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Losing "Eden"

"We are a biological species arising from Earth's biosphere as one adapted species among many." As one of the foremost naturalists in the world, E.O. Wilson has long argued that humans and nature share a deep, almost symbiotic relationship – they each shape and in turn are shaped by the other. This instinctive bond between people and other living systems, the product of biological evolution, he calls "biophilia" – literally "love of life." Yet of all earth's species, humans harbor the greatest capacity to inflict damage on and ultimately destabilize and destroy the very environments that sustain them. "Darwin's dice have rolled badly for earth," Wilson writes. Over time, evolution singled out our highly intelligent carnivorous primate as the dominant species in the food chain, and the traits that ultimately ensured human success fell heavily on the natural world. Wilson hopes, however, that the same big brains that enabled us to learn myriad languages, develop increasingly effective technologies, and create vibrant cultures, can also help us prevent catastrophe and collapse. "We are human in good part because of the particular way we affiliate with other organisms," he argues, and we must "save the natural world in order to save ourselves."

A close examination of the "deep history" of the environment in the American West, this evolutionary work in progress, illustrates Wilson's biophilia hypothesis, revealing how the unique geographies of the West have exerted such a powerful influence on the peoples of this region and how those people, in turn, have shaped and altered this largely arid region over time. As the first people to set foot on the North American continent, westerners

Losing Eden: An Environmental History of the American West, First Edition. Sara Dant.

constantly innovated. New tools, the advent of agriculture, fire- and irrigation-managed environments, and the development of extensive trade routes were essential to early survival and success in the West and belie the myth of a "pristine" "Edenic" America "discovered" by Europeans.

Christopher Columbus was not first. He did not "discover America" in 1492. In fact, he was very, very late. Instead, the discovery story begins much, much further back in time and on the *western* side of North America, not the eastern. In the beginning, earth's land masses were consolidated into one super-continent that scientists have called Pangaea. About 180 to 200 million years ago, Pangaea began to break apart as a result of plate tectonics. As the continents separated, the plants and animals on each began to evolve and adapt to their unique environmental circumstances. Over the ensuing millennia, this evolutionary divergence produced myriad species, including our own human ancestors, who first separated from the progenitors of chimps and apes in Africa between 6 and 10 million years ago. By about 4 million years ago, these forebears had evolved the unique trait of walking upright, and by 2.5 million years ago, protohumans had begun to use crude stone tools to hunt large game. Armed with this primitive weaponry, these early hunters effectively exploited the changing environments around them to become the most widely distributed large land animals on the planet. These protohuman precursors to our own species (*Homo sapiens*) included *Homo erectus* and *Homo neanderthalensis* (Neanderthals). Their migration out of Africa began about 1 million years ago and slowly diffused into Asia and eventually, by about 500 000 years ago, Europe. *Homo sapiens*, distinguished by their modern skeletons and larger brain sizes, emerged in Africa approximately 180 000 years ago. As *Homo sapiens* began to leave Africa for other destinations between 55 000 and 70 000 years ago, arriving in southeast Asia about 55 000 years ago and Europe and Australia about 45 000 years ago, their big brains enabled them to cope with colder climates, use fire to shape their environment, hunt larger game animals, and facilitated what some scholars have called the "Great Leap Forward" – a sudden burst of sophistication that led to greater social organization. By 30 000–40 000 years ago, *Homo sapiens* were capable of storing vast amounts of information, crafting more sophisticated hunting tools (e.g. flint flaking, spears), and transmitting this knowledge via spoken and then ultimately written language from generation to generation, in effect compressing the entirety of human experience and wisdom collected over thousands of years into the brains of the most current generation. All of this enhanced human adaptability. While paleoanthropologists, those who study early humans, hotly contest the nature of the interaction between *Homo sapiens* and Neanderthals, *Homo sapiens* eventually became the sole surviving species from this once-diverse family tree.

Although scientists still debate their precise arrival date in the Americas, archeological and paleontological evidence shows that modern humans first came from the Old World to the New World during the last Ice Age, at least 15 000 to 30 000 years ago (see Figure 1.1). During this time frame, the earth's climate was much colder and much of its surface water was locked up in sea ice and glaciers. As a result, sea levels dropped significantly and many previously flooded or submerged areas became dry. One of these places was the Bering Strait, which lies between today's Alaska and Siberia. While the Bering Strait normally cradles the Bering Sea, during the Ice Age this relatively narrow waterway became a land "bridge" called Beringia, perhaps 1000 miles wide north-to-south at times, across which large game animals (megafauna) slowly migrated and human hunter/gatherers followed in pursuit. Over time, both animals and humans followed ice-free corridors southward, eventually populating all of North, Central, and South America. Some archeologists have also argued that in addition to these inland migrants, other Old World humans may have followed the coastline along Alaska and then continued southward along the West Coast, using small boats to propel them to new destinations in the Americas. Tantalizing new scholarship also suggests the possibility of transoceanic immigrant travel to South America from Australia around 15 000 years ago. Regardless of how they arrived, these first Americans adapted to the diverse environments of the continents and developed hundreds of distinct cultures and languages long before Columbus and the Europeans eventually arrived thousands of years later.

