population grew, and its villages became more permanent, a central village ultimately emerged as an administrative center. Dawenkou culture exhibited such developmental signs.[7]

The Longshan people were the next group to produce farming communities in northern China (*c.*3000–1900 BCE). Longshan farmers lived in far more permanent settlements than those of the Dawenkou culture, although they, too, lived on the Shandong Peninsula. Longshan cultures improved upon earlier millet-cultivating techniques and spread out to cover a much broader area than the Yangshao and Dawenkou peoples combined. Longshan farmers used different soil-renewing methods prior to gaining control over the Yellow River's flood cycle through irrigation. The Longshan people spread fertilizers based on animal waste, as opposed to ash, and left some of their fields "fallow," letting the field rest for a year, giving the land a chance to recover from agricultural use. The permanence of Longshan sites supported a steady increase in human numbers that, in turn, caused significant population pressures. Longshan villages spread from their original location on the Shandong Peninsula both north and west, making them, in the eyes of most Chinese scholars, the founders of the first Chinese civilization.

A look at the artifacts of each of these early Chinese peoples reveals a steady development of Chinese technique in cultivation. The increasing level of permanence in farming settlements from the Yangshao to the

Longshan cultures points to a growing need for sedentary agriculture on sites where the Yellow river's floods regularly renewed soil fertility. The early farming communities did not endure, but they did lay the foundation for Chinese civilization, as well as a legacy of domesticated plants that would continue to feed a growing Chinese population dependent on well-established farming practices.

China's Domesticated Animals

Along with the domestication of millets, northern Chinese farmers added domesticated dogs, pigs, water buffalo, cattle, sheep, goats, horses, chickens, geese, ducks, and silk worms to their agricultural resource base. These ancient farmers acquired their animals by domesticating certain native species and, in time, importing others. Archaeologists have determined which of the animals listed above were actually domesticated by the Chinese by looking at skeletal remains. Did the remains of these animals indicate a transition from wild *alphas* to domestic *omega* species, or did they indicate only the domesticated skeletons of beasts belonging to some other local culture? The first animal to exhibit evidence of domestication was the dog, although since dogs played no role in agriculture they are of little relevance here.[8]

Sometime around 6200 BCE the Chinese domesticated the pig, the first useful beast as a food source in an agricultural community. Archaeologists found the remains of the earliest domesticated pigs at Kuahuqiao in Zhejiang province, near the mouth of the Yangzi River (the great waterway that dominated the southern half of China and its history). The remains indicate that the wild variety of pig had given way to the domesticated version in much the same way *omega* plants had replaced *alpha* grasses. The evidence of these changes lies in the skeletal size and the teeth of the pigs. In comparison to wild pigs, domesticated pigs are larger and also have distorted teeth, because they are breed to have teeth capable of chewing cast-off food, which tended to be quite coarse. Chinese pigs came under human control gradually, as the skeletal remains reveal, and in time the domesticated varieties became a standard food source, one celebrated in later Chinese literature.[9]

Archaeologists also found cattle remains in a cave at a Shantaisi site near modern Lizhuang in Henan province in central China. These remains date back to 2500 BCE, but the spread of cattle continued westward until 2200 BCE. The archaeologists who found these cattle bones in the Shantaisi cave could not determine if they were native to China or imported from abroad because they found too few specimens to examine.

Nevertheless, the bones indicated that the animals lived in the middle and lower reaches of the Yellow River, the same region in which millet cultivation was commonly practiced, suggesting that cattle might have become useful as draft animals to pull the ancient Chinese plow.[10] The way that agriculturalists actually used cattle, however, depended on the tools they had.

Ancient Chinese Tools

The oldest agricultural tools in China were stone axes, machetes, and hoes used in seasonal farming. These are tools common to slash and burn cultivation and indicate that the Yangshao people used this farming technique. Later, the inhabitants of Dawenkou and Longshan villages augmented stone axes, machetes, and hoes with spades that eventually became Chinese plows. All of these tools belong to the "Neolithic Age."* This is marked in the archaeological record by the finds of polished rather than chipped stone tools. Polished stone axe blades, for example, can be used to strip bark from trees, whereas chipped-stone axes would break on impact. Chipped stones tools, however, did make excellent blades, which is why they were common, and are found where there were hunting and gathering communities. Hence, chipped stone tools belong to the "Paleolithic" Era, or "Old Stone" Age. The development of Neolithic tools indicates the start of agriculture in northern China.[11]

The First Chinese Plow

All three early Chinese cultures started with the same Neolithic technology. All of the early farmers used polished stone axes, wooden and stone shovels, machetes, and hoes common to slash and burn cultivation. When the more permanent villages developed in the north, open fields with renewable soil techniques required a shift in technology, at which point the spade became the chief tool. Spades date back to 6000 BCE. Archaeologists found spades in Hubei and Henan provinces located along the central Yellow River floodplain, where the ancient Chinese farmers used them in an unusual fashion. The Chinese Neolithic farmers used spades as proto-plows by stamping them into the ground with their feet and then pulling them along in a straight line. Ancient spade heads changed shape over time, from square to triangular, and eventually evolved into the plowshare. Neolithic farmers originally fashioned spade heads from wood,

* The Neolithic Age (or New Stone Age) marks a new technology, where polished agricultural tools replaced sharpened chipped tools used in hunting.

but in time they began to craft the blades from bone and stone. The plowshares that emerged from the spade were all made of stone, the first plow appearing in China sometime around 3000 BCE.[12]

Archaeologists, however, have only found the stone plowshares themselves, not the bodies of the plows. This means that the total design of the first Chinese plow remains unknown, which makes understanding exactly how people used it difficult. Nonetheless, Chinese experts speculate that the first plows consisted of a converted spade head pulled through the ground, in the manner mentioned above. The widespread finds of these ancient plowshares suggests that Chinese everywhere, both in the north and the south, used them, so their use could not have been limited to just one Neolithic culture.[13]

How China's Dawenkou and Longshan cultures pulled these plows through the earth becomes a major question because this tool came into use before they acquired cattle. Therefore, most scholars believe that Chinese men served as the original draft animals. This is not unreasonable, given that Egyptian farmers, who did have oxen, also built a smaller plow to be pulled by men (see below). Furthermore, Egyptian black earth (deposited by the Nile in each flood cycle) and Chinese loess soils share a common feature: both forms of soil are very fine, soft, and non-stratified. This makes them easier to cut through with a blade than the types of soil found in Mesopotamia (also see below). Finally, man-pulled plows are still in use in China, in Guizhou province of Inner Mongolia and the Gansu and Shanxi provinces of northern China. Cattle were first used as draft animals quite late in Chinese history, during the Spring and Autumn Era (771– 403 BCE), but we will return to this part of the story below.[14]

The First Chinese Dynasties

The Xia Dynasty (2205–1766 BCE)

While the aforementioned tools and animals had been available since the emergence of the Dawenkou culture, it was the Longshan people who generated the first traditional Chinese dynasty: the Xia. Scholars noted that the Longshan agricultural villages in northern China far outnumbered similar Dawenkou agricultural sites. This means that the population of the Longshan people reached the critical mass that caused the formation of first towns, and later cities. It is from these first urban sites that the Xia Dynasty, which officially launched China's Dynastic Cycle, emerged.

One of the difficulties of studying Chinese history is the way that legend can become fact with each new archaeological discovery. While the Xia and the following Shang Dynasties were long shrouded in legend, the Shang Dynasty (1766–1046 BCE) emerged from myth in the 1920s. During that decade, archaeologists discovered ancient Shang sites that verified the actual existence of the dynasty's ruling family. Today, many scholars claim that the same type of discovery has verified the existence of the even older Xia. The key archaeological site in question is Erlitou, found in 1959.

Erlitou is situated in the junction between the Wei and the Yellow Rivers, ten miles southwest of Yanshi City in Henan Province. Artifacts discovered at Erlitou date back to somewhere between 2100 and 1800 BCE. These dates put this site beyond the traditional years credited to the Shang Dynasty. As a result, more and more scholars now argue that Erlitou proves the existence of the Xia.

According to legend, King Yu (*c.*2200–2100 BCE) founded the Xia. Yu was purported to be the last in a long line of figures selected to rule because of their remarkable talents. He was also the first monarch in Chinese history to transfer royal power to his son. Then, when King Yu's son inherited the throne, a line of succession followed that became China's first ruling dynasty. Also, King Yu is the first Chinese king of lore to qualify as a real historical figure because he is credited with achieving the impossible: he was the monarch that tamed the Yellow River.

According to Chinese legend, King Yu devised a method of controlling this violent river by digging canals and channels instead of simply building dams. These canals and channels distributed necessary supplies of water and new soil to the millet fields. To organize the labor needed for the massive task of digging a series of irrigation canals and channels, and to better rule his realm, King Yu divided his people into nine groups and dispatched them into nine different regions. Under his leadership, the Yellow River's floodwaters flowed to the sea through a network of nine newly dredged irrigation channels. After ten years of intense labor, he could claim victory over a river whose floods had regularly caused disaster. This reputation for having tamed the Yellow River and organizing the people into a well-planned society made King Yu the personification of the selfless, benevolent Chinese king. His image as a ruler, and his devotion to duty, also made him a model for other kings. He helped to shape the ethics of authority that later became "the Way" of Chinese philosophy. Finally, the fact that Yu was the first ruler to impose his will on the Yellow River supports the thesis that civilization in China required some centralized form of government to exploit the limited arable land

available for cultivation. At any rate, Yu is probably the first generally recognized historical figure in Chinese history.

