

AMERICAN ENVIRONMENTAL HISTORY



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American Environmental History

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1: City Life

As we have seen earlier, urban life in the Americas began millennia before European colonialism. Native Americans built cities such as Tiwanaku on the shore of Lake Titicaca. Begun around 1,500 BCE, Tiwanaku is older than Beijing or Rome. The city's giant stone walls were begun at about the same time as the Mycenaean fortress on the Athenian Acropolis, a thousand years after the building of the Egyptian pyramids and a thousand years before classical Greek structures like the Parthenon. At the peaks of their cultures, some ancient American cities were the leading centers of world population. Tenochtitlán, which became Mexico City after the fall of the Aztec Triple Alliance, had a population of over 200,000 before European conquest. Although history and popular imagination often focuses more on the unusual customs of these cultures, we should remember that early Americans were extremely successful providing food, water, sanitation, and other services to their large urban populations. The Aztecs' intensive urban agriculture, for example, was four times more productive than the best farming techniques used by Europeans and Asians at the same time.

Unfortunately, due to the Columbian Exchange and the near-complete collapse of native cultures that followed it, Europeans were able to learn few if any lessons from the urban Indians they conquered. Native cities were rebuilt along European lines, and new cities sprang up based on urban planning ideas familiar from the home countries of the colonists. American cities, as a result, followed in the traditions of Europe, and only slowly adapted to the environments they in which they grew.

Urbanizing America

When the United States took its first national census in 1790, fewer than one in twenty of the new nation's 4 million people lived in cities and large towns. New York was America's largest city, with only about 33,000 people. But as we have seen, urban America grew quickly. In 1850 there were ten American cities with populations over 50,000. And by 1890, over a hundred American cities were larger than New York had been a century earlier. Cities continued to expand in the twentieth century, becoming homes to more than half the American population for the first time in the 1920 census. After World War II, suburbs expanded and most American cities became the centers of urban-suburban sprawls. By the beginning of the twenty-first century, only about two out of ten Americans lived in rural areas.



Figure 1.1: In 1806, Boston was surrounded by salt water with only a narrow connection to the mainland. The city has grown tremendously since then, expanding onto land reclaimed from the ocean. (Public Domain; R. Phillips).

As populations expanded, the nation needed more food. And as a growing percentage of Americans living in cities no longer grew their own food, commercial agriculture and robust transportation networks were needed to keep the new city-dwellers fed. In this chapter, we consider other factors necessary for urban growth. Water has often been overlooked, because for most of our history it has been abundant and inexpensive. But it was a vital resource that was indispensable for growing cities. In addition to reliable sources of food, America's cities required plentiful, year-round supplies of drinking water. Many inland cities such as Detroit, Chicago, Cincinnati, and Pittsburgh were built on the shores of rivers or lakes. Coastal cities like Boston and New York, however,

were often surrounded by seawater or by brackish salt-flats. They relied on shallow surface wells that quickly became inadequate for growing populations, and the wells were frequently fouled by that population's waste. Just as vast quantities of food had to be delivered to growing city populations, equally prodigious volumes of waste needed to be removed. In addition to providing drinking water for residents, as American cities grew, water systems came to play a crucial role in waste disposal.

One of the earliest ways water aided sanitation was that waste was simply dumped into rivers, lakes, and the ocean. When New England textile mills flushed their dye tanks into the Merrimack River, they were only doing what people had always done. The amount of poisons they threw into the river may have been unprecedented, but the practice was nothing new. People throughout history have traditionally dumped their waste in water, where bacteria and marine life have broken down the waste-products and returned them to the ecosystem. Water provides an effective, natural recycling process for organic waste, until the volume of waste becomes too large for the ecosystem to purify.

Although new industries like the textile mills often contributed novel and challenging types of wastes into the natural purification system, the largest source of stress was the growing population. American cities grew tremendously in the early nineteenth century. Boston had fewer than 25,000 residents in 1800. By 1850, there were nearly 137,000, and by 1900 over a half million. New York City grew from 60,000 in 1800 to 515,000 in 1850 and 3.4 million in 1900. San Francisco began the nineteenth century as a village of 897 people. In 1850, the year after gold was discovered in the Sierra foothills, the city had reached a modest population of 21,000. But by 1900, San Francisco had exploded to nearly 343,000 residents. Los Angeles started as a pueblo of 29 buildings and a few hundred residents in Mexican Alta California. In 1850, the population had grown to only 1,600. But by 1900, Los Angeles was home to over 102,000 people and water was becoming an issue.

Water Fortresses, Pigs, Toilets

Coastal cities often contended with challenging environments, especially when they began to grow. Boston was originally built on a peninsula surrounded by ocean and salt marshes, anchored to the mainland by a very narrow connection at the city's southern tip. New York City occupied the southern tip of Manhattan Island, but the city's rapid growth quickly exhausted the island's shallow, easily-contaminated wells. Yellow fever and cholera epidemics in the early 1830s convinced New Yorkers they needed a new water source, and between 1837 and 1842, the city built an aqueduct and a reservoir to carry and store water from the Croton River forty-one miles away. The gravity-fed aqueduct supplied a Receiving Reservoir located at what is now the Turtle Pond in Central Park, and a Distributing Reservoir on Fifth Avenue between 40th and 42nd Streets. With granite walls 50 feet high and 25 feet thick, the Distributing Reservoir looked like a fortress guarding its 20 million gallons of fresh water. The wide promenade at the top of the reservoir's walls became a popular destination for Sunday-morning socializing. The Croton Reservoir was used until the 1890s, when it was torn down and replaced by the Main Branch of the New York Public Library and Bryant Park.



Figure 1.2: 1855 Manhattan, looking southward from 42nd Street. In the foreground is the Croton Distributing Reservoir and the Crystal Palace built for the 1853 Exhibition of the Industry of All Nations. (Public Domain; William Wellstood).

By 1844, more than 6,000 homes of upper-class New Yorkers had been connected to the public water distribution system and public bathing facilities had been constructed for the poor. Providing public water added to New York's challenges, though. Initially, most of the water closets in affluent houses were connected to cesspools and pits that had originally been built for solid waste from privies. The small cesspools were almost immediately flooded by the volumes of water and waste flushed into them. Responding to the complaints of its most affluent residents, the city allowed connections to its storm sewers. But the conduits designed to carry excess rainwater were too narrow and the underground pipes' bends and sharp corners clogged easily. New York's storm sewer system was quickly overwhelmed. And then there were the pigs.

Since the 1810s, city authorities had been trying to outlaw pig-keeping in New York. For generations, poorer city residents had turned pigs loose to forage on garbage until they grew large enough to slaughter. The animals were kept not only in the more open, rural areas north of the growing city center, but lived in basements and spare rooms in crowded tenements. Pigs were dangerous, attacking people and even occasionally killing children. But they were a low-cost food source and they disposed of more waste than they created, so they were tolerated.



Figure 1.3: *An Illustration of the great New York City pig roundup of 1859. (Public Domain; Frank Leslie's Newspaper).*

When another outbreak of cholera in 1849 was blamed on the roaming scavengers, efforts were resumed to ban city pigs. But removing the animals from city life did not happen overnight. Police conducted raids throughout the early 1850s, finding over 6,000 hogs hidden in cellars and garrets in lower Manhattan. The animals were driven north and the west-side district between 50th and 59th Streets known as Hog Town was raided and shut down in the 1850s. By 1860, pigs were illegal south of 86th Street. But hogs were not the only animals worrying New York authorities. In a single month in the summer of 1853, one of the city's largest waste contractors reported disposing of the remains of 690 cows, 577 horses, and 883 dogs, along with over a thousand tons of butchers' offal from over 200 slaughterhouses operating in the city.

New York City's success providing safe drinking water with the Croton aqueduct and its reservoirs encouraged its Massachusetts neighbor, and between 1846 and 1848 Boston completed the 14-mile Cochituate Aqueduct to fill a similar granite water-fortress. The 2.6 million-gallon Beacon Hill Reservoir supplied central Boston with water until the 1870s. Like the Croton Reservoir, Boston's water system provided not only drinking water, but also water for waste disposal. Boston's elegant Tremont Hotel, built in 1829, was the first building in the city to include indoor plumbing. The hotel initially provided only eight water closets for all its guests, but the novelty quickly caught on and affluent Bostonians began installing toilets and then full bathrooms.

Once toilets and baths became common in Boston homes, the supply of fresh water provided by the Cochituate system was no longer adequate. In 1897, the Nashua River was dammed to create Wachusett Reservoir and an aqueduct was built to carry the water to Boston. But the city's needs continued to escalate, and the Metropolitan Water Board began planning the world's largest drinking-water reservoir. The Quabbin Reservoir and Tunnel system was begun in 1926 and completed in 1946. In order to create a reservoir capacity of 412 billion gallons, the Metropolitan Water Board condemned, evacuated, and bulldozed four Western Massachusetts towns: Enfield, Dana, Prescott, and Greenwich.

Municipal water systems were built at such large scales because during an era when pure water was plentiful and cheap, urban planners could reduce cost by meeting all the city's water needs from a single source. Throughout its water system's history, almost half of Boston's water supply has been used to flush toilets. Even today, nearly every American home uses the same source of water for drinking and for all other uses, including cooking, washing, flushing toilets, and watering lawns and gardens. Most municipal

water systems provide drinking-quality water to all their residential, commercial, and industrial customers, for all uses. As pure, potable water becomes scarcer and more expensive in some regions, the policy of using the highest quality water for all purposes may need to be revisited.



Figure 1.4: Looking at Quabbin Reservoir from the south, surrounded by what locals call the “accidental wilderness” caused by the destruction of several Western Massachusetts towns. (CC BY; David Pinter).

Boston’s first sewer system was completed in 1884. It carried raw sewage from Boston and surrounding cities to Moon Island in Boston Harbor, where the waste was held in storage tanks and released with the outgoing tide. Although in the late 1880s this solution was considered adequate, the region’s population continued to grow and soon Boston Harbor could not support the levels of waste being flushed into it. Clam beds were closed due to pollution in 1919 and 1933, and by 1940 planning began on treatment plants. Boston’s first sewage treatment plant opened in 1952 and another followed in 1968, halting most of the dumping of raw sewage into the Harbor. Treated sludge was still dumped into the ocean until 1991, when a sludge-to-fertilizer plant was completed. In 2000, to support the city’s still-growing waste disposal needs, an outfall tunnel was built to carry Boston’s treated effluent nine and a half miles out to sea where it is released from 55 risers onto the ocean floor.

Before indoor plumbing became universal, waste disposal had been much more visible and personal. When the Croton Reservoir began delivering abundant running water to lower Manhattan in the late 1840s, New York City already housed half a million people. Although getting the water into the city was considered a public service, landlords were not required to use the system. The overall population density of the Manhattan was measured at over 41,000 people per square mile in 1880, but in the city’s poorer, more crowded areas, well over 150,000 people were crowded onto each square mile of land. Tenements built on single-family lots 25 feet wide by 100 feet deep, sometimes housed twenty families on a lot that had been designed for one. Although water and sewage were available on many of the main streets, builders were not required to connect tenements to them. Often, to save money, landlords installed a single standpipe to provide running water and built privies in the small backyards. After 1900, revised building codes required new construction to include running water and bathroom facilities in each apartment. It was a long time, however, before all the old tenements were abandoned and torn down.



Figure 1.5: Deer Island in Boston Harbor is the current site of the city’s sewage treatment center. (CC BY-SA; Doc Searls).

The adoption of indoor plumbing made human waste disposal a municipal service rather than the responsibility of the people producing the waste. Toilets broke an age-old ecological cycle that had returned nutrients back to the soils that had produced them. What had been a circular resource flow from farm to table and back to farm became a one-way trip. Crops drained farm soils of fertility only to be shipped to cities for consumption and converted into waste that was flushed away. Out of sight, out of mind.

Horses & Mobility

About the same time city people were discovering the convenience of indoor plumbing, transportation technologies such as streetcars, automobiles, and trucks began reducing the horse populations of American cities. In 1880 New York City for example, 1.75 million residents shared the streets with 175,000 horses. The average city horse produced an average of 20 pounds of daily waste, about ten times the output of the average New Yorker. With a population only one-tenth that of the humans, horses created just as much waste every day. And they could not be taught to use the city's new toilets.

New York City horses also ate a lot of locally-grown hay and oats. Farmers near American cities lost a major market for fodder products when urban horses disappeared. They also lost a big source of soil fertility, because along with the contents of privies, horse manure had traditionally been collected from streets and urban stables and sold back to the farmers to help replenish their fields. Although collecting human and animal manure provided employment for poor city people (often orphans and homeless children) and closed the ecological circle by returning fertility to the soil, night soil and horse manure collection was considered an unsanitary nuisance by many upscale residents and urban reformers.



Figure 1.6: Draft Horse overcome by heat in New York City, ca. 1901. (Public Domain; George Grantham Bain).

To add to the waste disposal problem posed by tons of daily manure, draft-horses had a working lifespan of about twenty years, but they were often worked hard right to the end. If only one-twentieth of New York's horses died in the city's streets and stables in a given year, they still produced nearly nine thousand half-ton carcasses that needed to be picked up and hauled away. By the end of the nineteenth century, city planners were more than ready to get the horses off their streets.

Although we have considered the rapid growth of American cities, it is important to note that the addition of thousands of new residents from one census to the next, every ten years, was just the tip of the iceberg. City populations not only increased rapidly, they changed even more quickly. During the decade 1880-1890, for example, the population of Boston increased by about 85,000, from 363,000 to 448,000. But the number of people who moved into Boston during that decade was nearly ten times higher. More than 800,000 people passed through Boston between 1880 and 1890. Most stayed for a while and then moved on. The rapid turnover of the city's residents can be seen in the directories Boston published annually. City directory canvassers found that only about half the homes they visited had the same residents, from one year to the next.

Population historians have discovered that the most mobile city-dwellers were wage-workers and the poor. People who owned businesses and real estate were much more "persistent," in demographic terms, because they were in a sense anchored by their possessions. Over time, though, the greater persistence of more prosperous residents often allowed them to gain greater political power than the poor, many of whom were not around long enough to organize or often even to vote. Many poor and working-class city-dwellers were also recent immigrants, who needed time to learn the language and customs of their new homes. By 1900, inland cities such as Buffalo, Detroit, Milwaukee, Chicago, and Minneapolis were all the centers of regions where more than 75

percent of people lived in an urban setting. More than three quarters of the residents of these cities were also classified as “Whites of Foreign Parentage,” according to Census language. Many were either immigrants or the children of immigrants, overwhelmingly from either Irish or German-speaking families. Descendants of German immigrants, who arrived in great numbers just as the Midwest was opening for settlement in the mid-nineteenth century, still make up the majority ethnicity of a wide swath of middle America.



Figure 1.7: 1898 panorama of Milwaukee Wisconsin, known as the “most German” of American cities by the late 19th century. (Public Domain; Gugler Lithographic CC).

Urban Reformers

In addition to engineers and city planners addressing growing cities’ needs for drinking water and sanitation, idealistic nineteenth-century reformers turned their attention to improving social conditions in American cities. Some reformers called attention to the social problems caused by the the cultural dislocation of immigration, economic inequality, and the rapid growth of America’s cities. Others experimented with solutions. This spirit of reform became a key element of the early-twentieth century Progressive movement in politics and culture that tried to correct some of the social inequities of the period known as the Gilded Age.

An early critic of urban inequality was Jacob Riis, a native of Denmark who became one of New York’s most prominent journalists. Riis, born in 1849 into a family of fifteen children, emigrated to New York at the age of 21. Originally trained as a carpenter, Riis became a newspaper reporter specializing in melodramatic accounts of the poverty and misery he found in neighborhoods like New York’s infamous Five Points. When words failed to convey the disparity he witnessed between the glittering world of New York high society and the hopeless world of the poor, Riis turned to photography. In 1889, Riis’s eighteen-page article “How the Other Half Lives” was included in the widely-circulated Christmas issue of Scribner’s Magazine, with nineteen line drawings rendered from his photographs. Riis expanded the material into a 303-page book, which he followed two years later with a sequel called *The Children of the Poor*. Riis wrote a dozen more books over the next ten years and lectured regularly on social conditions in New York City. His efforts to call attention to the inequities of city life brought Riis to the attention of New York Police Commissioner Theodore Roosevelt, who later called Riis “the most useful citizen of New York.” Although the narratives in Riis’s books echoed many of the stereotypes of his time, his photographs were revolutionary. Middle and upper class Americans discovered there was an “Other Half” living in Gilded-Age America, and some began to devote themselves to reducing the inequality of their time.

One of the most effective social reformers who put her ideals into action providing direct services to poor city people was Jane Addams. Addams was from a prosperous Chicago family, the youngest daughter of a prominent Illinois politician. Born in 1860, Addams lost her mother and several siblings at a very young age, then grew up reading Charles Dickens’s depictions of poor Londoners and revolutionary tracts like the Italian revolutionary Giuseppe Mazzini’s *Duties of Man*. After visiting London’s famous settlement house, Toynbee Hall, Addams decided to start her own in Chicago. She returned home and opened Hull House in 1889. Begun in an old mansion that Addams purchased, moved into, and renovated with her own funds, Hull House grew to a thirteen-building complex that housed twenty-five women volunteers and served over 2,000 people per week. Services included cultural, recreational, and educational programs, as well as public baths, boys’ and girls’ clubs, and a summer camp. In addition to their service work, Addams’s volunteer staff produced detailed studies of conditions in the Chicago neighborhoods Hull House served.

Addams’s approach to solving problems of urban poverty included equal parts of direct aid to poor city people, scientific study into the roots of poverty and dependency, and political activism to bring this information to the public and elected officials and to

advocate change. The success of Hull House in Chicago made it a model for settlement houses in other cities, and Jane Addams and her organization began to influence public opinion and political debate on issues such as education reform, immigrants' rights, occupational health and safety, child labor, and pension laws. Jane Addams was awarded the Nobel Peace prize in 1931 for her work at Hull House, her advocacy work, and her anti-war activism.

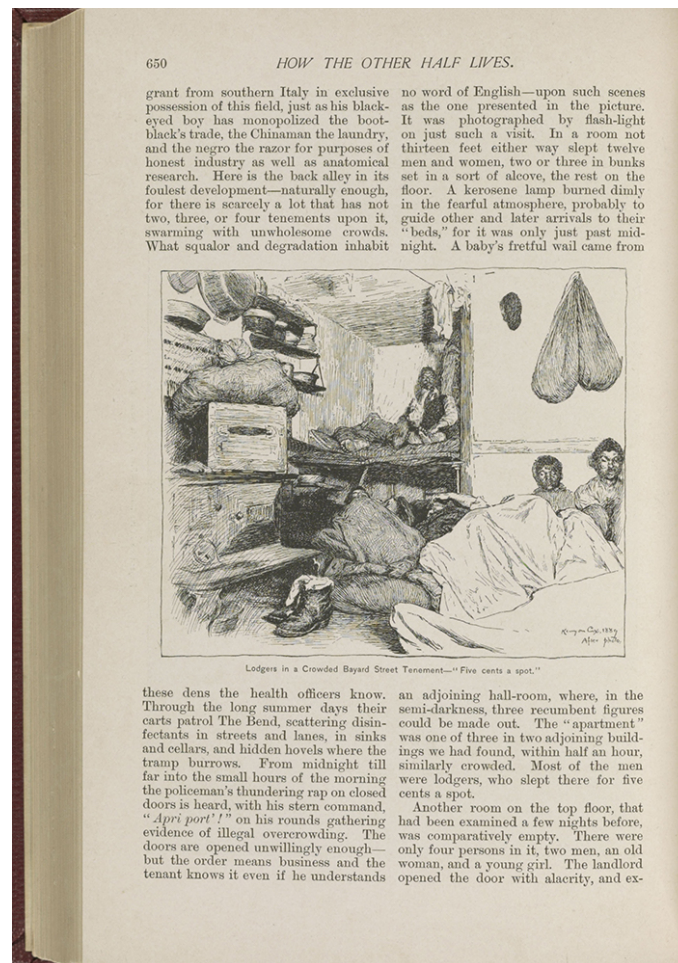


Figure 1.8: An illustrated page from Jacob Riis's expose of New York City, published in 1890. (Public Domain).

Parks & Suburbs

As cities grew more crowded and their buildings larger and more numerous, residents missed the natural scenery of the countryside and a sense of connection with nature. Some city-dwellers began vacationing in the country, but many could not afford to travel or simply did not have the time. In the mid-nineteenth century, many American cities began building parks to bring a bit of the countryside back into the urban lifestyle.

America's first city park was the Boston Common, a 50-acre parcel adjacent to the Massachusetts Statehouse, established in 1635. Although the Common is sometimes remembered by nostalgic Bostonians as having once been used as a public pasture, feeding cattle on the Common was limited after 1646 due to overgrazing. Since then, the Common has served as a drilling field for militia, a camp for the British army before the start of the Revolutionary War, a public meeting-place, and as a site for public executions. In 1837 a 24-acre Public Garden was added to the Common.

America's most-visited city park is New York's Central Park, established in 1853 by an act of the New York state legislature on 700 acres between 59th and 106th Streets. Although at the time most New Yorkers still lived south of the land chosen for the park, central Manhattan land had appreciated rapidly, especially since the opening of the Croton Receiving Reservoir between 79th and 86th Streets in 1842. A small community called Seneca Village was condemned by eminent domain to build the park, forcing about 1,600 people to relocate. Central Park's 700 acres cost the state \$5 million, which was quite a lot of money in 1853.

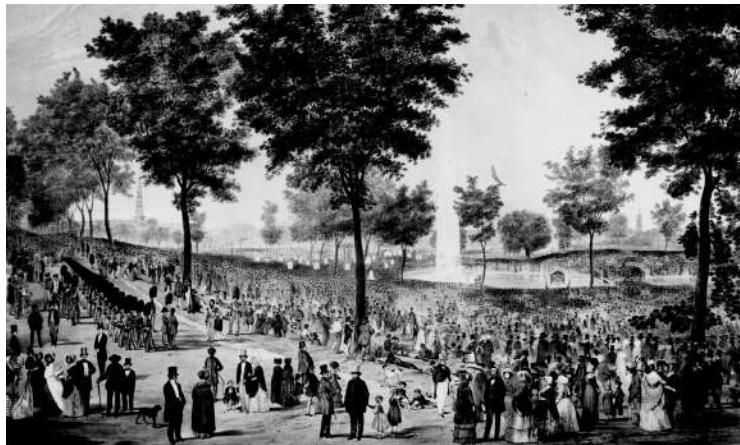


Figure 1.9: Boston crowds enjoying the Water Celebration on the Common in 1848. (Public Domain; P. Hyman and David Bigelow).

In 1857, American landscape architect Frederick Law Olmstead and his British mentor, Calvert Vaux, won a design contest and began building what they promised would be “a democratic development of the highest significance.” Central Park would be a place where New Yorkers of all social classes could relax and enjoy a peaceful break from the bustle of the city. The park’s design actually echoed the idyllic landscapes of urban cemeteries, which had become popular destinations for many city-dwellers seeking a natural setting. Sunken roadways called transverses hid crosstown traffic, and separate circulation systems for pedestrians and vehicles helped maintain a peaceful, natural ambiance. In 1873, the park was expanded to its current size of 843 acres.

In addition to countless smaller parks, there are now over 140 urban parks in the Americas greater than 1,000 acres, including 116 in the United States and 12 in Canada. The largest is the Serra da Catagreira in São Paulo, Brazil (160,124 acres) and the smallest is Stanley Park in Vancouver, Canada (1000 acres). But statistics do not tell the whole story. Vancouver, a densely populated city of 603,500 people, has 3,200 acres of parkland and devotes over 11% of the city’s land area to parks. Parks provide recreational areas and give city-dwellers a needed sense of connection to the natural world. Ecologists have recently suggested that city parks also help clean urban air and reduce the heat island effect, making cities more livable for the growing percentage of Americans who occupy them.

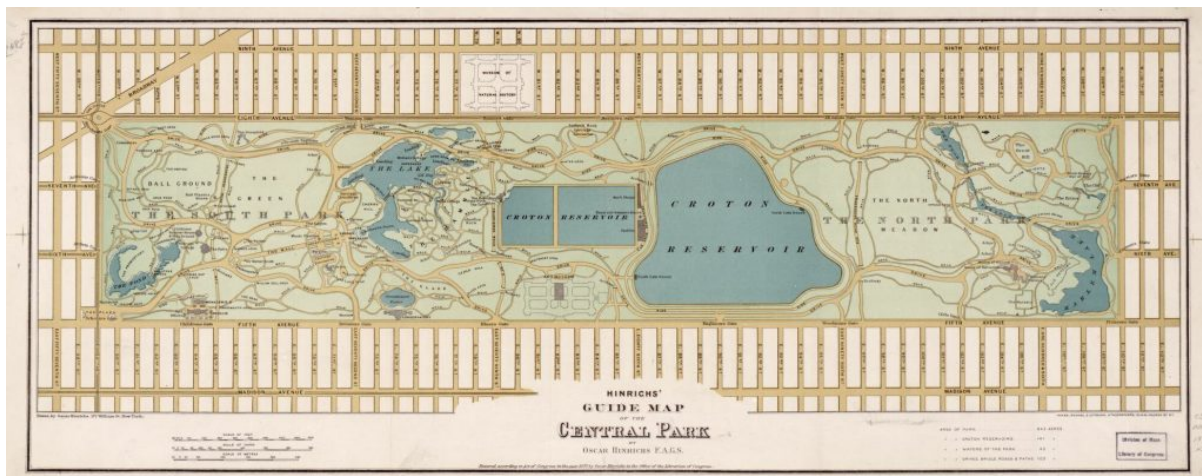


Figure 1.10: Central Park in 1875 including the Croton Reservoir. (Public Domain; Oscar Hinrichs).

As transportation networks improved in the nineteenth and twentieth centuries, it became increasingly practical to commute to work in the city. Residential suburbs began to appear along railway lines and later along highways. Unlike the older satellite towns that had once supplied cities with food, animal fodder, and other goods, suburbs mostly supplied people. And unlike towns and small cities that had traditionally been economically self-contained, suburbs were mainly residential. Suburban economies generally depended upon the consumption spending of residents who earned their incomes in nearby cities.

The first suburban developments in America were New York City's bedroom communities in Westchester County. Originally a rural area along the Hudson River north of the city, Westchester County became a weekend retreat for wealthy New Yorkers toward the end of the nineteenth century. When convenient rail service from Grand Central Station made it practical for commuters to leave the city every night, developers began building residential communities for affluent city workers. Soon middle and even some working class New Yorkers began following the examples of their bosses and managers, and moving their families to the suburbs.



Figure 1.11: First-tier suburbs were often called “streetcar suburbs” for the transport networks that served them. (Public Domain; Ontario Safety League).

After World War II, a long period of prosperity and growth created opportunities that had not been available during the Great Depression and the war years. A rapidly-expanding American middle class looked for a place of their own in the suburbs. Communities like Levittown, a 1950s development of over 17,000 affordable, ranch-style homes about fifty miles from Manhattan, sprang up along rail lines and highways close to major cities. Zoning laws controlled the placement of commercial and residential buildings, creating a separation not seen in cities and heightening residents' reliance on automobiles. Suburban families increasingly depended on their cars not only to get to work in the cities, but to visit shopping centers and malls, to get to recreation and entertainment centers, and to get the kids to little league or band practice. Many families acquired a second car, and then sometimes another for teenage children. Today, there are 250 million automobiles in America; substantially more than the number of licensed drivers.

In some cases, expanding suburban development coincided with the migration of black families to northern cities. Segregation, Jim Crow laws and the ongoing lack of opportunities for black people in the South caused many to look for a better life in the North. Many urban whites reacted to the changing racial mix of the cities by fleeing to newly-created suburbs, and some communities instituted discriminatory policies to prohibit or discourage black Americans or other people deemed undesirable from buying houses in white suburbs.



Figure 1.12: Aerial view of Levittown Pennsylvania in 1959. (Public Domain).

The first suburbs were usually built immediately outside the city limits of the urban centers they served. Communities such as Brookline and Newton Massachusetts, Angelino Heights and West Hollywood outside Los Angeles, and Scarborough and Parkdale outside Toronto were all first-tier or “streetcar” suburbs. As automobile ownership and interstate highways expanded, second and third tier suburbs developed in widening rings. In many cases, nearby towns and cities that had once been self-sufficient became part of an expanding sprawl around major cities. The U.S. Census Department had to develop an entirely new way to categorize places. The Census now uses the designation Combined Statistical Area to describe places that contain major cities, smaller satellite cities, towns, and suburbs. There are 169 Combined Statistical Areas in the United States, with a total population of about 250 million. In other words, about 78 percent of America’s 320 million people live in urban/suburban complexes. The other 70 million Americans live in the sparsely-populated white areas on the map.

As suburban populations grew, some businesses followed their workers and moved facilities into the suburbs. Ring roads and beltway highways attracted newer industries that were not already located in city centers. An early example was Route 128, a semicircular state highway through Boston’s suburbs that became known as “America’s Technology Highway” before the advent of the Silicon Valley. And much of California’s own epicenter of technology, located on the southwestern shore of San Francisco Bay, is ringed by Highways 280 and 101. When many of the most innovative firms began locating themselves in the suburbs, cities rapidly lost their most affluent citizens, the businesses those people worked in, and the places where they shopped. The effect on urban tax bases was often visible in services cities became unable to provide and infrastructure they could no longer afford to maintain.