Anthropologists and historians have identified and classified three basic phases of human history in the Americas prior to European contact. The term "Paleoindian" refers to the earliest inhabitants and their culture, which dominated from at least 15 000 years ago until approximately 9000 years ago. As these highly nomadic first Americans diffused across the continents, they engaged in intensive hunting and gathering, utilized stone tools, and lived in bands of between 20 and 60 individuals. By about 11 500 years ago, this included the Clovis Culture, characterized by their fluted-stone spear points and named after the site in today's New Mexico where archeologists first discovered their artifacts. Clovis (and later Folsom) peoples ranged across much of the West and incorporated a rich variety of plants and big game animals into their diet.

Approximately 10 000 years ago, global environmental changes that featured a gradual warming trend and the end of the Ice Age, also brought to a close the long Pleistocene Epoch (2.6 million years ago until 11 700 years ago). This profound environmental transformation was one of the causes of the disappearance of most of the Americas' megafauna and ushered in the "Archaic" period. During this phase, which predominated until about 4000–5000 years ago, Native peoples augmented big game hunting with seasonal fruit and vegetable gathering, fish, and small game. Many Natives continued to employ

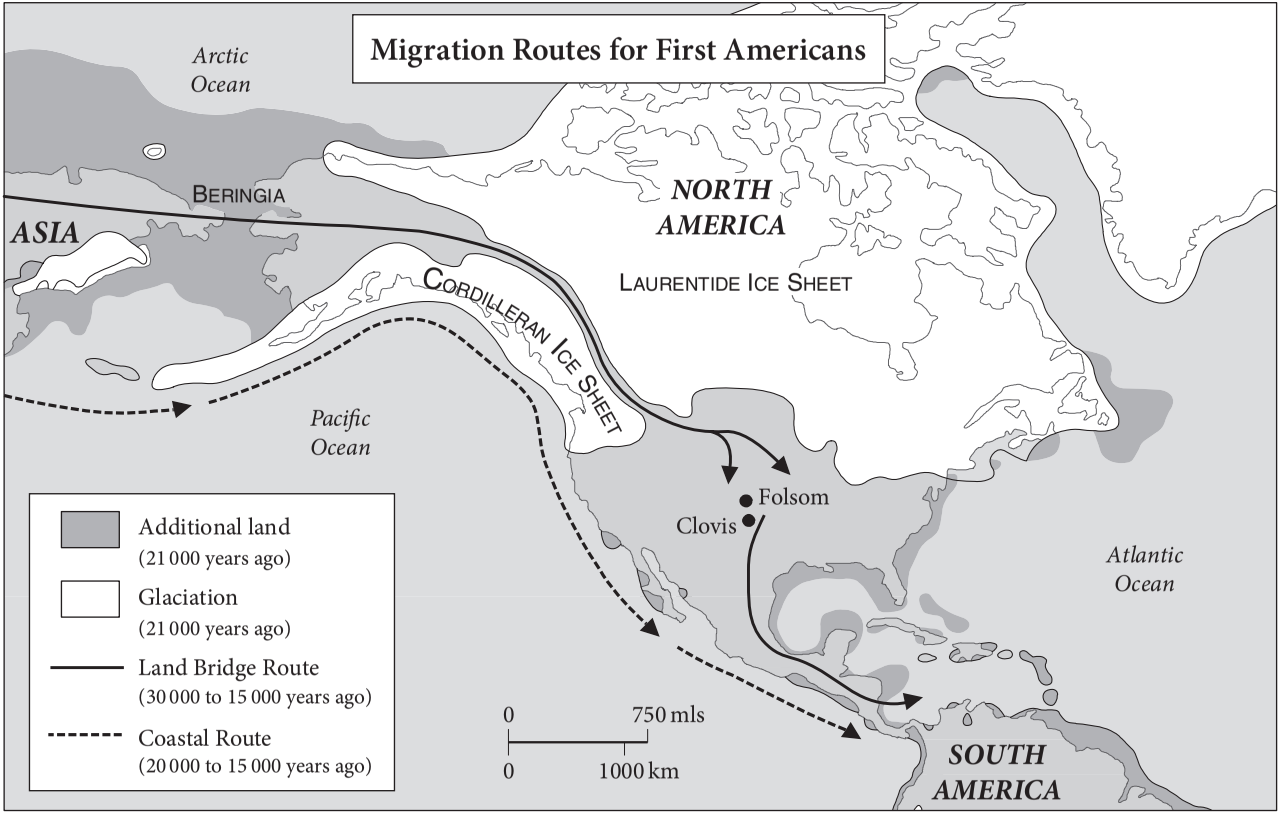

Figure 1.1 Archeological, geological, and anthropological evidence indicates that Eurasian inhabitants migrated to the Americas at least 15 000 years ago.

this subsistence strategy even after European contact, but others embraced agriculture and animal domestication beginning approximately 5000 years ago. This last phase of pre-contact history is known as the Neolithic Revolution.