The Shang Dynasty (1766–1046 BCE)

The Xia Dynasty lasted from 2205 to 1766 BCE and commanded huge swathes of land along the Yellow River, some three hundred miles long and one hundred miles wide. The Xia followed a pattern of rise and fall that became known as the dynastic cycle. King Yu, the model monarch, characterized the energy and devotion to duty that brought a ruling family to power. Seventeen generations later, the last of the Xia kings, King Jie (reigned *c.*1818–1783 BCE), became a model of the corrupt ruler. His selfish ways, self-indulgent quest for pleasure, and neglect of his people caused a man named Shang Tang to rebel (reigned *c.*1783–1753 BCE). He defeated King Jie, restored order to China, and became the founder of the Shang Dynasty (1766–1046 BCE). Shang Tang possessed all the virtues of an ethical monarch.

Ancient Chinese scholars noted the fall of what had over time become a corrupt dynasty and its replacement by one that restored order and virtue, and from this created the traditional Chinese model of the rise and fall—or succession—of dynasties. They based their explanation of the rise of a ruling family on the virtuous ruler, one whose talents, intelligence, and compassion served his people well. They explained the eventual fall of the same dynasty on the vile practices of a corrupt king, one whose egotistical quest for pleasure and indifference toward his people caused them to suffer. And once the people were suffering, it was only a matter of time before the overthrow of the old dynasty and the rise of a new one occurred. This model outlined the traditional history of the Xia, and it would become a central theme in the Chinese vision of the natural order of things, as will be discussed further in chapter two.[15]

The territory controlled by the Shang connected the eastern half of the Yellow River valley with the Yangzi valley and comprised a realm about a thousand miles long by a thousand miles wide, making it about three times larger than the Xia's realm. This increase in size meant a comparable increase in agricultural complexity. To administer such a massive expansion in cultivation under the control of the new regime required literacy. It is no surprise, then, that the Shang developed Chinese writing. This development facilitated the use of rationing, the allocation of resources, and the conscription of the labor needed to serve the ruler. The Shang rulers also implemented a system of feudalism, with local lords overseeing the work of peasant farmers to try to maximize crop yields and produce food surpluses.

Each of these developments reveals the increased complexity of life under the Shang. And such complexity indicates the growing distance between Chinese agriculture and the natural setting from which it first sprang.

Life in the Bronze Age placed significant limitations on the efficiency of agricultural production. Bronze is a hard metal made up of two softer metals: copper and tin. Copper and tin ores were scarce compared to iron, making bronze technology highly prized. In Bronze Age cultures everywhere, only the urban elite could afford to own objects made of precious bronze, so Chinese farmers continued to rely on stone and wooden tools. This effectively kept Chinese agriculture in the Stone Age, which restricted food production and resulted only in limited surpluses. In addition, because Shang kings had chosen to rely on feudal lords to ensure sufficient attention to local food production, they had to devise a way to ensure the loyalty of the lords, as well as that of the peasant farmers under them.[16] In time, the Shang rulers came to rely on religious authority to justify their rule.

The Shang claimed the right to rule by linking the ruling family to Shang Di, the ancestral deity of Shang Tang, who now became the supreme god of all the Shang Dynasty. The creation of a divine ancestry—the blurring of the line between emperor and god—filled China's nobility and farmers with awe, a sense of amazement, and respect that combined with fear to inspire loyalty among all of the Shang's subjects. And it was this strong devotion that allowed the Shang to develop a military system that could field an army of 13,000 soldiers if pressed with a crisis. Such numbers were very impressive for the Bronze Age, given the limitation on available metal weapons. Normally, however, the Shang mounted wars against raiding nomads with forces numbering no more than around 5000 men.

In time the Shang rulers combined religious with political and military authority. They performed religious ceremonies, administered the state, appointed subordinates to specialized offices, and commanded aristocratic clan leaders and their men. Once possessed of a mighty military the Shang rulers began to engage in offensive warfare to expand their domain, consolidating their control of the land by building new towns and opening new fields for cultivation. As mentioned, the Shang rulers devised the earliest form of Chinese ideograms (i.e. written characters) that would evolve into the modern Chinese language. Finally, the Shang rulers transformed China's climate and landscape by cutting down the forests that once dominated the North China plain to clear land for cultivation. Deforestation reduced the humidity of the region as an unintended consequence of expanding food production.[17]

The Shang rulers wished to convert as much of China's landscape into arable field as they could. This massive assault on the countryside required conscripted laborers engaged in all manner of complex projects, which included clearing land, building new cities, constructing defensive walls, and digging new series of irrigation canals. The Shang kings continually had to expand agricultural production to meet the needs of a continually growing population, and in so doing continually increased the complexity of life in China.[18]

Meanwhile, nomads living north of the Yellow River posed a constant threat to Shang farmers because there were no topographic barriers separating cultivated fields from pastureland. The threat to every Chinese dynasty posed by the nomads came to the fore whenever these pastoralists ventured into farming regions on raiding expeditions (see chapter three for the role of nomads in Chinese history). The Shang kings responded to these raids with warfare, using the chariot as their principal weapon, which helped them retain control of their newly open farms along the frontier line.[19]

The religion the Shang rulers had created to help them command the loyalty of the people relied heavily on the family to maintain obligations to both the living and the dead. For this reason the family came to form the core labor unit necessary to keep the dynasty running. Since the Chinese dynasties that followed the Shang counted their populations by the number of hearths around which families assembled, the hearth, or household fireplace, represented the basic labor unit. The importance of the family as the link between Heaven and Earth tied this fundamental labor unit back to Chinese religion.

Shang religion assigned the role of high priest to the Shang kings. In order to communicate with their ancestors in Heaven, the kings would write a question on the thigh or shoulder bone of a sheep, place the bone in a fire, and then "read" the cracks in the bone caused by the heat. They believed that their interpretations of the cracks would impart the insights of their dead ancestors to whom they had sent their questions. The Shang believed that if they properly honored the wishes of their ancestors, they might avoid natural disasters.[20] When natural disasters did occur, they typically took the form of floods, famines, droughts, or plagues, any of which signaled Heaven's displeasure with the ruler by killing mass numbers of people. Sequences of such disasters indicated the need for rebellion.

The history of the Shang Dynasty paralleled that of the Xia. The first Shang kings exemplified the moral, compassionate, and talented ruler, but the last Shang kings exhibited selfish desires, petty jealousies, and indifference to their people. In 1046 BCE, the last Shang king fell to rebellion,

giving rise to a new dynasty, just as the first Shang king had overthrown the last Xia ruler. The last Shang king, Zi Xin (reigned *c.*1075–1046 BCE), was a tyrant who lost the respect and support of his people.†

By the thirteenth century BCE, the Shang had expanded into Gansu province, the region once occupied by the Xia Dynasty at the junction of the Wei and Yellow Rivers. The Shang assigned this region to the Zhou people. The Zhou sub-kings guarded the Shang's western flank from raiding bands of nomads and provided security to the Shang's seat of power in the east. Ji Chang (1152–1056 BCE) was a ruler of the Zhou and a vassal of the Shang Dynasty. King Zi Xin grew fearful of the highly competent Ji Chang's growing regional power and popularity. Known to his people as King Wen, Ji Chang possessed charismatic qualities that allowed him to expand his power within his own domain. Eventually a wary Zi Xin decided to put Ji Chang in prison, where he perished. Outraged by the harsh treatment his father had received, Ji Chang's son, Ji Fa, engineered a rebellion, raising armies in the west of Gansu to face the Shang. Ji Fa, later known as King Wu (reigned *c.*1046–1043 BCE), defeated those men loyal to Zi Xin in the Battle of Muye (1046 BCE), thus launching a new dynasty and era, the Zhou.

The Zhou Dynasty (1046–256 BCE)

The Zhou Dynasty justified its victory against the Shang by introducing a central theory of power to Chinese civilization: the Mandate of Heaven. The Mandate stated that Heaven supported all of China's rulers who worked to secure the prosperity of the people. Heaven smiled upon virtuous kings and punished wicked ones. Heaven provided good weather, fertile lands, and rich agricultural yields to hard-working peasants who served benevolent kings. And Heaven caused famine, plague, warfare, and rebellion to punish depraved kings who failed to sustain their people. The Zhou used this theory to supplant Shang Di, the supreme god of the Shang Dynasty. The Mandate reassigned the awe needed by a Bronze Age ruler from the Shang to the Zhou. Hence, the legitimacy of the new Zhou Dynasty was sanctioned by Heaven in its victory over a worthless Shang monarch.

Having acquired the realm through divine sanctions, the Zhou replaced the Shang and gained control over its domain, and the realm the Zhou

† During the Bronze Age, kings ruled China. The term "emperor" did not come into use until the Iron Age, when an agricultural revolution supplied the ruler with enough food surpluses to unify China and forego feudalism.

commanded was impressive. Its lands drew water from both the Yellow and Yangzi Rivers; the size and dimensions of the Zhou's domain was roughly the same as the Shang's, but the Zhou developed a system of cultivation that tilled the soil more thoroughly. This superior methodology that made better use of the land relied on an important change in Chinese feudalism.