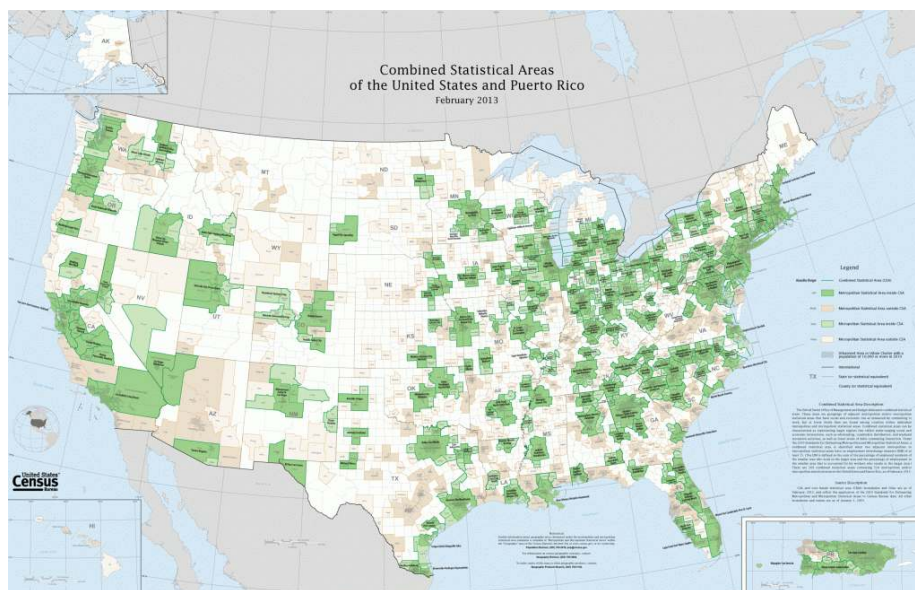


Figure 1.13: Nearly 4 out of 5 Americans live in the 169 urban/suburban complexes shaded green on this 2013 map. Image used with permission (Public Domain; Bureau of the Census).

Recently, residents of many American cities have expressed concern over the high level of dependency involved in an urban lifestyle. As more Americans have crowded into urban/suburban environments, a larger percentage of the population have become separated from the agriculture, energy production, and resource extraction that make their lifestyles possible. Cities have begun exploring local energy generation, urban farming, and recycling to regain some control over the production sides of their economies. These efforts not only reduce the economic dependence of cities, they offer people opportunities to participate in the re-imagining of urban life. But changing American city life is not going to be easy. Increasing global trade has shifted both resource extraction and the manufacture of most consumer products outside the boundaries of the United States. Urban Americans depend on the world outside their city limits more than ever. We will explore that world in the next few chapters.

Further Reading

- Jane Addams, *The Subjective Value of a Social Settlement*. 1892.
- Edwin G. Burrows and Mike Wallace, *Gotham: A History of New York City to 1898*. 1999.
- Marc Reisner, *Cadillac Desert: The American West and its Disappearing Water*. 1986.

- Ted Steinberg, *Gotham Unbound: The Ecological History of Greater New York*. 2014.

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2: Wilderness and Country Life

As discussed earlier, until quite recently most Americans lived on farms or in villages and small towns surrounded by countryside. The idea of a vanishing American wilderness developed at about the same time and for similar reasons as concern about country life, during a period when most American intellectuals and political leaders lived in cities and had lost a daily personal connection with their environments. While their interest in the land and the lives of rural people was usually genuine, the privileged, urban lifestyles of the people who became known as Progressives often colored their thinking about the wilderness and about life in the country. In this chapter we will examine the ideas about nature and life in rural America that have helped shape public policy and our own understanding of the environment in modern America.

As we have seen, farmers, trappers, lumberjacks and others working on the frontier were parts of global commercial networks from the very beginning of European activity in the Americas. But new technologies such as steamboats, railroads, and rolling mills upset relationships between producers and consumers in this global commercial web. During the nineteenth century, for example, American farmers increasingly found themselves negotiating not with the people who ate their food, or even local millers or grocers; but with highly capitalized, well-financed industrial mills, stockyards, and food manufacturers. When many small producers negotiate with just a few large buyers, the buyers tend to hold most of the power.



Figure 2.1: A print inspired by the Grange movement, asserting the importance of the farmer to American society, 1875.

The economic power of the corporations who were their suppliers and customers was not the only problem facing farmers. Railroads that had been built with government loans and with generous grants of public land became the farmers' only choice for transporting their produce to markets in cities such as Chicago and Minneapolis. Although heavily subsidized, the railroads were run as private, for-profit corporations and were allowed to manage their own schedules and set their own prices. When farmers discovered that big corporations, including the food processors they sold their harvests to, were paying the railroads much lower freight rates, they felt they had been betrayed not only by the railroads, but by the politicians they believed the railroads controlled.

Following the end of the Civil War in 1865, a new wave of migration began and thousands of families moved westward to farm in states such as Kansas, Iowa, Minnesota, and the Dakota Territory. The population of Kansas grew from about 365,000 to over a million in the 1870s, and Nebraska also tripled in size. Unfortunately, grain markets did not offer these new farmers the lucrative opportunity they had anticipated. A short post-war recession lasting from 1869 to 1870 was followed by the Panic of 1873 and then by the Long Depression of 1873-1879, which until the 1930s had been known as the Great Depression. Prices for farm commodities were driven down and remained low for decades. Facing increased competition in commodity markets and continuing high rates from the railroads, farmers sought a way to improve their chances of financial success.

Farmers were well aware of their numerical advantage over railroad capitalists and corporate shareholders, and they organized to turn their numbers into political power. The Knights of Labor, one of America's first unions to open its membership to workers

outside a particular trade or specialty, was organized in 1869 to promote the ideal of the unity of all producing groups. Agricultural organizations included the Granger movement, the National Farmer's Alliance, and the Colored Farmers' National Alliance and Cooperative Union, which combined in 1875 to form the Farmers' Alliance. In 1890 the Farmers' Alliance joined with the Knights of Labor, which had become a leader of the growing urban labor movement, to form the People's Party.

The People's Party, also known as Populists, was ultimately unsuccessful in its attempt to establish a permanent third party and end the two-party system in American politics. But Populist ideas and proposals influenced the policies of both parties. The People's Party platform called for a graduated income tax, direct election of Senators, civil service reform, and an eight-hour workday. Many Populists also advocated government control of "natural monopolies" such as the railroads, telegraphs, and telephones. These services were provided by the public sector in nations throughout Europe, Populists argued; often more efficiently and more equitably than in America. Although the People's Party did not convince the majority of American voters to support these causes, their observations about the efficiency and quality of publicly-provided services like European railroads are as valid today as when they first made them.

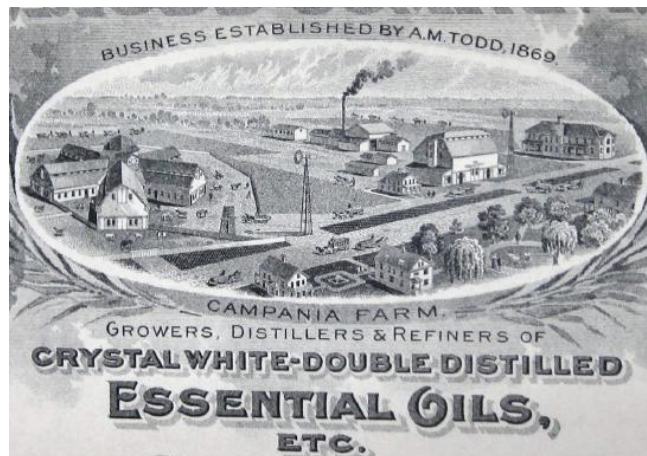


Figure 2.2: 1904 image of Campania, a farm community created by Albert M. Todd, from one of his peppermint oil bottles.

Although many Populists came from rural backgrounds, they took full advantage of the travel and communication opportunities provided by technological change. For example, Albert May Todd was a Michigan farmer's son who built an international business in the last quarter of the nineteenth century processing and marketing peppermint oil. Based in Kalamazoo Michigan, Todd established several large-scale farms with their own company towns and agricultural research stations. The A.M. Todd company became the world leader in peppermint oil, and its owner decided to try his hand at politics. Like Robert Owen, Todd was both a successful capitalist and a committed socialist. He financed community centers in his rural company towns where workers could hold meetings, concerts and dances. Todd visited Europe regularly to promote his business, but he also devoted a great deal of time to studying European politics, especially events such as the Swiss referendum that nationalized the alpine country's railroad system. Todd was also an art-lover who bought paintings and sculptures in Europe that he donated liberally to libraries, colleges, and even the public schools of Kalamazoo. Todd was elected to Congress in 1896 and spent his time in Washington arguing against the corrupting influence of monopolists and the railroads on American government. Later, Todd founded The Public Ownership League of America to advocate for municipal ownership of public utilities and nationalization of the railroads. Members of the League's board of directors included the former governor of Illinois, the president of the United Mineworkers Union, and Chicago social reformer Jane Addams.

The activities of rural Americans like Albert Todd show that the ideas of Populist reformers were often informed by the most inclusive national and even international networks. Rural reformers had as much access to information and often had as much influence as their urban counterparts. Populist issues were gradually adopted by mainstream politicians, which drew many members of the People's Party back into the two major parties. Populists should be given credit for the fact that nearly all the proposals in the People's Party platform were later adopted by the major parties and passed into law.

Progressives & Nature

Unlike the People's Party, the Progressive movement, which tried to merge Populist ideals of social justice with a celebration of scientific and social progress, was led to a much greater degree by urban intellectuals such as New Yorker Theodore Roosevelt and

Princeton University president Woodrow Wilson. Progressives expressed their concern for the America outside the cities primarily through conservation and agrarian reform. America's early conservation movement sprang from a growing appreciation of nature, especially among people whose lifestyles separated them from the natural world. At the beginning of the nineteenth century, Prussian aristocrat and scientist Alexander von Humboldt traveled through Latin America collecting impressions and data that filled dozens of articles and books, making Humboldt one of the most famous men of his time. In 1804, Humboldt stopped in Washington on his return from the Andes and met with President Thomas Jefferson. Jefferson had recently completed the Louisiana Purchase, and was curious about conditions in the Spanish colonies Humboldt had visited, in addition to sharing an interest in natural science. When Jefferson sent Louis and Clark to explore the northwest, he specifically directed them to collect scientific data about the plants and animals they encountered. This was partly because Jefferson believed detailed knowledge of the region would help support American claims on the territory, but also because he was genuinely interested in what they would discover.



Figure 2.3: Alexander von Humboldt in front of the Chimborazo volcano in Ecuador, which he climbed in 1803.

Interest in nature spread to the arts when British-born painter Thomas Cole became well-known in the 1830s for a style of romantic landscape painting that became known as the Hudson River School. Cole and his students painted not only scenes from the local countryside, but also natural monuments such as Niagara Falls. The falls were an inspirational destination for European travelers in America, and as transportation improved, for growing numbers of Americans. Thomas Cole and several of his students painted the falls, and many then traveled west to find new heroic vistas to paint. In the early 1860s, German-American painter Albert Bierstadt journeyed west with a survey expedition to paint in the Rocky Mountains and in the Sierras. His paintings, and those of other artists such as California natives Thomas Hill and William Keith, were reproduced as illustrations in popular magazines and travel guides. For many easterners, the western frontier became a land of unspoiled beauty imagined from these romantic depictions.



Figure 2.4: (left) Thomas Cole's 1836 painting of The Oxbow on the Connecticut River helped establish the romantic Hudson River School. (right) Paintings like Albert Bierstadt's 1868 "Among the Sierra Mountains, California" helped increase popular interest in western "wilderness" lands.

Yosemite Valley, in the California Sierras, was first painted in 1855 by a San Francisco artist named Thomas Ayres, who had moved to California in 1849 during the Gold Rush. In 1856 San Francisco's newspaper, *The Daily Alta California*, carried Ayres account of "A Trip to the Yohamite Valley." The article generated a lot of interest in the scenic region, and Ayres returned to Yosemite and

produced sketches which he showed at the American Art Union in New York. On his return trip to California, around the Straits of Magellan in South America, Ayres's ship sank and he and all his sketches were lost. But American leaders including Abraham Lincoln were influenced by Ayres and other artists' representations of the west. In 1864, Lincoln signed the Yosemite Grant, giving the region to the State of California as a park for "public use, resort and recreation." Frederick Law Olmsted, the architect who had designed Central Park in New York, was appointed chairman of the park's board of commissioners. During the Civil War, Montana Territory governor, Thomas Francis Meagher and railroad financier Jay Cooke suggested the "Great Geyser Basin" should also be protected. In 1872, President Ulysses S. Grant signed the act that created Yellowstone, America's first national park. In 1891, at the urging of preservationist John Muir, Yosemite joined Yellowstone as a national park. In 1903, Theodore Roosevelt camped with Muir at Yosemite's Glacier Point.

Today we think of Yellowstone and Yosemite as grand refuges, where pristine wilderness has been protected for future generations of Americans. But like many other American frontiers discovered since Europeans arrived in the New World, the national parks were already occupied when white men first encountered them. John Muir's Sierra Club pressured the U.S. government until army troops removed the Indians whom Muir believed had "no place in the landscape." Muir's vision of the park as a "mountain mansion where nature has gathered her choicest treasures" did not include "such debased fellow beings." In Yellowstone, park managers used the U.S. Army to evict resident Indians, declaring "we know that our right to the soils, as a race capable of its superior improvement, is above theirs."



Figure 2.5: Naturalist John Muir and President Theodore Roosevelt at Glacier Point in Yosemite, 1903.

In addition to removing Indians from national parks, Progressives waged a war on poor rural people much closer to home, in the Adirondack Mountains of upstate New York. In 1887, Progressive New York City Police Commissioner Theodore Roosevelt and several of his close associates formed a hunter-conservationist group called the Boone and Crockett Club, which dedicated itself to the preservation of big game. Members preached the sport-hunting ideal of "fair chase," and opposed hunting for food or for the sale of food, which they called market hunting. In 1900, the Club helped pass the Lacey Act, which outlawed market hunting and prohibited the sale of wildlife, fish, and plants that had been illegally taken. Rural people who had hunted, fished, or gathered wild plants to feed their families and had occasionally sold surplus game were designated as poachers and prosecuted. While the regulations may have helped prevent game populations from being over-hunted, the laws also declared the subsistence practices of rural people illegal. People far from cities who took animals to feed their families suddenly found themselves fined or jailed as poachers, while rich members of the Club visited the woods to hunt big game and brought trophies home from African safaris.

The Adirondacks are a 166-mile wide dome of mountains, about two hundred miles north of New York City. The Hudson river begins in the Adirondacks, and although the high terrain made poor farmland, it was ideally situated for wealthy New York

sportsmen seeking weekend wilderness adventures. By 1893, sixty private game parks had been established, containing more than 940,000 acres of the region's best hunting and fishing grounds. Another 730,000 acres was controlled by the State-owned Forest Preserve. In 1894, *Forest and Stream Magazine* observed that "private parks in the Adirondacks today occupy a considerably larger area than the State of Rhode Island." Wealthy Manhattanites continued buying upstate parcels for estates they called "camps" in spite of the mansions filled with servants they established there. By 1899, the New York State Legislature was considering bills that would completely exclude poor people who had lived in the region for generations from hunting in the Adirondacks. Residents had little influence in Albany, but they knew their way around local forests. In 1903, after prosecuting several trespassers and poachers on his estate, 49-year old millionaire lawyer Orrando Perry Dexter was murdered by northern vigilantes.

One of the most visible and symbolic battles between wealthy "camp" owners and northern residents was played out in the courts beginning in 1902. Oliver Lamora, a Civil War veteran living in the Adirondack town of Brandon, supplemented his military pension with fishing and hunting in the woods surrounding the town. Originally a lumber town, Brandon's fortunes had declined after the best marketable timber was cut. Around 1900, the town's sawmill and surrounding timberland was sold to William Rockefeller, who had co-founded Standard Oil and along with his brother John was one of the world's richest men.

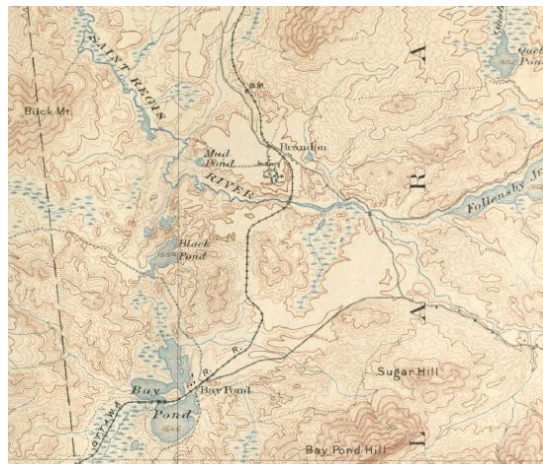


Figure 2.6: 1905 USGS map of the village of Brandon and its surroundings.

Rockefeller bought out Brandon residents who chose to leave, and tore down their houses. Within a couple of years, he had removed several hundred buildings and New York magazines had begun humorously referring to Rockefeller as a "Maker of Wilderness." But fourteen Brandon families decided not to sell. Oliver Lamora was among the holdouts. The problem was, there was virtually no way to leave the town of Brandon without crossing Rockefeller's land. And anyone who trespassed was liable to be arrested and prosecuted. In April 1902, Lamora set out along one of the paths that crossed William Rockefeller's camp. Worse, he stopped to fish in the St. Regis River, which Rockefeller considered his personal property. After catching over a dozen fish, Lamora was himself caught by one of the estate's guards, and was prosecuted under New York's Fisheries, Game, and Forest Law.

Lamora demanded a jury of his peers, and his peers acquitted him. Rockefeller was embarrassed and charged \$11.39 in court costs for bringing a frivolous lawsuit. Rockefeller appealed and lost. But the co-founder of Standard Oil was one of the world's richest men, and he was not accustomed to defeat. The *New York Times* remarked that "the case was carried from one court to another until a decision was rendered in favor of Mr. Rockefeller." But sympathy for Lamora was strong and the jury awarded damages of only 18 cents. In the meantime, Adirondack locals had taken up subscriptions to cover Lamora's court expenses and began going out of their way to fish in Rockefeller's park. In 1903, the *Times* reported that "Mr. Rockefeller's men have taken the names of upward of fifty persons who were found fishing in the Rockefeller park."

Although newspapers and magazines like *Forest and Stream* were critical of the camps, pointing out that "Rockefeller, J. Pierpont Morgan...and other landed proprietors in the Adirondacks are only doing with our woods what they have already done with our industries," wealthy New Yorkers were not prevented from buying up Adirondack land. In 1900, the park's area was roughly 2.8 million acres. About 1.2 million acres was state-owned, the rest private. By 2000, the park had grown to 6 million acres. About 2.4 million acres are state-owned, and another 600,000 acres taken up by towns, lakes, and small holdings. That leaves 3 million acres in private hands. Rather than shrinking during what has been typically considered a very liberal century, private holdings have nearly doubled, until they now take up an area roughly equal to the State of Connecticut. As an illustration that the trend continues,

in 2015, Alibaba.com founder Jack Ma purchased a 28,000 acre estate including the Rockefeller camp, the former town of Brandon, seven miles of river, eleven trout ponds, and a 2,200-foot mountain, for \$27 million.



Figure 2.7: 1907 photo of the Hetch Hetchy Valley, seen from the southwestern end, showing the Tuolumne River prior to damming.

In the western states, conflicts over wilderness did not end when the Indians were evicted from the new national parks. One of the most divisive issues ever faced by Progressives focused on a battle between conservationists and preservationists when a portion of Yosemite was proposed as a source of water for the city of San Francisco. Like Boston and New York, San Francisco had grown around its harbor and the city was surrounded by seawater that its residents could not drink. As population climbed in the early years of the California Gold Rush, drinking water was actually ferried across the bay from Sausalito and sold by water vendors. Carts loaded with barrels and horse-drawn tankers plied the city's steep streets daily, delivering water to homes and businesses. San Francisco had dammed small, nearby rivers to build the Pilarcitos and San Andrés Reservoirs in the 1860s and 1870s, but the city's need for water kept increasing. And water sources close to San Francisco were all controlled by private companies, which worried city planners. The city of San Francisco wanted to control its own water supply, so plans were made in the late 1880s to look for a source farther away. By 1901 city water planners had decided the best source was the Hetch Hetchy Valley of the Tuolumne River.

The Tuolumne River was fed by a glacier in the Sierra Mountains and flowed through a scenic valley 150 miles from San Francisco. To keep their interest in the Hetch Hetchy secret, San Francisco officials filed for water rights in the valley as private citizens. They claimed this was to prevent speculators from buying up the water supply, which had actually happened in 1875 when San Francisco had expressed interest in the Calaveras Valley watershed. It may also have been an attempt to keep the project secret as long as possible from wilderness preservationists like John Muir, a nationally-known activist who had lobbied the U.S. Congress for legislation that had created Yosemite National Park, in which the valley was located, in 1890, and had founded the Sierra Club in 1892.

San Francisco's interest in damming the Tuolumne River reached a new intensity after the Earthquake and Fire of 1906, which destroyed over eighty percent of the city. Although most of the city's water mains had been broken by the quake, many blamed inadequate water supplies for the extensive damage inflicted by three days of fire. Opponents of San Francisco's plan to dam the Tuolumne believed the valley was too valuable as wilderness to be sacrificed for a city water supply. Critics were also suspicious of the San Francisco officials who insisted that a Hetch Hetchy dam was the only viable plan. In 1907, San Francisco's mayor and his political sponsor were both convicted of graft and corruption for supporting a scheme to have the city buy the Bay Cities Water Company, a private corporation that controlled water sources closer to town. The mayor was convicted and sentenced to five years in prison, which he did not serve. The mayor's wealthy patron was actually sent to San Quentin.

Since the Hetch Hetchy Valley was inside America's second national park, it required an Act of Congress to approve the dam project. After years of intense lobbying by both sides, dam supporters won the support of Washington lawmakers, and the project was begun in 1913. The Hetch Hetchy controversy forced conservationists and preservationists to articulate and debate their competing visions of how Americans should interact with nature, and especially of how the government should deal with the environment. The arguments supporting the dam were presented by Roosevelt's Chief of the U.S. Forest Bureau, Gifford Pinchot, and the arguments against the project by John Muir. Although the decision was ultimately made to flood the valley, the issues raised by the debate regarding the value and purpose of wilderness have yet to be fully resolved.



Figure 2.8: The Hetch Hetchy Valley and reservoir as they appear today.

In addition to difficulty agreeing who wilderness should be for, modern America has struggled with the basic concept of wilderness. In the inaugural issue of the journal *Environmental History* in 1996, historian William Cronon contributed an essay titled “The Trouble with Wilderness or, Getting Back to the Wrong Nature.” Cronon observed that for many modern Americans, “wilderness stands as the last remaining place where civilization, that all too human disease, has not fully infected the earth.” The more we learn of its particular history, Cronon said, the more we realize that “wilderness is not quite what it seems. Far from being the one place on earth that stands apart from humanity, it is quite profoundly a human creation.” When we look at “Nature”, Cronon said, “in fact we see the reflection of our own unexamined longings and desires.” Cronon recounted the stories of Indians excluded from national parks to make them appear pristine, and of the Hetch Hetchy Valley. He discussed Euro-American cultural traditions and concluded that although we fail to understand that what we believe are wild areas are usually constructed, the connection we seek is a sense of wonder. Wilderness, he said, “gets us into trouble only if we imagine that this experience of wonder and otherness is limited to remote corners of the planet, or that it somehow depends on pristine landscapes we ourselves do not inhabit.” Even though a tree in a pristine forest might represent a more complicated web of ecological relationships, Cronon concluded, “the tree in the garden is in reality no less other, no less worthy of our wonder and respect.” Nature remains important, Cronon said, even if it has people in it.

The idea of nature with people in it returns us to *Country Life*, the other concern of liberal intellectuals and Progressive reformers at the beginning of the twentieth century. Progressive solutions to what they perceived as a “rural problem” in the early twentieth century were often quite different from those advocated by rural people themselves. Progressives were frequently urban elites, who although genuinely concerned about country life, were not really living it. The issues they perceived were not always the same as the problems country people experienced. But sometimes, like rural Populists such as Albert Todd who had visited Europe and drawn on the experiences of a wider culture, American Progressives were joined by foreigners with wider perspectives, who were able to see causes and connections that were not apparent to rural people or to the urban Progressives who sought to help them.

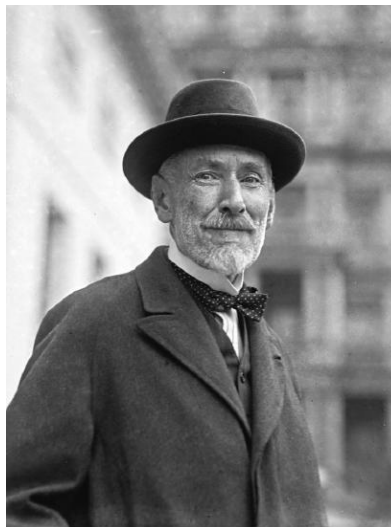


Figure 2.9: Country Life Reformer Sir Horace Plunkett in 1923.

One such foreigner who contributed to the examination of country life was an Anglo-Irish aristocrat born at Dunsany Castle in Ireland. Sir Horace Plunkett was the third son of the sixteenth Baron Dunsany and the uncle of the famous fantasy author known as Lord Dunsany. Horace Plunkett was a leading activist for Irish home rule, and he developed the idea of Irish rural cooperatives. Plunkett believed that “The city has developed to the neglect of the country.” He suggested that of Theodore Roosevelt’s “Three

Pillars of Country Life,” which were “better farming, better business, and better living,” the business problems of farmers should be addressed first. Being a wealthy aristocrat, Plunkett had access to American leaders like President Roosevelt, conservationist Gifford Pinchot, and railroad tycoon James Jerome Hill, all of whom had expressed interest in country life issues. Plunkett wrote a series of magazine articles beginning in 1908 that he compiled into a best-selling book called *The Rural Life Problem of the United States*.

During the first phase of the industrial revolution, Plunkett said, “economic science stepped in and, scrupulously obeying its own law of supply and demand, told the then-predominant middle classes just what they wished to be told.” Social and political science, he said, “rose up in protest against both the economists and the manufacturers, but they were pushed aside in the rush for progress.” Aside from this strangely antique language, many of Plunkett’s ideas apply equally well to problems we face today. Unusual for an analysis written a hundred years ago, Plunkett introduced the idea of a world market. And he said that neglect of rural regions was caused in part by the fact that reciprocity between the city and country had not really ceased. Interactions had actually increased, Plunkett said, but had become national and even international rather than local. Plunkett noted that “42 percent of materials used in manufacture in the United States are from the farm, which also contributes 70 percent of the country’s exports.” But the complexity of new trade patterns and supply chains had hidden the mutual dependence of city and country. Plunkett concluded, “Until the obligations of common citizenship are realized by the town, we cannot hope for any lasting national progress.”

If there was specific blame to be laid, Plunkett directed it not at the system, but at what he called “profiteers.” He wrote in 1908, “Excessive middle profits between producer and consumer may largely account for the very serious rise in the price of staple articles of food.” But even though urban middlemen were to blame and the problem impoverished rural people at the same time it aggravated the plight of poor city people, Plunkett said, “the remedy lies with the farmer” rather than with legislative action or government reform. Like the country life advocates who followed him, in the Progressive era and the New Deal of the 1930s, Plunkett connected the rural problem to the breakdown of democracy. Plunkett said that excluding people from the political sphere had damaged the democratic process. Farmers’ experience of the cycles of nature, which Plunkett described as slower and less affected by fads and market forces than the commercial and industrial processes that city people lived within, gave country people a more balanced political sense. City-dwellers’ one-sided experience may account for what Plunkett called “that disregard of inconvenient facts and that impatience of the limits of practicability which many observers note as a characteristic defect of popular government.” Plunkett also suspected farmers might be less attracted to socialism, which was a big concern in the early twentieth century, because in the country, he said, “the divorce of the worker from his raw material by the force of capitalism does not arise.” Unlike urban factory workers, Plunkett believed American farmers were not alienated from their means of production, because most of them were the proprietors of their own small businesses. Farmers were not victims of capitalism in the same way that urban wage-workers were. This entrepreneurial element of farming has definitely been eroded in the twentieth century, as agribusiness expanded and power shifted to the food processors who were the farmers’ customers, and often also their suppliers and their mortgage-holders. But it could be restored if more farmers could build connections with consumers through farmers’ markets, direct marketing, or community supported agriculture (CSAs).

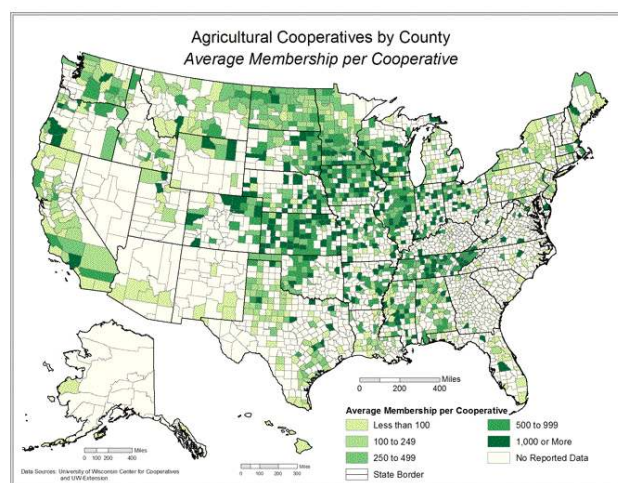


Figure 2.10: Plunkett advocated for the establishment of cooperatives. USDA map of membership in agricultural cooperatives, 2006.