Long before Columbus and the Europeans "discovered" the New World, Paleoindians and Archaic peoples had to learn to adapt and thrive in the Americas, and their interactions with the land profoundly shaped their cosmology. In sharp contrast to the Judeo-Christian creation story, which Europeans interpreted to mean that their [white male] God created the earth for humans to subdue and dominate, Native American origin stories depict a much closer bond between humans and nature, although most reject the basic premise that Paleoindians migrated from Asia to the Americas. The Kiowas believe they emerged into this world through a hollow log; the Pawnees arrived via whirlwind; Old Man Coyote created the Crows; and Southwestern Pueblos emerged from a dark underground womb-like portal called a *sipapu*. Regardless of their genesis, all Native creation stories are deeply rooted in nature and centered around bringing order out of chaos. Many accounts also involve the establishment of kinship ties between humans and animals, reinforcing their shared connection – their biophilia – with the natural world.

Whatever their point of origin, Paleo- and Archaic Indians relied directly upon their immediate environment to sustain them as hunters and gatherers, and the world these first Americans occupied was a floral and faunal cornucopia. As recently as 15 000 years ago, the primeval American West rivaled Africa's Serengeti Plains. A safari across that western landscape would have encountered camels and sloths and saber-toothed cats, herds of elephant-like mammoths and mastodons, giant early bison, horses, as well as lions and dire wolves and short-faced bears. According to many paleoanthropologists, once the Clovis hunters arrived around 13 000 years ago, they quickly helped drive the vast majority of these easy-target giants to extinction. Since many of these beasts were not prime hunter prey, however, some scientists have also argued that these massive extinctions resulted from climate change in the wake of the last Ice Age. Whatever the cause, and it is likely a convergence of both, the massive Pleistocene die-off permanently wiped out mammoths and mastodons, gigantic beavers and condors, and even a 6.5-foot saber-toothed Pacific Northwest salmon, in addition to the animals listed above. Indeed, with the exception of native pronghorn antelope, only those species that had migrated across Beringia with humans and had evolved earlier survival and co-existence strategies, such as elk, deer, and bighorn sheep, avoided this grim fate. This great ecological simplification meant the West lost much of the wildlife diversity that Africa still retains.

Among the most puzzling extinctions of the great Pleistocene die-off was that of North American horses. Historians and anthropologists have offered

numerous explanations for their disappearance, but none seems quite adequate. Archeological evidence supports the combination of over-hunting and climate change as the major culprits for the extinction of mammoths and saber-toothed cats, whose small numbers and long gestational periods limited their populations anyway, yet little evidence exists regarding the disappearance of horses. Scientists believe that until about 10 000 years ago, ancestors of the modern horse dominated the natural environment of North America, constituting as much as one-third of the continent's faunal population. From their American base, these wildly successful inhabitants spread around the world (reverse Beringia migration) and became, over time, the zebras and wild Asian steppe ponies of the modern era. So, what happened here? How did this obviously successful, stable, significant population crash? Completely? Especially when their habitat, the vast grasslands of the western Plains, remained intact?

The usual suspects provide no answers. Paleontologists have found no evidence of horse jumps, for example, the mass-death kill sites used by early human inhabitants to harvest bison, nor have they found arrow points or hunting implements preserved with fossilized horse remains to indicate hunting as they have with, say, mastodons. Furthermore, if as some have posited, horses were so susceptible to human predation, why did they live on in other parts of the world? At this point, there seems to be no definitive answer to these vexing questions. But the consequences of the Pleistocene die-off were definitive. In combination with the slow development of agriculture in the Americas, the absence of big game animals with domestication potential further handicapped Archaic Indians in the coming Neolithic/Agricultural Revolution. When pastoral Europeans finally did arrive, they encountered Native Americans who had domesticated only one large mammal, the South American llama (and related alpaca), a few fowl, and dogs. American Indians utilized no other beasts of burden and their agricultural development lagged behind that of Europe's as a result.