Unlike the Shang kings, the Zhou rulers assigned their nobles to semi-independent realms, meaning that each of the subordinate rulers had sufficient authority to refine agricultural production to achieve maximum crop yields. In addition, each of the assigned rulers received a walled capital city and the power to hand their titles and estates down to their sons. Subordinate to the Zhou king, these great nobles supplied the monarch with the warriors (armies raised locally) needed to defend the entire realm against a constant nomadic threat (see chapter three). Supporting and subordinate to the warriors were the Chinese peasants, the backbone of agriculture. At the very bottom of Zhou society were the slaves, who performed the least desirable tasks in the Zhou kingdom. The only major flaw in the structure of Zhou feudalism was that the degree of autonomy offered to the Zhou nobles encouraged these men to become more independent over time. This form of decentralization slowly began to erode the Zhou king's power.

It was the Zhou who introduced the well-field system to Chinese agriculture, a model of food production that later Confucian philosophers would praise. The well-field system allotted 100 *mu* of land to each adult male in a family (one ancient *mu* being one pace wide and one hundred paces long).‡ Eight families received eight plots of land comprised of as many *mu* as adult males in the family. These eight family farms were situated around a central communal field, making the pattern of all such fields resemble the shape of the mouth of a well. Since the Chinese ideogram for "well" looks very much like the English ideogram for number, "#," this is how the "well"-field system got its name. Each peasant family worked the outside farms that ringed the common inner plot, that which supported the local aristocrat. The peasants who worked the outer plots did not own their land. Instead, it was the aristocratic families of the Zhou Dynasty who owned all of the fields.[21]

The millet yield per ancient *mu* was 12–13 *dou* per harvest. A *dou* was a measurement of food, the amount of which varied widely until the Qin Dynasty (221–206 BCE) standardized the weights and measures of China (see below). The Qin *dou* provides a sense of how much a Zhou *dou* produced in terms of crops yielded. The value of a *dou* for the Qin was two meals served to an adult male engaged in heavy labor on a government

‡The modern *mu* is much larger: 0.6667 of an acre.

project. This means that an adult male working his 100 *mu* of land could expect to yield from 2400 to 2600 meals of grain per harvest or ([2 × 12 to 13 dou] × [1mu] × [100 mu]). Such a high yield illustrates the rewards for the intensity of family labor units involved in producing food all along the course of the mighty Yellow River.

Over the length of an almost eight-century reign, the Zhou's well-field system eroded in a manner similar to Zhou feudalism. Zhou feudalism, as mentioned, began to erode because the practice of inheritance of estates had slowly undercut the loyalty between the Zhou rulers and their subordinate regional noble aristocrats. The sons of these Zhou aristocrats came to perceive that they owned their estates because they had received their land from their fathers and not the Zhou king. The breakdown of these feudal bonds then began to influence the way the Zhou nobility felt they could use their lands. Between 1046 and 403 BCE, feudal lords of the Zhou Dynasty discovered that peasant-owned plots were more productive than the small farms allotted to family units in the well-field system. Peasant-owned plots led to larger farms worked by several peasant families with a will to succeed. As royal power disintegrated with time, the aristocracy found that agricultural reforms linked to the peasant's will to produce food increased the nobility's wealth. Higher yields on peasant-owned acreage allowed the lord to tax the larger harvests instead of receiving a fixed income from one-ninth of a communally cultivated collective farm.[22]

These changes in agricultural labor came just as China entered the Iron Age, sometime around 600 BCE. Unlike bronze, iron was plentiful. The greater availability of this abundant hard metal allowed for the development of a new farm technology, releasing Chinese farmers from the Stone Age and permitting them to cultivate with the most efficient metal technology available. Iron-bladed plows, iron scythes, and iron rings and sickles replaced wood and stone farm equipment. The efficiency of such tools encouraged the growth of larger and larger farms, which came to supplant the tiny plots common to the well-field system. In the Iron Age, China experienced an agricultural revolution.[23]

This agricultural revolution caused by iron plows in China combined with the disintegration of royal authority due to Zhou feudalism to unleash a wave of political chaos that led to the fall of the Zhou. In 770 BCE, partially assimilated nomadic warriors on the Zhou's northwestern frontier, as well as two former Zhou vassals, rose up in rebellion. The rebel forces killed the Zhou king and forced the remnants of the Zhou family to flee east. From their new eastern headquarters, the weakened Zhou monarchy claimed to rule what remained of their realm, from 770 to 256 BCE. With the move east, however, the Zhou kings effectively forfeited political and military control

over their nobles, the Zhou aristocracy now feeling free to function as potential kings. Added to the rise of these petty monarchs was the sudden increase in food surpluses generated by the development of iron plowshares and the use of oxen as draft animals. The timing of the agricultural revolution and newly liberated—and competing—kings drove China into political turmoil. The Zhou's ex-nobles decided to use their windfall harvests to draft peasants, train them as soldiers, and place them in Iron Age armies.

Scholars call the times that followed "the Eastern Zhou" (770–221 BCE), during which the agricultural revolution continued to spread rapidly. In addition, the development of large-scale irrigation projects and expansion of cultivated fields brought the Yellow and Yangzi River valleys under tillage. Engineers such as Sunshu Ao (*c.*630–593 BCE), Ximen Bao (*c.*445–396 BCE), and Li Bing (governor of Sichuan *c.*277–250 BCE) built the largest irrigation systems located in China during the fall of the Zhou.[24]

The first half of the Eastern Zhou era produced what Chinese scholars call the Spring and Autumn Period (770–481 BCE). During this time, the Zhou nobility used their expanded farms to feed private armies that they raised and maintained to invade neighboring non-Chinese realms. The result of this was that Chinese-controlled territories begin to expand beyond the old Zhou kingdom. As addition of new territories to the Chinese realm increased, the ethnic diversity of China also began to change. Furthermore, as the Zhou nobility changed into petty kings, they selectively incorporated practices from their newly acquired non-Chinese subjects. One of these non-Chinese practices was the use of cavalry in warfare. With this new tactical force at their disposal, the power (and heads) of the newly minted petty kings began to swell, and they began to turn on one another. This launched the second half of the Eastern Zhou, the Era of the Warring States (403–221 BCE). By 403 BCE, a state of anarchy swept across the land.

The struggle that unfolded during the Era of the Warring States caused so much chaos that it inspired Chinese philosophy (see chapter two). At the same time, the agricultural revolution (mentioned above) that led to competing kingdoms, spread beyond what was once Zhou China. Finally, one kingdom destroyed all its rivals and ended the wars. This kingdom, the Qin, presented China with its first emperor.

The Qin Dynasty (221–206 BCE)

The Qin victory completely changed China. The Zhou originally ruled lands stretching from the loess plateau in the west, through the Yellow River floodplain, and onto the ocean in the east. The Zhou also expanded

south, incorporating large portions of the Yangzi River basin. As mentioned above, the Zhou built a feudal system that ultimately unraveled due to decentralization. By the end of the civil war in 221 BCE, the Qin began building a new China. In so doing they abandoned the feudalism of the Zhou era. Qin China was a fully integrated empire with an iron-based agriculture. And thanks to Iron Age surpluses of food, the Qin could rule this empire without having to carve their state into petty feudal estates ruled by nobles. The food surpluses fed the labor force as well as the armies the Qin used to assimilate all of China's lands politically. The Qin also linked the peoples of the Yangzi River basin to those of the Yellow River basin, bringing much of what is modern China under the authority of one imperial office. This new arrangement combined the agricultural resources of these two major rivers into one community. Through a process of cultural assimilation, the Qin created a style of absorbing foreign peoples into the mainstream culture that became known as *sinicization* (transforming non-Chinese cultures into Chinese civilization).[25]

The territories controlled by the Qin eventually included the entire Yellow River basin and a new realm in Southern China called the kingdom of Qu, the people of which had ruled an area more than a thousand miles long and a thousand miles wide that encompassed a multi-ethnic population of non-Chinese. From the Qin's perspective, the problem they faced—continually as it turned out—was how to integrate the holdings in the north with the new lands in the south. Interestingly, the Qin never completely solved this problem, nor would their successors, the Han (202 BCE– CE 220).[26]

The main drive of the Qin south saw them expand toward the headwaters of the Yangzi, pushing south and then west, in the process acquiring fertile lands occupied by tribal peoples who farmed rice. Next, they moved toward Zhejiang and Fujian on the south-west coast of China. The Qin also added Lingnan, which is today modern Quangdong and Quangxi on the southernmost coast of China. Once they had conquered this area, the Qin divided it into three military commands that served as buffers for northern China from rebellion in the south. Thereafter these newly acquired southern provinces became a colonial zone that the Qin settled with banished criminals and political exiles. The southern tribal peoples naturally resisted this type of expansion, prompting the Qin to send a series of expeditionary forces into the region to pacify the various peoples of the land. This military exercise ended up taking seven years (221–214 BCE), and only partially succeeded.[27] Soon after the death of the first Qin Emperor, Qin Sui Huangdi (221–210 BCE), portions of this southern region broke free under the rule of rebel Qin generals.[28]

Despite the vast additions of lands acquired by the Qin Dynasty, the amount of arable acreage available to agriculture did not exceed more than 11 percent of the entire empire. Due to this shortage of arable land, farming in China remained labor-intensive, which required a further increase in the level of centralized authority. This remained the case well after the fall of the Qin, continuing as an economic reality for all the Chinese regimes that followed. The Qin, however, was the first to confront this fact as they tried to pull together the vast new lands that they had conquered. They tried to achieve too much too quickly, however, and pushed their people to the brink of rebellion.[29]

For example, the Qin overtaxed its people with the great costs associated with the construction of the first Great Wall of China, the standardization of all weights, measures, coins, and written scripts, and the conquests and assimilation of new lands. Within four years of the first emperor's death in 210 BCE, the Chinese people rebelled and the great Han Dynasty captured power in 202 BCE. From this moment forward a pattern of political, economic, and cultural controls transformed the Chinese people into the "Han" people. In addition the Han Dynasty (202 BCE– CE 220) set the pattern for the dynastic cycle and imperial rule that dominated Chinese history for more than two thousand years, all the way up to the year CE 1911.