Plunkett called for what he called “a moral corrective to a too-rapidly growing material prosperity.” But he did not really identify the motivation for what he called “the reckless sacrifice of agricultural interests by the legislators of the towns.” The issue he avoided confronting directly was the increasing unevenness of prosperity. Even in rural areas, the rewards went disproportionately to the few, and in most cases profits were captured by middlemen at the expense of both rural producers and urban consumers. “Under modern economic conditions, things must be done in a large way if they are to be done profitably,” Plunkett said, “and this necessitates a resort to combination.” Corporate organizations had three benefits, he said: economies of scale, elimination of what he called “the great middlemen who control exchange and distribution,” and political power. For better or worse, Plunkett said, “towns have flourished at the expense of the country by use of these methods, and the countryman must adopt them if he is to get his own again.” But farmers, Plunkett admitted, “being the most conservative and individualistic beings,” were unlikely to organize themselves in joint stock companies or corporations, and hand over control to others.

Plunkett’s solution, the farmer’s cooperative, was a social and political as well as an economic tool because, “when farmers combine, it is a combination not only of money but of personal effort in relation to the entire business.” Plunkett tried to emphasize that the distinction between the capitalistic basis of joint stock ownership and the more human character of the cooperative system is fundamentally important. Compared to Ireland, where Plunkett had been instrumental in developing rural cooperatives, “the American farming interest is at a fatal disadvantage in the purchase of agricultural requirements, in the sale of agricultural produce, and in obtaining proper credit facilities.” Cooperatives could address each of these needs. “The long-term result of better business,” Plunkett said, would be Theodore Roosevelt’s other two priorities, better farming and better living. Cooperatives would begin a process of renewing rural social bonds, leading to a new neighborhood culture. Rather than trying to bring the advantages of the city to the country, Plunkett hoped rural communities would “develop in the country the things of the country, the very existence of which seems to have been forgotten.” After all, he said, “it is the world within us rather than the world without us that matters in the making of society,” once the physical necessities like clean water, medicine, and electricity had been made available by attending to better business.

Plunkett was well aware that his subject was rural but his audience was urban, and this may explain why his final chapter focused on education and socialization. Many urban Progressives felt that in addition to the economic and social challenges rural people faced, that there was something wrong with country people themselves. Unlike Plunkett, many American reformers believed rural people were inferior, either genetically or socially. Rural problems became a popular subject of study in the 1900s and 1910s, and groups like the American Sociological Society organized conferences and published books and articles on subjects such as “The Mind of the Farmer”, “Folk Depletion as a Cause of Rural Decline”, and “Social Control Through Rural Religion.” Universities published the results of studies announcing that the problem with country people was that nearly all of them had intestinal parasites. Other academics claimed the problem was the decline of rural schools or rural churches. Roosevelt’s Commission on Country Life was genuinely concerned about the problems of rural America, where half the nation’s population still lived. But the reformers were often perceived as condescending elitists who were out of touch with actual rural life. A century after the Country Life Commission issued its report, the rural webzine Daily Yonder commemorated it with an article titled “Country Life Movement—Miles To Go.”

The Country Life movement of the early twentieth century did produce some tangible results. The American Farm Bureau Federation, the Cooperative Extension Service of the land-grant colleges, the Bureau of Public Roads that paved many of the old mud tracks that people in the countryside struggled with, and the Farm Credit Bureau were all established in response to concerns identified by the movement. A couple of decades later, in the New Deal, rural electrification and the Farm Credit Administration addressed what were perceived as continuing problems of rural America, while at the same time providing employment and financial opportunities for unemployed workers, idled businesses, and underutilized credit markets. It is interesting that in addition to obvious issues like social change and natural resource use, people concerned with country life a century ago were well aware of globalization, of middlemen, and sometimes even of the differing world-views of rural and urban people. It will be interesting to see whether the twenty-first century makes better progress on these issues than the twentieth century was able to achieve.

Further Reading

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3: Farmers and Agribusiness

In early America, just about everyone was a farmer. Everybody must eat, and in a time before transportation, refrigeration, and foods manufactured for long-term storage, that meant everybody was responsible for making food to put on their tables. Some people such as pre-Columbian Indians in the far north survived on hunting alone, and it is still possible to survive as a hunter today. But only if population density is so low the hunter community does not overwhelm the available game. Throughout America's history, population growth has only been possible on a strong foundation of dependable food. That means farms.

As we have seen in previous chapters, the growth of American industry and cities depended on availability of foods produced by commercial farmers and on transportation networks able to get them to consumers. Let's review population growth in the United States, paying close attention to American farmers. In the first U.S. Census of 1790, the new nation's population was about four million people, almost all of them living in the countryside or in small towns and villages, and 90 percent of them listing their occupation as farmers. Actually, the other ten percent often farmed quite a bit too. Rural professionals such as doctors, lawyers, ministers, and merchants pastured horses and put up hay for their winter fodder, kept milk cows, and raised a few chickens or a hog for the table. Very few people had absolutely no connection with food production. Even sailors kept chickens for eggs and meat on long ocean voyages.



Figure 3.1: Currier & Ives illustration of a slave plantation on the Mississippi River. Note the steamboat in background.

In the 1820 Census, Americans discovered the population of the United States had more than doubled to 9.6 million people, of whom 1.5 million were slaves. There were 61 towns and cities with more than 2,500 people, and nearly 9 million people, or 93 percent of the population, lived outside cities. Agricultural exports were about \$42 million per year, amounting to about two thirds of total exports.

By 1840, when industry was accelerating in the Northeast and cities were beginning to expand rapidly, America's population was just over 17 million. More than 9 million people were farmers, or about 69 percent of the total labor force. About 2.5 million slaves were recorded in the census, and in states like South Carolina enslaved people outnumbered free whites. Only ten percent of Americans lived in cities, and there were only 131 places in the country with more than 2,500 inhabitants. Most people living in small towns and villages still raised animals to eat and cut hay to feed their horses, even if the census recorded a different occupation. Of the people listed as farmers, many still grew crops primarily to feed their own families, and sold the excess in local markets. But some commercial farmers, like the Ranneys of Michigan and Upstate New York discussed in Chapter Four, regularly shipped agricultural products to distant markets for sale.



Figure 3.2: The American farmyard, depicted in this 1857 illustration for Currier and Ives, included all the domesticated animals imported to the Americas by European settlers.

On the eve of the Civil War in 1860, the American population was about 31.5 million, and 15 million people, about 58 percent of the work force, were farmers. Four million Americans were slaves, and in the tidewater plantation regions of many Southern states, the slave population significantly outnumbered the white population. In the inland “piedmont” region on the slopes of the Appalachian Mountains, poor white families had difficulty finding a place in an economy oriented around plantations. Eight out of ten Americans still lived outside cities, and there were still fewer than 400 towns with 2,500 people. Many residents of the middle west listed in the census as farmers had begun focusing on growing staple crops like corn and wheat for new commercial food processing corporations in Buffalo, Chicago, and Minneapolis, or raising hogs or cattle to ship to the stockyards. But most still practiced a diversified style of farming that included growing a variety of crops and raising animals on the farm, if only for home use. Outside the slave-based cotton-growing region of the South, farming was a lifestyle and the family farm was an important economic and social unit. Most American farmers thought of themselves as independent businesses run on family labor and capital, and local credit.



Figure 3.3: Another (1873) Grange poster showing scenes of farm and family life, celebrating contributions of farmers to American society.

In 1880, America's population passed the fifty million mark. 23 million Americans were farmers, and although the number of farmers was still growing, the farm population was growing slower than the non-farm population and for the first time less than half of working Americans were farmers. Three in ten Americans lived in urban settings. Some were farmers or the children of farmers who had had moved off the land; others were immigrants who settled in cities as soon as they arrived. There were nearly a thousand towns and cities with populations over 2,500. The largest cities, like New York and Philadelphia, held over a million people, and Chicago had a half million. There were about 4 million farms, and the average farm size was 134 acres. Farmers were becoming aware that they were numerous enough to be politically powerful, and were beginning to understand that their concerns were not the same as those of working people in the cities. They began organizing in groups like the Grange and the People's Party to lobby for rural issues.

The American population in 1900 was over seventy-five million, and the number of farms and of farmers was still growing, although by the beginning of the twentieth century farmers only made up about a third of the U.S. workforce. 29 million people lived on about 5.75 million farms, and the average farm covered 147 acres. About a quarter of these farmers were former slaves and their descendants living in the South. 90% of America's 8.8 million African American citizens lived in the rural South, although some were beginning to migrate to Northern cities in search of jobs and an escape from oppressive Jim Crow laws. Four out of ten Americans lived in nearly 2000 large towns and cities, and the nation's commercial farmers were responsible for feeding them. Corn and wheat fields got larger and were planted year after year instead of being rotated into pasture. Commercial fertilizers and tractors became indispensable to maintaining a high level of agricultural productivity.



Figure 3.4: Food vendors on Mulberry Street in what was then Little Italy, New York City, 1900.

By 1920, America's population had grown to over a hundred million people through both natural increase and immigration. U.S. borders remained largely open to immigrants until the early 1920s, when laws were passed to slow the flood of Europeans and Asians seeking a better life in the "land of opportunity." In spite of coming from the countryside, many immigrants settled in cities and found work in industry. Although urban employment was growing more rapidly than rural and farmers made up just a quarter of the U.S. labor force, the number of American farms and farmers was still rising. Over 31 million people lived on 6.5 million farms, and another twenty million country people lived close to the land and were part of the rural economy. But for the first time, more than half of Americans lived in large towns and cities. Most of the city dwellers were completely dependent on foods raised by farmers they had never met, processed and distributed by large corporations in distant cities.

Many urban people regained a connection with the land when food rationing during the two World Wars and scarcity during the Great Depression caused the widespread planting of Victory Gardens and the keeping of backyard chickens. City people who had grown up on farms or emigrated from agricultural areas reconnected with their rural roots and took more responsibility for feeding their families. During these crises the government toned down its traditional support of the food processing industry and encouraged self-sufficiency, telling citizens that by feeding themselves they were helping the war effort. Unlike many European nations, the U.S. had never depended on food sources outside its own borders, but the wars and the Great Depression introduced many Americans to the concept of food security.



Figure 3.5: World War II Victory Garden poster from the War Food Administration.

In 1950, at the start of America's post-war boom, U.S. population was about 150 million and the farm population had finally begun to decline. 25 million farmers made up only one eighth of the work force, and over a million farms had disappeared since the previous census. Many had been swallowed by the Depression or erased by the Dust Bowl. However, the size of the average farm grew to 216 acres, because much of the cropland from failed family farms was consolidated into larger commercial operations able to take advantage of expensive new equipment. Industries that had built tanks and explosives during World War II were converted to civilian production, which meant larger tractors and combines, and more nitrate fertilizer. At the end of World War II, the U.S. military was supported by ten large munitions factories with an annual capacity of 1.6 million tons of ammonia. This capacity was turned over to fertilizer production, flooding the market with low-cost nitrate fertilizers that produced a boom in staple crops. A population that had faced high prices and food shortages for nearly two decades suddenly had disposable income and access to nearly unlimited, inexpensive food products.

By 1980, U.S. population exceeded 225 million and early three out of four Americans lived in large towns and cities. The farm population had fallen to just 6 million. Farmers now made up only 3.4 percent of the U.S. work force, and although there were still 2.5 million farms, their average size had ballooned to 426 acres. This was the era of the Farm Crisis, when Americans became aware that debt-strangled family farms were being forced into foreclosure at alarming rates. Saving the Family Farm became a political slogan, but even for those farms that survived, the nature of farming was changing dramatically. Unlike the self-sufficient small businesses of the early twentieth century, the new farms depended on extremely expensive capital equipment, high debt, and often on cheap, transient labor. Whether officially owned by corporations or families, most modern farms are controlled by the food-products manufacturers whose supply-chains they feed. Often the farmer's single customer is also his banker and the mortgage-holder on his equipment and buildings. Many farmers only raise the crops and animals they're instructed to raise by their corporate customers, and depend as heavily on the supermarket for their own food needs as any city-dweller.

According to the most recent information available, there are currently about 2.2 million farms in the U.S. Since 1980, the number of farms over 2000 acres has increased by nearly 25 percent, and the number of farms smaller than 50 acres has increased by about a third. A few of these smaller farms are part-time or "hobby" farms. But most are feedlots or concentrated animal feeding operations (CAFOs), that are allowed to house 10,000 hogs or 125,000 chickens on a ten-acre parcel under most state guidelines. The number of traditional farms, between 50 and 2000 acres, has decreased by about 25 percent. And the number of corporate-owned farms has doubled.

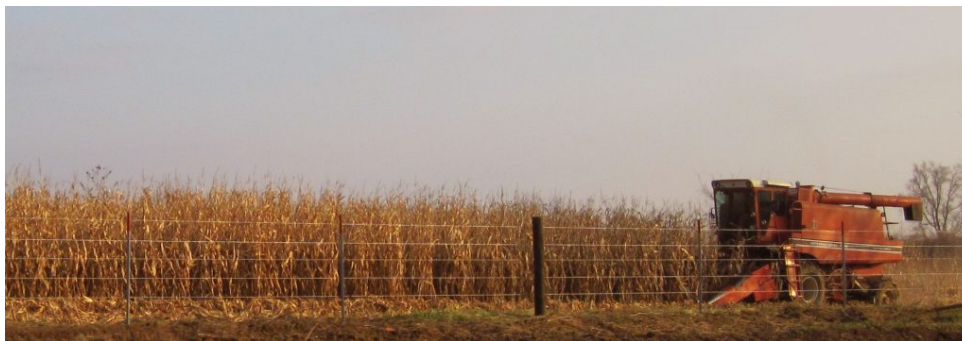


Figure 3.6: Corn planted “fence-row to fence-row” to take advantage of subsidies. Much of the surplus ends up as ethanol and High Fructose Corn Syrup.

Technology, transportation, and markets encouraged the growth and specialization of American farms. But another, often ignored influence on the American farm sector has been government agricultural policy. The United States Department of Agriculture began in 1839 as a department of the Patent Office, charged with compiling statistical data on American farming. Abraham Lincoln established an independent Department of Agriculture (because most Americans were farmers, Lincoln nick-named it the “people’s department”) in 1862. During the Progressive Era, the department opened agricultural experiment stations and extension agencies to promote scientific farming and improve country life. The federal government became much more actively involved in the American economy and agriculture during the Great Depression. The market crash of 1929 plunged the United States into a prolonged economic crisis and was perceived by many as evidence the free market could not avoid boom-and-bust swings. Just under half of Americans lived outside cities at the beginning of the Depression, so Franklin D. Roosevelt’s New Deal included rural development and “agricultural adjustment” farm policies that became part of the American political landscape.

Farmers had been complaining since the nineteenth century that they were treated unfairly by the railroads and corporate food processors. Railroads were granted monopolies by the government, the farmers argued, and food processors were supported by USDA safety inspections. Farms were many and small; the corporations on the other side of the bargaining table were few and large. It was only fair, farmers argued, that a government that had stacked the deck in favor of big corporations should do something to protect the farmer. During the New Deal, the government finally threw its support behind the farmers, instituting crop-reduction programs that paid farmers to set land aside and limit the volume of crops reaching the market. Crop reduction stabilized prices, but resulted in higher food costs for consumers. Critics of the program argued that paying people not to produce something is absurd. But what makes sense and what is politically expedient are not always the same. The program was supported by rural constituencies and their representatives, and survived until the late 1970s, when political changes in Washington eliminated the New Deal price-stabilization and farmers were encouraged to plant “fence-row to fence-row.” Following the supply-side economics that became politically fashionable in the 1980s, the USDA’s official policy became “Get big or get out,” and farm programs were rearranged to incentivize the greatest possible production.

Of course, when supply explodes without an equally rapid increase in demand, prices plummet. When all the excess grain could not be absorbed in the export market, the free-market-oriented politicians who had criticized the absurdity of paying people to not produce crops instead found themselves setting price floors. The government began paying farmers more than the market would bear, to produce crops the market didn’t want. Direct Payments from the USDA made it possible for farmers to plant more corn than the market would buy, sell it below their cost of production, and then collect the rest of the floor price from the government. Like crop reduction, the program made no sense; it was a political compromise. But it helps explain why the government became so interested in turning corn into fuel. Ethanol production increases demand for corn, according to USDA economists, resulting in savings of over \$6 billion in annual farm subsidies. While it is unclear whether that savings is offset by other subsidies elsewhere, or whether it is in the United States’ best interest to continue producing so much corn, reducing subsidies is probably a good thing. USDA direct payments to farmers between 1995 and 2012 totaled \$292.5 billion. Subsidies attracted a lot of attention, but the number is more meaningful with context. Although USDA Direct Payments to farmers are high, two thirds of American farmers receive no subsidies at all, while the top 10 percent receive 75 percent of the money. Corn receives the most government support, nearly three times more than wheat, the next largest recipient. In the early years of the twenty-first century, food processors and manufacturers discovered they could buy corn for less than it cost to grow, which changed agriculture and the American diet in ways no one had anticipated.

High fructose corn syrup (HFCS) is a chemical sweetener developed by Japanese industrial chemists in the late 1960s. Because the US maintains a high tariff on foreign sugar that makes domestic table sugar two to three times more expensive than sugar in the rest of the world, and because of USDA corn subsidies, HFCS is the cheapest sweetener available to American food manufacturers. It can be found in nearly all processed foods, even those that are not considered particularly sweet. U.S. government actions like sugar tariffs and the corn subsidy have contributed to making manufactured foods cheaper than most fresh foods. It is now possible to buy about five times more calories of processed food than of fresh food per dollar, in the average supermarket. That means from a purely economic perspective, a family on a tight budget trying to buy the most calories they can per dollar is much better off eating processed foods rather than fresh. Because of government farm policies, American families are actually better off financially if they never eat fresh foods. Another way of expressing this is that over the last generation, American family food spending as a percentage of income has dropped from 18% to 9%, while family health care costs over the same period have increased from 9% to 18%.



Figure 3.7: A Florida Concentrated Animal Feeding Operation (CAFO) where broiler chickens are fed subsidized corn.

The way government policies have changed farms has a direct impact on the food choices available to American families. Due to the subsidy provided by USDA Direct Payments, it costs less to buy corn than it does to grow it. That means it makes economic sense for farmers who feed corn to animals not to grow the corn themselves. This has resulted in animal production being moved off the old-fashioned mixed-production farms that were once thought of as the backbone of America, onto concentrated animal feeding operations (CAFOs). On traditional mixed-production farms, livestock were usually raised on pastures, often in a rotation with crops. Forage crops and the animals' manure helped the land recover from staple crops like corn that mined soil fertility. The animals ate the grasses they had evolved to eat and contributed to the fertility cycle of the farm. The barnyard full of animals pictured in the Currier and Ives print earlier still represents the type of farm most people imagine when they think of American agriculture, and this was normal until the last couple of decades. Nowadays, trying to make a living in farming means obeying not only the orders of corporate customers, but the government's incentives. Grain farmers specialize in a single high-yield crop, and animals are off the farm.

In concentrated animal feeding operations, animals are fed corn because corn is the universal low cost feed. CAFOs always use corn, whether they're feeding chickens, turkeys, hogs, dairy cows or beef. But cattle, like goats and sheep, are ruminants. Grazing animals whose digestive systems evolved to ferment the cellulose in grasses do not thrive on a high-starch diet of corn. Feeding cattle a diet of corn results in chronic digestive diseases that must be continually treated with antibiotics. Introduction of permanent antibiotics into animal feeds over the last few decades has resulted in the evolution of antibiotic-resistant bacteria. And manure produced by millions of confined, medicated animals cannot be used as fertilizer without releasing those antibiotics into the ground-water and the ecosystems it supports.

Manure is no small problem in CAFOs. The hog-confinement operations of North Carolina alone produce twenty million tons of waste per year. In comparison, the cities of New York, Chicago, and Los Angeles combined do not produce as much human waste. And the waste produced by people in cities is heavily regulated, with specific requirements for treatment and safe handling. This is not the case with animal waste. But North Carolina, with just under ten million confined animals, is not even the largest hog state. Iowa has nearly eighteen million hogs, and Minnesota has nearly eight million. The top ten hog states house over 52 million animals in CAFOs. America's hogs produce more waste than the nation's entire human population. And then there are the confined flocks of laying hens and meat chickens, the turkeys, and the separate populations of dairy and beef cattle. When these animals lived on farms, their manure was an important source of soil fertility. On CAFOs manure is toxic waste, and the farms make up for

its loss by spraying more synthetic ammonia produced using the high-energy Haber-Bosch process. As we have already seen, much of this fertilizer finds its way into America's lakes, rivers, and the Gulf of Mexico.



Figure 3.8: Manure can be broken down in anaerobic lagoons, but most CAFOs are not required to manage their wastewater.

But medicated cattle and hog manure are not the only issues facing agribusiness. Another element of modern farming that has undergone dramatic change that often goes unnoticed is the livestock itself. Most people are familiar with the efforts of corporations such as Monsanto, Syngenta, and Dow to produce genetically modified GMO crops and the determination of organic advocates to ban them. But even many organic enthusiasts seem unaware of the changes that have been made to the animals that become the meats they eat. We'll focus here on the history and current condition of chickens, because I have some personal experience raising them. But the same pattern of increasing production concentration and specialization of the animals themselves can be seen in the commercial turkey, pork, and beef industries.

Go to your local food coop's freezer and pick up the most expensive free-range, organic, vegetarian-fed broiler chicken you find. I can almost guarantee you it is a Cornish Rock hybrid, a specialized crossbreed designed for rapid growth, short legs, and lots of white meat. Unlike the hybrid broiler's ancestors, this chicken can only live about nine weeks before it develops heart disease and its legs break under its own weight. The hybrid broiler cannot even reproduce naturally.



Video 3.1: A season-long side-by-side comparison of raising traditional chicken breeds on pasture vs. commercial hybrid birds. The conclusion at the end may surprise you -- it surprised me! <https://youtu.be/kgG4zm92dY8>

Chickens were domesticated in Asia about ten thousand years ago, from two related species of red and grey jungle fowl. They spread throughout Europe, Asia, and Africa, and reached the Americas along with other Eurasian livestock as part of the Columbian Exchange. Unlike most wild birds that only lay eggs during a short mating season, chickens have been bred to lay year-round. Chickens served a dual purpose on traditional farms as a source of both eggs and meat. Until recently, the same birds were usually used for eggs and meat, although many cultures have also bred specialized chickens for show or for cock-fighting. In early

America, most chickens were considered “dunghill fowl,” a phrase that appears regularly in old documents and even in wills and estate inventories. Contrary to what the growers of the vegetarian chickens selling at your food coop would like you to believe, chickens are omnivores. They were associated with dung-hills because they can live on kitchen scraps and will happily pick through your compost pile, looking for the insects, worms, and grubs they consider special treats.

In the late 1840s and early 1850s when most Americans still lived close to the land, chicken breeding became a popular pastime. There was even a short-lived chicken mania and a poultry investment bubble in America, which began when the port of Shanghai was forcibly opened to western ships at the end of the Opium War. Because they can be fed so cheaply, live chickens were a regular part of the food carried on long sea voyages. A few exotic-looking Asian birds apparently survived their first voyages from China to America, and American breeders were excited by the large, attractive, feather-footed chickens they called Cochins and Shanghais after the birds’ ports of origin. The popularity and high prices paid for exotic birds prompted American farmers to pay more attention to chicken breeding, and soon varieties like the Plymouth Rock, the Rhode Island Red, and the Jersey Giant began to appear at regional fairs and agricultural shows. These varieties, now considered heritage breeds, were larger than the old dunghill fowl and were prodigious egg-layers. They are still popular as dual-purpose egg and meat producers.

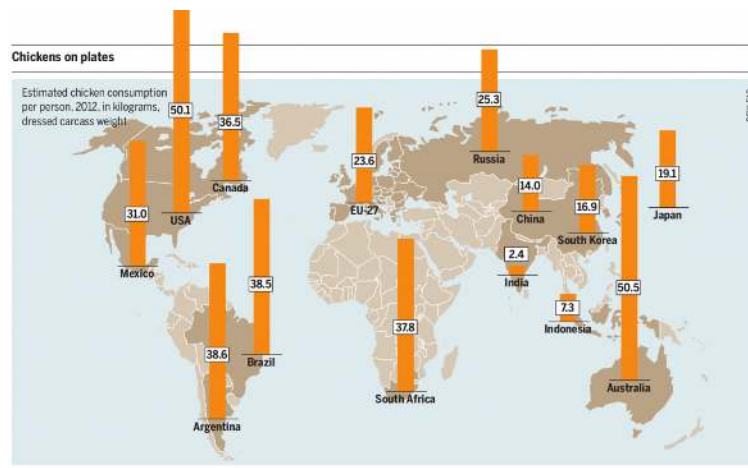


Figure 3.9: Chicken consumption now exceeds beef in industrialized countries. Demand in Asia is rising.

After World War II, more than half the American population lived in cities where keeping livestock was usually illegal. When prosperous, professional families wanting more space moved to suburban developments rather than back to the countryside, backyard chickens became socially unacceptable even where it was possible to keep them. The sanitary cities movement had eliminated urban animals and the suburban lifestyle of mobility, consumerism, and affluence was quick to leave behind reminders of the hardships and Victory gardens of the Depression and the war years. The 1950s also saw the rise of scientifically-bred hybrid birds, and of the development of separate breeds for egg production and meat.

The average heritage hen lays about 200 eggs per year, lives up to eight years, and weighs five or six pounds. Today’s commercial layers are usually White Leghorn hens, a small Mediterranean breed that weighs three to four pounds, produces up to 320 eggs annually, and has a very high feed-to-egg conversion ratio. As egg production became a specialized business rather than something that happened in everyone’s backyard, feed conversion efficiency became much more important. It is not such a big deal when you keep a few backyard hens and they eat your kitchen scraps, grass, grasshoppers, and a little scratch feed. But feed efficiency is critical when you are managing two million hens in a factory. A smaller-sized bird was also valuable, because hens were kept eleven to a cage in 18 by 20 inch battery cages for the duration of their 72-week lives. 95 percent of the laying hens in America live in battery cages. The cage-free eggs you see selling for two to three times the price of regular eggs come from birds that don’t live in battery cages, but rather in large barns like broilers. Chickens raised for meat are even more specialized than laying hens. Although they are nearly all hybrid crosses of the White Cornish and the White Plymouth Rock breeds, the specific bloodlines are jealously-guarded trade secrets. Since the birds can’t reproduce naturally, breeding is centralized and three corporations control the primary genetic stock accounting for 80 percent of the 83 billion metric tons of broiler meat produced annually.



Figure 3.10: Laying hens in battery cages in India, where at least they are exposed to daylight and fresh air.

Cornish crosses have very large breasts, very short legs, and grow extremely rapidly. They are generally raised indoors on large open floors holding populations of up to a million birds. Unlike heritage chickens, hybrid broilers are not particularly effective as foragers. Broilers are usually fed medicated high-protein feeds, partly because hybrids are susceptible to illnesses that do not usually bother regular chickens, and partly because of the stress of overcrowding. The medication in the feed also promotes even more rapid growth in the fast-growing broilers. After about seven weeks of age, broilers begin to show signs of difficulty walking, and after nine weeks old they begin to suffer from heart disease and kidney failure. Their feed conversion has been improved by breeding to 1.9 pounds of feed to 1 pound of live weight, which is about twice as good as a heritage bird. But you have to feed them a specialized diet and be sure to kill them at eight weeks.

As you may know, chickens are making a bit of a comeback in hobby-farming and back-to-the land circles. There are several hatcheries that will send you day-old chicks by mail, and many towns and even some suburbs are beginning to allow backyard coops and small flocks. Oddly, although a variety of heritage breeds are popular for eggs, the hybrid broiler is still the best selling meat bird. The hatchery I use, for example, offers about twenty breeds of white-egg layers, thirty-five brown-egg layers, and specialty birds like the Chilean Araucana that lays green or blue eggs. For meat birds, however, the choices are the White Broiler or its recent hybrid cousins the Rainbow Ranger and Black Ranger, which are variations on the standard broiler that are slightly more mobile and grow out in about 13 weeks. The broilers are \$2.40 each, and the Rangers are about \$2.75. Recently, the hatchery added a fourth choice, which is the one I demonstrated in the video above. Instead of hybrid meat birds, you can buy what they call a Fry Pan Bargain, an assortment of whatever excess males the hatchery happens to have on the day you order. Since people mostly buy heritage hens for egg-laying, there are always leftover roosters that have to be shipped or killed. To avoid killing thousands of day-old chicks, the hatchery sells them at extremely low prices. You can buy Fry Pan chicks for 29 cents each if you take them a hundred at a time. The birds you receive are usually Rhode Island Reds, Plymouth Rocks, and Orpingtons, since those are the hatchery's best-selling layer breeds. The heritage birds take longer to raise, but by the end of the summer they grow to three to four pounds each. While that is only about half the size of a hybrid bird at eight weeks, it is enough to make a decent family meal. And the heritage breeds can live on the pasture and eat mostly grass and bugs. Finally, if there is one you really like and you cannot bear to part with him, you can keep him, breed him with your laying hens and raise a whole new generation for free.