Interestingly, of all the habitable continents colonized by migrant human populations, the Americas were the last to experience the "Neolithic Revolution" (Australia never experienced it). Literally "new stone age," the Neolithic Revolution was the grand human experiment in living with domesticated plants and animals that also included grinding stone tools and smelting metals. So why were the Americas late and with what consequences? The Fertile Crescent of the Middle East (present-day Iraq, Syria, Lebanon, Egypt) occupies the vanguard of the Neolithic Revolution, the most critical period of human development. Historians argue that this sweeping geographic arc encompassing the Tigris and Euphrates rivers of ancient Mesopotamia and the Nile River Delta of ancient Egypt formed the cradle of human civilization. It was here, at least 8000–12 000 years ago, that humans first learned to farm and raise livestock, and later to irrigate agricultural fields. Archeological

evidence indicates that this Agricultural Revolution would also evolve independently at later dates in several other locations around the world. Everywhere the Neolithic Revolution occurred, it profoundly transformed the relationship between people and the natural world: human populations became less nomadic and more sedentary, produced food more efficiently and in greater quantities, and used the escape from daily hunting/gathering responsibilities to further develop art, culture, math, science, religion, and government. In essence, agriculture allowed humans to appropriate the energy of the sun for their own gain and accelerated cultural advancement.

In the Americas, however, the Neolithic Revolution began slowly and "accelerated tardily," according to environmental historian Alfred Crosby, leaving Native Americans at a distinct disadvantage when iron- and steel-wielding Europeans finally did arrive. Corn offers one explanation, he believes. Because this eventual staple evolved from a grass to a food source so slowly, the populations of the Americas, as well as their innovations, fell further and further behind those of wheat-growing Europe.

Europeans aggressively embraced sedentary agriculture, domesticated animals, and cultivated their farmlands far more rapidly than their Native American counterparts. Why? Population pressure. As human numbers increase and their demand for food rises correspondingly, people face a choice: control population or produce more food. They must "become either celibate or clever," Crosby humorously concludes. Celibacy has never been popular and population control was usually brutal, including instances in prehistory where Native peoples killed up to 40% of their female infants. Faced with such horrible prospects, humans usually chose plan B, a more reliable food supply, which farming readily addressed. But the shift from hunting and gathering to agriculture, which fundamentally altered their relationship with the natural world, usually did not occur until population densities outstripped the carrying capacity of the surrounding environment. In other words, only when people could no longer sustain their communities through subsistence hunting and gathering did they turn to the innovation of domestication. The limits of nature, in essence, forced steadily expanding human societies to make the leap. And because people settled in Europe far earlier than in the Americas, the population densities there reached critical mass earlier. The interconnectedness of the Old World – Eurasia and Africa – further facilitated the transmission of innovation through migration and trade, thereby giving Europeans a head-start in the Neolithic race. The Americas, by contrast, were disconnected from the rest of the world; as global temperatures gradually began warming approximately 15 000 years ago, signaling the end of the Ice Age, glaciers retreated and Beringia re-flooded. Paleoindians and later Archaic peoples, geographically isolated in the New World, would pay a heavy price in the long run for their Neolithic tardiness.

Despite an extensive scientific record of human habitation and alteration of the natural environment, the myth of a virginal American wilderness prior to the arrival of Europeans persists. Historians have challenged this Edenic vision, arguing that nineteenth-century writers and painters such as Henry David Thoreau and George Catlin created the "pristine myth" by overlooking the extensive habitat alteration that Indians had imposed and depicting them instead as rare and benign occupants simply waiting for "real" (European) history to begin. Nothing could be further from the truth. This mythology of a hemisphere "untrammeled by man" (to use the words of the 1964 Wilderness Act) is problematic for several reasons. First, it drastically underestimates the size and sophistication of Native populations. Prior to the arrival of Europeans, New World Indians probably numbered around 54 million, with 3.8 million living north of Mexico. Thus the Americas were far from "empty" and hadn't been for 15 000 years.

Second, the pristine "Eden" myth ignores the influence these millions exerted over the lands on which they lived. Environmental historians and anthropologists know that Indian use of fire throughout the West dramatically altered forest composition, expanded grasslands essential for game animal grazing, and dispatched pesky parasites such as lice. Burning favored fire-tolerant tree, shrub, and grass species and created more open park-like forest patterns in places like California. Regular seasonal burning also preserved open grasslands by halting tree and shrub growth and expansion; ecologists believe, for example, that the modern sagebrush landscape of the interior West only assumed that aspect by the 1800s, when non-Indian fire suppression replaced historic burning regimens. These ecological changes, in turn, created ideal habitats for large game animals, limiting Native need for domesticated livestock, and opened up suitable swaths for agricultural cultivation. In the Southwest, extensive canal systems irrigated fire-cleared gardens and fields and enabled sizable populations to live in otherwise arid environments. Deforestation, burning, and cultivation all also exposed soils to erosion.