The Rise of the Han Dynasty (202 BCE– CE 220)

Han agriculture consolidated all the developments of previous dynasties from the Bronze Age Xia to the Shang and Zhou and through the Iron Age Qin. The agricultural surpluses offered by the iron-based revolution that led to the rise of the Qin then fed the Han. And the Han spread this Iron Age agriculture as they conquered vast new lands. The Han Dynasty successfully built a stable system of power and economic integration that became the hallmark of China's enormous wealth during the ancient and medieval times. Using the philosophies generated during the Era of the Warring States (see chapter two), the Han developed a political ideology that allowed them to control their expanding empire. The spectacular success of the Han Dynasty overshadowed all that came before and set the pattern for all that would follow. Hence, the remainder of Chinese history involved the expansion, consolidation, and refinement of Han practices, coupled with numerous innovations that enhanced centralized authority throughout Chinese ancient and medieval history.

Roman Agriculture

When considering Western civilization, one notes immediately that the Roman Empire relied on a highly diversified economy when compared to that of China. The Roman economy, centered on the lands surrounding the Mediterranean Sea, comprised numerous and varied provinces organized to feed and service the people of Rome through food production, manufacturing, and trade. In contrast, Han China depended on managing the waters of a particularly volatile river, and later the other major river in the land. The "control" of the Yellow River required the implementation of a centralized political authority to administer what would become a vast and complex system of irrigation. This irrigation system, in turn, fed an expanding political society. At the same time, countless nomads, amassed on the frontiers of the empire, posed a constant military threat to the security of China, one that only reinforced the need for a powerful and highly centralized imperial rule (see chapter three). In contrast, the Roman Empire, the basis of what would become known as Western civilization, engaged in a pattern of conquests that periodically added new provinces to an expanding political base. As Rome continued to expand, the number of military challengers to Roman rule seemed to diminish, and each new province added to the empire provided a unique economic stamp that served to feed Roman society.

The genius of the Roman Empire was that it managed to combine military prowess with a highly pragmatic political system that allowed its inventive culture to conquer, incorporate, and consolidate an empire equal to that of Han China to the east. Indeed, each newly conquered Roman province seemed to enhance the ability of the empire to continue to survive on its own economically. In terms of food production, each of the new local provinces had already developed its own system of agriculture, manufacturing capability, and trade networks—all of which Rome simply absorbed. As a result, however, the Roman Empire never really achieved the same level of internal coherence throughout its vast domain as did Han China.

Unlike China, Rome was actually a cultural consumer of Greek civilization rather than an exporter of its own traditions. As a Hellenized civilization, Rome found it much more difficult to Romanize other civilizations than China. Also, Rome conquered other sedentary cultures rather than absorb nomadic peoples into its civilization. Rome expanded against well-established civilizations, while nomads surrounded China. Only the Celts north and west of Italy and some of the Berber tribes of North Africa consumed Roman practices, while all other sedentary

foreign communities maintained their well-established agricultural habits. This meant that Rome allowed most conquered local peoples to continue with their original traditions so long as these traditions did not interfere with Roman rule. Accordingly, local agricultural production continued along the earlier lines of those people that founded the regional system of food production in the empire's various provinces. In contrast, China *sinicized* nearly every foreign population that ventured into Chinese territory, with perhaps the Mongols being the only exception (see chapters four and six).

To study Roman agriculture, then, one needs to consider this vast economic diversity of the empire's regional food production. To try to impart a working understanding of Roman food production, this text will feature several key provincial economies to show how the empire fed itself. One of these provinces, of course, must be Italy, for this is the peninsula on which Rome was based and fed in its formative years. A second province must be Egypt, because this ancient culture, eventually absorbed by Rome, supplied the latter the wheat and barley it needed to continue to feed the vast and growing population of Rome itself. A third province (actually a set of provinces) includes the Levant Coast and Mesopotamia, which made up the Fertile Crescent. It was the peoples of this region that domesticated the first plants and animals that would feed Western civilization. A fourth and final province is Greece. The Greeks occupied a unique geographic region, one with landforms that encouraged the formation of a system of independent city-states. This same region also had soil conditions—a rocky terrain with mostly thin and nutrient-poor soils that discouraged local food production. Instead, the peoples of the Greek city-states turned to the development of sailing technology and the development of sophisticated trade networks. These so-called network cities survived on the export of olive and grape products in exchange for the import of foreign-grown wheat and barley. This saw the major Greek city-states develop a highly urbanized population that helped shape the very influential Greek worldview, one that Rome consumed (see chapter two). Finally, an overview of the Roman economy is necessary, one that will explain how the Roman Empire actually worked. To begin, we turn to a consideration of the Italian peninsula.

Italian Agriculture

Throughout the first half of Roman history, known as the Roman Republic (509–30 BCE), land use on the Italian peninsula evolved from tiny family farms to massive commercial plantations. Over the course of five centuries,

the Italian landscape provided not only level plains for cultivation, but also the slopes of the Apennine Mountains, where the Romans developed a system of terraced agriculture. To plow their fields, the Romans used an ard, a simple plow only capable of breaking the soil by scratching the earth with an iron blade. With use of this crude tool, the Romans plowed their fields in two directions set at right angles, to create an even, flat surface. Since the soils of Italy tended to be heavy, and contain a good many roots and vines, the Romans used powerful oxen to draw two different types of plowshares, one with a curved, knife-like blade to cut into thick soil, and the other with a broad, flat blade useful for breaking up looser soils. The Romans attached both types of plowshares to a frame with two small wheels to reduce traction as the plows cut into the ground. To help them prepare the land for agricultural use, the Romans also built dams and reservoirs for irrigation, lining their reservoirs with a form of waterproof cement. Their development of such extensive sophisticated irrigation systems was essential in light of the increasing size of the empire and the attendant demand for ever more food.

Rome expanded slowly throughout the Italian Peninsula from 509 to 265 BCE, the slow pace of this initial expansion giving the Romans time to link their agriculture to an expanding political system that could maintain an internal balance. As Rome continued to grow, so, too, did the number of its citizens who doubled as farmers and soldiers. Rome added significantly to its citizenship on two occasions: the Latin Wars (340–338 BCE) and the Social Wars (91–88 BCE). In both conflicts, the peoples of the defeated cities (Latin and Italian) became part of Rome when the Romans granted either Roman citizenship or associated citizenships to its former foes. Full Roman citizenship permitted an ally to marry a Roman, vote, and hold office in Rome; associated citizenship granted the right to marry Romans but not to vote or hold office. Both types of citizenship, however, required citizens to fight alongside Rome in its various wars. Hence, the people of these former enemy states joined Rome's citizen-farmer-soldiers in the dangers of and shared with them the spoils of war. From the combination of Roman and allied citizens, as well as the Roman citizen-farmer-soldier, one can see that the early Republic had linked agriculture to its political and military system. As a result, Rome's initial slow growth over two and a half centuries gave the Romans time to integrate systems of food production with a successful and expanding military and a constitutional-republican system of governance.[30]

The Roman citizen-farmer-soldier engaged in a wide variety of seasonal activities, from planting and harvesting, to fighting and voting. Each activity had its season and, if done correctly, ensured high crop yields per acre,

a secure realm, and stable politics. Considering agriculture alone, the Romans practiced hoeing and weeding in much the same way as those of traditional rural communities do today. They also understood that by growing a certain variety of crops concurrently, they could reduce the number of weeds in their fields. Furthermore, they recognized the benefits of the use of animal wastes as fertilizer, and they often used fallow fields as grazing land for their cattle. During the harvest, the Romans replaced the straight handle on a sickle with one set at an angle, to reduce back pain. They also developed a mowing scythe for fields of greater size. For milling their grain, the Romans used a waterwheel that produced the rotary motion needed to grind wheat into flour. Eventually these waterwheels developed into the watermill, around 20 BCE. The Romans built their largest known set of watermills around CE 300, which had two rows of eight wheels each placed one below the other as the water cascaded down a long canal to turn each wheel. The Romans developed different milling processes to produce different grades of flour.

The Romans domesticated several different species of animals. They used oxen, mules, and donkeys for work, and sheep and cattle for their milk, wool, hides, meat, and manure. They raised pigs and goats, and they fancied birds, such as ducks and peacocks, for gourmet meals. The Romans developed saltwater fish farms as early as 95 BCE to satisfy their taste for fresh fish. Lucius Licinius Murena, a Roman Consul (chief magistrate) in the year 65 BCE, expanded the idea of fish farms by drawing seawater onto his estates using channels dug to the sea. Soon these types of farms became common, and they effectively allowed even those Romans who lived far from the coast to enjoy fresh fish. Control of the fish populations joined with a system of breeding animals to supply food early in Roman history. Together, livestock and fish allowed for a diet rich in protein for many citizens of Rome.