Figure 3.11: Another typical broiler operation, where the birds have less than a square foot each, on average.

Not everyone can raise a hundred pastured chickens, of course. Even backyard chickens are not for everybody. But a lot of people could keep a friendly, colorful little hen or two in a coop on their porch or in the backyard and have fresh eggs for breakfast. Keeping chickens is really not that difficult. The hardest part, like many of the life changes that end up seeming inevitable years later, might really just be imagining it as a possibility.

One last issue to consider with poultry, which applies equally to hogs, cattle, and other CAFO livestock, is vulnerability. 2015 will be remembered by many American farmers as the year of the Avian Influenza. According to industry sources, H5N2 and H5N8 bird flu viruses swept through the Midwest in the Spring of 2015 in the worst epidemic ever experienced by American poultry farmers. At least 223 outbreaks were recorded, causing the destruction of tens of millions of chickens and turkeys. By late spring, the epidemic was national news. The New York Times reported that a single Iowa farm was being forced to euthanize 5.5 million laying hens and dispose of the carcasses. The farm, located in an Iowa county that earns close to \$2 billion annually from agriculture, housed its layers in battery cages in 26 barns. Although the operators had isolated the outbreak to just two of those barns, the article said, they were forced to dispose of all their birds and thoroughly disinfect the entire operation.

While the epidemic was clearly frustrating for the farmers and tragic for all the chickens that had to be suffocated in spray-foam, there was more to the story than the Times reported. The Iowa farm the newspaper described was part of the Center Fresh Group, a corporation owned by eight Iowa families that controls 17 percent of the nation's poultry and is the largest producer of eggs and shell products in America. Although the story said operators of the farm were "forced" by the USDA to destroy their birds, Center Fresh, like all the other operations that disposed of birds suspected of being diseased, killed their chickens voluntarily and was compensated by the USDA for the birds they destroyed. Chickens that died of disease were not covered by the reimbursement program, which provided growers with a strong incentive to cooperate with the government's biosecurity protocols.



Figure 3.12: Raising "Fry Pan" chickens on my pasture, where they run around, eat grass and bugs, and do not catch avian flu.

The flu outbreaks were blamed by the poultry industry on migratory waterfowl and the USDA issued instruction pamphlets on how to maintain biosecurity in commercial poultry operations. The precautions they recommended included eliminating wetlands and seasonal ponds used by migrating flocks of ducks and geese, and eliminating food sources for wild birds. Neither the industry nor the government commented on how the H5N2 and H5N8 influenza viruses, known to have originated in Asian commercial poultry, had migrated to the Americas and infected migrating ducks, or how the disease managed to move northward from Nebraska into Iowa and ultimately Minnesota, during the spring when waterfowl were migrating south. The industry and government biosecurity experts also failed to explain how so many flocks of commercial chickens, raised in cages indoors, managed to come in contact with the droppings of wild waterfowl. Media outlets like newspapers and TV news cooperated, reprinting the press releases issued by industry sources and the USDA without asking any questions. The poultry industry did notice that 90 percent of the flu outbreaks were in commercial flocks and only 10 percent in “backyard” flocks. But when the media mentioned this statistic, it was usually to emphasize the potential economic impact to growers forced to destroy million-bird flocks. No one asked why most backyard birds didn’t get the flu, just as no one had asked why wild birds, claimed to be the vector spreading the infection, were not sick.



Figure 3.13: My heritage turkeys in the snow. Narragansetts and Black Spanish. They didn’t catch avian flu either.

Turkey producers were especially hard hit. The Hormel corporation, whose Jennie-O brand is the world leader in turkey products, warned that prices would rise steeply and that corporate profits would suffer. Biosecurity experts in the turkey industry claimed commercial flocks had caught the virus from wild turkeys. In Minnesota, the nation’s leading turkey-producing state, newspapers carried alarming stories of the nightmare virus and helpless farmers. Once again, wild turkeys, which regularly survive outdoors through Minnesota’s harsh winters, did not seem to be suffering. And no one could explain how barn-raised birds had caught the virus from their elusive woodland cousins. When scientists at the University of Minnesota’s Center for Infectious Disease Research and Policy and the Minnesota Department of Natural Resources announced there was no evidence linking wild birds to the flu outbreaks, the industry issued angry statements to the press, discrediting the scientists and reiterating their wild-bird theories. In late April, Minnesota’s Governor declared a state of emergency and visited a poultry company in southern Minnesota. A few miles from where the Governor commiserated with worried area residents was a commercial hatchery that ships 45 million day-old turkey poults to Minnesota growers every year. But no one seriously considered any of the commercial poultry industry’s centralized supply chains as possible vectors for disease. Minnesota’s leading newspaper, covering the Governor’s visit, quoted a local woman wondering about the mysterious disease threatening the region’s economy. “What is the source?” she asked. “Are they ever going to find the source?” A more accurate question might have been, are they ever going to honestly look for the source?

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4: Treasures Underground

Natural resources found underground have been important throughout American history. As discussed earlier, extracting wealth from the newly-discovered continent was one of the earliest motivations for the Europeans who invested their time and wealth in the New World. Natives of North and South America already used gold, silver, and copper to make tools and ornaments, and European explorers from Europe confiscated the riches of native cities and speculated about hidden cities of treasure like the legendary El Dorado. The wealth they did find transformed European, Asian, and later American economies and helped create a global economy where borders are porous to the treasures found underground.

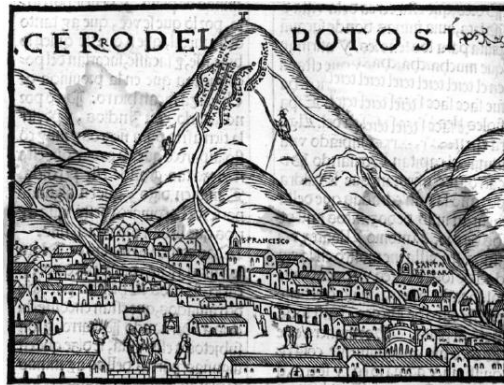


Figure 4.1: The first image of the Cerro Rico of Potosí published in Europe, 1553.

The Spanish Imperial City of Potosí in what is now Bolivia was the site of the largest silver lode discovered in the Americas, which has turned out to be the largest in the world. The city was built in the mid-1500s on top of an earlier Indian mining village in the shadow of a mountain the Spanish dubbed the Cerro Rico (or rich mountain). The Cerro Rico has been mined continuously for five hundred years and is still producing silver. By the early 1600s Potosí's population exploded to 160,000 Spanish colonists and nearly 15,000 Indians forced to work in the mines in a mandatory labor system called the mita originally developed by the Inca Empire and continued by its Spanish conquerors. After silver ore was removed from tunnels in the Cerro Rico, it was processed using a technique involving grinding and mercury amalgamation. The ore was crushed in 140 ingenios or mills operated with water power from 22 reservoirs, mixed with mercury, and the slurry was baked in kilns to separate the silver. Workers stamped bars of the precious metal with the mark of the Spanish Royal Mint and carried them by mule trains to Panama to be shipped to Seville.

The Cerro Rico is a volcanic dome rising about a half-mile over the city which stands at an altitude of over 13 thousand feet. Conditions in the mines were harsh and mercury poisoning from the vapors of the kilns caused weakness, poor coordination, kidney disease, and ultimately death. Due to the strenuous work they do in the thin atmosphere, most natives had to chew coca leaves to counteract altitude sickness. But the mountain's wealth was a potent motivation and during the second half of the 16th century, Potosí produced 60% of all the silver mined in the world and the Spanish Empire depended on the Cerro Rico's constant flow of revenue. When there were no longer adequate numbers of Indians to fill the mita, colonial mine owners began importing African slaves, who also died in large numbers. After Bolivian independence in the early 19th century slavery was outlawed, but labor conditions have remained harsh to the present day. Even in modern times, the average life expectancy of a Potosí silver miner is only about 35 years, due to silicosis. The Cerro Rico is known locally as "the mountain that eats men," but in the past 500 years Potosí has produced over 60 thousand metric tons of silver.



Figure 4.2: Miners at work on the flank of the “Cerro Rico”, Potosi, Bolivia.

The Spanish Empire was not as successful finding gold in the Americas as it had been finding silver. Although conquistadors managed to loot the Aztec and Inca Empires of their treasures, many of the most important American gold mining breakthroughs were made centuries later. Gold was first discovered in the United States in the 1790s, when several large nuggets weighing up to 28 pounds were discovered in North Carolina. In the late 1700s and early 1800s, North Carolina mines produced all the gold sent to the US Mint until 1829 when Virginia, Georgia, and Alabama began producing small quantities. The discovery of substantial amounts of gold in 1848 and 1849 in California created America’s first gold rush. It is unclear whether the American government was completely unaware of the possibility of finding large quantities of precious metals in the West when the nation went to war against Mexico in 1846, but in the treaty ending the Mexican-American War of 1846-1848, the US acquired territory that became California, New Mexico, Arizona, Nevada, Utah, Wyoming, and Colorado.

Unlike the Spanish Empire, which had controlled mineral production through a longstanding legal tradition that reserved ownership of subsurface resources for the nation rather than allowing individual ownership of mines and their products, the United States created a property ownership system that included subsurface as well as surface assets. Title to mineral claims in the US was validated primarily by proof of discovery and by persistence. That is, a prospector could claim the land and the minerals beneath it if he could prove he had discovered and consistently worked the claim. A rush of migration following news of the discovery at Sutter’s Mill on the American River west of Sacramento resulted in California statehood in September 1850. In 1849 alone, California gold mines produced three times the \$15 million payment the US given Mexico for the entire territory. After the new territory’s population doubled in less than a year, California became the 31st state in September 1850. Congress accepted California under the terms of the Compromise of 1850, which although it created the Bloody Kansas controversies of the 1850s, probably helped the Union win the Civil War. Under the Compromise of 1850, California entered the United States as a free state in return for concessions to strengthen Southern slavery. But when the Civil War began in 1861, California’s mines delivered gold to the US Treasury throughout the conflict, sending \$186 million between 1861 and 1864. To better connect California with the Union, the Lincoln administration rushed legislation through Congress authorizing transcontinental railroads and granting the Union and Central Pacific Corporations large amounts of public land, as we have seen.

The silver that supported the Union cause came primarily from Nevada, where the Comstock lode, developed in the last years of the 1850s, had quickly shifted from the hands of its original discoverers to well-financed corporations run by investors like George Hearst. Nevada is still the second-largest silver producer in the US, after Alaska. The Comstock Lode was discovered in 1859 in western Nevada and quickly fell under the control of Hearst, who later developed the Ontario silver mine, discovered in 1872 in northern Utah. Hearst went on to invest in the Homestake gold mine in the Black Hills of South Dakota and the Anaconda copper mine in Montana. The Homestake mine, discovered in 1876, operated until 2002 and became the second largest gold producer in North America as well as the world’s largest and deepest gold mine. Hearst originally bought the Anaconda mine in Butte Montana as a silver mine in 1881, but after high-grade copper ore was discovered there, Butte became known by locals (who had apparently never heard of Potosí) as the “richest hill on Earth.” From 1892 to 1903, the Butte Anaconda mine was the world’s leading copper-producer.

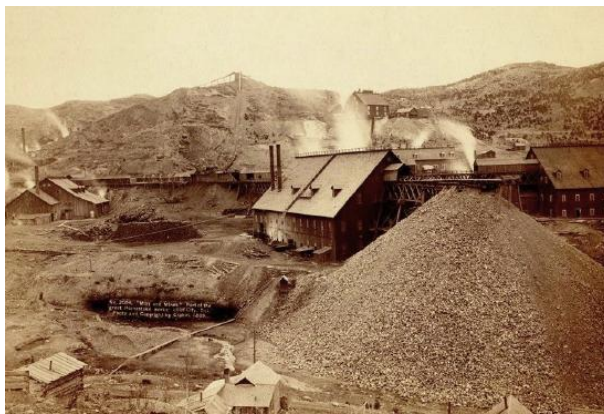


Figure 4.3: The Homestake gold mine, Lead South Dakota, 1889

By the early twentieth century, American mining companies had become highly capitalized corporations. Homestake, for example, was first listed on the New York Stock Exchange in 1879, making it the first mine listed and one of the longest-listed stocks in the Exchange's history. Homestake was bought by the Canadian-based Barrick Gold Corporation in 2002. Anaconda profited from copper's increasing value with the development of electrification, and the company fought off a takeover bid by the Rothschild international banking conglomerate by allying with the Standard Oil Company. In the early 1920s, Anaconda began acquiring mines in Mexico and Chile. In 1923 Anaconda bought the Chuquibambilla mine in northern Chile from the Guggenheim family of New York. The legendary "Chuqui" was the world's largest copper mine throughout the twentieth century and has been an important factor in Chile's history and in the story of American intervention in that history. We will consider the involvement of American corporations in resource extraction, and in Chilean copper mines, shortly.

North American copper was widely used by pre-Columbian natives, who found the metal in large deposits in what is now northern Michigan and beat it into ear pendants, necklaces, bracelets, knives, and arrowheads. Copper items became widely used by Indians and were carried over a surprisingly wide trade network. Explorer Sebastian Cabot wrote in 1497 that the native people of Newfoundland used "a great plenty of copper," and Giovanni Verrazzano reported that among the Indian residents of Nantucket Island, copper was valued higher than gold. On the other side of the continent, Russian explorers in what is now Alaska found natives using copper knives in the 1740s.

Although they did not possess the types of smelting and forging technologies that Europeans and Asians had developed by the time they began colonizing the Americas, there is ample evidence that native Americans mined gold, silver, and copper, and even used coal for cooking in the centuries before their first contact with Europeans. Most of the copper now mined worldwide comes out of the ground in ores that need extensive processing, but Michigan copper was unique. Indians and later European prospectors discovered rich veins of metallic copper that did not require processing. In some cases, miners found boulders of solid copper weighing several tons. One large copper outcropping reported by a British trader in 1766 was estimated at five tons and was surrounded by old stone tools and cut marks where pieces had been chopped away. The British trader wrote that "such was its purity and malleable state, that with an axe I was able to cut off a portion weighing a hundred pounds." When miners finally dug up the entire "Ontonagon" copper boulder and sent it to the Smithsonian Institution in 1843, it still weighed 3,708 pounds. In addition to the remote copper deposits of Michigan, in the 1710s Dutch colonists rediscovered a smaller vein of copper ore in New Jersey (old hammers and tools found at the site suggest the vein had also been worked even earlier by colonists). By the 1730s, the output of this New Jersey vein was 1386 tons, in spite of the fact that the colonists were not allowed to smelt ore and refine the copper. Instead, the ore was packed in barrels and shipped to Bristol England for processing.



Figure 4.4: The 3,708-pound Ontonagon copper boulder on display at the Smithsonian Institution

In spite of their initial failure to discover great caches of precious metals, English colonists in North America continued trying to develop mineral resources. In 1619 the London Company sent 153 iron-workers to Virginia to develop three discoveries. Work began on the largest site, 32 miles inland on a branch of the James River, in 1620. A year later twenty additional experienced workers were sent to the new mine, under the direction of an English aristocrat named John Berkeley. Although these miners made progress, Indians attacked the iron-works in 1622 and killed 347 workers there, including Berkeley. The operation was completely destroyed. Two decades later, John Winthrop Jr., the son of the Massachusetts Colony's governor, organized a company to develop the iron ore discovered in bogs around the town of Lynn. When the younger Winthrop became governor of Connecticut in 1657, he began an iron-works in New Haven. Smelting of bog-ore continued in Middleborough Massachusetts along with the forging of nails – until another Act of Parliament prohibited smelting in the colonies to support industry in England. This protectionist measure was resented by the colonists and probably helped fuel the Revolutionary cause.

By 1810 production of iron in the new United States was valued by the Treasury Department at \$13 million, more than three times the iron Americans imported. The Treasury's report counted over 500 forges in the new nation, and to protect the fledgling industry the first tariff on iron imports was levied in 1816. The first large deposit of iron ore in the Lake Superior region was reported in a letter written in 1840 by Douglass Houghton, Michigan's first state geologist. This discovery was corroborated in 1844 by a survey party whose compass needle was attracted by a large mass of iron ore. And in 1845, a local Indian chief named Manjekijik led a prospecting party to what the prospectors described as a "mountain of solid iron ore, 150 feet high [and] as bright as a bar of iron just broken." In return for his help, the chief was promised a substantial share of the mining company's stock. This bounty was never paid and the chief died in poverty.

The first blast furnace was built to process Michigan ore in 1858 and the Civil War greatly accelerated development of Michigan iron for use in the Union's war effort and for the building of railroads. Development of coal resources also accelerated the production of iron. As mentioned earlier, coal had been used by Indians for cooking, and early missionaries and explorers wrote frequently of Indians "making fire with coal from the earth" in the seventeenth century. The missionary explorer Father Louis Hennepin reported visiting an Indian mine by the Illinois River in 1679. Coking of coal to increase its effectiveness began in the 1840s using vast anthracite coal deposits discovered in western Pennsylvania, which helped Pittsburgh become a center of steel production in the late 1850s. Pittsburgh steel producers introduced a number of technological improvements to the process, including coke-fire smelting in 1859 and the Bessemer process for removing impurities by oxidation in 1875. By the beginning of the 20th century, Pittsburgh was the center of a steel-producing area that produced a quarter of the nation's railroad track and nearly two thirds of the structural steel used in construction.

By the late 1880s, Carnegie Steel was the world's largest producer of pig iron, steel rails, and coke. In 1883, Andrew Carnegie bought rival Homestead Steel Works and in 1892, he launched the Carnegie Steel Company. In 1901, when the sixty-six year old Carnegie was preparing for retirement, he was approached by Wall Street banker J.P. Morgan. Morgan paid Carnegie \$250 million for his business and combined it with several others to create U.S. Steel, the world's first corporation with a market capitalization over \$1 billion. Carnegie, who believed that "a man who dies rich, dies disgraced," devoted much of the rest of his life to giving his wealth to philanthropic causes including over 3,000 public libraries he established in the U.S., Canada, and throughout the English-

speaking world. By the time of his death in 1919, Carnegie had distributed over \$350 million; his remaining \$30 million was given to a variety of foundations and charities.

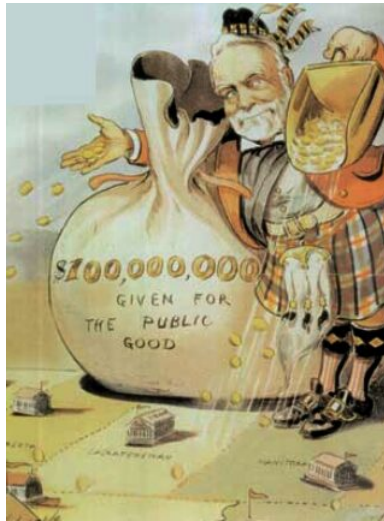


Figure 4.5: Puck Magazine cartoon showing Carnegie showering money on American states.

Mining and the West

Historian Patricia Nelson Limerick summed up the opinions of generations of historians when she said “no industry had a greater impact on Western history than did mining.” Mining introduced westerners to an entrepreneurial ideal, but also to an expectation of making extreme profits—often with little effort. Many Americans looked to the West as a source of easy wealth, which led hundreds of thousands of young men and women to throw caution to the wind and rush out to the California Gold Rush or to Virginia City or Pikes Peak, and later to the Yukon. But as Limerick observed, mining changed rapidly from an individual enterprise where average people could become rich by luck and hard work, to a highly capitalized industrial business. Far from being a refuge from toiling for wages in factories, western mines created a new industry of mineral extraction and processing. In fact, mines featured the same combination of expensive capital and interchangeable wage labor as the textile factories of Massachusetts. However, as many who migrated to the mining frontiers found to their distress, there were fewer employment alternatives for disgruntled workers in mining regions. Many unsuccessful prospectors found themselves in debt for supplies, lodging, and food, and trapped in low-paying jobs until they could save enough money for a ticket back to “civilization.” The unique element that mining retained, however, was what Limerick called the “mood” of extractive industry, which she described as “get in, get rich, get out.”



Figure 4.6: Prospectors working a claim during California's gold rush, 1850.

Many young prospectors were excited by tales of the quick money that could be made panning and working easy-to-obtain placer claims, where extraction amounted to little more than picking up ore lying around on the surface. Thousands succumbed to the “fever” and rushed West, only to find themselves stranded in California without enough money to return home. After several years

of hard work for low wages, some men earned enough to return home. In the meantime, many felt themselves to be “in the condition of convicts condemned to exile and hard labor.” And as the first phase of placer collection gave way to a second phase of hydraulic or underground mining, the advantage quickly shifted to corporations that controlled capital and technology and could coordinate the efforts of wage workers. Power transferred to corporations with access to eastern capital and large labor forces. People who had flocked to the goldfields in hope of windfalls found themselves working for wages under conditions every bit as demanding as the urban factory workers they had left behind.

Mining was very dangerous work, but miners were generally not compensated for the risks they took and rarely taken care of when accidents happened. The courts used the principal of “assumed risk” to rule that mining companies bore no responsibility for injured workers because the workers presumably had known the job was dangerous when they took it. The court’s assumption that workers could refuse tasks they considered too dangerous may have been deliberately naïve, but labor unions did not have the power to challenge mine owners in the courts. Mining companies took advantage of a “lag of perception” in which “the old times of individual opportunity still set basic attitudes, and the new times of corporate centralization of power still waited for recognition.” In other words, the myth of prospectors taking risks in order to get rich was used as cover for corporations to subject wage-workers to danger and harsh conditions. Another area where the ongoing myth of a Wild West of easy, democratic resource exploitation was used to benefit mining corporations was the anti-environmentalist idea expressed by a mining executive who said of future generations, “those who succeed us can well take care of themselves.”

Petroleum

The word petroleum comes from Latin root words meaning “rock” (petram) and “oil” (oleum), to distinguish it from plant or animal based oils. As we’ve already seen, before the development of the petroleum industry, both whale oil and ethyl alcohol were burned as fuels. As mentioned earlier, the petroleum industry in America began in 1859, when George Bissell and Edwin L. Drake drilled the first commercial oil well in Titusville Pennsylvania at a site known as Oil Creek. These weren’t the world’s earliest oil wells, however. The very first oil wells were drilled by Russian engineers in the Aspheron Peninsula on the west side of the Caspian Sea near Baku Azerbaijan, beginning about 1848. American attempts to drill for natural gas had begun in the 1820s, in Chautauqua County New York. After the success of the Titusville well, oil was drilled at other locations in western Pennsylvania, New York, and in the Ohio River Valley where oil had been discovered seeping to the surface. The Appalachian Basin was America’s leading oil-producing region at the beginning of the last quarter of the nineteenth century. By 1881 the Bradford Field in western Pennsylvania was producing 77% of global oil output. The principal product of this oil was kerosene, used as lamp oil. Early kerosene was produced with a wide range of volatility and flammability; John D. Rockefeller named his company Standard Oil to highlight the safety and consistency of the kerosene he produced. The Standard Oil Company, begun in Cleveland in 1870, soon dominated the kerosene market in Ohio and the nation. A few decades later, by the beginning of the twentieth century, the Russian Empire once again led the world in oil production and commercial oil extraction was also underway in Sumatra, Persia, Peru, Venezuela, and Mexico in addition to Ohio, Texas, and Southern California.



Figure 4.7: An early oil field in Pennsylvania, 1862.

American oil exploration spread quickly to Kansas, Oklahoma, Arkansas, North Louisiana and East Texas in the 1890s. The Los Angeles Basin began producing oil products in the 1880s and 1890s, but due to the different chemical makeup of California oil, it was less appropriate for kerosene and was used mostly to produce fuel oil and asphalt. In the early years of the twentieth century, California's Long Beach and Wilmington Oil Fields became the world's leading producers of oil per acre, leading to the development of the port of Los Angeles as a hub for overseas shipment of oil. In addition to drilling wells on land, oil companies developed both anchored and floating platforms for extracting oil from the sea bed. The Gulf of Mexico is the most explored, drilled, and developed offshore petroleum province in the world. Developed since the end of World War II in 1945, the Gulf of Mexico now produces about 34% of the world's crude oil and about 25% of the world's natural gas. The continental shelf off the coast of Texas and Louisiana is dotted with over 4,000 active platforms with 35,000 wells and 29,000 miles of pipeline. But in spite of these new offshore projects, conventional oil discoveries in the lower 48 states peaked in 1930 and production peaked in 1970.



Figure 4.8: President Theodore Roosevelt depicted as the infant Hercules grappling with Standard Oil in a 1906 Puck magazine cartoon.

Standard Oil was prosecuted as a monopoly under the Sherman Antitrust Act in 1911 and forced to split into 34 independent operating units. The largest were Standard Oil of New Jersey (which became Exxon), Standard Oil of New York (Mobil), Standard Oil of California (Chevron), Standard Oil of Indiana (Amoco), and Standard Oil of Ohio (Sohio). In addition to the “baby Standards,” there were a small number of international petroleum companies formed in the early years that retain control of a large portion of the industry. These included Royal Dutch Shell, formed in 1907 as a merger of a Dutch and a British company, and the Anglo-Persian Oil Company, now known as British Petroleum (BP), founded in 1909. In 1968 BP bought Sohio and began developing a major oil field discovered in Prudhoe Bay, Alaska. Multi-national petroleum companies like Exxon-Mobil (the two baby Standards merged in 1998 to become the world's largest oil company) and BP have become increasingly able to project their economic power to shape the politics of the nations where they do business. Effects of this power include the opening of new federal lands (including national parks and nature reserves) to drilling in the Arctic Circle and the minimal penalties assessed against corporations for disasters such as the 11-million gallon Exxon Valdez spill in 1989 or the BP Deepwater Horizon explosion and 210-million gallon spill in 2010.

As multinational petroleum corporations grew, they not only influenced the politics of the nations in which they operated, but tried to direct the foreign policies of their home nations. When President Lázaro Cárdenas nationalized oil production in Mexico in 1938, oil companies asked the American government to intervene. But Franklin D. Roosevelt was busy fighting against corporate interests trying to undermine the New Deal policies he had implemented to mitigate the Great Depression. He declined to interfere with Mexico's right to control its subsurface assets, which were a natural continuation of the legal traditions of Spanish America. The corporations had better luck after Iranian Prime Minister Mohammad Mosaddegh decided to nationalize the Anglo-Iranian Oil Company (BP) in 1951. BP got the help of British Prime Minister Winston Churchill to convince US President Harry S. Truman that Mosaddegh had to go. Britain's MI-6 and the CIA replaced Iran's elected government with Shah Mohammad Reza Pahlavi,

who ruled with an iron fist until the Iranian Revolution of 1979. After the Shah's installation, Iranian oil production jumped from an average of about a million barrels per day in the early 1950s to nearly 6 million barrels daily in the 1970s.

Petroleum is not the only resource that has led corporations to interfere in the political affairs of nations. The Norte Grande region that Chile took from Peru and Bolivia in the War of the Pacific to gain control of nitrate deposits in the Atacama Desert (mentioned in Chapter 8) also contains some of the richest copper deposits on Earth. Chuquibambilla is the largest open-pit mine in the world. The nearby Escondida mine is nearly as big, and is the world's most productive copper mine. In central Chile, about 57 miles south of the capital, Santiago, is the world's largest underground mine, El Teniente. Copper mining has been a leading industry in Chile throughout the nation's history, but in the early twentieth century Chilean mines were bought by American investors and the industry became dominated by large US mining conglomerates like Anaconda and Kennecott, owned by the Guggenheim Partners. In the late 1960s, Chile began nationalizing its copper industry, with seizures beginning under a Christian-Democrat coalition government and continuing under the socialist government of President Salvador Allende. Corporate dissatisfaction with the nationalizations led to a CIA-backed coup that resulted in the death of President Allende and the dictatorship of General Augusto Pinochet from 1973 to 1990.



Figure 4.9: Chuquibambilla, the world's largest open pit mine, begun in 1882. For scale, there are several giant mine trucks climbing the access roads on the far side.

Ironically, Pinochet did not give back the copper mines, and Codelco, Chile's national copper company, is still the world's largest supplier. Since the end of the dictatorship and reestablishment of democracy in Chile, foreign companies have been invited to develop mines in parallel with Codelco, and the Escondida mine mentioned earlier is actually owned by an Australian-based multinational, BHP Billiton. Other companies operating mines in Chile include US-based Phelps Dodge and the Japanese zaibatsu Sumitomo. Chile's economy is now regarded as one of South America's most stable and prosperous. The nation produces a third of the world's copper, which accounts for 53% of Chile's exports. The emergence of China as Chile's main export partner, purchasing fully a quarter of the country's exports, has probably helped reduce the influence of US corporations in Chilean internal affairs and may even have helped end the dictatorship that had been widely (if quietly) supported by American diplomats and vocally supported by "free-market" economists like the technocrats of the Chicago School who were key advisors to the Pinochet regime.

National borders have never been particularly effective in preventing natural resources, especially nonrenewable resources like minerals and petroleum, from finding their way to the markets where they are most valuable. Underground treasures like oil, silver, gold, and copper have become the energy and mineral wealth that powers the world economy.