The final problem with the pristine myth is that it reduces all early Indians to primitive terms and disregards their social and cultural sophistication, further obscuring the environmental impact of their urban settlements. Large populations took a heavy toll on local ecosystems necessitating long-range trade for goods and resources. These trade routes connected Native peoples throughout the continent and led to the establishment of extensive road systems, some of which remain in use to the present. In 1492, then, Columbus and arriving Europeans "discovered" not a pristine wilderness devoid of human influence, but a thoroughly Indianized natural environment and populations that had significantly altered and managed the American landscape for thousands of years. Far from being "benign," Archaic and Neolithic

Indians in fact exerted a disproportionate influence over the natural world and its major components. Perhaps nowhere was this influence more dramatic than in the evolution of maize/corn.

In the Americas, the shift from Archaic hunting and gathering to Neolithic agriculture occurred relatively recently, just 5000–7000 years ago in Mexico and about 4500 years ago in what is now the United States. Despite its recent appearance, agriculture was nevertheless transformative, and while the earliest domesticated plant in the Americas was squash, corn became the staple that allowed some New World Indians to flourish and expand. Humans and corn formed a powerful symbiotic relationship and the plant's evolution profoundly shaped the lives of Indians. Indeed some Mexico Natives still refer to themselves as "the corn people" and many western Indian creation stories revere the Corn Mother as the origin of their people – homage to the grain that sustained and sustains them.

Corn's caloric value derives from its ability to efficiently capture and store energy, but its modern cob-and-husk design renders it utterly dependent upon human beings for seed dispersal and reproduction. Simply put: without people to de-husk and plant it, corn would become extinct; husked cobs can't grow. Historically, there were no wild maize plants, no corn forebears so to speak, but Neolithic Indians quickly embraced hybridization to improve both the size and quantity of weedy grasses that eventually became corn. Corn, however, is terribly inefficient compared to wheat and other grains (grown by Europeans). It not only requires intensive human attention during all parts of its lifecycle – manual planting rather than simple scattering, individual hand-harvesting rather than sickle-swath mowing, and physical seed removal – but it is also lower in vitamin and protein content than wheat and more rapidly depletes the soil. Thus, corn farmers in the Americas had to expend far more energy to produce their staple than did their European wheat-growing counterparts.

Furthermore, while this "new" food sustained larger and larger populations, particularly in the arid American Southwest where it flourished, it also rendered Indians fundamentally less healthy. Paleopathologists, who study disease in early human populations, have discovered that corn consumption caused a dramatic increase in cavities and tooth decay, osteoporosis, increased the frequency of disease, and led to a *rise* in mortality at every age. The reasons are fairly simple: hunters and gatherers enjoyed a much more varied and rich diet of proteins, vegetation, and vitamins and minerals, while malnourished (especially in iron and calcium) agriculturalists relied heavily on this central starchy corn crop. Such a single or "monocrop" reliance also increased the potential for starvation among agriculturalists. If the one crop failed, so too did the Indians who cultivated it. Hunters and gatherers' dietary variety at least ensured the availability of *something* to eat. Finally, the sedentary life of

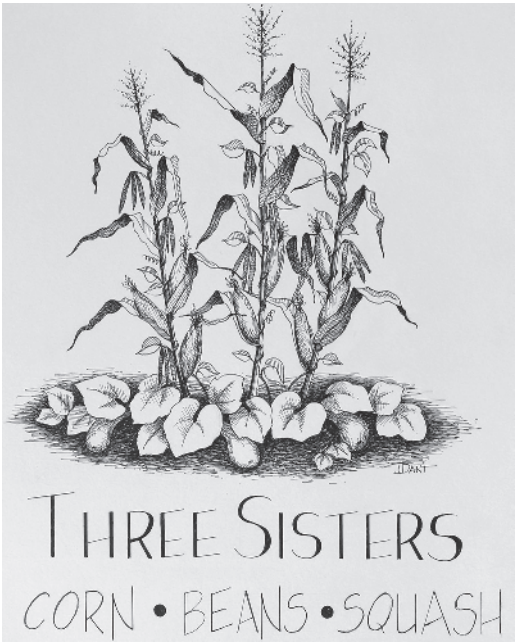

Figure 1.2 The "three sisters" constituted the primary agricultural crops of various Native American groups and were grown as a sustainable trio: beans vined up sturdy corn stalks and restored corn-depleted nitrogen to the soil, while ground-trailing squash acted as a weed barrier and conserved soil moisture. Source: Original artwork by Joyce Dant and reproduced with permission.

agriculturalists proved a fertile breeding ground for diseases and parasites, a fate nomadic hunters and gatherers nimbly avoided.

Corn, along with squash and beans, formed the "three sisters" trinity of Neolithic Native American domesticated agriculture (see Figure 1.2). Cultivation of squash, in the form of pumpkins and various gourds, predated that of maize, while the origins of bean cultivation are less clear. The combination of the three, however, creates a perfect and sustainable planting symmetry: cornstalks support vining bean plants; beans restore vital soil nitrogen depleted by corn; and squash plants provide a water-saving ground cover that shades the roots of all three. And compared to corn alone, the "three sisters" provided a more balanced suite of essential vitamins and complete proteins to Neolithic farmers as far north as the Dakotas.