Farms during the Roman Republic varied sharply in size, so much so that historians have divided them into three different categories. First came the small farms that ranged from 18 to 108 *iugera*. (One *iugerum* is equal to about 0.65 acres, so the small farms varied in size from 11.7 to 70.2 acres.) The next level comprised medium-sized farms ranging from 80 to 500 *iugera* (52 to 325 acres). Finally, came the large estates called *latifundia*, which exceeded 500 *iugera* (more than 325 acres).[31]

Over the course of the Republic's history, farms increased in size. Early on, most farms fell into the first two categories: small and medium. In the Late Republican Era (265–30 BCE), latifundia began to dominate Roman agriculture. This shift from small and medium-sized farms to large estates began in earnest after 265 BCE. From 265 to 202 BCE, Rome defeated

Carthage, a Phoenician colony, and added the lands and wealth of the Western Mediterranean to the empire. This rapid expansion of the empire pumped riches into the hands of Rome's wealthiest citizens. After 202 BCE, these wealthy Romans began buying up farms from Italian planters who could no longer make a living in agriculture. The reason behind the failure of the small and medium-sized farms was a new war policy the Romans initiated after 202 BCE. This policy drew the Roman citizen-farmer-soldiers away from the land to fight in the military. In short, Rome's poor and middle-class citizens could not farm and fight at the same time. The land of the many failed farms then became available for sale, and latifundia increased in number. A secondary consequence of the increasing number of latifundia was a major change in Roman politics—one that led to civil war.

Part of this change entailed a social bond known as the patron-client relationship. Poor Roman citizens often sought legal and financial support by seeking out wealthy Roman benefactors. The benefactor gave his support in return for expected political backing. These benefactors typically belonged to Rome's aristocracy, the *patricians*, but they could also be among the rich *plebeians*, the commoners. Rich Romans of either class seeking a political career enlisted as many clients as possible. As more and more Roman farmers lost their farms, more of them sought out patrons. These increasingly powerful patrons became political rivals who competed for office. Eventually the competition increased in violence until, finally, only civil war could resolve the issue.

The Roman civil war erupted in 131 BCE and lasted until 30 BCE. The conflict pitted rival combinations of poor citizens and their rich patrons against one another. Spanning four generations, the civil war began when the wealthy leaders of the poor devised a land reform program to restore small and medium-sized farms to the plebeians. This led to the creation of the Popular Party, the goal of which was to break up the growing numbers of latifundia (owned by aristocratic rivals) and grant the land to the farmer-soldiers who had originally built up the Roman Empire. This threat to the owners of the latifundia, in turn, led to the formation of an opposition party, the Optimates, comprised mostly of the aristocrats and their clients. Violence followed.[32]

Using and abusing the Roman constitution, the Popular Party fought the Optimates without either side winning a decisive victory. In the second generation, Gaius Marius (155–86 BCE) shifted the direction of the Popular Party's land reform program by recruiting Roman soldiers directly from Rome's lowest economic and social stratum and equipping them with armor. This undercut the link between the farmer and his duty as a soldier, which justified his citizenship. Marius' military reform created a professional

army and linked it to a general's military and political career. After 20 years of service in the army, Marius secured a farm for each of his soldiers as a form of retirement program, which further eroded the citizen-farmer-soldier bond. Finally, these reforms made the civil war worse: now rival politicians could rely on their own armies to settle their differences.[33]

In the third generation of the conflict, a leader of the Popular Party, Julius Caesar (*c.*102–44 BCE), launched a political and military career that saw him defeat all of his rivals. He rose to power linking success in public office with conducting winning military commands. He then used these military commands to win higher offices. His genius as a politician and soldier was unequalled. Finally, his rivals threatened his future in politics as his command over his army in Gaul, site of his latest military victory, neared its end. He decided on open warfare to resolve the issue. He destroyed the Optimate Party in battle and prepared to rule Rome as a dictator for life. Not long after assassination ended Julius Caesar's political career, but ended up transferring his wealth and prestige to his great-nephew, Octavius Caesar (63 BCE– CE 14). Octavius ultimately realized Julius' political goals as a member of the fourth and final generation of the civil war. Octavius defeated his rival Mark Antony (83–30 BCE), one of Julius Caesar's generals, at the Battle of Actium in 31 BCE. This victory secured Octavius' command over Rome. Then, between 30 BCE and CE 14, Octavius Caesar established the Roman imperial system.[34] While Octavius Caesar won the contest for command of the state, citizenship died in the process. Octavius Caesar, every bit the dictator, maintained the façade of the Republic to avoid assassination, as befell his great uncle Julius, but Roman citizenship had become a sham (see chapter two for the consequences).

The Imperial Era (30 BCE– CE 476), or the second half of Roman history, dominated the remainder of Rome's political existence. The imperial era produced a regime that brought Roman history in line with the Han Dynasty of China. By this time, both of the new and mighty empires had reduced all their people to mere subjects. Even though Rome continued to call some of its people "citizens," they were no longer the politically active individuals who had run the Roman Republic.[35]

Originally farm size, military service, and political responsibility went hand in hand in Roman society. The shift of the bulk of Rome's population from active citizens to passive subjects, however, destroyed a vital aspect of the Roman constitution. This shift had eliminated the political-economic-ideological bond that had held society together. Initially, as mentioned, the early Roman Republic had relied on citizen-farmer-soldiers to supply the men needed to serve in the infantry as well as raise food to feed a growing population. The concept of the citizen-farmer-soldier was

a vital part of the pact laid out in the constitution because he used his own income to outfit himself for war and play his role in politics. Also, the original small number of latifundia supplied the officers of the army with its cavalry and the men who served as the city's magistrates. Again, farm size and political responsibility went hand in hand. During the Late Republic, however, Marius' military reforms broke up the farmer's responsibilities to the state as a soldier and a citizen. Thus, the professional soldier had replaced the citizen-farmer-soldier, which broke the link between self-reliant farmers, citizenship, and military duty.[36]

Considering the role played by the farmer in the Rome's military, focuses attention on the availability of farmland in the Roman system. The amount of arable soil in the Roman Empire stands in sharp contrast to the limited fertile acreage found within the Chinese Empire. The fact that the size of a Roman farmer's holdings defined his role as a citizen and a soldier was necessarily based on a large supply of farmland in the Italian Peninsula. In contrast, the relatively small supply of arable land in China imposed intense labor requirements on families working very small farms. Simultaneously, the danger posed by the unpredictability of the Yellow River also imposed the need for a strong centralized authority, in order to organize labor and funds to build and maintain an extensive irrigation and levee system.

The various sizes of early Republican farms generally exceeded those of Chinese peasant families. Even the small and medium-sized farms of the early Roman Republic were larger than the average Zhou family farm.[§] The amount of income a Roman farmer derived from a small farm supplied him with the light weapons needed to serve as a skirmisher. A medium-sized farm provided enough income to equip him as a heavy infantryman. In contrast, Chinese peasants served as draftees in the Zhou and later the Qin and Han armies; the ruler simply imposed both military service and a labor tax on the Chinese people. Chinese peasants' labor belonged to the state, which compelled them to maintain the irrigation systems, construct such massive state projects as the Great Wall, and build canals, roads, palaces, and defend the empire. Chinese peasants did not have a choice in the matter because the state used their labor for the common good—and however it liked. So long as China's peasants believed that their efforts did serve the common good, they worked willingly.

However, to limit the history of Roman agriculture to the Italian peninsula is to misunderstand the complexity of food production in imperial

[§] The only exception to this issue of comparative farm size was Rome's smallest farms. These were smaller than Zhou farms, but Romans that worked so few acres could not buy the armor needed to be soldiers or serve as citizens.

Rome. Much of the livestock and the domesticated plants that fueled the Roman army, government, and economy came from conquered lands. Rome added numerous provinces to its empire between 509 and 30 BCE. The acquisition of these lands opened Rome to diverse agricultural practices. For example, the domesticated plants and animals consumed by the Romans came primarily from the earliest agricultural sites of Mesopotamia and Egypt. Both regions became part of the Roman Empire, as did every other culture whose shores touched the Mediterranean and much of the Black Sea. To begin to understand the scope of the vast wealth of the agricultural lands available to Rome, one must start with Egypt, the Levant Coast, and Mesopotamia. This is where the domestication of plants and animals, as well as the formation of the first cities of Western civilization, began.

Egypt

When considering Egypt's contribution to the Roman economy, it is necessary to go back to the Bronze Age (3000–1200 BCE). This is because the domesticated plants, animals, and tools that helped form the bases of Western civilization were developed by peoples living in the Ancient Near East (i.e. Egypt and Mesopotamia). Also, once cultural traditions were fixed in an ancient culture like that of Egypt, patterns of life rarely changed. Finally, when the Iron Age began in 1200 BCE, Egypt was one of the few cultures in which an agricultural revolution did not occur. Egypt's methods of cultivation remained unchanged because so little land was fertile in this desert domain that the introduction of new and better iron tools changed little. Only the acreage that was watered by the Nile River produced food, though the amount of food generated by Egyptians working the Nile's floodplain was staggering. Hence, this text must travel back in time the see how the ancient culture of Egypt ended up feeding the people of Rome.