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5: Limits to Growth?

One of the most basic but often overlooked aspects of human interactions with the environment that we study in Environmental History is the impact of population growth. There are a number of reasons people have tended to avoid thinking about the danger of having too many humans around. We like people. Especially those that are close to us. And historically, the growth of our own particular group has been important for our survival and therefore has been desirable. In the past, people haven't always been too concerned if the success of their particular community came at the expense of their neighbors. And recently that neighborhood has expanded to cover the whole globe.

There's an economic concept called the zero sum game that says for every winner there has to be a loser. Since the industrial revolution though, Westerners have been able to live outside of the constrictions of zero sum logic. But that doesn't mean Westerners have been unaware of the question. At the very beginning of the modern age, an English economist named Thomas R. Malthus (1766-1834) published a short book called *An Essay on the Principle of Population*. Malthus's theory, published in 1798, became instantly controversial on both sides of the Atlantic. Thomas Jefferson sent a copy of the book to his favorite economist and asked for an opinion.

Malthus stated his basic idea like this: "The increase in population is necessarily limited by the means of subsistence...the population does invariably increase when the means of subsistence increase, and ...the superior power of population is repressed and the actual population is kept equal to the means of subsistence only by misery and vice." Another way of saying that is, population grows as long as there is food and water to support it, and when these resources run out, population is brought back down through famine, disease, and war. These three causes of depopulation are often termed "Malthusian disasters."

Malthus went on to observe that populations tend to increase geometrically: two people become four, four become eight, eight become sixteen, etc. In contrast, he said, food supplies at best increase only arithmetically: two bushels of wheat become four, which become six, which become eight. By this logic it is easy to see that a society can easily outrun its ability to feed itself if the population is not kept down by reducing births or increasing deaths, and to understand why early modern Europeans were so obsessed with acquiring new territories to improve their food production abilities. The famines, diseases, and wars of European history gave Malthus the examples he needed of the crises that tended to reduce populations. If society was going to avoid these periodic disasters, he argued, then it would need to find some way of limiting the birthrate to avoid starving.

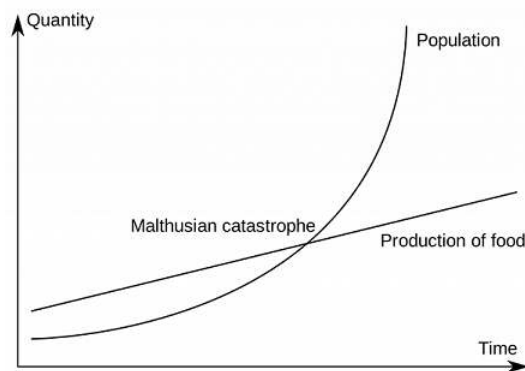


Figure 5.1: The Malthusian Catastrophe happens when the exponential growth of population overwhelms the linear growth of food supplies.

The Malthusian theory, as it is called, was intensely controversial right from the start. One of the reasons was that it advocated birth control. Malthus himself only called for what he termed "moral restraint" to help reduce the birth rate, but many Malthusians had more active contraceptive measures in mind. The idea of limiting reproduction was seen by most religious people as a violation of the injunction to "be fruitful and multiply," and eliminating the risk of pregnancy was seen as an encouragement of vice and an invitation to sin. Over two centuries later, we have not left these arguments behind.

The other big controversy surrounding Malthusian thought was that it was used by some members of the British upper classes to argue that the conditions of the poor should not be improved. If poor people had higher wages and more to eat, they argued, they would have more children and more of their children would survive, which would put unnecessary stress on the social system and in the long run lead to mass starvation. The poor simply had to suffer, they said, or society was doomed. But the assumption held

by Malthus and those members of the British upper class (and by many people today) that feeding the poor would lead to a population explosion turns out, actually, to be untrue. Population scientists today agree, after studying societies all over the world, that as economic security increases, a “demographic shift” occurs and birth rates decline. In other words, if the poor have enough to eat, infant mortality rates and the fear of starving in old age decrease. Death rates decline and as a result parents have fewer children. Educating women is the other major factor demographers have identified with reducing birthrates. Both factors have contributed to a demographic shift in the developed world where family sizes have decreased from an average of six children per family to 1.6 in the modern era.



Video 5.1: A short, emphatic video by demographer Hans Rosling. CC BY license, Gapminder.org. <https://youtu.be/BkSO9pOVpRM>

In spite of the developed world’s success limiting population growth by providing education for women and a social safety net, the argument is still raging regarding the “developing world.” The Gates Foundation recently started a campaign called #StopTheMyth. According to their short video titled “You Decide: Save the People or Save the Planet,” the issue is still very poorly understood. Melinda Gates points out that in Afghanistan, where 10% of children die before the age of five, population is expected to nearly double by 2050. In Thailand, on the other hand, the number of children dying has decreased substantially. And so has the birthrate. “Clearly,” Gates says, “letting children die now so they don’t strain the planet later doesn’t really work. It’s a myth.”

The other assumption you may have noticed in the Malthusian theory was that food production can only increase slowly. As we have already seen, this has not been the experience of the nineteenth and twentieth centuries. Abundant land, fertilizers, and technology created a global Green Revolution that has allowed us to continually outrun Malthus for the last two centuries. But an agricultural scientist named Karl Sprengel noticed in 1828 that plant growth was limited by the availability of the essential nutrient with the lowest concentration. Sprengel’s contemporary, biologist Justus von Liebig, realized Sprengel’s idea had wider applications and popularized it as Liebig’s Law. The Law, which became a key idea in ecology, states that growth is dictated not by the total resources available, but by the scarcest resource, which he called the limiting factor. So the question is, will we be able to keep outrunning Malthus forever, or will a limiting factor end our exponential growth?

Until very recently in human history, the Earth has been so big and the total human population so small relatively, that the resources available to us have often seemed infinite. In 1800 there were fewer than a billion people on the planet. In 1900 there were still less than two billion. By 1960 there were three billion, and in 1999 there were six billion. Current world population is estimated to be about 7.6 billion people. During this dramatic increase, there were periods like the early industrial revolution when worriers like Malthus and his followers expressed doubts and anxiety. Malthus had no idea that his nation was about to expand its empire into Africa and Asia, or that continuing emigration to the Americas and Australia would continue to reduce populations at home. And of course he couldn’t anticipate advances in technology or the demographic effects of increasing economic security we have just discussed. But sometimes even these advances proved temporary or subject to disruption. The population of Ireland boomed in the first decades of the nineteenth century, as potatoes increased the calories available to poor people and seemed to eliminate the threat of famine. The Irish population peaked at over 8 million in 1841, but the blight that eliminated their main food source killed over a million people and forced a million more to emigrate to America. The Irish population is about 4.8 million today, a little more than half its peak 175 years ago. And finally, as the science of ecology developed in the second half of the twentieth century and we began to distinguish between renewable and nonrenewable resources, Malthusian anxiety has returned.

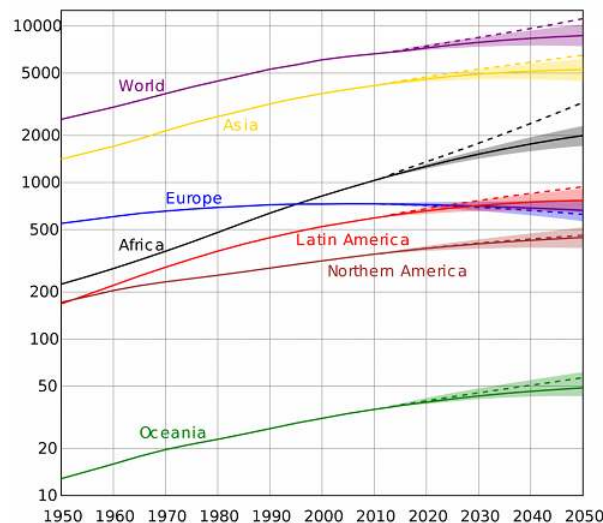


Figure 5.2: Population by continent with estimates until 2050. Dashed line assumes no change in fertility rates.

In 1968 Stanford University Biology professor Paul R. Ehrlich published a sensational book called *The Population Bomb*, that was an instant bestseller. It began with the statement, “The battle to feed all of humanity is over. In the 1970s, hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date, nothing can prevent a substantial increase in the world death rate.” Ehrlich became a celebrity and publicized his theories of social collapse on popular media like Johnny Carson’s *Tonight Show*. Ehrlich’s scenarios inspired some great dystopian science fiction, but luckily they did not happen in the way Ehrlich had predicted. Actually, a couple hundred million people did die of hunger in the decades after the book’s publication (it’s hard to tell exactly because when the United Nations reported worldwide deaths, it specifically omitted deaths from hunger). But these deaths did not reduce world population overall or result in the social chaos that Ehrlich had prophesied.

The *Population Bomb* may have done more harm than good in the long run, by making the population issue an easy target for critics. But people remained concerned about the rapid increase of the world’s human population. In 1972 an international organization called The Club of Rome published a study titled *The Limits to Growth*. Unlike Ehrlich’s sensational predictions of doom, *Limits* applied mathematical systems modeling to five particular variables: world population, industrialization, pollution, food production, and natural resource depletion. The researchers used newly-available computer technology to produce a study that illustrated the interaction of these variables by showing three potential future outcomes. In two of these scenarios, the global system experiences what the researchers called “overshoot and collapse” in either the mid or the late twenty-first century. In the third scenario the computer models arrived at what the researchers called a stabilized world system.

Peak Oil and Climate Change

But not all the warnings that humanity is reaching resource limits have come from university academics or international think-tanks that are naturally distrusted by regular people and corporate leaders. Marion King Hubbert was an American geophysicist working for Shell Oil in 1956 when he presented a research paper to the oil industry trade group The American Petroleum Institute, where he showed that for any geographical area (and by implication, for the planet as a whole), petroleum production follows a predictable bell-shaped curve. Hubbert’s theory correctly predicted that oil production in the continental US would peak between 1965 and 1970, and then begin to decline. Hubbert also predicted that world oil production would peak “in about fifty years.” Although the data and especially its interpretation are very controversial, several credible sources suggest that the peak in world production happened between 2003 and 2004, right on schedule.

Petrochemical prices can be expected to rise as supplies diminish. Currently, new technologies such as fracking and converting tar sands have added some new sources to the supply we now designate as “petroleum.” These new additions do not refute the logic of Hubbert’s predictions, although they do potentially push back the anticipated supply crunch expected to raise prices. Two elements of *The Limits to Growth*’s computer model, industrial production and food, depend heavily on the price of energy, and a third (pollution) is an issue for both fracking and tar sands processing. A reduction of the supply of oil, an increase in its cost, or an increase in pollution could all have a significant negative impact on those variables.

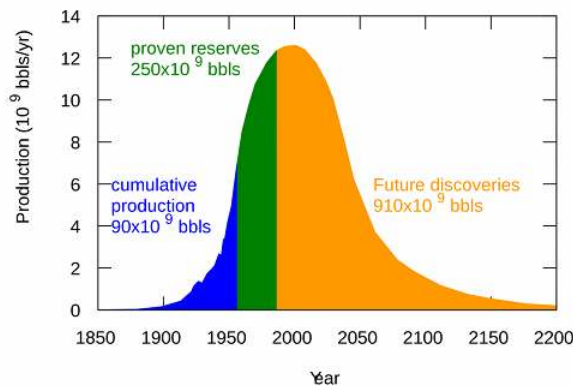


Figure 5.3: Data originally presented in figure 20 of Hubbert's 1956 article, describing global peak oil ([link in Further Reading below](#)).

Hubbert's words actually echoed Malthus. "Our principal constraints," he said, "are cultural. During the last two centuries we have known nothing but exponential growth, and in parallel we have evolved what amounts to an exponential growth culture. A culture so dependent on the continuation of exponential growth for its stability that it is incapable of reckoning with problems of non-growth." These are not the words of some dewy-eyed environmentalist or crazy academic or sensationalist. Hubbert was an oil industry analyst. Some have argued that possible future discoveries of more oil could postpone society's shift to a non-fossil fuel energy economy. But even the oil industry for the most part agrees that production will decline. So the question we are left with is, how quickly will we use up what remains?

Some climate activists have begun to suggest that for the sake of the environment, we ought to switch from fossil fuels to other energy sources as soon as possible and leave a lot of what is left in the ground. The argument against burning the rest of the oil (and coal) is that fossil fuels are one of the biggest contributors of atmospheric carbon that leads to global warming. While this is true, other factors such as deforestation and even agribusiness release comparable amounts of carbon. Simply stopping the use of oil will not solve the whole climate change problem, although it is an important element of the change society needs to make to stabilize the global climate.

But because energy is such a large part of the economies of developed nations, any change is heavily contested. Global energy corporations have a nearly incredible ability to influence politics. A few years ago BP (British Petroleum, established in 1908 as the Anglo-Persian Oil Company and now operating in 72 countries) issued an "Energy Outlook" report for the year 2035, which claims that Hubbert's Peak Oil scenario is actually incorrect and announces the company's intention to burn just as much as possible over the next two decades. BP's claim that oil production hasn't peaked, however, depends on a redefinition of the word oil that includes both tar sands and biofuels such as ethanol. Ethanol production, as discussed previously, depends not only on the energy-intensive production of surplus corn and cane sugar (used in Brazil as the primary plant source), but in government subsidies that keep the price of these commodities below their cost of production. So it's hard to see how biofuels could legitimately be called a new source of "oil."

Climate change, more than any other environmental concern, has dominated the attention of Americans in recent years (and has in many cases pushed pollution off the table, which is unfortunate). Although the idea that the planet's climate has been adversely affected by human activity is very controversial in the media, politics, and popular culture, it is almost universally accepted by scientists. According to NASA, at least 97% of climate scientists agree that global warming over the past couple of centuries is due to human activities, or anthropogenic. American and international science organizations like the American Geophysical Union, the American Meteorological Society, and the American Medical Association, in addition to the Intergovernmental Panel on Climate Change, have all gone a step further, saying in the words of the American Physical Society, "We must reduce emissions of greenhouse gases beginning now."

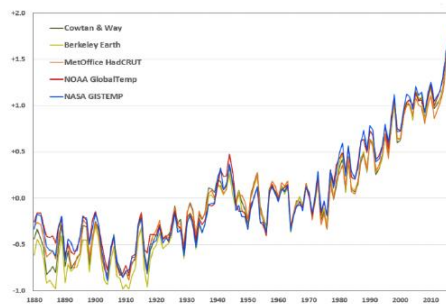


Figure 5.4: Temperature data showing rapid warming in the past few decades. The 10 warmest years in the 138-year record all have occurred since 2000, with the four warmest years being the four most recent years.

Of course who they mean by “we” is unclear, and the penalties for heeding their warnings are really hard to specify. The science is complicated and it is difficult for some people to understand. And to make matters worse, most Americans share a belief system that distrusts science and scientists, because science seems to contradict their most cherished religious doctrines about the nature of the world and their place in it. To make matters even worse, concern over climate change has been identified with a particular political orientation. The claim that only liberals care about the environment is not only absurd, but it ignores the traditional meaning of the word conservative. In reality, this is not a liberal vs. conservative issue. The argument against climate change has been carefully managed and funded by political action committees and foundations representing corporations that oppose changes in energy policy.

Although 97% of climate scientists agree on anthropogenic climate change, when Americans are asked, “Do most scientists believe that the Earth is getting warmer because of human activity?” 55% say either “No” or that they don’t know. Less than half of Americans are aware that scientists are basically unanimous on this issue, and thinking that scientists are unsure affects their own opinions about climate change and the the government policies they are willing to support to mitigate it. A recent study found that most of the public statements against climate change made from 2003 to 2010 could be traced to about 91 organizations which received \$558,000,000 in grants during that period. From 2003 to 2007 this money was easily traceable to sources such as Exxon-Mobil and Koch Industries, two corporations opposed to changes in energy policy. With the changes in foundation funding that followed in the wake of the 2008 Citizens United Supreme Court decision that allowed corporations to hide their political spending, the sources of money funding climate change denial have been more difficult to trace. Ultra-free market foundations and even a few religious organizations like the John Templeton Foundation fund websites like Climatedepot.com that go out of their way to label any scientist endorsing climate change a “Warmist” who is probably working for Al Gore in an effort to regulate every aspect of our lives in some big global prison state. Climate deniers warn of the “command economies” they claim environmentalists wish to impose, using language designed to rile up libertarians and free market enthusiasts and mobilize them against changing the economy in ways that although bad for oil companies, would almost certainly create millions of new jobs.



Video 5.2: A 4-minute University of Queensland video on *Climate Change Denial*, showing that the issue isn’t unique to America.

CC BY license, <https://youtu.be/5bmyOaWKksA>.

This is unfortunate, to say the least. While Germany is becoming a world leader in solar energy deployment, in spite of receiving only as much sunlight as Alaska, and while Britain is mapping its shift to a post-oil based economy with its “transition towns,” many Americans continue wasting their time arguing over the make-believe issue of climate change denial. Of nearly 14,000 peer-reviewed climate articles published between 1991 and 2012, only 24 reject global warming. There really isn’t any doubt that the Earth’s climate is changing in ways that are going to cause serious social disruption in the future. When political leaders say there is still doubt about the need to address climate change, we should follow the money to discover why. Our unwillingness or inability to understand the situation causes us to continue being manipulated by organizations interested in maintaining the status quo, and may mean that our choices in the future will be much more limited than they need to be.

Further Reading:

- David Holmgren, *Future Scenarios: How Communities Can Adapt to Peak Oil and Climate Change*. 2009.
- Marion King Hubbert, “Nuclear Energy and the Fossil Fuels”, Publication No. 95, Shell Development Company, 1956.
www.hubbertpeak.com/hubbert/1956/1956.pdf
- Bill McKibben, *Eaarth: Making a Life on a Tough New Planet*. 2010.
- Donella H. Meadows, *Limits to Growth: The 30-Year Update*. 2012.
- Naomi Oreskes and Erik M. Conway, *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. 2010.

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6: Economics and Externalities

The study of economics as a distinct academic field began at about the same time as the industrial revolution and many of the economic ideas proposed by early writers on the subject, such as Adam Smith, David Ricardo, Friedrich Engels and Karl Marx, are still taken very seriously today. Economics is described as the science of human choice, but unlike other scientists in fields like psychology, economists often claim to be able to extrapolate from numerical data about people's behaviors (that is, from the records of transactions in markets) to predict the future. And although most of the economic news and analysis we hear seems very dry and statistical, it is important to understand some of the basic philosophical beliefs and assumptions about human nature that stand behind these numbers.

At its most basic level, economics is the study of supply and demand. The classical supply and demand curves of modern economics textbooks go all the way back to Smith and Ricardo. They remain the bedrock of the field, and the first things students learn in high school or college courses. So let's look at them first.

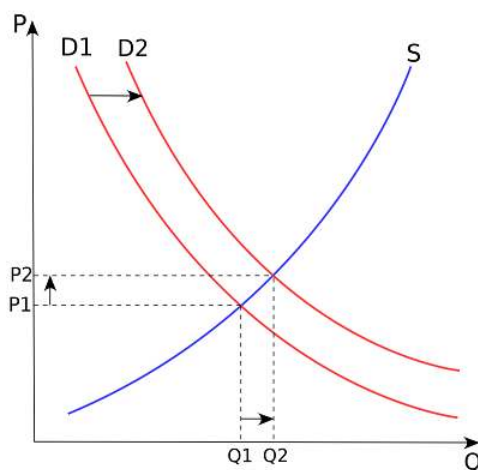


Figure 6.1: Supply and Demand: A positive shift in demand from D1 to D2 results in an increase in price (P) and quantity sold (Q) of the product. Image used with Permission (CC BY-SA; Paweł Zdziarski)

The first philosophical assumption supporting the supply-demand graph is so obvious that most people, including many economists, don't even notice it. There are two curves, supply and demand. Where they meet is where the transaction happens: where two players in the market exchange goods and services for money. See the assumption? Two players. Separating the world into producers and consumers is so basic nowadays that it's difficult to imagine a different way to think about economic relationships. Of course economists understand that a person can be a producer in one transaction (say, as a teacher, a bricklayer, or an office worker) and then be a consumer in the next (at the grocery store or buying a car). But even so, these different activities are generally thought of as being completely separate from each other. What you do to earn a paycheck, for example, is not supposed to influence the brand of breakfast cereal or yogurt you prefer.

This reductive logic makes some sense, since for most of us the paycheck-yogurt relationship is probably pretty tenuous. And seeing that, economists conclude they are just describing reality when they tally up the dollars we spend on particular yogurt brands; that they have accurately described the real world without making any "normative" judgments about it. But as any photographer knows, choosing what to exclude and include when framing an image has a profound effect on its meaning and significance and can completely change the viewers' understanding of what they see.

Societies like America before the industrial revolution are often described as non-commercial. Historians have argued for generations whether early Americans went through some sort of "Market Transition" as they became more embedded in commerce — and if so, where and when that may have happened. This was one of the areas I studied closely in Graduate School, and I think historians' ideas about what commercial behavior looks like have changed at least as much as Early Americans' actual behavior. As we saw at the very beginning of this course, Americans have always bought and sold products in markets. The Spanish Empire exported hundreds of shiploads of gold and silver from its colonies to Europe. The North American colonies depended on financing from Britain to get off the ground at all, and later depended on trade with the West Indies for their survival when the support of

their British patrons was cut off by Cromwell's civil war. Later, western settlers sent grain down rivers or hauled barrels of whiskey over the Appalachian Mountains.



Figure 6.2: Salem Massachusetts was already a commercial shipping hub in the early 1770s before the Revolutionary War. (Public Domain; Balthasar Friedrich Leizelt)

Every sack of flour and barrel of whiskey or salted pork that changed hands in Early America was a market transaction. But what was special about these transactions was that at first they were usually between people who knew each other and had a relationship that extended beyond that moment when the seller's supply curve and the buyer's demand curve intersected. In Early America, commercial transactions usually took place in a larger social context. Buyers and sellers were often neighbors. A farmer who sold his grain to the local miller often also bought supplies at the general store the miller ran. And beyond their purely business transactions, they probably saw each other at town meetings, or at the local tavern or church. They probably helped each other build barns and fences, and their children went to school together and occasionally even married. The big change came, as we saw in Chapter 7, when transactions became impersonal and exchanges were more often between strangers than between neighbors and friends. Government inspections were never necessary when your meat came from the butcher down the street whom you had known your whole life. But it was the only thing that prevented Chicago packing corporations from cutting corners and selling bad meat to strangers half a continent away. Similarly, when prices were negotiated between people who had complicated ongoing relationships with one another (especially where people changed roles and were sometimes buyers and at other times sellers), they often reflected more than simply a meeting of supply and demand curves. The economic logic of supply and demand expects buyers to always pay the least they can to acquire a product and sellers to always try to maximize their profits on each transaction. Real transactions were often more complicated, especially where economic relationships were embedded in a larger context of other social interaction.

The other change brought about by the rise of central markets was that not only did buyers and sellers become anonymous strangers to each other, but the products themselves became standardized and undifferentiated. As discussed in Chapter 7, railroad technology made the centralization of production in cities like Chicago and Minneapolis possible. Telegraph technology made it possible to establish national prices for commodities. And mass media allowed central producers like General Mills and Armour to create brands that tried to replace the familiarity and trust that had been part of buying from someone you knew. All these technologies helped concentrate wealth in the centers, as farmers on the periphery often became little more than sources of raw materials. Consumers became increasingly dependent on powerful corporations whose decisions they could have little hope of influencing. One sign of this change, which we have trouble seeing because it is such a regular part of life, is fixed retail pricing. You don't haggle with the supermarket checkout clerk over the price a box of Cheerios. You take it or leave it. General Mills doesn't really care whether you buy them or not, as long as the rest of the faceless consumers do; just as they don't really need the oats from any particular farmer, as long as the rail cars are full when they reach the factory.

Economists consider the independence of these huge corporations an important part of "economies of scale," which they explain are a good thing because they result in lower costs for the producer, and often (although not always) in lower prices to consumers of the final product. The basic idea is that it's cheaper to make a million boxes of Cheerios in a huge factory than to make one box of Cheerios in your kitchen. Usually the explanation is that expensive capital equipment and technology is used that makes producing each individual unit less expensive — but only if you're making enough of them to average the cost of that equipment

over a large number of units. But as critics of this logic have pointed out, the real source of savings is often in the raw materials. A single buyer purchasing oats from a hundred thousand farmers clearly has the upper hand in negotiations about price. So the low cost of Cheerios may come partly from the machines used to manufacture them, but it also comes from the corporation's ability to make the farmer accept a lower price for his oats than he might like to get. This is how profits at the center can be thought of as forced subsidies from the periphery. Technology (and the field of economics itself) tends to make this relationship harder to see by focusing attention on the apparent impartiality of the markets and on the profits achieved in the center.



Figure 6.3: Cereals on sale at even a small supermarket can take up an entire aisle. (CC BY-SA; Min).

In addition to being a source of cheap raw materials for central processors, the periphery is often a dumping-ground for waste the center chooses not to deal with. Economists so frequently ignore adverse effects of economic transactions when they take place outside of the center of profit that they have a special name for this type of “market failure.” They call it externality. Standard economic textbooks describe externalities as “the costs created by one party or group and imposed on or spilled over onto some other non-consenting party or group.” Economists understand that “When the act of producing or consuming a product creates external costs, an exclusive reliance on private markets and the pursuit of self-interest will result in a misallocation of society’s resources.” In other words, economists understand that you can’t expect people acting in self-interest to work these issues out for themselves. Often the result of ignoring these externalities, economists admit, is that much more of a product will be made than even the economists view as “socially efficient output.”

The introductory economics textbook I’m quoting from (William D. Rohlfs, Jr., *Introduction to Economic Reasoning*, Seventh Edition, 2008) includes a chapter called “Market Failure” that discusses externalities and possible ways of dealing with them. The textbook says that in some cases the externality can be addressed by considering the property rights of the injured party (in a lawsuit or negotiation). This remedy would clearly work best when the injured property was privately owned and the owner had the resources to pursue legal action or other types of arbitration. The textbook also mentions government regulation, but warns that such regulations often specify remedies that are “needlessly expensive” (by what standard? The textbook doesn’t say) and that regulations reduce the incentives for business to solve its own problems. The chapter gives simple examples of “local externalities” with “local remedies” but fails to mention that often the externality happens far from the corporation’s headquarters, where it is less visible but not necessarily more serious. For example, coal from the Appalachian Mountains in West Virginia, Kentucky, and Tennessee to generate electricity that lights the major cities of the East Coast, like New York City. Mountaintop removal destroys habitats and poisons streams and rivers throughout the region. But this externality is not reflected in the cost of electricity to New York City consumers. The fact that the residents of Appalachia who protest for clean water have much less economic clout than the urban-based mining and power companies and their customers, certainly effects the outcome of negotiations over the externality and its remedies.

Critics of our free market economy often claim that large corporations deliberately produce externalities in faraway places where the residents are powerless to object. Global corporations can now choose to work wherever in the world costs are lowest. In effect, they are exporting externalities to the “less developed world” — which in fact has to remain less developed in order to keep the cost of those externalities as low as possible. This is what critics of capitalism mean when they say that the wealth of the center comes at the expense of the periphery. In the past, it was American corporations such as Union Carbide who built factories in places like India where safety regulations were much less stringent and the people had no recourse when avoidable accidents such

as the 1984 Bhopal disaster killed 3,800 people and injured 550,000. More recently, the tables have been turned on Americans. An example of this is a current proposal by a global mining conglomerate, GlencoreXstrata, to begin open pit copper mining in national forest land in northern Minnesota. In addition to having been run by a known criminal (pardoned by President Bill Clinton), GlencoreXstrata is notorious for its human rights and environmental record in the “developing world” — and they are planning on treating northern Minnesota like the “developing world.” The proposed mining project would have a lifespan of twenty years, during which the mine would provide profits for the corporation and employment for residents of the region. Afterward the corporation’s proposal admits, the water treatment would need to be continued for 200 years for the mine and 500 years for the processing plant. But the corporation promises they’re “good for it,” and the EPA, which only a couple of years ago threw out the proposal, is now willing to consider it with no modifications.

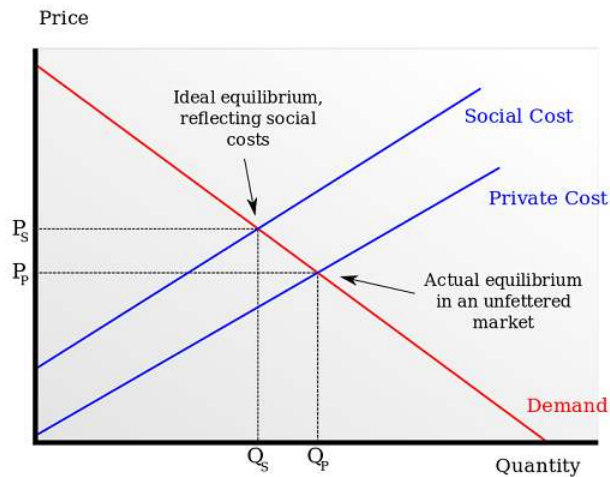


Figure 6.4: Demand curve with external costs: if social costs are not accounted for, price is too low to cover all costs and hence quantity produced is unnecessarily high because the producers of the good and their customers are essentially underpaying the total, real costs of production. (CC0; Struthious Bandersnatch).