The environmental shift to domesticated farming not only altered the diets and settlement patterns of Native American communities that adopted it, but

also led to profound social changes. As Indians embraced agriculture, they also introduced class divisions into their societies. Unlike relatively egalitarian hunters and gatherers, agriculturalists developed social hierarchies to distribute food surpluses and manage lands. Not surprisingly, the elites thrived. Their control over and ability to "afford" to store food enabled them to survive during lean times while the working masses paid the ultimate price. Women's work also expanded as they added corn planting, weeding, harvesting, and grinding to their continued responsibilities for gathering, cooking, fuel collection, and child care. These responsibilities could convey influence, too; control over food carried power. These myriad challenges of corn evolution and cultivation have led many historians, like Crosby, and anthropologists to conclude that corn lies at the heart of the dramatic disparity between Old World and New World development and achievement. It certainly destroys the "pristine myth"; as the evidence above demonstrates, the West was no "Eden." Native peoples brought about their own substantial and significant environmental changes. In combination with their origin stories, these environmental relationships reinforced the first Americans' connection to the land.

As early as 8000 years ago, diversified cultures across the American West began developing technologies and lifestyles ranging from Archaic hunting and gathering to Neolithic agriculture specifically adapted to their particular location. Native people in this area occupied four geographic/topographic regions: the Pacific Coast, the Great Basin, the Rocky Mountains, and the Great Plains. And they did so in surprising numbers. Although a precise census count is impossible to achieve, as mentioned earlier, historians and anthropologists estimate that prior to the arrival of Europeans, Native populations north of Mexico probably numbered around 3.8 million. Of these, approximately 800 000 lived along the coast, just over 1 million lived in the Great Basin and Rocky Mountain regions, 908 000 lived in the Southwestern farming regions, and another 378 000 lived on the Great Plains. Again, these numbers hardly constitute a pristine or "virgin" wilderness, or the "Eden" that later European arrivals would mythologize.

The Sierra Nevada and Cascade ranges form the eastern boundary of the Pacific Coast region and enclose a diversified set of ecosystems ranging from the golden grasslands of California's interior to the lush and bountiful seashores that stretch from Baja to the Gulf of Alaska. In the Pacific Northwest and Columbia River Plateau, Archaic Indians diverged from their Southwestern corn-growing cousins and derived both their culture and their calories from salmon. Plateau peoples adhered to a more traditional hunting and gathering strategy that also utilized fire to manage their local environment, all of which centered around the great salmon runs. Salmon are anadromous fish, which means that they are born in freshwater rivers

and streams and then make their way to the ocean where they live their lives in open waters before returning to the exact beds of their origin to spawn and die. Estimates of these annual prehistoric runs vary between 8 and 25 million fish. Native peoples gathered at sites along rivers such as the Columbia in places like the Dalles (about 65 miles east of present-day Portland), and harvested this rich bounty in staggering numbers. As a result, the Dalles became a major trading center with links extending south to California and ultimately across the continent. Not surprisingly, for people so dependent upon a fish, salmon became not only a source of calories but also of cosmology; the Chinookan-speaking people of the Pacific Northwest viewed their lives and fate as intimately intertwined with their primary food source. In addition to salmon, Pacific Coast Indians also fished for cod and halibut, harpooned whales, collected shellfish, hunted deer and elk, and gathered huckleberries, wild strawberries, and roots.

Farther south along the California coastline, cultural sophistication proliferated in the absence of corn-based agriculture but the presence of the sea. Shellfish, sea mammals, and a now-extinct flightless duck, in addition to gathered harvests of acorns, helped sustain nearly 10% of the total pre-Columbian population north of Mexico. These skilled, trade-based, class-organized settlements defy the traditional logic that only agriculture communities possessed social sophistication and sedentary villages. They were also far from the "heathen savages" described by early European explorers. As historian Colin Calloway has shown, "coastal peoples were hunters and gatherers, fishers and foragers, not farmers, yet they lived in sedentary villages, owned property, practiced economic and craft specialization, developed an elaborate material culture, built monumental architecture, held slaves, and measured rank by wealth and heredity."