It was Egypt and Mesopotamia that contributed the oxen that pulled the Roman plow, the sheep, goats, and pigs that fed and clothed Romans, and the wheat and barley that Romans baked into bread or cooked into soup. Egypt itself became Rome's granary toward the end of the Roman Republic. In 31 BCE, Octavius Caesar defeated Mark Antony as well as the Egyptian Queen Cleopatra VII at the Battle of Actium and ended the Roman civil war. This victory gave Octavius control of Egypt as his personal domain. Now Octavius could use the fertility of the floodplains of the Nile River to feed even the poorest Roman citizens for free, so long as they came to Rome to eat.[37] In effect, the acquisition of Egypt made Octavius the patron of Rome, with all its citizens his clients.

The bounty of the Nile Valley approximately matched that of the Yellow River, but the Nile was a far gentler river then the Huang He. The first Western historian, Herodotus (*c.*484–425 BCE), aptly called Egypt, "the gift of the Nile." Surrounded by harsh deserts on the Libyan and Arabian sides of the river, the Egyptians needed the Nile to survive. As Egypt lies in a region that receives only one inch of rain per year, the Nile was the vital source of water and fresh mud that renewed Egyptian fields each year. To understand the limited amount of soil available for cultivation in ancient Egypt, one must learn a little bit more about the Nile itself.

The Nile is a remarkable river that flows from south to north, out into the Mediterranean. It headwaters are over 4000 miles away, near Lake Victoria. Lake Victoria is the largest body of fresh water in Africa, one whose shores are shared between modern Uganda, Kenya, and Tanzania. Supplied by the monsoon rains of eastern Africa, the Nile fills a deep riverbed with water that has cut a narrow crevasse on its trip to the sea. This narrow crevasse is also the fertile floodplain of Upper Egypt in the south. Emptying into the eastern Mediterranean, the mouth of the Nile has built up a massive river delta that offers more arable land to the Egyptian people. The delta is called Lower Egypt. Taken together, Upper and Lower Egypt represents 2.92 percent of all the land available to Egypt: approximately 11,675 square miles. This ribbon of fertile earth created the acreage used to feed the ancient Egyptian culture.

The Nile draws its water from very stable monsoonal rains. The abundance of moisture that these rains bring to eastern Africa fill Egypt's riverbed and cause a slowly rising and overflowing flood pattern. Given the relative gentleness of the Nile's flood cycle, Egyptian farmers never faced the Chinese farmers' central dilemma: the best land for cultivation also proved to be the most dangerous to work. On the contrary, Egyptians cultivated fields that seemed already prepared by nature for human use. Due to the annual monsoons, the Nile increases its water volume by fifty-fold during its flood cycle, and then retreats back into its deep riverbed, saturating the floodplain along its banks with moisture and fresh soil. In other words, the annual rise and fall of the Nile permitted a single, very long growing season on a very narrow ribbon of land with relatively little demands on labor.

The Egyptians formed a central government very early in their history. This central government arose from two key facts. First, the Nile's deep riverbed, gentle currents, and stable floods made this river an excellent highway. And second, the winds in Egypt blow steadily from north to south at a rate stronger than the south-to-north current of the Nile. Hence, a ruler could unify the country through travel. He could send a ship north

by lowering his vessel's sail and moving with the current. Then, to make a voyage south, all he had to do was raise the ship's sail and catch the prevailing winds. This permitted a royal presence throughout Egypt so that by 3100 BCE the country came under one king's rule.

Even though Egypt developed a central government very early in its history, the king never controlled the entire realm, as did the first Qin and Han Chinese emperors. Along the course of the waterway, local administrators managed the waters of the Nile for the Egyptian king. These officials governed *nomes*, or administrative divisions of the Nile, and thus were called *nomarchs*. They represented royal authority in their districts and built the dams that regulated the Nile's water and the soil. The laborers these nomarchs oversaw did not have to work very hard to maintain the irrigation system. They only had to move an estimated thirty cubic meters of soil each year, which only amounted to about ten days of labor.

In contrast, silt carried by the waters of the Yellow River continually clogged the riverbed, as well as the irrigation canals and channels. Compared to the Nile, the Yellow River carried 6.3 times the amount of silt in just over three-quarters the length.**

In hard numbers, the Yellow River carried 1.764 billion tons of silt each year as compared to the Nile's 280 million tons. This made the accumulation of mud in the Yellow River's irrigation system a constant problem. Every year, the Chinese had to mobilize thousands of peasants from many different provinces to dredge the Yellow River's mud deposits.

Unlike their Chinese counterparts, Egyptian *nomarchs* simply organized local peasant labor to build dams to irrigate portions of the Nile's floodplain. Constructed at right angles to the river's flow, these dams cut Upper Egypt into agricultural basins. Each basin varied in size from the smallest at 990 acres to the largest at 4200 acres. Within each basin, Egyptians carefully leveled the land so that the flood saturated every square inch of available earth. The annual flood began in June and ended in October, with the high-water level reached by September. At its peak, the Nile covered most of the river valley within Upper Egypt's crevasse. Towns and villages obviously had to be built on ground sitting above this water line, lest they be flooded, too, or mired in fresh mud. The moisture of the flood penetrated about one to two meters beneath the soil, which meant that farmers had enough water on the land to plant and grow their crops without the need to water the plants many more

** The Yellow River carries 57 pounds of silt per cubic yard, and the Nile carries 9 pounds in the same volume of water. This is a difference of 6.3 times the silt in the Nile. Also, the length of the Yellow River is 3395 miles, and the Nile is 4258 miles.

times as the plants matured. Hence, cultivation began in October, when the standing water had gone but the soil was still moist. This aligned Egypt's cultivation pattern with the winter planting cycle of the *omega* grasses of the Fertile Crescent: wheat, barley, lentils, peas, chickpeas, bitter vetch, and flax.

With the amount of labor needed to prepare for cultivation at a minimum, nearly all of Egypt's farmers focused their energies on planting, weeding, and harvesting after the flood. In addition, Egyptian soil was easy to work because the mud was fresh and simply laying on the surface of the floodplain. Rapid field preparation and generous harvests made Egypt a very rich country. Also, since the June to October flood cycle left the Egyptians idle, they were free to develop a type of peasant-cottage industry. This free time also liberated labor to build the land's spectacular monuments that made their civilization so famous.

Due to the soft mud deposited regularly by the Nile, Egyptian farm tools reflected the light demands of the agricultural workers. Put simply, they did not need to use heavy plows. The Egyptian plow was lightly built and harnessed to oxen by the animals' horns. The Egyptians shared with the Chinese the non-stratified soils of loose earth that made plowing easy. When draft animals were not available, Egyptian farmers simply harnessed themselves to a smaller and lighter version of the ox-pulled plow. They worked the land in a manner similar to the Stone and Bronze Age Chinese farmers.

In addition to the plow, Egyptian farmers also used a short-handled hoe with a very long blade. Farmers developed the latter early in Egyptian history, when they first started digging the earth along the Nile. The design of the hoes did not change with time, as the Egyptians continued to find them adequate for weeding and excavating the land. Because of the very short handles, however, these hoes required farmers to bend over quite close to the land, making the work they performed very hard on their backs.

Using the domesticated grains, pulses, and animals of the Ancient Near East to plant their fields, the Egyptians produced spectacular harvests on their fertile soil. The total harvest for any given year in Egypt depended on the amount of land covered by the Nile's flood. On average, the acreage ranged from 8 million to 14.7 million square acres per year, from which an Egyptian farmer could anticipate an average yield of 165 bushels of wheat for every 2.2 acres. This meant that harvest ranged from 600 million to 1.103 billion bushels per year. Scholars estimate that the subsistence requirements to feed an Egyptian farming family of six came to about 132 bushels per year, meaning that an Egyptian harvest could produce the bare minimum of food to feed some 27.2 to 50.1 million

farmers.[††] In other words, each year Egypt alone could have fed anywhere from 40 to 83 percent of the entire Chinese population during height of the Han Dynasty. Since Rome fed as many people as did Han China, Egypt must have been the Roman breadbasket.

Compared to other agricultural zones of the Levant, Anatolia, Greece, and Rome, Egyptian arable land was extremely productive. As a result, Egyptian farmers produced three to four times the yield of their counterparts in Greece or Italy. Also, while the river valleys of China were as fertile as Nile Valley, the quality of the Nile's soft water and natural tendency to irrigate the land eliminated the need for extra labor. Also, the Nile watered its floodplain without ravaging the land with periodic floods; but the Yellow River flooding often killed thousands of Chinese peasants. Such a stable supply of food as found in Egypt fuelled the political unity that helped to make Rome the ruler of the West.

The Levant and Mesopotamia

Turning back the historical clock to see how Egyptians worked the land revealed practices that survived into Roman times and belong to Western civilization. This is also required to understand how farmers cultivated the Fertile Crescent, which became part of the Roman Empire during the Roman civil war. Gnaeus Pompeius Magnus (106–48 BCE), also known as Pompey the Great, was a rival of Julius Caesar. Pompey was a talented general who oversaw successful military campaigns that added Turkey, Syria, and Palestine to the Roman Empire between 67 and 62 BCE. Caesar, however, defeated Pompey at the Battle of Pharsalius in 48 BCE, and Pompey suffered assassination in Egypt while trying to raise a second army to rechallenge Caesar. Pompey's death eliminated Caesar's last great rival to power, and Caesar went on to defeat what was left of his political opposition by 46 BCE. Mesopotamia fell under Roman rule during Trajan's reign (CE 98–117), but never fully remained in the hands of the Romans due to military threats from the Persians under the rising Parthian Dynasty (250 BCE–CE 226). Nonetheless, the addition of the lands of the Fertile Crescent to the Roman Empire set the stage for agriculture in Western civilization.