The GlencoreXstrata proposal highlights not only the discrepancy in economic power between a Swiss-headquartered global corporation and the residents of a poor rural area, but also the difficulty dealing with economic externalities that happen in the future. Because its calculations are based on decisions people make in response to present circumstances, the field of economics tends to focus solely on what is important right now. Corporations have often been accused (even by friends of business) of being too obsessed with the next quarterly earnings report. But the whole economic system they use to measure themselves is entirely about the present. Economists have almost no way of accurately gauging the present value of an event that may (or may not) happen at some time in the future. Guesses can be made, but they are rarely taken seriously. This makes markets a particularly inappropriate tool for dealing with issues like long-term environmental damage and global climate change. Even if the immediate profit is slim and the potential future problem is catastrophic, in economic reasoning the present overwhelmingly trumps the future. So free markets and economic calculations cannot be relied on to provide long-term solutions.



Figure 6.5: Mountaintop removal along a formerly scenic highway in eastern Kentucky. (CC BY; Matt Wasson).

A final challenge to the way we normally use economics comes from a surprising direction. In the 1980s, decades of liberal economic policy beginning in the New Deal was reversed in America in a political sea-change known as the Reagan Revolution. After nearly fifty years of national economic policy based on the idea that consumer demand drove growth (Keynesian economics), a new generation of economists chose to put the supply side first. Both schools of national macro-economic policy use the same assumptions about impersonal markets and short-term profits, and many of the changes that were made in the 80s were no more than window-dressing. But it's ironic that the supply-side position rested on a misunderstanding of a radical libertarian economic theory known as the Austrian School of economics.

When Ronald Reagan was asked who his favorite economist was, he regularly answered by proudly naming an obscure European admired by libertarians. Ludwig von Mises was the leader of a splinter group of economists who vehemently opposed state-sponsored economic policies. They were Europeans working during the cold war, so a lot of the Austrians' criticism was inspired by and directed at the central planning and "command economies" of Russia and Eastern Europe. But libertarians in America believed that any government involvement in the economy basically deranged the ability of the free market to operate efficiently. There are several levels of irony in this story. The first is that in spite of Reagan's claims that government was the enemy and should stay out of the economy's way, he presided over the biggest increase in government spending and national debt since the Great Depression. But an even deeper irony is that the supply side economists based their macroeconomic policies on a theory that basically said that macroeconomics was a fraud. Ludwig von Mises's magnum opus was an economic tome called *Human Action*. One of the basic principles of Mises's theory was that economics was only one way of thinking about human choices. There were economic values that could be measured in dollars, Mises said. But there were also esthetic and moral values, and even if they didn't have a convenient currency to measure them in, these values were important. People did not make decisions, Mises said, based only on money.

Mises's other principle was even more problematic for modern economists. Not only were economic values just one of several ways people make decisions, Mises said, but they weren't even consistent. *Human Action's* central point is that value is not objective and constant (like economists need it to be), but subjective and situational. A glass of water, as Mises observed, is worth very little to me when I'm standing in my kitchen. But strand me in the desert for a couple of days and that same glass becomes incredibly valuable. Not only does value depend on circumstances, Mises said, but it is based on too many subjective factors for anyone to add it all up and create an aggregate demand curve. In other words, the basic diagram that the whole field depended on was illegitimate — or at least it was severely limited in ways we don't normally take into account. Of course, Reagan and his economists were probably unaware of this, since they had undoubtedly claimed von Mises as their patron saint without bothering to read his book!

None of these issues mean that we shouldn't use economics at all to try to make rational decisions based on the best data we can get. But it's important to know the limitations of our tools, so we don't use them where they are not appropriate. We should understand the economics' basic assumptions and its weaknesses. We should be aware that economic analysis is based not only on numerical data but also on a set of philosophical beliefs about human nature. We should recognize that economics, like technology, tends to put certain members of society at the center, often at the expense of others on the periphery. We should realize that

externalities are common and that they are often deliberately hidden or shipped to places where the costs can be controlled. We should understand that economics naturally favors short-term results and tends to ignore long-term consequences (especially when they are hard to value in dollars). Finally, we should admit that even at its best economics is just one tool among many that we can use to make decisions. It is not the only guide for human action.

Further Reading

- Alf Hornborg, *The Power of the Machine: Global Inequalities of Economy, Technology, and Environment*, 2001
- Ludwig von Mises, *Human Action*, 1949
- William D. Rohlfs, Jr., *Introduction to Economic Reasoning*, Seventh Edition, 2008

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7: Food and Choice

Sometimes Environmental History can be a frustrating or even a depressing topic of study. Many of the interactions between people and their environments we have explored in this course have been stories of tragedy and disaster, and the environmental future we and our children face will probably be challenging. In this final chapter, we are going to ask whether individuals can do anything to influence American society's relationship with its environment for the better. Specifically, we will examine food.

The exact relationship between history and the present is something not all historians agree about. Just because things turned out the way they did, we are not compelled to believe this outcome was inevitable. And although most historians try to avoid using overly simplistic "lessons" from history to argue about what we should do in the present, most would also agree that we study the past to learn about our present circumstances and about how to choose the best future. Over the years I have spoken with many teachers of Environmental History and they have usually expressed two interests. First, trying to end the semester on a positive or at least on a hopeful note. And second, trying to turn all the information we've covered in Environmental History toward the question, "Okay, here we are, so what should we do now?"



Figure 7.1: NASA's "Blue Marble" images of Earth are composite satellite photos taken in 2001 and 2001. (Public Domain; NASA).

Here are some examples. In April 2014, a Supreme Court decision called *McCutcheon v. FEC* (Federal Elections Commission) effectively eliminated limits of campaign contributions. In other words, the the new law says more money you have, the more influence you should have in the political process. Whether that actually changes anything or simply acknowledges a reality that has existed for some time remains to be seen, but either way *McCutcheon* shows how little impact individuals have in our current political system. The Supreme Court Decision is particularly bad news for the environment. The plaintiff in the case, Sean McCutcheon, is CEO of an Alabama-based corporation called Coalmont Electrical Development. As the name suggests, McCutcheon's company is a contractor working primarily with mining and utility companies. McCutcheon brought the suit because he opposed the \$117,000 limit on aggregate contributions in a national campaign cycle. The coal-based energy industry had a lot of money to spend opposing what they called "President Obama's War on Coal" and they desperately wanted to pack the government with people who would support their coal mining and their coal-fired power plant agendas. Since the 2016 election, the coal industry has had allies in the highest national offices. We'll see if that saves the coal industry or just delays its end.

One place where actual voters seem to have a little bit more power is California, which has a ballot proposition system that allows proposed laws to be submitted directly to the people for a vote. In the 2012 election there were eleven propositions on the California ballot and in 2016 there were eighteen statewide initiatives ranging from marijuana legalization and gun control to tobacco taxes and educational bonding. In 2016 twelve of the sixteen propositions passed; in 2012 only five passed and six failed. One of the failed 2012 initiatives was Proposition 37, which called for GMO (Genetically Modified Organism) food labeling. GMO labeling was supported by a few food-related companies like Whole Foods, Organic Valley, and Annies (at the time a publicly-traded corporation making organic macaroni and cheese, bought out by General Mills in 2014). Advocates for Prop. 37 raised \$8.7 million to use in their media campaign supporting labeling. Their basic message was not that GMOs should be banned, but simply that people had the right to know what was in their food. Opponents of the labeling law raised \$46.5 million, the biggest contributor being Monsanto whose \$8 million contribution was nearly equal to all the money raised by proponents. The list of companies that contributed more than \$150,000 to block GMO labeling is a who's-who of food manufacturers and chemical companies. At the top of the list, below Monsanto, was DuPont (\$5.4 million), Pepsico (\$2.1 million), The Grocery Manufacturers

Association, DOW Agrisciences, Bayer Cropscience, BASF, and Syngenta (all contributing \$2 million). Kraft Foods, Coca-Cola, Nestle, Conagra, General Mills, Kellogg, Smithfield, Del Monte, Campbell's Soup, and Heinz all contributed between a half million and two million dollars to defeat GMO labeling. Even Ocean Spray Cranberries threw in \$387,000.



Figure 7.2: One of many global protests against GMOs in general and Monsanto in particular following the failure of Prop. 37 in 2012. (CC BY; Rosalee Yagihara).

All these companies believed GMO labeling would be bad for their bottom line, and that a California law might lead to more labeling laws across America. So it is fair to assume they all use GMOs to some extent, and that they would prefer for their customers not to know the actual extent of their GMO use. It is unclear, of course, exactly what effects foods containing GMOs actually have on nutrition and on the health of the people who eat them. But in a large part, that mystery is due to a lack of research at universities and regulatory organizations that rely on the industry for most of their grant funding and personnel. However, we should note that in spite of being outspent 5 to 1 by labeling opponents, Prop. 37's advocates garnered over six million votes or 48.6% of the final tally. Nearly half of California voters wanted to know what was in their food. The proposition almost passed — but if a GMO labeling law can't pass in California, what hope is there for a legislative solution anywhere else?

The good news is that California consumers and their allies in other states now have a detailed list of the few food companies that supported and the many that opposed labeling, which they can use to make decisions about what to buy. Even if some GMOs turn out to be harmless, the corporations that opposed labeling have identified themselves with the cause of reducing transparency and making it harder for their customers to make informed purchase decisions. The California election results suggested to many activists that if people are going to change the food system in today's political environment, it won't be through government action. Luckily, no one is actually holding a gun to our heads forcing us to eat Smithfield meat, General Mills Cheerios, or Del Monte canned beans. Everybody eats, but somehow most of us have forgotten we can vote with our food dollars. Partly this is because the food industry has been seducing us for decades with inexpensive, tasty treats. But if six million Californians stopped drinking Coke and Pepsi products or eating Kraft's Mac & Cheese, Lunchables, and Velveeta, would that be a more effective method of voting for change than Prop. 37?

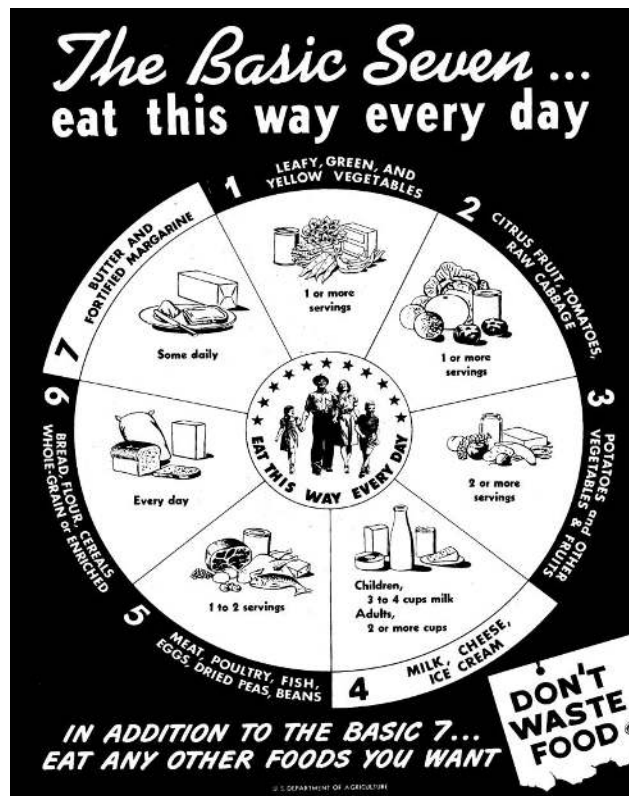


Figure 7.3: Three of the USDA's original 1943 "Basic Seven" food groups included fresh fruits and vegetables. (Public Domain; USDA).

Humans are hard-wired by evolution to crave fat, sweets, and salt because those were the essential nutrients that were scarcest in our diets. Nowadays, they're just cheap ingredients for food manufacturers. And as anyone who has been to cooking school will tell you, the easiest way to make anything taste good is to add fat. Even bland water chestnuts can become tasty hors d'oeuvres if you wrap them in bacon. And if a normal helping of fat and salt isn't enough to attract consumers, manufacturers can add even more fat or some sugar on top. Have you noticed the recent explosion of "sweet and salty" and "barbecue" flavors that add sugar, on top of the already wide assortment of "nacho cheese" and "sour cream and onion" flavored chips on supermarket and convenience store shelves?

An element of the food puzzle that causes a lot of disagreement is meat. Americans eat about 270 pounds of meat every year per capita. That's more than anyone else except Australians and, oddly, citizens of Luxembourg. Our consumption of beef peaked in the mid-1970s and since then chicken has steadily increased until it finally overtook beef in the last few years. For a while food experts claimed that a chicken dinner was actually healthier than a burger or a steak. But most of the chicken consumed in America today is eaten in the form of nuggets, buckets, and wild wings. And in terms of farming practices and environmental impact, chicken and beef are very similar. Both are raised in large-scale confinement facilities (CAFOs) where the animals are fed a diet of corn and antibiotics. Then they, along with pigs and turkeys, are shipped to processing factories that are increasingly owned by just a couple of global corporations such as Tyson, JBS of Brazil, and the Shuanghui Group of China, which recently bought US meat processor Smithfield Foods's pork operation for \$4.7 billion (JBS bought Smithfield's beef operation in 2009).



Figure 7.4: A Smithfield hog CAFO in Missouri, now owned by a Chinese conglomerate. (CC BY; Socially Responsible Agricultural Project).

We examined the growth of the meat-packing industry in Chapter 7 and noticed that a major factor in the success of the Chicago industry was the introduction of USDA inspection. The government is still responsible for inspecting food products at taxpayer expense, but the agencies given the task of insuring food safety don't have the budgets or manpower to do the job very effectively. Most problems with food are discovered only when someone becomes sick. The US Food and Drug Administration (FDA) maintains an online list of product recalls and safety alerts. Most of the food products on the bulletin either contain an unlisted ingredient like milk or peanuts that might be dangerous to consumers with allergies, or they are contaminated. The most common contaminants are salmonella and listeria. The USDA maintains its own list, and most of the food products it recalls either contain unlisted allergens or contain salmonella or E. coli. It's important to note that when the USDA and FDA recall a food product, on the average 63% of the product recalled is not recovered from store shelves, and is sold through to consumers.

The *Escherichia coli* 0157:H7 variety that is found in many meat products is an enterohemorrhagic strain that causes bloody diarrhea and kidney failure, and can be fatal. Recent research discovered that this strain can bind to plant surfaces (like the skins of fresh fruit and vegetables) and can colonize the roots of lettuces and spinach plants in commercial operations. In 2001 a two-year old boy named Kevin Kowalczyk died of hemolytic uremic syndrome after eating an E. coli-infected hamburger. Legislation called Kevin's Law designed to strengthen the USDA's ability to shut down packing plants that have multiple health violations was defeated a couple of years later by the meat industry. But some of the elements of Kevin's Law were included in an FDA Food Safety Modernization Act that finally passed in 2011. Unfortunately, according to Barbara Kowalczyk (who has a Ph.D. in Epidemiology and Biostatistics and is also the dead boy's mother who founded the Center for Foodborne Illness Research and Prevention), "The FDA does not currently have sufficient resources to implement the new provisions."

In addition to the danger of contamination, meat has been criticized by some food activists as a ridiculous waste of resources. According to *The Journal of Animal Science*, a quarter-pound hamburger takes 6.7 pounds of feed and over 50 gallons of water to produce. Multiply that by the "billions and billions" served by just one major fast food chain, and you begin to see the magnitude of the issue. Most critics of meat estimate that the ratio is about 10 to 1. Ten people, they claim, could be fed plant products using the resources used to feed one person meat. The 10:1 ratio argument has been embraced by Vegans as proof that their diet is the only way to feed all the people of the world. But is this an argument against meat per se, or against meat produced the way we make it now?



Figure 7.5: Newborn calf and mother on pasture. (CC BY-SA; Uberprutser).

In a recent book called *Meat: A Benign Extravagance*, British author Simon Fairlie coined the term "default livestock" to describe animals raised in a more traditional and, he argued, more sustainable way. Animals, Fairlie observed, have historically been fed things that humans either could not eat or chose not to eat. Ruminants such as goats, sheep, and cattle, grazed on pastures that were either fallow fields in a crop rotation system or hillsides and rangelands unfit for planting. Pigs and chickens ate leftovers and byproducts like peelings and the mash left after a batch of beer or wine was made. Or they ate foods like acorns and fallen fruit that humans could consume but usually can't be bothered with. If meat production was taken out of CAFOs and returned to this historic "default," Fairlie argued, people could still enjoy a diet including some meat. The portions would be a bit smaller, but they would be healthier and they'd be sustainable.

As we've already seen, CAFOs and corn-fed livestock are the results of subsidies that make it cheaper for a farmer to buy feed than to grow it. But they are also a result of consumer decisions. When we buy a Smithfield pork tenderloin at the Walmart to grill, Americans generally do not think about how the animals were raised and slaughtered. We are unaware of the conditions in the packing plant, where workers who are often illegal aliens working for low wages are judged on speed and on the number of animals they can put through the system in a day. According to a recent book, an animal was killed every 12 seconds at the head of the "disassembly line" where the author was stationed. We are not even aware that the profits from that Smithfield pork loin are going to end up in the Brazilian bank accounts of JBS S.A. rather than in the hands of the American farmer or processors who made the product.

A growing number of Americans, however, are visiting farmers markets and buying shares in CSAs (Community Supported Agriculture). They are taking the opportunity to eat more fresh vegetables and locally produced meat, and eggs. In some cases they are even getting raw milk, although the food safety laws that were designed to protect the public from distant, anonymous food processors now sometimes prevent people from buying food from their neighbors unless those products have gone through a similar regime of processing and inspection. One of the big barriers preventing more people from selling farm products locally is the time and expense involved in obeying all the rules and laws written to regulate global corporations. Another barrier is the cost of land and equipment. An acre of farmland that is anywhere near an American city is usually priced like a suburban house lot, because the alternative to planting it is building a new subdivision. And when starting as a commercial chicken farmer means that you have to build a confinement building to the specifications of the company that sends you a couple hundred thousand day-old chicks, often the only way to get going is to become what amounts to an indentured servant of a poultry company like Tyson. As a result, the average age of the American farmer is now well over 60.



Figure 7.6: Joel Salatin explaining his "chicken tractor" to visitors at his Virginia farmstead. (CC BY-SA; nick v).

With these costs in mind, farmers like Virginian author Joel Salatin are beginning to design systems that can be started at a reasonable commercial scale without much capital investment, and that are portable. Salatin's chicken and turkey "tractors" can be hitched to a pickup truck and hauled to pastures where the farmer is going to raise the birds. This scheme allows a farmer to grow thousands of premium-priced free range birds on rented land. Salatin himself inherited a 500-acre farm in Virginia's Shenandoah Valley, but to his credit he understands that's not the way a new generation of sustainable farmers is going to be created. Salatin says that the electric mesh fence and battery-based fence charger he uses may be the most important agricultural innovations in decades (I use them too, and I agree). The fence controllers use microchips to pulse the electrical charge in millisecond increments, preventing the lightweight fence material from melting and allowing fences to be powered by 12-volt rechargeable batteries. This means fences can be set up quickly and moved easily. Animals can be contained and protected from predators far from permanent electrical sources, and can be rotated through fields with unprecedented flexibility. Salatin has designed a grazing rotation using cattle and chickens that he believes could be scaled up to a level where it could actually feed the world.

Scalability is an important issue in this new style of local farming. Critics have argued for decades that farmers markets and CSAs are elite institutions that appeal only to affluent liberals who can afford to spend more than necessary to support local farming for political reasons — but are irrelevant in the “real world” where we have to feed everybody. Feeding the world a diet equivalent to that of a typical American, they say, would take 90% of the available land area. The key, of course, is that feeding everyone like a typical American isn’t what locavores have in mind. Advocates of local solutions believe everyone’s diet needs to change. Fairlie’s idea of default livestock and Salatin’s claim that his grassfed cattle and chicken operation could be scaled up are at least a starting point for discussing a new food system. Sustainable food advocates like Michael Pollan are quick to point out that changing our eating habits produces immediate health benefits as well as long-term social benefits. “Eat food. Not too much. Mostly plants.” is the motto of Pollan’s 2008 bestseller, *In Defense of Food*. Pollan argues that the food system is going to change, because it is unsustainable. As fossil fuel costs rise, fertilizer production, farm-equipment operation, food processing, and transportation will all become more expensive. The average American’s food travels over 5,000 miles from farm to fork. The typical grocery cart is filled with out-of-season fruits and vegetables, many of which cross the equator on their way to the supermarket. Millions of pounds of perishable produce are actually shipped by jet because they would never make it to market before spoiling if they went by container ship. So jet fuel is actually part of the social cost and the carbon footprint of the pint of strawberries I might buy in Minnesota in January.

A lot of time and energy go into subsistence farming, and we have come a long way since the days when nearly everyone was a farmer in Early American society. Very few people want to give up their careers and their interests and live like the pioneers did in the eighteenth and nineteenth centuries. Although many Americans may decide to supplement their diets with vegetables from a garden or with eggs and meat from a backyard henhouse, the food industry will likely be where the most significant changes are made (or not made) in the future. So the question is, can consumers influence the food industry in ways that will lead to healthier food choices and increased sustainability?



Figure 7.7: A Buy Nothing Day notice attached to a Walmart cart by an activist. (CC BY; Brave New Films).

For some people, lifestyle is politics. Conspicuous consumption makes as statement, as does living out of dumpsters. Between these two extremes are a lot of alternatives, and they have changed over time. “Baseball, hot-dogs, apple pie, and Chevrolet” was once a popular advertising slogan. Since then, the old fashioned conservative value of “Buy American” has gone so far out of style (in reality, if not always in rhetoric) that no one would seriously consider running a national advertising campaign in which the product’s American-ness was its most important attribute. In recent years, an organization called Adbusters has sponsored an annual, national anti-consumerism boycott, calling on people to buy nothing on “Black Friday,” the day after Thanksgiving. Buy Nothing Day was an event for several years, and is still observed by some critics of consumerism. Perhaps “sustainable” might be a better concept for people to build a movement around, rather than GMO-free. The science is still unresolved regarding GMOs, as mentioned earlier. But for many people, the issue with GMOs isn’t really genetic modification per se, as much as the idea that global corporations like Syngenta and Monsanto should not be patenting genomes and manipulating them behind a veil of secrecy and government protection that destroys transparency and makes people paranoid.

Organic is another difficult concept. Given the choice between a certified organic bag of chips and a regular one, what are we actually choosing? Which bag of chips is better for the environment, if the regular chips are local and the certified organic ones had to be shipped all the way from a factory in California? And in any case, are either of the bags of chips actually any good for us? Sustainability, as a concept, has the additional advantage that it may actually be measurable and we may be able to ask questions

based on those measurements about how our choices affect sustainability at both a personal and societal level. How do my personal choices about food, or about which car to drive, or about how to heat my house influence my ability to sustain my family's lifestyle? Does our social choice to subsidize corn increase or decrease the sustainability of our food system? If nothing else, discussions about sustainability would tend to focus our attention on the long term and on those economic externalities we usually fail to see.



Figure 7.8: Free-range heritage chickens on my pasture in northern Minnesota. (CC BY-SA; Dan Allosso).

I'm not sure how much of an answer that is. But for my part, I'm going to continue planting a garden and raising chickens so I know where the meat I feed my family comes from. I may also stop buying from those companies on the list of corporations that opposed labeling in California. If a lot of people did that, it might be a more effective way to change their behavior than through a government that is pretty much owned by those corporations. Now all I have to do is convince a few million of my fellow consumers to join me! But seriously, maybe that's easier these days than representative democracy. Maybe the moral of the story really is that talk is cheap, but everything we actually do is political.

Further Reading

- Simon Fairlie, *Meat: A Benign Extravagance*, 2011
- Michael Pollan, *In Defense of Food: An Eater's Manifesto*, 2008
- Joel Salatin, *Folks, This Ain't Normal: A Farmer's Advice for Happier Hens, Healthier People, and a Better World*, 2011

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8: Introduction

Environmental History is about looking at the past as if the environment matters. American History is about looking at the past of not only the United States, but of both the American continents. This wider view is especially important when we realize that people occupied the Americas for over 15,000 years before Europeans arrived and that when they came to the Americas, Europeans focused their interest for centuries on areas that are not part of the current United States. As we get closer to the present, we will focus more on the U.S., but we'll try to remind ourselves from time to time that we're not the only nation in the Americas by considering how other nations have experienced and affected the environment.

Not that long ago the world seemed so big and human actions seemed comparatively so small that it was easy to ignore our effect on the world around us. Today we understand that people have a big impact on our surroundings. And we're becoming aware that our environment has played an important part in our individual lives and in the growth of our cultures. Instead of being just a neutral backdrop, the environment is now recognized as a powerful shaper of human choices. That is, history.



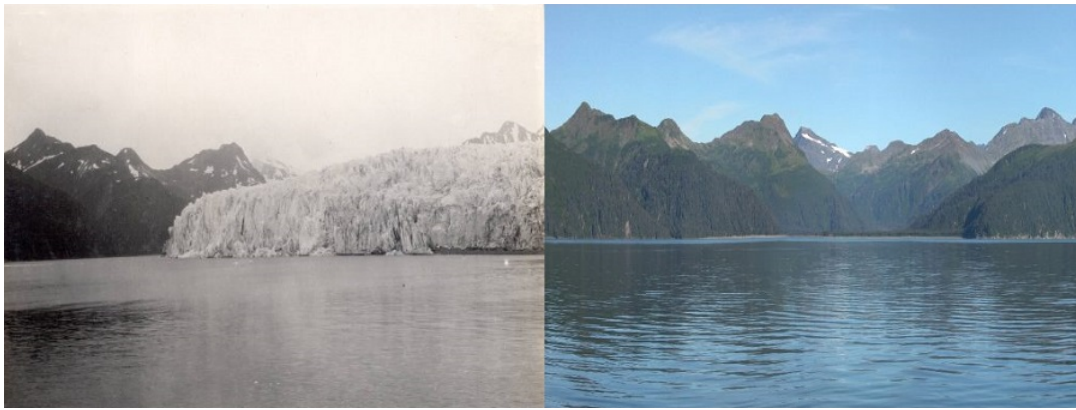
Thomas Moran's 1872 painting, *The Grand Canyon of the Yellowstone*, helped galvanize public opinion and Congressional support that led to the creation of the first national park in the United States. (Public Domain; Smithsonian).

By the environment, I mean everything around us. The natural world, but also the manmade world. Often it's difficult to draw a distinct line between those two. We intuitively feel that tree-lined suburbs are more natural than the city and that the wilderness is even more pristine. But if we look closer we often find the suburban trees were part of a developer's design, and even wilderness areas are special human-made places that have been deliberately protected or even rehabilitated so they resemble our idea of pristine nature.

The environment is also more than just the green part of the world. Even the most sophisticated urbanite depends for her food, water, and energy on elements of a much wider environment than she may be aware of. Nor are we talking only about environmentalists. The most jaded materialist depends on the environment just as much as the most dewy-eyed idealist.

If environment is a surprisingly complicated word, so is history. Most Americans live our lives within a set of stories that describe who we are and who we think we ought to be. These are the civics and social studies lessons we are all so familiar with. Historians recognize that many of these stories are not as true as we'd like to think. A lot of our histories have changed quite a bit over time, as have our reasons for telling them. History isn't just data about the past, it's the stories we tell about the past.

So where does that leave us? American Environmental History, for the purposes of this book, means looking at our past with special attention to how our surroundings influenced our opportunities, our choices, and our actions; and to how our actions reshaped our surroundings.



McCarty Glacier, Alaska. July 30, 1909 and August 11, 2004. (Public Domain; United States Geological Survey)

There are two basic elements of looking at a past that includes the environment. First, we pay close attention to the physical world. For example, the shape of the American continents and the fact that they are connected to each other but cut off from the rest of the world has influenced American cultures from their prehistoric beginnings to the present. Landforms, waterways, natural resources, and climate have all been important factors in how our society has developed and how it continues to change. Second, we remember that how we think about the environment, like how we think about the past, has changed over time; and that those changes affect our current choices and actions. You don't have to dig too deeply into current headlines to find debates raging over coal mining, oil pipelines, depleted fisheries, mass extinctions, and climate change. Our beliefs about the world around us and our role in it are important elements of the competing positions taken by advocates on either side of these important issues.

Our goal is to deal with both events and ideas. But realistically, this is a survey of American Environmental History stretching from prehistory to the present. We're going to spend most of our time on events, especially because the environmental elements of many key events in American History are not well understood. Too often our stories about America's past devote all their attention to political debates and to the ideologies of elite leaders or philosophies of founding fathers, and these tales are told against a neutral background that isn't part of the story at all. The main goal of this text is to show that it's really not possible to understand our past while ignoring the environment.

In a sense, that simple goal is also one of the ways this American Environmental History text differs from the academic field. When historians study Environmental History, we typically spend a lot of our time drilling into the details and rarely step back to talk about the big picture. As a result, there are plenty of books available about particular issues such as the Dust Bowl, Colonial America, Agriculture, or our changing perceptions of Wilderness. I assign chapters from some of these texts to my students. But we never had a textbook for my college course, because there wasn't a survey text that covered the whole, big picture.

Until now. This book is based on the content of the course I taught for several years at the University of Massachusetts in Amherst and currently teach at Bemidji State University. It's designed to give you an overview of American Environmental History and includes suggestions for further reading and chapter supplements that discuss some of those detailed studies I mentioned. There's a lot of material to cover. I've tried to arrange it so it's both concise and comprehensive. So welcome and let's get started!