East from the Pacific Coast, the Great Basin region between the Sierra Nevadas and Rocky Mountains displays a striking geographical diversity and demanded unique adaptations from its inhabitants. The glacial retreat that came about at the end of the last Ice Age left some 400 000 square miles of the formerly lush Basin arid and austere. The Great Basin is home to the largest desert in the northern hemisphere, the Sonoran, and sagebrush-speckled steppes provide the other significant vegetation pattern across this topography. These sere, harsh conditions usually meant that population densities were very low, following the ecological principle known as "Liebig's Law," which argues that the minimum amount of food available during the scarcest period limits population. Species, including humans, that fail to keep their numbers in check find that nature will do the dirty deed for them. Without food, "surplus" populations – of people or animals – die off, reducing them to more sustainable numbers, which in turn contributes to the overall stability of the ecosystem. In this region, piñon nuts provided valuable nutrition to

Archaic hunting and gathering bands, and everywhere, as Calloway notes, "Great Basin peoples pursued subsistence strategies that required intimate knowledge of the land and its animals, regular movement to take advantage of seasonal diversity and changing conditions, and careful exploitation of the environment." Traditional hunting and gathering also supported small bands of "Digger Indians," ancestors of modern Paiutes, as nomadic interior desert dwellers.

As the climate of the southwestern Great Basin continued to dry out and heat up, Indians there adapted by vigorously embracing agriculture, which allowed them to be more efficient consumers of calories by eating lower on the food chain. Successful Neolithic Indian populations switched from hunting big game to farming small plants. For Fremont culture groups living in Utah and parts of Idaho, Colorado, and Nevada, corn was critical. These part-time farming cultures lived in smaller family groups and supplemented their diets with hunting and foraging. In the desert Southwest, knowledge of corn cultivation flowed north out of Mexico and arrived in the Four Corners region of today's Utah/Arizona/New Mexico/Colorado approximately 3000 years ago. Across a relatively short span of time – perhaps 25 generations – corn, along with beans and squash, fueled population growth by providing efficient and storable calories that could sustain growing numbers through the unpredictable weather and precipitation cycles that marked this period. It also led to the development of pottery and basketry for storage and more permanent villages in the form of multi-storied pueblos. Near present-day Phoenix, Arizona, for example, the Hohokam people, forebears of modern Pimas, engineered their survival through the construction of the largest and most sophisticated irrigation network in the Americas, channeling scarce water from the Salt and Gila rivers through more than 1000 miles of canals to support populations in excess of 50 000.

This primary reliance upon agriculture, supplemented by more efficient foraging, proved remarkably successful, and also led to the coalescence of large pueblo settlements like those of the Chaco Canyon Anasazi in modern-day New Mexico (see Figure 1.3). Characterized now by its spectacular ruins, Chaco served as the center of ancestral Pueblo Indian culture. Massive, multi-storied, ceremonial great houses utilized sophisticated architectural and construction techniques and precisely aligned with solar, lunar, and cardinal directions. At its peak in 1050, Chaco's large sphere of influence sustained a population perhaps numbering as many as 15 000 in this harsh and arid environment of short growing seasons and long winters. Like the Hohokam, Chacoans built irrigation works to make their agricultural fields bloom.

Life here was not easy, however. Historian David Stuart's analysis of human remains at Chaco reveals that "broken bones, overwork, bad teeth, and seasonal hunger were common." Like so many successful cultures, the

Figure 1.3 Between 850 and 1150, ancestral Puebloan peoples built this four-story, 350+-room Pueblo Bonito, Spanish for "beautiful town," which served as the center of the far-flung Southwestern Chacoan Culture that flourished for more than 300 years.

Anasazi eventually overreached the carrying capacity of their lands. By 1000 CE, foraging resources, especially meat, were already beginning to disappear, thus intensifying reliance on agricultural production, which itself relied on relatively predictable rainfall patterns. Despite the claims and promises of Anasazi elites, however, the weather did not fall under their purview. They could not make the sky rain. In the 1090s, severe drought devastated Chacoan corn and food reserves and, before long, the greatest society in ancient North America unraveled, just as Liebig's Law predicts. Anasazi farmers buried their dead, abandoned their homes, and dispersed to wetter climates, such as Mesa Verde in Colorado and the pueblos along the Rio Grande in New Mexico. The vast regional trade networks this ambitious society established, which included Pacific Coast shells, Plains bison hides, Idaho obsidian, Mexican macaws, and local turquoise, also disintegrated. Nature had taught a powerful lesson about the costs of environmental overreach – that human populations ignore natural parameters at their own peril. Native descendants of the Anasazi would not make the same mistakes again. New World European immigrants would.