[††] I developed these population figures by using 132 bushels per year to feed a family of six as a base number. Then I used a yield of 165 bushels for every 2.2 acres. Next, I divided 8,000,000 cultivated acres by 2.2 to get 3,636,363, and multiplied this number by 165 bushels to obtain a harvest of 600,000,000 bushels. The next step was to divide 600,000,000 bushels by 132, giving 4,545,454 bushels that fed a family of six. And finally, I multiplied 6 times 4,545,454,giving a total of 27,272,727 people. I repeated this process with 14,700,000 cultivated acres and obtained 50,113,636 people.

Two varieties of wheat, emmer and einkorn, barley, peas, chickpeas, lentils, bitter vetch, and flax, plus pigs, goats, and sheep all come from the Fertile Crescent. Slash and burn farmers domesticated these plants and animals at beginning of agricultural revolution in 9600 BCE. Ecocide caused by deforestation drove these first farmers to rivers in quest for permanent fields. The Tigris and Euphrates rivers supplied the water and fresh soil these early farmers needed, and they chose the marshes at the mouth of the Persian Gulf, where the Tigris and Euphrates empty into the sea, as the most desirable place to grow their crops and found the most ancient of all the farms of Western civilization.

Interestingly, the *omega* plants and animals from the Fertile Crescent did not include cattle. Archaeologists have recently traced the domestication of cattle to the eastern Sahara with a very high level of certainty. In light of this find, the primacy long given to the Fertile Crescent as the region responsible for the most varied and generous supply of domesticated plants and animals to find their way into Western civilization needs at least slight modification. Nonetheless, the remainder of the original *omega* plants and animals produced on the floodplains of the Nile, Tigris and Euphrates, and Indus Rivers still belong to the Levant and Mesopotamia.

Modern world historians have long called the Fertile Crescent the "Cradle of Civilization." Surrounded by desert, the Fertile Crescent's lands enjoyed a Mediterranean climate that provided the perfect conditions for the earliest foragers to decipher the secrets of cultivation. Warm dry summers and mild wet winters produced an abundance of wild seed-producing grasses. From the knowledge they gained from gathering these seeds, the foragers developed the first *omega* varieties of grains and pulses. Also, the geographic location of this crescent-shaped region, spanning, as it does, a land bridge, provided a natural conduit for the transference of the Fertile Crescent's discoveries to three continents: Europe, Asia, and North Africa. The end result was the development of the oldest cities in world history.[38]

The phrase "Fertile Crescent" comes from James Henry Breasted (1865–1935), a nineteenth-century archaeologist from the University of Chicago. He was one of the most widely known scholars of antiquity and the founder of the field of Egyptology in the United States.[39] The region he described for its fertility comprised territories that span from modern Iraq to Syria, Lebanon, Israel, and Palestine. Also included is the southern fringe of Turkey. These lands were home to the Natifin people, foragers from the Neolithic era (16000–5000 BCE). They built tiny hamlets, spreading from the Levant Coast (Syria, Lebanon, and Israel) to the Tigris and Euphrates Rivers. During the Younger Dryas (10,400 and 9,600 BCE), a bitterly cold millennium, some of the Natufin people domesticated several of the key crops that helped

them to survive this violent shift in climate. These crops made up the food base of the Fertile Crescent. After 9600 BCE, heirs to the Natufin legacy took up residence in the Shot-al-Arab region (marshes near the Persian Gulf) and produced the food that fed the world's first civilization, Sumeria.[40]

As a geographic site, the Fertile Crescent is a product of plate tectonics. This crescent shaped land bridge is a place where the African and Arabian continental plates collided with the Eurasian plate to produce a complex topography filled with broad alluvial basins (water-based floodplains rich in river sediments). Powerful rivers created marshlands that allowed the Fertile Crescent to support a long history of ancient cities. Starting with Sumer (4000–2200 BCE) at the mouth of the Tigris and Euphrates Rivers, civilization marched upstream. Akkad, Babylon, and Assyria followed, from 2800 to 600 BCE.

The Fertile Crescent also played host to invading chariot cultures: the Kassites who conquered Babylon, the Hittites who occupied Turkey, and the Mitanni who captured Syria from 1800 to 1200 BCE. Finally, the region supported the Phoenicians of Lebanon and Israelites of Palestine during the late Bronze and early Iron Ages (1200–500 BCE). From all these many cultures came the original artifacts of Western civilization: the first written scripts (which later became alphabets), legal codes, empires, agricultural tools, the oldest bronze and iron metallurgy in world history, the first monotheism, and the first plants and animals that fed the West and India.

It was the Fertile Crescent that set the stage for the development of Western civilization. Although its agriculture did not play a critical role in feeding the Roman Empire directly, it was the peoples of the Fertile Crescent who taught the founders of Rome what to grow, what animals to use, and what tools to adapt to their fields. Besides the material foundations of Western civilization, the cultures that began in the Fertile Crescent also supplied the Western civilization's first calendars, written scripts, and system of mathematics, something crucial for the efficient management of an agricultural system. Finally, it was a tiny sliver of the Fertile Crescent, Palestine, which provided the religious concepts that came to dominate Western civilization's cultural imagination. Hence, knowledge instead of food proved to be the key contribution of this "cradle of civilization."

Greece

The legacy of the Fertile Crescent, and the bounty of Egypt, made those two cultural zones highly valuable districts within the burgeoning Roman Empire. Less generous in terms of agricultural production, but

more valuable in terms of economic development, was Greece. A study of ancient Greek agriculture, however, reveals a set of problems that produced some completely unexpected consequences. Some of these consequences were negative and others positive, but all of them were factors that shaped the Greek economy and ended up playing a major role in the development of the Mediterranean world and Rome (and therefore Western civilization).

Greece first became a province of the Roman Empire in 146 BCE, when a Consul (chief magistrate) of Rome, Lucius Mummius (*c.*175–126 BCE), crushed the Achaean League at the Battle of Leucopetra on the Isthmus of Corinth and ended Greek independence.[41] The addition of Greece to the Roman Empire inspired Quintus Horatius Flaccus (65–8 BCE), otherwise known as Horace, to utter the phrase "*Graecia Capta ferum victorem cepit, et artes intulit agresti Latio*," which translates as: "Greece, once conquered, in turn conquered its uncivilized conqueror, and brought the arts to rustic Latium." Taken together, both the conquest and the addition of the highly influential, cultural and intellectual Greece to Rome's growing empire changed the economy and creative imagination of the Roman people. How Greece made these changes to the Roman world reflects the way Greek geography influenced Greek culture.

The geography and climate of Greece created the setting for the development of a unique economic culture. The effects of plate tectonics made the Greek peninsula what geographers call a "shatter belt zone," meaning a region featuring chaotic, or irregular mountain patterns. The Greek mainland formed from a collision between the African, the Eurasian, and the Aegean Plates. The jagged mountains formed in this land were always prone to frequent earthquakes and volcanic activity. Sharp earth trimmers and massive lava flows further shaped a complex landscape. With the land's many valleys isolated from one another by the nearly impassable mountain ranges, the development of overland travel was discouraged, but the many natural harbors and easy access to the sea fostered sea travel and soon maritime trade. The climate offered hot, dry summers, temperate springs and autumns, and mild and wet winters. In the isolated valleys the people undertook agriculture.[42]

Greece's unique geographic setting and climate encouraged the integration of ancient Greek farming with trade so that soon these two economic activities became inseparable. Farmers had access to fertile fields in their various valleys so long as they were willing to invest the time and labor in clearing the land. Such activity, however, also caused significant erosion when the winter rains hit the open landscape. As a result, all ancient Greek communities soon became aware of the precarious balance between plowed fields, sharp variation in seasonal rains, and soil erosion, all three

of which determined the year's food supply. Because of the uncertainty of water volume during the rainy season and the limited spaces in which to practice cultivation, each ancient Greek community developed a strong possessiveness of their locality. These conditions combined with a reliance on sea travel to shape Greek religion, social organization, law, government, commerce, and immigration. The end result was the formation of the Greek city-state as the dominant political system and the spread of their sophisticated network of commerce throughout all of Greece, as well as all the lands along the Mediterranean and Black Sea coastlines.[43]

Many of the features and conditions of ancient Greek agriculture matched those found in Italy. The use of ards, oxen, sickles and scythes, the valleys, the plains, and the terrace cultivation patterns were similar, but the availability of space in Greece was far more limited compared to Rome. Jealous protection of these isolated fields led to constant warfare between the city-states, which aligned the defense of a town's lands with the concept of citizenship. The perfection of defensive body armor, helmets, and shields, along with offensive weapons such as spears and swords, encouraged infantry formations that aligned able-bodied farmers with the defense of their city's food source. The inability to support a large population of horses on the limited grazing lands of Greece restricted military engagements to combat on foot. The result was the formation of a city-state system that encouraged a union of military action, politics, and agriculture.[44]