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9: Prehistory

History is about understanding the past using the best resources available, and as tools and information about the past become available, history changes. In recent decades, scientific breakthroughs have made it easier to understand the long centuries before people started leaving written records. This new information allows us to look farther back, and we've discovered that what happened long before the beginning of recorded history had a huge influence on our lives today.

A big part of this change in understanding the past, for Americans, is recognizing that our continent's history does not begin with Columbus or even with the Vikings, but with the stories of people who arrived in the Americas ten thousand years before the first Europeans. America's deep past was once thought of as just a prehistory that had no bearing on later events or on the present. As we'll see, that view was mistaken.



Figure 9.1: Ice was central to the story of prehistoric America. The Perito Moreno Glacier, Argentina.

Humanity evolved in Africa over a period of about a million years. When they left their original homelands, early humans first spread over the adjacent continents they could get to on foot, as you'd expect. Over thousands of years, these humans settled nearly all of Europe and Asia. But they didn't reach the Americas, because during those early periods of expansion the Americas were separated by wide, un-crossable oceans. You may be aware that a long time ago the continents were all joined together in a landmass known as Pangaea. This is true, but that ended millions of years before the first humans evolved. By the time people came along, the continents and oceans were pretty much where they are today. The isolation of the American continents and the changes that occurred on them when global climate change allowed humans to finally reach them had a major influence on the beginning of our story.

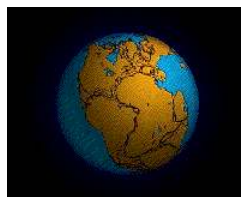


Figure 9.2: Animation of the break-up of the supercontinent Pangaea and the subsequent drift of its constituents, from the Early Triassic to recent.

People Like Us

Human expansion across the continents of Earth must have been an epic story of courage and tenacity. It's too bad it all happened long before the invention of writing, which was only about five thousand years ago, so we can only speculate about what these people felt and thought about their adventures. Luckily, scientists have recently been able to tell us more about the environments these humans faced, and even about the people themselves. So we can now see at least an outline of this prehistoric epic.

The modern humans scientists call *Homo sapiens* have been around for close to two hundred thousand years, and for all that time they have been more or less physically and mentally the same as us. That's an important point to remember. Ancient people lacked writing and other technology we enjoy today, but they had comparable physical and mental abilities. They looked like us and to a

great extent they thought like us. A few scientists have even suggested that some prehistoric individuals may have had more highly developed physical and mental abilities than we do. After all, they had to survive by their strength and their wits to a much greater degree than many of us living in luxury today. Prehistoric hunter-gatherers who we once pictured as little more than ignorant cavemen adapted and thrived in conditions we'd have trouble facing even with our technology. A cavewoman might actually have an easier time getting along in our world of WIFI and supermarkets than we would have surviving in her world without all the modern conveniences we depend on every day.

The people I'm calling humans in this chapter include a wider variety of folk than you might expect. Until recently, it's been common to reserve the term "human" for only the most recent branch of the evolutionary tree, *Homo sapiens*. It was thought there were extreme and obvious differences between us and our ancestors—that we were in fact different species. But as we learn more about our earlier ancestors, we're discovering they are more like us than we had imagined. Neanderthals, for example, had bigger brains than we do and made stone tools very similar to those made by neighboring *Homo sapiens*.

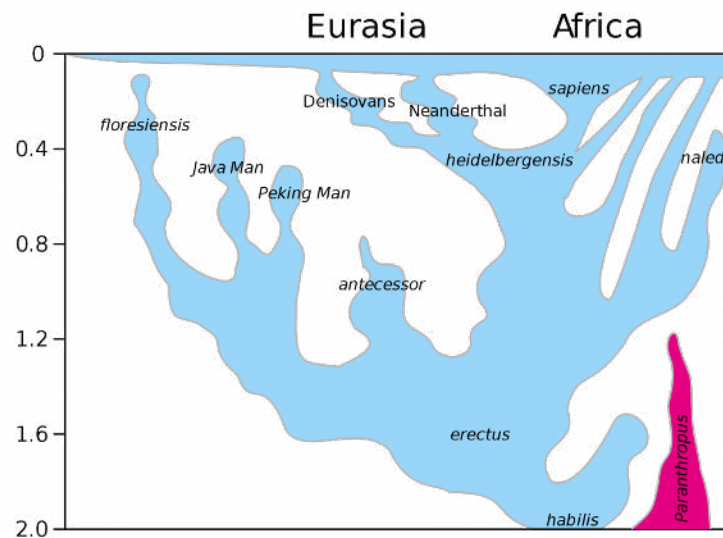


Figure 9.3: Human (genus *Homo*) family tree. Note the connections where the Denisovans and Neanderthals contributed DNA to modern *Homo sapiens*. *Paranthropus* refers to robust australopithecines that did not contribute to our family tree.

And these earlier people weren't as isolated from their *Homo sapiens* neighbors as we had thought. One of the biggest discoveries geneticists have made in the past few years is that most modern humans carry genes from people like the Neanderthals and the Denisovans. Since the definition of a species includes being able to breed viable offspring, Neanderthals and early *Homo sapiens* who had children together were clearly much more closely related than we'd once believed them to be. So it makes sense to expand our understanding of humanity to include these people our ancestors mixed with. Maybe we can even learn something from them, as we discover more about their prehistoric lives.

Before 1492

Now consider America. For most people—even for many historians—American history begins in 1492. Everything that happened before Europeans began exploring what we used to call the New World is still often considered to be prehistory. Remote, unknowable, and largely irrelevant. But is it really?



Figure 9.4: The Landing of Columbus, John Vanderlyn, commissioned for the rotunda of the U.S. Capitol in 1846.

If you happen to be descended from the people who were here before Columbus, you would probably disagree with the idea that American History began in 1492. And actually, outside the United States most of the people in North and South America are descended at least partly from people who were here before Columbus. But even if all your people came to America on the Mayflower or on a slave ship or passed through Ellis Island, there still are reasons why American prehistory is an important part of your story. We'll explore them in the rest of the chapter, but here are a few highlights:

- The people who settled the Americas came from the same ancestors as the people who settled Europe. In other words, we're all related.
- The people who settled the Americas made one of the epic migrations in the history of our species. So it's a great human adventure.
- Early Americans developed three of the five most important foods eaten throughout the world today. So they had a lot to do with making the modern world we live in possible.

One reason historians often skip over this prehistory is that most of its data comes from other fields of study. It's obviously much harder to know what happened a long time ago, when people didn't leave written records or when those records have been lost. This is a problem not only in the Americas, but throughout the world. Historians have learned to rely on anthropologists, archeologists, geographers, and linguists to fill in the gaps in their knowledge. And more recently on climatologists, geneticists, geophysicists, and even satellite remote-imaging systems to help piece together the stories of ancient peoples and how they lived. As these sciences develop and as new techniques and data become available, our understanding of the remote past can change radically—and sometimes very abruptly. For example, our understanding of human origins has changed quite a bit in the since archeologists first began discovering the bones of our distant ancestors.

The most up-to-date data available as I write suggests several waves of human migration out of Africa. The most recent wave—the one that leads directly to us—began roughly 80,000 years ago. Before that, around 150,000 years ago, some type of disaster seems to have reduced the *Homo sapiens* population in Africa to a couple thousand or maybe even just a few hundred people. This time period corresponds with the glacial maximum (the peak of the ice age) before the most recent one, so it's likely that changes in weather patterns altered global patterns of vegetation, reducing the foods available to our ancestors. Scientists aren't sure of the exact cause of the population crisis. What they do know, based on genetic analysis, is we are all descended from those few hundred Africans. The human population recovered gradually and some of the survivors began moving northward from their original homes in Central Africa as climate continued to change, probably following the animals they hunted.

But our *Homo sapiens* ancestors were not the first humans to travel the world. *Homo erectus* left Africa 1.8 million years ago and their descendants were incredibly successful. *Homo erectus* actually survived in East Asia until about 40 thousand years ago, when they were displaced by migrating *Homo sapiens*. A recently-discovered group called the Denisovans left Africa about 1.2 million years ago. The Denisovans settled in central Asia and contributed a crucial gene to modern people living in Nepal and Tibet that allows their blood to absorb more oxygen in the high altitudes of the Himalayas. And the ancestors of the Neanderthals left Africa about 600,000 years ago. They thrived in what is now Europe for more than a half million years, and contributed to the genomes of

all modern non-Africans. Neanderthals were unbelievably tough. They survived through several ice ages and only disappeared about 25 thousand years ago when they too were displaced by Homo sapiens.

By about 40,000 years ago, a population of Homo sapiens hunter-gatherers descended from the people that had survived the African population crisis were living on the Eurasian plains north of the Black Sea. These are your ancestors, if you are Asian, European, or Native American. They used spears, fire, and cooperation to defend themselves from predators, and were experts at hunting huge prey animals like the woolly rhinoceros and woolly mammoth. The Eurasians' ability to adapt to life on the plains and tundra gave them an evolutionary advantage when a new cycle of global cooling once again changed weather, vegetation, and animal migration patterns. These changes extended the hunter-gatherers' habitats across the whole Eurasian land mass from the Atlantic to the Pacific.

Ice Ages

Global climate has been very stable for extremely long stretches of Earth's 4.5 billion-year history, such as during tens of millions of years when dinosaurs roamed the planet. But over the last million years there have been a series of cyclical climate changes. Over the last 500,000 years (a period we have better data for), global temperatures have varied by about ten degrees Celsius (about 18° F) in a regular cycle lasting around 100,000 years. The highest temperatures were about three or four degrees Celsius higher than now, and the lowest were about six or seven degrees cooler. These are global averages, not local. On a global basis a six-degree Celsius drop in average temperature is enough to bring on an ice age. That's exactly what happened during the cold part of each cycle. Snow fell and didn't melt. Ice accumulated into glaciers that spread northward from Antarctica into the southern oceans and southward from the Arctic Circle to cover most of what is now Europe, all of Canada, and quite a bit of the northern United States. The last time this happened, roughly 36,000 years ago, is when American History really began.

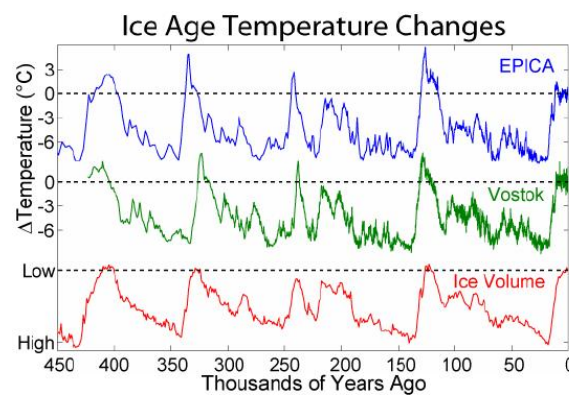


Figure 9.5

This chart shows the relationship between global temperatures and the Earth's volume of ice. The ice volume line at the bottom is inverted so you can see how ice cover and temperature changes line up. When temperatures fell the ice-pack grew. Notice that about 150,000 years ago, Earth experienced the frigid temperatures of a glacial maximum. That's the climate change that may have caused the population crisis in the African Homo sapiens mentioned earlier. As snow became trapped in glaciers, rainfall patterns changed in central Africa, killing plants that had evolved under different conditions. Lack of food reduced the numbers of grazing animals and the humans who hunted them. Later, when the climate warmed, Eurasian glaciers receded and opened new grasslands for the herds, forcing hunters to migrate along with their prey. After expanding across Europe and Asia during tens of thousands of years of mild weather, our ancestors once again faced centuries of cooling and finally another ice age beginning about 36,000 years ago. This climate change created new opportunities as well as challenges.

When global temperatures began to drop slowly at the beginning of the last ice age, the forests of central Europe and Asia died. Trees have a hard time adapting to big changes in climate, and slow-growing forests can't relocate to places with better conditions as easily as other, shorter-lived plants. The Eurasian plains lost their trees and became grassy steppes and then frozen tundra. The onset of the ice age took centuries, and Eurasian hunter-gatherers gradually followed the grasslands and the animals that grazed them. People who would become the first Americans expanded slowly eastward from Central Europe across what is now Siberia, while other members of the same ancestral population expanded slowly westward toward the Atlantic. All these people were the descendants of the survivors who had left Africa between eighty and fifty thousand years ago to live north of the Black Sea.



Figure 9.6: Eurasian hunter-gatherers tracked migrating herds like these caribou, ultimately following them across the entire continents of Europe and Asia as climate gradually changed.

As glaciers expanded southward to cover Europe and Central Asia, the tundra in the northeastern corner of Siberia stayed relatively ice-free. Ice age weather patterns generally dumped all their moisture in snowstorms over northern Europe, leaving eastern Siberia frigid but dry. The Eurasian plains people adapted to this climate, living in small hunting groups that followed herds of caribou, mammoths, and woolly rhinoceros. These animals provided the hunters with food, hides, and bone tools. The hunters didn't form any large communities we know of, but archaeologists have found the remains of many small camps. A thin, widely spaced population of Siberian hunters held their own in this harsh environment for thousands of years.

By about 21,000 years ago the Earth had reached the coldest point of that glacial cycle. Scientists call this the Last Glacial Maximum—which means only that it was the most recent glacial maximum and is not meant to imply that it was the final one. By the Last Glacial Maximum, the Eurasians had already reached the northeastern edge of Asia. Archeologists have discovered sites in Eastern Siberia over 35,000 years old. One settlement near the Laptev Sea, called Yana RHS, was occupied 27,000 years ago. The Yana RHS settlement is located within the Arctic Circle at 70° north latitude, near where the Yana River empties into the Arctic Ocean. This is extremely challenging territory even today, but the area may have had a slightly milder climate when Eurasian hunters lived there during the ice age. Excavations at Yana RHS have yielded stone spear-points and shafts of woolly rhinoceros horn and mammoth ivory very similar to objects found at sites in North America. That's because when these hunters got to what is now the edge of Asia, what they found there was not the frigid water of the Bering Strait and Arctic Ocean we'd see today. They found more tundra.

Beringia

So much snow fell during the last ice age that glaciers up to two miles thick covered much of the northern hemisphere. Enough water became trapped in those glaciers that many of the world's largest rivers slowed to a trickle or stopped flowing completely. Global sea levels fell by 120 meters (over 360 feet) and coastlines around the world expanded dramatically. For comparison, if all the ice left on Antarctica and Greenland melted, the oceans would rise 60 meters from their current level. This would be a global catastrophe, but it's only half of the sea level change experienced during the last ice age.

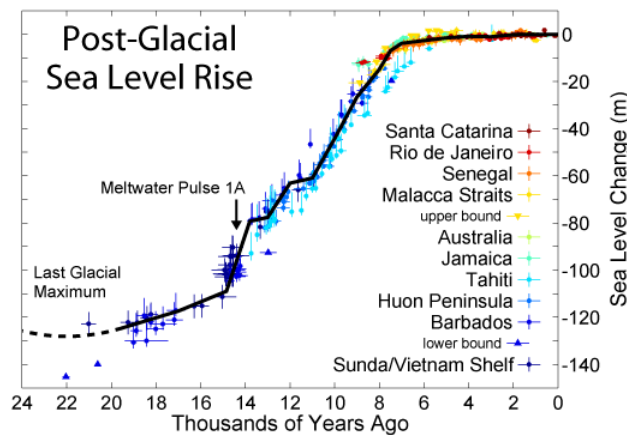


Figure 9.7

The graph above shows sea level changes during the last ice age. Near the left-hand side you can see the last glacial maximum. Sea levels were 360 feet lower than they are today, and people were able to walk from Asia to America. The stretch of ocean that separates Siberia from Alaska isn't very deep. The continental shelf would have been exposed when sea levels had dropped by only about fifty meters. So by the time the Eurasian hunters arrived at the eastern edge of Asia about thirty thousand years ago, the tundra just continued eastward in a thousand-kilometer wide strip of land scientists call *Beringia*. Although in the past the connection between Asia and America has been described as a "land bridge," the term gives the wrong impression. There was nothing narrow or temporary about Beringia. Worse, the word "bridge" leads us to imagine people deliberately crossing to get from one place to another place. This is a mistake. Beringia was a place. It was nearly as wide as Alaska from north to south and it lasted at least 16,000 years, from about 28,000 years ago until 12,000 years ago. That's three times longer than recorded history. Eurasian plains hunters probably lived in Siberia, Beringia, and in northern Alaska that entire time.

The Eurasians who hunted caribou, mammoths and other big game from what is now Kamchatka to what is now Alaska had no reason to think any differently about the land they occupied. They were following the herds of game animals, living as they had for thousands of years. It's important to understand that the people living in Beringia were not migrating to the new world. If they had been migrating, they probably would have brought more than dogs, which people began domesticating from central Asian wolves about thirty thousand years ago. As far as they were concerned, the Beringians were living the way their ancestors had lived for uncounted hundreds of generations.

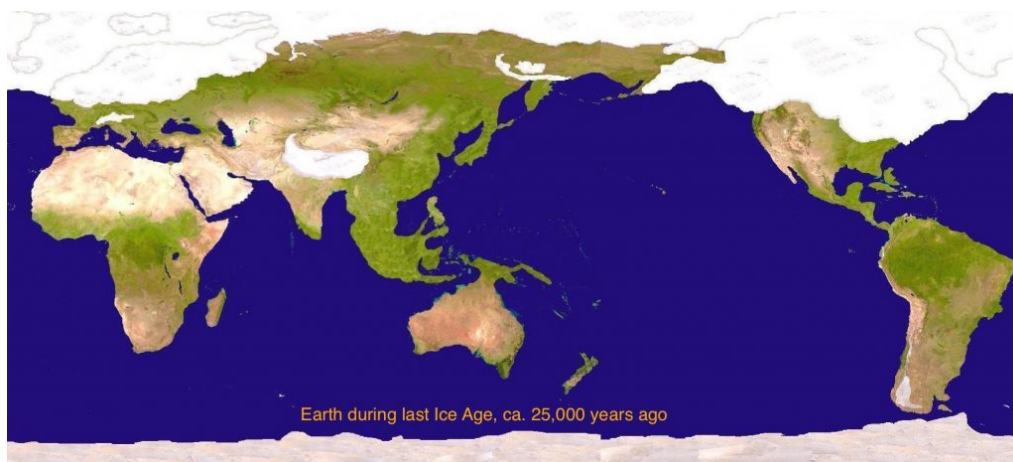


Figure 9.8: An estimate of the expanded coastlines and glaciers of the last ice age.

The most compelling evidence Beringians weren't deliberately migrating into America is genetic. The most recent analyses by paleo-geneticists show there was a period lasting several thousand years, when the ancestors of native Americans paused on the edge of the continent. The likely explanation for this pause is that there was a wall of ice cutting off Beringia from the rest of North America. People living during the ice age would have been very unlikely to climb up onto a two-mile high glacier and try to cross it, even if they knew there was anywhere to go. But beginning about 15,000 years ago, as ice melted and sea levels rose, Beringians would have found themselves gradually cut off from Asia. There was still a narrow strip of land joining the continents until about

11,000 years ago. But the route back to Asia would have been over rougher terrain, former highlands and mountains rather than the wide, flat country the hunters had lived on for so long. The plains the Beringians had spread across had already disappeared under the sea.

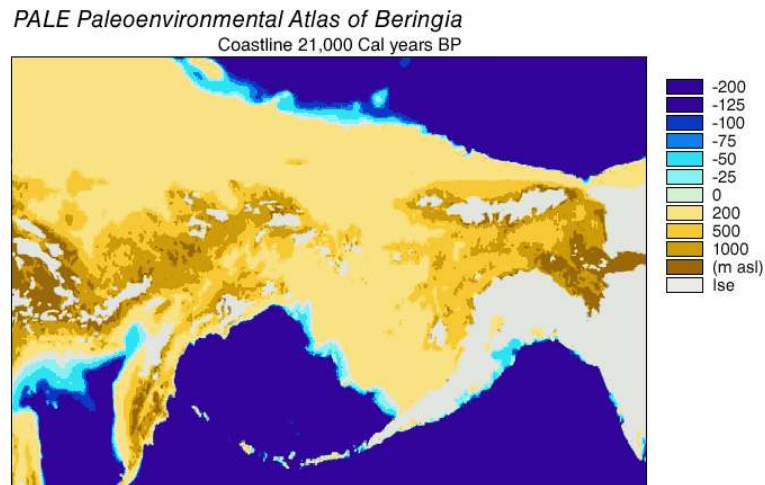


Figure 9.9: Watch the coastline change. By about 11,000 years ago, the route back to Asia was pretty well closed.

Rising oceans created the coastlines of the modern globe and filled the Bering Strait by about 11,000 years ago. The people who expanded from Alaska into North and South America were part of the very sparse population of Beringia. They were not joined by any large migrations of additional Eurasians, although scientists have found evidence of a couple of small migrations back to Asia, when some Beringians returned to Siberia carrying genetic mutations they had developed in Alaska. Based on the most recent DNA evidence, the entire western hemisphere seems to have been colonized from an initial population of fewer than 5,000 Beringians, who entered the Americas in more than one wave. Once they reached the Americas the Beringians (who many historians call Paleo-Indians or Indians, but who I'm going to call Americans) were then cut off from Asia and left isolated by climate change for over 12,000 years.

As the ice age ended, glaciers slowly melted and retreated northward into the Arctic. But glaciers don't disappear quickly. The two-mile high walls of ice blocking southwestern Alaska began melting on their southern sides in what is now the U.S. and Canada. But they remained a pretty effective barrier in the north. However, on the Alaska coast ocean warming and rising sea levels attacked the edges of the ice, just as they are now doing in Greenland and Antarctica. Scientists don't know exactly when a coastal corridor opened up, or whether Beringians walked south along the water's edge or paddled small boats. What they do know is that by 14,800 years ago, the new Americans had reached the southern coast of Chile and set up camp in a place called *Monte Verde*.

Southern Chile is a long way from Beringia. The site archeologists discovered on the banks of a small river is about fifty kilometers from the Pacific coast and about the same distance from Puerto Montt, a small city that stands at the southern end the Pan-American Highway. The other end of the Pan-American Highway is in Prudhoe Bay, Alaska, not far from where the Beringians probably began their journey. The official distance of the Highway between Alaska and southern Chile is just under 30,000 miles. The coastal route curves more than the Highway does; so if you hug the coast the distance is even greater. It may have taken Beringian explorers a thousand years to make the trip. Scientists don't know because they haven't yet found many camps or settlements along the way. One explanation for the lack of archaeological sites could be that rising sea levels at the end of the ice age may have hidden evidence underwater. Recent finds on California's Channel Islands may shed light on the issue—we'll have to wait and see.

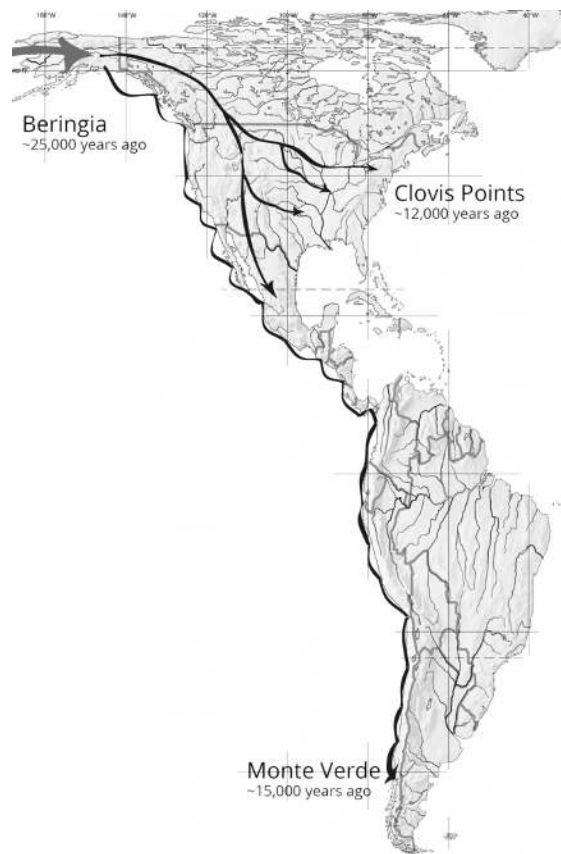


Figure 9.10: Routes into the Americas

Archaeologists at Monte Verde found stone tools and scraps of mammoth and llama hides, log planks, wooden tent-pegs tied with grass twine, and a wide variety of other plant and animal remains. Nearly a third of the plants found at Monte Verde were charred from cooking, which tells us the new Americans who lived there had a varied diet that included a lot of vegetables. About a quarter of the plants archaeologists have catalogued were not from the immediate area, but had been imported to the site. Seaweeds were found stuck to stone tools, that must have been carried from the Pacific coast 50 kilometers away. Other plant foods had been brought from their high-altitude homes in the Andes or from grasslands up to 600 kilometers away. It's interesting that more than half these plants are still used by the Mapuche Indians of southern Chile as food, drink, medicine, or construction materials.

Early Americans were not only incredibly mobile, they were remarkably good at learning which local plants were healthy to eat. This knowledge is even more impressive when we recall that as they traveled southward along the coasts of North, Central, and South America, the Beringians left the arctic tundra environment they knew so well, and passed through strange new ecosystems. The explorers crossed the equator and experienced tropical weather for the first time in a thousand generations. But early Americans were apparently very fast learners. According to a leading archaeologist, no one has ever found a plant native to the Americas with food or medicinal value that was not familiar to the pre-Columbian natives.

Monte Verde was an unusual find for archaeologists. Plant remains almost never last more than a couple thousand years, and even bones are rare at most American sites over a few thousand years old. Stone tools are the most common artifacts found, and scientists have been able to trace the movements of ancient Americans by the types of stone they preferred and the tool designs they left behind. When making their tools, ancient Americans chose high-quality minerals that could be accurately chipped into the sharpest, most durable points. Craftsmen actually traveled hundreds of kilometers to particular quarries. For example, dolomite from the Texas Panhandle shows up in spear points found in northeastern Colorado, 585 kilometers away. Blocks of Ohio chert were carried 380 kilometers to Michigan to be chipped into points and blades.

Clovis

The people who made most of the stone spear points found in North America used slightly different techniques from those used by the Monte Verdians. Their style of chipping stone points is distinctive enough that scientists think it represents a new culture in

North America, which they called Clovis after the New Mexico town where the first points were discovered in the 1930s. Unlike the first migration of Beringians who traveled down the coast to Monte Verde over fifteen thousand years ago, Clovis people seem to have followed a land route that opened about 12,000 years ago as the glaciers receded. As the two major ice sheets covering the top half of North America began to melt, a gap opened between them on the eastern edge of the Rocky Mountains. Beringians still living in Alaska would have been able to walk south onto the Great Plains, following the animals that also migrated into the new temperate grasslands. And as the ice sheets melted, sea levels began to rise more rapidly. The land route into North America seems to have opened at about the same time the route back to Asia began to close once and for all.



Figure 9.11: Clovis spear-points found in Iowa in 1965, dated to about 11,000 BCE.

Archaeologists have found many Clovis sites of about the same age throughout North America, leading them to believe the continent may have been completely explored by Clovis people in as little as 500 years. There's a bit of controversy surrounding the relationship between Clovis people and other groups, because Clovis was discovered first and the discoverers have been reluctant to see Clovis people lose their status as the First Americans. It's unknown, and a source of ongoing debate, how many coastal travelers like those who made the trip down to Monte Verde might have been in the Americas before the Clovis people. But the evidence is mounting that remains like those of *Kennewick Man* and Hoyo Negro Girl are from people who lived in the Americas before the Clovis culture arrived. Some people have even suggested that small groups may have managed to cross the Pacific from Oceania or the Atlantic from Africa. Although these possibilities can't be completely ruled out, DNA evidence shows that most of the ancestors of the early Americans came through Beringia.

The important point is that after countless generations living as hunters in ice age Siberia, Beringia, and Alaska, early Americans quickly adapted their lifestyles to a variety of new American environments. This rapid change may be related to a dramatic drop in large animal populations called the Holocene Extinction. In just about a thousand years, around the time the Beringians entered the Americas, most of the largest mammal species died out. Predators like the Beringian Cave Lion, the Saber Toothed Cat, the Dire Wolf, and the Giant Short-Faced Bear disappeared. Most of the biggest prey species like the Ancient Bison, the Woolly Mammoth, Mastodon, Stag-Moose, and Western Camel also went extinct. Scientists disagree over whether humans caused the die-off through overhunting the animals, or climate change at the end of the ice age eliminated their habitats. In either case, the continent-wide extinction event had dramatic consequences on the people hunting these animals—and also on people who were hunted by them. The disappearance of these species changed the American environment substantially.



Figure 9.12: Smilodon, the saber-toothed cat, lived in North and South America from 2.5 million years ago to ~10,000 years ago.

Luckily for early Americans, there were still plenty of large animals to hunt, even if they weren't quite as big as the ones that had disappeared. The modern bison, although not eight feet tall at the shoulder like its extinct ancestor, still weighs about a ton and its habitat expanded rapidly as ice sheets and melt-water lakes gave way to grassy plains. Smaller quarry for early American hunters included deer, pronghorn, jackrabbits, prairie dogs, and freshwater fish and mussels. The Beringians had brought their dogs with them from Asia, but the only American mammals they were able to domesticate were llamas and their smaller cousins alpaca and vicuña, which they used as pack animals and for their meat, wool and hides. The Americans' lack of large domesticated mammals caused their societies to develop differently from African, European, and Asian cultures that had beasts of burden such as oxen and horses. However, the early Americans quickly found plants they could expertly adapt to their needs.