To the east of this extensive Great Basin region lies the Rocky Mountain range, which bisects the northern hemisphere and, at its fullest extension

from present-day New Mexico through Colorado, Utah, Wyoming, Idaho, and Montana into Canada, is one of the world's longest. Sculpted by water in its many forms, this craggy, undulating spine claims more than 50 peaks above 14 000 feet and supports a mosaic of vegetative zones ranging from mixed and short-grass prairie through broad-leafed deciduous forests; piñon, juniper, and ponderosa woodlands, fir, spruce, and lodgepole pines; to alpine tundra. This iconic range provides the headwaters for many of the West's mighty rivers – the Rio Grande, Platte, Arkansas, Colorado, Green, Columbia, Salmon, Missouri – and her towering heights act as the last major continental cloud obstacle for east-bound storms, scraping moisture from the sky and leaving a thirsty Great Plains grassland in their wake. The difficulties of life in these steep terrains dissuaded Paleo- and Archaic Indians from large-scale settlements here. Yet prior to European arrival, various groups did find ways to live on these slopes. Ancestors of the Crows, Shoshonis, Utes, and Salish peoples combined nomadic foothill hunting of mountain sheep, deer, and elk, with Plains forays for mammoths and ancient bison, and the gathering of roots and berries to forge long-term survival strategies. Archeological evidence also indicates that these early inhabitants made rock walls to herd and drive game animals and deliberately altered floral and faunal conditions to their advantage with fire.

Sprawling east from the Rockies lie the Great Plains, a seemingly endless expanse of grass lapping against the ephemeral "line of aridity" along the 100th meridian, where less than 20 inches of rain falls annually (the "magic" number needed to sustain non-irrigated agriculture). This vast savannah experiences periodic droughts as the aridity line fluctuates, which in turn has dramatic impacts on its flora and fauna. In this environment, agriculture and buffalo hunting formed the foundation of early Plains Indian subsistence. By 1000 CE, groups such as the Mandans, Pawnees, Wichitas, and Osages cultivated the "three sisters" in farming villages established along Plains river corridors. Post-glacial climate conditions also favored the smaller modern American bison (*Bison bison*) – a dwarfed evolutionary survivor that emerged approximately 5000–10 000 years ago, and early Blackfeet and pre-horse Apache hunters effectively adapted their technology to this thick-hided animal. Plano-pointed weapons lacked the fluting found in Clovis and Folsom projectiles, but around 7500 years ago, Plains peoples invented the atlatl, a wickedly effective spear/dart-throwing device that used a lever action to increase the velocity of the projectile at a range of more than 100 yards. By about 100 CE, these hunters replaced the atlatl with even more efficient bows and arrows. Despite this hunting pressure, the great shaggy bison herds quickly multiplied in the vast expanses of the continent's plains, especially in the absence of horses, sustaining larger human populations and becoming central to the grasslands ecosystem that lured Native hunters and gathers for centuries.

Historians have argued that the expansiveness of the Plains encouraged herd evolution among the bison and that the Pleistocene disappearance of predators allowed their numbers to multiply. But the presence of proficient human hunters also contributed to the efflorescence of this Plains icon; as Archaic Indians shaped both the animal's population size and distribution, the Plains became a vast Bison Belt. Hunters who understood the seasonal patterns and habits of bison found an almost limitless bounty and thus a predictable and reliable food source that supported population expansion. Archaic Indians used fire to improve and expand bison-favored grasslands, direct herd movement, and drive them toward pre-selected kill sites. Communal hunters also utilized dead-end canyons and corrals to herd large groups of bison into a mass slaughter. But the most sensational form of buffalo hunting was surely the buffalo jump, where well-coordinated and timed maneuvers drove entire herds off a cliff to plummet to their death. Folsom-era jumps in Alberta and Texas date this practice as far back as 10 000 years. Carnage at this scale led to huge food surpluses, such that food drying and preservation became essential, and also to some waste. Not surprisingly, bison were central to the religious lives of Plains people. Strict spiritual guidelines and rituals governed all aspects of the hunt, preparation, and consumption of bison, sometimes blurring the distinctions between humans and animals. On the northern Plains, for example, the buffalo-calling ceremony transmitted the animal's power and maintained the close bond between the species through highly ritualized sexual intercourse between tribal women and men dressed as bison.

As this deep history demonstrates, it is time to lose the myth of "Eden." By the time Europeans finally arrived, Native peoples had flourished in the New World for tens of thousands of years, evolving societies ranging from relatively primitive hunting and gathering bands to sophisticated, agricultural, urban metropolises. In the American West, they had wrested a living from sometimes harsh and formidable environments that arriving Europeans shunned as inhospitable, through careful management of scarce natural resources. Native peoples also paid attention to changes in climate and rainfall and reacted accordingly. Approximately 5500 years ago, following the relatively wet and abundant Pleistocene Epoch, the West experienced a profoundly dry and hot interval geologists call the Altithermal. Native peoples responded by moving away from the areas that could no longer sustain them. As global warming transforms the American West of the twenty-first century in much the same way, the adaptive patterns established by these first westerners offer a useful cautionary tale and provide important insights into the central role of the environment in human history. As Wilson concludes, "expansion and stewardship may appear at first to be conflicting goals, but they are not." In 1492, however, newly arriving Old World Europeans were only interested in "expansion."

Suggested Reading

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