The relative poverty of Greek agriculture compared to that of Egypt, the Fertile Crescent, and Italy set the tone for a spectacular event that unfolded in Greece, one that profoundly shaped Western civilization. Between 750 and 550 BCE, a population explosion on the Greek peninsula quickly outstripped the land's capacity to feed the increased number of people. The end result was an exodus of citizens on a quest for new land that took members of different city-states, first east to the Aegean Islands, then to the Turkish Coast, and finally into the Black Sea. Soon after, there were further migrations westwards to southern Italy, Sicily, the southern coast of France, the eastern coast of Spain, and south to North Africa. The Greek colonies in North Africa and Sicily soon encountered, clashed, and then fought the earlier settlers, which led to a long history of conflict. Each of these new Greek colonies brought the institutions of their founder city with them, but all of them were independent economic and political experiments. All these Greek ventures looked for several qualities in a site on which to establish a colony: good soil, plentiful natural resources, defensible land, and a good location for trade. Once they had firmly established themselves, the new colonies soon formed commercial networks with the Greek mainland, making agriculture and trade even more inseparable. The end result was the formation of so-called network cities.[45]

A network city is one that lives by trade more than by local food production, a profile that numerous Greek city-states fit. Among the most prominent of these Greek network cities of the ancient world were Athens and Corinth. Their commercial design and their colonies allowed both network cities to import food from abroad and specialize in grape and olive production for export—a type of commercial design that made food production and commercial exchange nearly the same activity. Although both cities developed powerful trade networks, local politics still followed independent lines of evolution. Athens became famous for its democratic institutions, and Corinth was a notable oligarchy.[46] Both cities also engaged in independent political decisions, diplomacy, and military campaigns. But it was Athens that stood out as an intellectual center, so much so that it was soon distinguished from all other cities in Greek history.

It is this intellectual tradition that was the most important to Western civilization. Greek philosophy and science blossomed as a result of the linking of trade and agriculture. All the cities that contributed to the Greek philosophical tradition belonged to the network of commercial activity that colonization stimulated. Situated all across the Mediterranean basin, these various cities made contact with many different and contradictory cultural practices. These contradictions led the Greeks to question their own traditions. Doubt undermined the Greek religious worldview and opened the Western mind to explanations of nature that did not necessarily include the gods. This was a unique approach to an understanding of the natural world that only the Chinese would match. These new philosophical beliefs that functioned without a visible role for the gods emerged in China and the West at roughly the same time. This is the subject of chapter two.

Soon after Rome conquered the Greek colonies of Italy, the Romans began to imitate the Greeks. When the Romans conquered Carthage, Macedonia, and Greece, Rome added trade to its agricultural base. As Rome expanded to gain control of the entire Mediterranean, the Romans became completely Hellenized. The end result is that a new and powerful culture emerged in Western civilization: the Greco-Roman culture. This is the civilization that statistically matched China in size, number of people, and administrative structure. Yet, all the different elements that went into the Roman Empire still made it much more diverse in design than China.

Overview of the Roman Economy

Diversity defined the geographic composition of Rome's conquests. Each new province that Rome acquired went through a process of economic assimilation, a process that followed a common pattern.

Wherever the Romans added a new province, they engaged in vast deforestation projects that served as a general method of clearing the land for agriculture. Each new province they acquired became part of a growing, complex economy. From this complexity emerged three broad economic spheres between 200 BCE and CE 400. The first of these spheres, the inner sphere, comprised Rome and Italy; this sphere functioned as a consumer magnet that drew in wealth from all Roman provinces, as well as the trade that went beyond Rome's frontiers. The second sphere was a ring of rich provinces comprised of Spain, Syria, Greece, Gaul, North Africa, and West Asia that generated a wide variety of goods and products that matched the economic model first established by Greek commercial network cities. The third sphere included the border provinces that took up defensive stations to protect the inner workings of the Roman Empire.[47]

By the first century CE, the Roman Empire fed some 50 to 60 million people, which required a highly elaborate infrastructure. To reach inland territories, the Romans built a primary system of roads that eventually comprised 56,000 miles of paved highways. These roads remained unrivaled in design until the macadam roads of nineteenth-century Europe. To these highways the Romans added another 200,000 miles of secondary roads that supported a widely dispersed and regionally specialized economy. This vast overland commercial network sustained a wide variety of inland urban centers; these were the cities that trade and travel by sea could not reach. Among these cities were some 900 towns in Rome's eastern provinces, over 300 in North Africa, and another 300 on the Iberian and Italian peninsulas. These cities made up the urban areas of the first and second economic spheres and served them as the richest provinces of the Roman Empire. They ranged in size from 500 to 1000 acres, or between just under 1–2 square miles. Rome itself covered 3500 acres, or 5½ square miles, and housed 750,000 people. The towns of the third economic sphere were frontier fortresses, such as the now modern cities of Cologne, Strasbourg, Vienna, Belgrade, and Mainz and sustained major concentrations of legionaries. These cities grew into major manufacturing centers, and served a well-equipped standing army estimated at 350,000 strong.[48]

Within this urban landscape, the distribution of the Roman population placed 23 million people in Europe, 20 million in Rome's Asian provinces, and another 11.5 million along North Africa's shores. Among Rome's provinces, Syria, Egypt, Cyrenaica, and Cyprus maintained the most densely populated zones, with as many as 45,600 people per square mile. Italy came in second, with populations ranging from 2400 to 22,800 per square mile. With such heavily concentrated urban centers and rural zones to support, Roman agriculture and overland transport had to be very effective.[49]

Roman trade routes crisscrossed the Mediterranean and its surrounding lands in every direction by the end of the first century CE. All these trade routes placed Rome at the center and then expanded outwards across Asia Minor, the Levant coast, the Red Sea, and the Persian Gulf, reaching as far east as China and India. In time the Roman Empire became highly dependent on imports such as grain, natural resources, spices, animals, ores, gems, exotic birds, gold, silver, copper, lead, and other essential materials, from well beyond its borders. Such an elaborate internal system, which matched and relied on an equally elaborate external commercial network, took over five hundred years to build. The trade routes themselves linked Rome to the Eurasian and African worlds. The items exchanged within the Roman Empire, and between the Roman world and Eurasia and Africa, emphasized the differences between a highly urbanized civilization and far less technologically developed regions found within Asia and Africa. From the first century CE, Rome imported at least 15 million bushels of grain from North Africa and Egypt per year. The western trade routes brought great quantities of gold and silver into Rome, which it needed to balance its payments with China and India. Gold, silver, tin, and other metals were brought to Rome from mines in Spain, Gaul, and Great Britain. Wine and oil traveled from Spain, Gaul, and Greece. As a result of this elaborate system of trade, Rome ran a deficit in its exchange of goods with China, India, and Africa. Nonetheless, this complex system represented an elaborate economy that the Romans built, and medieval Europe would not be able to duplicate Rome's achievements[50]

Because of the complexity of its economy, the Roman world denied ancient Western civilization the economic and political focus found in China. Unlike the model of political organization created by the Han Dynasty that demonstrated to the Chinese people how to organize the vast terrain of their enormous empire, the Roman system was simply far more diverse. The Han imperial example taught the Chinese how to manage their agricultural resources and tame their violent rivers. This model also included the development of a workable philosophy that served as a successful political ideology to remind the Chinese how to conduct the state's business (see chapter two). This meant that when the Han Dynasty fell, the circumstances for the successful reorganization of a replacement state still existed. Western civilization did not share these same attributes and, as we shall see in chapter two, Western philosophy and political history never successfully integrated. Finally, the diversity and variation in Western agriculture denied a similar economic focus as found in China. When Rome fell, no good economic or philosophical system existed to facilitate reunification in the West. This made the post-Rome splintering

of Western civilization into localized, separate political systems both possible and likely. This, however, will be the subject of chapter three.

Notes

1 Steven Mithen. *After the Ice: A Global Human History 20,000–5000 BC*, p. 37.
2 Jared Diamond. *Guns, Germs, and Steel: The Fate of Human Societies*, pp. 186–187.
3 For an excellent description of China's loess deposit see: *The Secret of China's Vast Loess Plateau*. Biot Report no. 357, May 7, 2006. http://www.semp.us/publications/biot_reader.php?BiotID=357 and http://news.stanford.edu/news/2011/june/china-reap-part3-061511
4 For a cross section of the Yellow River's riverbed and flood patterns see John K. Fairbank and Edwin O. Reischauer. *China: Tradition and Transformation*, p. 10.
5 Paul S. Ropp. *China in World History*, p. xv.
6 For a description of ancient Chinese agriculture see: *Chinese Geography and Maps*. Ronald Knapp consultant. http://afe.easia.columbia.edu/china/geog/maps.htm
7 See Neolithic Tomb at Dawenkou. http://depts.washington.edu/chinaciv/archae/2dwkmain.htm
8 Jing Yuan. *Livestock in Ancient China: An Archaeological Perspective*. http://anthro.unige.ch. p. 84.
9 *Ibid*. pp. 87–89.
10 *Ibid*. p. 89.
11 *Ibid*. p. 89.
12 Yin Shaoting. *The Source, Types and Distribution of Chinese Plows*. Sessions III. The Folk Implements and Folk Techniques. pp. 103–104 http://www.himoji.jp
13 *Ibid*. p. 104.
14 *Ibid*. p. 107.
15 Dun J. Li. *The Ageless China: A History*, pp. 333–337.
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