Agriculture

Farming was once believed to have developed in the Middle East at sites such as Jericho and Mesopotamia six or seven thousand years ago, where the ancestors of modern Europeans (and the men writing the histories) were usually credited with the invention of agriculture. Then, responding to evidence of prehistoric farming in Africa, India, and China, it was suggested agriculture may have developed more or less independently in several regions of the world. But it was difficult to imagine how such parallel development could have occurred, with people in different parts of the world not only making the same basic discoveries but making them pretty much simultaneously. More recently, scientists have begun to suspect this confusion may reflect the difficulty of finding archaeological evidence, since plant materials decay in the ground much more quickly than arrowheads and stone spear points. And some have suggested we may have been thinking about agriculture wrong.

It now seems likely that agriculture began in a very gradual process that goes back much farther than we had imagined, to a time when hunter-gatherers began favoring certain plants, weeding around them to help them grow, and then transplanting their favorites closer to home. This horticulture or part-time farming may have begun before our ancestors began to spread from Central Europe across Eurasia, which would explain the seemingly coincidental parallel development of farming across the globe. Various regions may have each developed their distinctive versions of what we now recognize as agriculture from a deep pool of common techniques. But whatever the original source of their knowledge, Monte Verdians were already experts at finding and using native plants nearly fifteen thousand years ago. And it didn't take long for their descendants to begin selectively breeding native American plants into some of the world's most important staple crops.



Figure 9.13: The gradual development of Teosinte into Maize was accomplished in Central America about 9,000 years ago.

Maize, which we call corn, was developed by Central American natives of what is now Southern Mexico beginning about 9,000 years ago. The Central Americans created the single-stem, large-eared maize plant we're familiar with by very gradually improving a native grass called teosinte. Year after year farmers saved seeds from the best plants with the biggest seed heads. Eventually, after generations of patient improvement these seeds began to look less like grass, and more like what we'd call ears of corn. This process of selective breeding may have taken centuries, and along the way the maize plants lost the ability to reproduce by themselves. Modern corn seeds are trapped on their ears, and most will never germinate unless they're removed by people and replanted. Today, maize is the world's most important food crop. Corn feeds billions of people and domesticated animals and produces a wide range of materials for energy, plastics, pharmaceuticals, and other industries.



Figure 9.14: Potatoes, first developed about 10,000 years ago, are still available in dazzling variety in Andean village markets.

Potatoes are even older than corn. Papas, as they're called in the Andes Mountains, were developed by South Americans over the period from 10,000 to 7,000 years ago, in a high-altitude region of what is now Peru and Bolivia. Even today, markets in many Andean villages still sell hundreds of potato varieties people outside the region have never seen. South Americans bred potatoes for a wide range of uses. Farmers were freeze-drying potatoes for long-term storage thousands of years before these techniques were first recorded by Spanish conquistadors. Potatoes were among the first "New World" products carried back to Spain by the conquistadors. They were widely adopted by European farmers and had solved Europe's recurring famine problem by 1900. British economist Adam Smith called Europe's attention in *On the Wealth of Nations* to the fact that fields planted with potatoes instead of wheat would feed three times as many people. Potatoes remain one of the top five staple foods in the world today.



Figure 9.15: Manioc, domesticated in Brazil nearly 10,000 years ago, is poisonous in its natural form and must be processed for human use.

Cassava trees are native to central Brazil, where they were first domesticated between 10,000 and 7,000 years ago. Although the product of the cassava tree, called manioc, is only familiar to most North Americans as the desert tapioca, the processed roots of this jungle tree are another of the world's top five staple crops. Manioc feeds billions of people in Asia and Africa. But unlike maize and potatoes, the roots of the cassava tree are toxic in their raw form, containing cyanide compounds that must be removed before manioc can be eaten. Processing manioc involves grating, milling, fermenting, drying, and roasting the cassava roots—in various combinations depending on the end-product being produced. So in addition to discovering this food source when they reached Brazil, early Americans had to develop processing technologies to make it useable.

Early American Cultures

Learning to grow and store plant foods in addition to hunting changed everything in the Americas, just as it had in Europe, Asia, and Africa. Nomadic hunter-gatherers who had always followed herds of prey animals began staying in one place, literally putting down roots with the crops they planted. Abundant, regular food supplies allowed populations to grow. Soon people were building the ancient cities whose ruins still amaze us today. Like their cousins in Egypt, India, and Asia, early Americans built remarkable cities. Tiwanaku, located near the shores of Lake Titicaca in the Bolivian highlands, was built about 3,500 years ago. Its 30,000 inhabitants developed a farming technique called flooded-raised field agriculture and covered the hills around the lake with walled terraces. This was an especially impressive achievement since the Tiwanakans were working at some of the highest altitudes ever inhabited by people. The water level of Lake Titicaca is at an elevation of 12,500 feet; the irrigated hills around the lake rise from there.



Figure 9.16: The remains of ancient terraces on Taquile Island, Lake Titicaca, Bolivia.

In the twelve thousand years they were cut off from the rest of the world, early Americans developed a variety of civilizations. Many of these cultures existed simultaneously and trade networks developed that carried items like Upper Michigan copper, New England seashells, and Minnesota pipestone across entire continents. Cities such as Cahokia in Illinois, Machu Picchu in Peru,

Chichen Itza in Mexico, and Pueblo Bonito in Colorado are just a few of the most visible, well-known remains of native cultures. By the fifteenth century, when the Americans would once again encounter their European cousins, the western hemisphere was probably equal to Europe in both population and culture.

Civilizations rose and fell in the Americas, long before the Americans and the Europeans met again in the fifteenth century. The Mississippian culture of North America peaked around 1200 CE, and seems to have collapsed during the Little Ice Age. The Anasazi or Ancient Pueblo culture of southwestern North America seems to have gone into a similar decline during this period of rapid climate change. The Mayan culture of Mexico flourished between about 1800 BCE and 900 CE. There are several theories about Mayan decline, but the consensus seems to include a combination of overpopulation and agricultural collapse, possibly brought on by increased aridity and desertification. In South America, the Inca Empire called itself Tawantinsuyu, or four parts together, referring to the four distinct ecological regions the Inca joined together to form the largest empire in pre-Columbian America. And many continuously successful regions such as the territory occupied by the Triple Alliance (Aztecs) in the fifteenth century had been home to earlier cultures such as the Toltecs (800-1000 CE) and Olmecs (1500-400 BCE) that were conquered or absorbed by the cultures that followed.

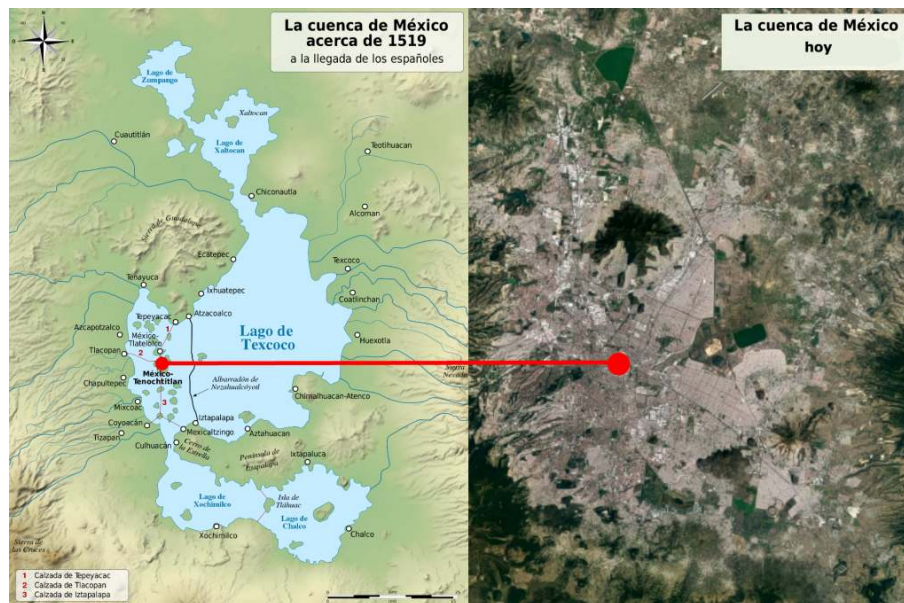


Figure 9.17: Left: Tenochtitlán in Lake Texcoco ca. 1519. Right: Mexico city today.

The Triple Alliance capitals of Tenochtitlán and Texcoco, in the Valley of Mexico, each had more than 200,000 inhabitants when they were discovered by the Spanish. Tenochtitlán was built on an island in Lake Texcoco, and was connected to the lakeshore by a series of causeways. Each of the Aztec cities was larger when the Spanish arrived in the Americas than Paris, London, Rome, Venice or Lisbon. In 1492, the region surrounding Lake Texcoco contained at least a million people. Mexico City, which the Spanish built on the ruins of Tenochtitlán, was America's largest city when the Europeans arrived. It remained America's largest city in 1600, 1800, and 2000.

The urban Aztecs had a lot of people to feed. They farmed using what we might now call intensive gardening techniques. The Aztecs surrounded their island capital of Tenochtitlán with raised planting-beds called chinampas on floating platforms in Lake Texcoco. This technique allowed Aztec farmers to carefully control soil fertility and watering. The Aztecs supported fifteen people per hectare using chinampas in the fifteenth century. Chinese intensive farming, the most successful agricultural technique known in Europe and Asia, supported only about three people per hectare at the same time.

Although North America had seen its share of city-building cultures such as the Mississippians who built Cahokia, Central and South Americans were much more urban than their northern cousins. And they radically changed the landscapes surrounding their cities. In addition to the Aztec chinampas surrounding Tenochtitlán, the Incas built over 6,000 square kilometers of terraced farms in the Andes. Surrounding Lake Titicaca in Bolivia there were another 5,000 square kilometers of terraces—rising from the lakeside elevation of 12,500 feet. Dotting the eastern slopes of the Andes were cities like Machu Picchu, which was also

surrounded by terraces. Many of these sites have been covered and their buildings and terraces torn apart by rainforest trees over the last five centuries, and only recently rediscovered.



Figure 9.18: Machu Picchu from a distance, showing the extensive agricultural terraces surrounding the city.

Even more surprising than finding new cities belonging to known American cultures is the recent discovery that some areas where it was never believed the environment could support large populations have hidden completely unknown cultures. The Beni region of Amazonian Bolivia is now believed to have been home to a culture that built raised islands on the river's floodplain. They connected their island homes with miles of causeways. Although the remains of these earthworks survive, it was assumed they were natural formations until just a few years ago when archaeologists dug into them and discovered they were constructed from the broken shards of old pottery. The earthworks and canals of the Beni still have not been completely mapped.

The Amazon Rainforest has always been considered extremely inhospitable to civilization. The dense jungle simply couldn't feed enough people, it was argued. And if the rainforest was cut down to make space for farms, the region's shallow soils were almost immediately exhausted. But recently, archaeologists have discovered a city called Marajó which was home to over 100,000 people. Marajó thrived on the banks of the Amazon for a thousand years. Instead of the slash and burn agriculture people currently practice in the Amazon, the Marajoara turned the rainforest into an orchard. According to a recent study, the Marajoara grew 138 crops in the forest, more than half of which were trees. And they fertilized their orchards with a charcoal-based supplement called terra preta, which can still be detected in hundreds of square miles of Amazon soils over a thousand years later.

Meanwhile, In Europe

But what about the other Eurasian plains people who had expanded westward, toward Europe? We'll rejoin them in the next chapter, but one interesting change the ancestral Europeans experienced during their westward trek was, they began drinking milk.

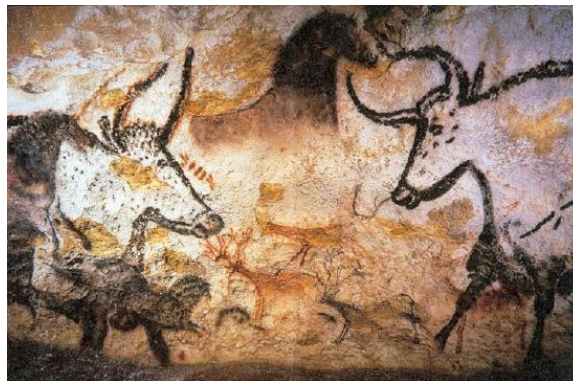


Figure 9.19: Aurochs in cave painting with horses and deer, Lascaux France, painted ca. 17,000 years ago.

Unlike the Americas, Eurasia was home to several large mammal species that people were able to domesticate. One of these species was the aurochs, a grazing animal like a buffalo that stood about six feet tall at the shoulder. The wild aurochs is now extinct. Although at first it was probably hunted for its meat, aurochs were different from other prey animals. Aurochs were a social species and some would accept humans as the leaders of their herds. The aurochs could be bred in captivity, and they gradually lost their fear of people and allowed themselves to be herded. Over time, in exchange for prime grazing lands and protection from predators, aurochs even allowed themselves to be milked. After hundreds of generations, the wild aurochs became domestic milk-cows.

At the same time, some of the people who began keeping cattle developed a genetic mutation that allowed them to digest cows-milk as adults. The ability to metabolize lactose, the sugar compound in milk, after childhood is not shared by most of the world's people. Only Europeans and some Africans can digest lactose. In spite of the fact that cows have been familiar companions since the beginning of recorded history, this is a useful reminder that recorded history covers only a tiny sliver of time. Nearly all of the changes that made Native Americans different from the Europeans they met in the Caribbean in 1492 happened recently, after the Eurasian hunter-gatherers who were our ancestors went their separate ways during the last ice age.

Further Reading

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- David J. Meltzer, *First Peoples in a New World: Colonizing Ice Age America*. 2009.
- Charles C. Mann, *1491: New Revelations of the Americas Before Columbus*. 2005.
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<https://www.theatlantic.com/magazine...3/1491/302445/>

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10: Recontact

We all learned as children that Columbus "discovered" America on October 12, 1492. But as we discussed in the last chapter, important human interactions with the American environment had been going on for millennia when Europeans first made their way to the "New World." In recent years, some historians have retold the traditional story of European exploration with an emphasis on the brutality of groups like the conquistadors. Indian activists have called for boycotts of Columbus Day and Thanksgiving. Our goal here is not to choose sides, but to recognize environmental factors that influenced the course of events. Some of these factors were introduced in the last chapter. The shapes and placement of continents on our planet, and the climate changes surrounding the ice ages influenced the development of civilizations in both Eurasia and the Americas. In this chapter, we'll examine how less obvious environmental factors such as the distribution of animal species and the ways humans changed when they first domesticated animals also had a major impact on history when Europeans began sailing ships across the Atlantic Ocean.

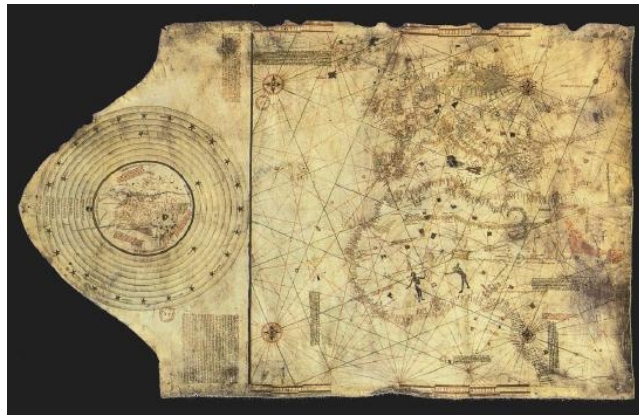


Figure 10.1: Navigational Map drawn ca. 1490 in the workshop of Bartolomeo and Cristoforo Colombo

As you're probably already aware, the 2 AM arrival of Christopher Columbus's little fleet of three ships in the fall of 1492 has been frequently challenged as the first contact between Europeans and the Americas. Some claims of first contact are better supported by evidence than others. One of the best documented happened nearly five hundred years before Columbus's arrival.



Figure 10.2: Site of the Viking settlement at L'Anse aux Meadows, on the northern tip of Newfoundland.

Vikings

At the northern tip of Newfoundland, there's a Canadian Provincial Park called *L'Anse aux Meadows* built on the site of a Viking settlement. The Norse have an old legend that Viking hero Leif Erikson founded a colony in a new land they called *Vinland*. The discovery of the Norse village in 1960 and its acceptance as a UNESCO World Heritage site in 1978 established the Newfoundland colony as the oldest known European site in the Americas, and very probably as the *Vinland* settlement of Norse legends. The

Canadian ruins date from the appropriate period, around 1000 CE. Artifacts found in the remains of eight buildings include farm implements and blacksmith tools. There is also a spinning room containing a soapstone spindle and stone weights that were probably part of a loom. The presence of these artifacts suggests the settlement probably included women, and possibly even families. In other words, the Newfoundland site seems to have been a permanent colony rather than merely a seasonal fishing camp. It was probably an extension of the permanent Viking settlements on Greenland that were the home of Leif Erikson's father, Erik the Red.



Figure 10.3: “Summer on the Greenland Coast circa the year 1000” painted by I.E.C. Rasmussen about 1890, suggests the danger of crossing the North Atlantic in small ships and the tenacity of Vikings sailing in frigid arctic waters.

Norse legends say the Vinland colonists were attacked by vicious natives the Vikings called Skraelings, suggesting the native Newfoundland population resisted the newcomers fairly effectively. The Norse also traded with natives, who were very interested in milk the Vikings offered. Since cattle were not indigenous to North America, the presence of cows-milk in the Vinland settlement is another indication it was a long-term colony rather than a temporary camp. The map below, drawn in 1570 in Skálholt, Iceland, shows Great Britain on the bottom right, Iceland in the center, and on the left Grönlandia (Greenland), Helleland (the land of flat stones), Markland (the land of forests) and Skralingeland, which a note in the text says was close to Vinland (the land of meadows). The forests of Markland would have been especially interesting to explorers from Greenland, because the Norse settlements there lacked trees for building.



Figure 10.4: Skálholt map shows Iceland, Greenland, and several North American regions including Skralingeland, known for its hostile natives.

The scarcity of additional Norse sites and the fact that we’re not all speaking Norwegian remind us that the Vikings failed to sustain their settlement in Vinland. While we can probably attribute this failure partly to the resistance of the Skraelings, another decisive factor was a change in global climate. In the middle of the fourteenth century, a four hundred-year period of global cooling known as the Little Ice Age began. Scientists have measured the effects of this climate change in tree rings as far away as Patagonia. Changes in temperature and weather were noticed and recorded in Mayan and Aztec Chronicles, and also in European paintings depicting Londoners drinking, dancing, and skating on the frozen Thames. Pack ice in the North Atlantic expanded southward, making travel to America much more difficult and dangerous. Greenland’s glaciers advanced and shortened growing seasons

threatened the five hundred year-old Viking settlements there. By the early 1400s the Norse had abandoned these settlements, and without Greenland it was impossible to sustain a colony in Vinland. This 1747 map of Old Greenland mentions that the coastline where settlements had once been located had become “inaccessible” due to “floating and fixed mountains of ice.” The map even includes the location of a legendary strait that was believed to have once allowed travelers to sail through the center of the continent to North America, but had become “shut up with ice.” It’s interesting to speculate what American history would look like today, if the Vikings hadn’t been defeated by Skraelings and climate change.



Figure 10.5: This 1747 map of “Old Greenland” includes a legendary straight passing directly through the landmass believed to have once been open to ships, “but now they are shut up with ice.”

Fishermen

Even during the Little Ice Age, Europeans continued to venture into the icy Atlantic and many probably sailed most of the way to the new world. Basque fishing fleets, for example, began crossing the North Atlantic to visit the Grand Banks in the middle of the fifteenth century. The Banks are areas of shallow water on the edge of the North American continental shelf which are warmed by the Gulf Stream. These warm, shallow waters are an ideal home for bottom-dwelling species like Cod and Lobster. Whoever first discovered the rich fisheries of the Grand Banks off Newfoundland and Georges Bank off Cape Cod, by the late 1400s thousands of Europeans were crossing the ocean to take advantage of the bounty. Venetian explorer Giovanni Caboto (who Anglicized his name to John Cabot) reported in 1497 that Grand Banks cod were so abundant that you could almost walk across the water’s surface on their backs.



Figure 10.6: Atlantic cod once attracted Europeans to the Grand Banks and Georges Bank, on the edge of North America.

Cod had been fished in the North Atlantic at least since the period of Viking exploration, 800 to 1000 CE. The Vikings and the Basques used similar techniques, catching fish close to shore and then drying them on wooden racks assembled on nearby beaches. They probably landed regularly on the coastlines near the fishing grounds, to dry fish and to replenish their supplies of fresh water. While the locations of prime fishing grounds were closely-guarded trade secrets, by the late 1400s the Portuguese had found out and had begun sending their own fleets to the Grand Banks. Salted Cod is still an important element of Portuguese cuisine, although nowadays they get their fish from Norway.

Until their defeat as part of the Spanish Armada in 1588, Portugal was a North Atlantic naval power. And in the early 1480s, Christopher Columbus was a sailor on the West African coast, where he regularly visited the Portuguese trading post at Elmina.

Columbus's home base was in Lisbon, and his wife was Filipa Moniz Perestrelo, the daughter of the Portuguese governor of Porto Santo, an island off the Atlantic coast of North Africa. It's very possible that Columbus first heard of the new world from Portuguese sailors retelling the stories of Basque fishermen.

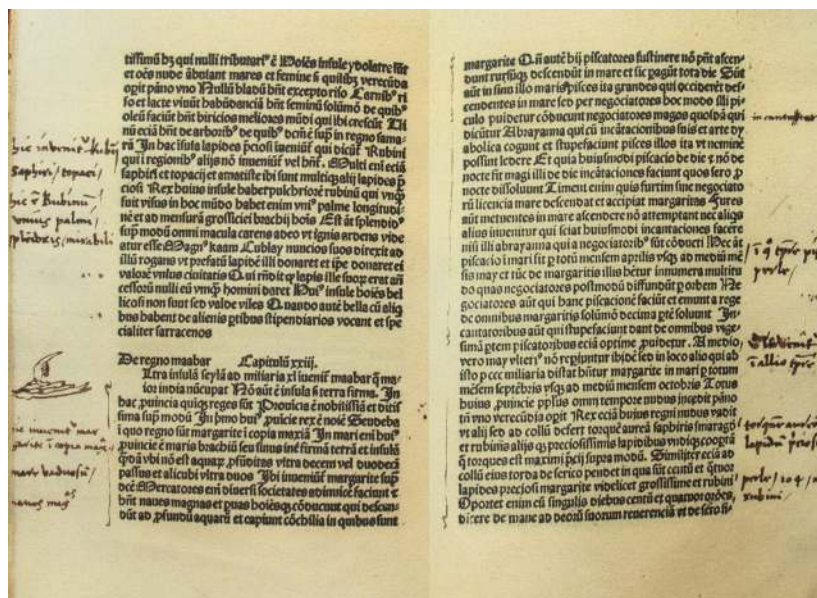


Figure 10.7: The Travels of Marco Polo, printed by Gutenberg, with Christopher Columbus's handwritten notes in the margins.

By the end of the fifteenth century, Europe was recovering from the Black Death that had killed between 100 and 200 million people 150 years earlier. Fish from the Grand Banks helped feed growing populations, and Europe entered a period of economic and cultural growth we know as the Renaissance. Merchants were reminded of the existence of wealthy empires in India and China, and began taking advantage of trade routes such as the Silk Road. German blacksmith Johannes Gutenberg developed a printing press, which allowed Christopher Columbus to read The Travels of Marco Polo as a young man in Genoa. The Italian learned to sail and became a navigator working the Atlantic coast of Africa. In 1492 Columbus convinced the monarchs of a newly unified Spain to finance a mission to discover a sea-route to China. King Ferdinand of Aragon and Queen Isabella of Castile had just combined their kingdoms and their armies and completed the "Reconquista," driving the Muslims out of the Iberian Peninsula after nearly 800 years of war. It is vital to our understanding of Spanish America to remember that the new Iberian nation that turned its attention to exploration in 1492 had been at war constantly since the dark ages.

As you would expect, it's very difficult to be certain about the exact population of the world at the end of the fifteenth century. There are a number of competing estimates, but the consensus is that there were probably about 500 million people alive in 1492, and that slightly over a third of them lived in Asia. The other two-thirds seem to have been about evenly split between Europe, Africa, and the Americas – although there's still a great deal of controversy surrounding those numbers. Even so, if we take a conservative number from the middle of the range of estimates, we get an American population of 80 to 100 million just before Columbus and his fellow explorers arrived. All but 2 or 3 million of those Native Americans lived in Central and South America, which were much more densely populated than North America.



Video 10.1: Maps & Bias: <https://www.youtube.com/watch?v=BZOCogf1t2A>

The Columbian Exchange

Columbus arrived in the Caribbean in October 1492 and explored until late December. His flagship, the Santa Maria, ran aground on Hispaniola on December 25th and had to be abandoned. With permission of the local chief, Columbus left 39 sailors behind in a settlement he named La Navidad. He returned to Europe with two ships, a few Indians, some gold, and specimens of native species including turkeys, pineapple, and tobacco. Arriving in Barcelona in mid-March, Columbus was celebrated as a hero.

It is often mentioned that Columbus believed he had reached Asia, and he did make that claim in his extravagant “Letter on the First Voyage.” But this letter was the explorer’s report to his royal sponsors, and he wanted very badly to be sent back again. Columbus wrote “Hispaniola is a miracle...both fertile and beautiful...the harbors are unbelievably good and there are many wide rivers the majority of which contain gold.” Whether or not Columbus understood he was reporting on previously unknown lands, he definitely got people excited about the places he had visited.

When other European explorers reached America they were equally amazed. People throughout Europe read exciting traveler’s accounts like Amerigo Vespucci’s 1504 best-seller, *Mundus Novus*, which actually coined the term New World and made it clear for anyone who might still be confused, that these lands were not Asia but a previously unknown continent. Like Columbus, the explorers carried back to Europe not only stories of wealthy civilizations and legends of cities of gold, but samples of native plants, animals, and captive Indians. And when Columbus himself returned to the Caribbean, he brought with him European plants and animals that he transplanted into the promising new environment.

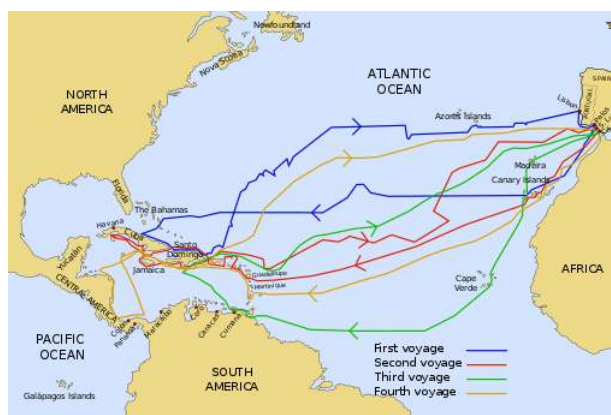


Figure 10.8: Columbus visited the Caribbean in 1492, 1493, 1498, and 1502, before dying in Spain in 1504.

Europeans realized not only that American food crops could be brought back to Europe, but also that the Americas were a great place to grow many of Europe’s traditional foods. Columbus returned to the Caribbean in 1495 with 17 ships, 1,200 men, and according to his diaries, “seeds and cuttings for the planting of wheat, chickpeas, melons, onions, radishes, salad greens, grape vines, sugar cane, and fruit stones for the founding of orchards.” Other old-world crops that thrived in the Americas included coffee

and bananas, which were brought from the Canary Islands in 1516. The Spanish had introduced sugar cultivation to the Canary Islands in the early fifteenth century, so it only made sense to try the plant in the tropical paradise their explorers had discovered across the Atlantic. Cattle were delivered to Spanish conquistadors in Mexico in 1521. By 1614, according to one of the conquistador chronicles, “the residents of Santiago [in Chile, over 4,000 miles away] possessed 39,250 head,” as well as flocks totaling 623,825 sheep. According to local traditions, when Pizarro first invaded Peru in 1524, he crossed the Andes with only eighty fighting men and forty horses, but with over 2,000 pigs.

Most of the really significant Eurasian species brought to the Americas had already been introduced by the Spanish by the early 1500s, long before North American settlement began. Even species like the wild horses of the American West that would transform Plains Indian culture were escapees from the herds of the conquistadors. As mentioned earlier, the Americas were home to very few large mammal species, and most could not be domesticated. Domestication is only successful with social animals that will accept a human as the leader of their herd or pack. Nearly all the species humans have successfully domesticated, the familiar residents of the modern farmyard, originated in Europe and Asia. These include goats, sheep, cows, horses, pigs and chickens. Eurasians began domesticating these animals between ten and fifteen thousand years ago. This was just a little too late for the Beringians to bring domesticated animals with them into North America. In any case, the Beringians were tundra hunters, not temperate-zone pastoralists. But as any good hunter would, the Beringians had brought their dogs.

Historians call the transfer of plants and animals that began with fifteenth and early-sixteenth century European-American re-contact the Columbian exchange. The directions of these transfers and their effects on the environments and people of Europe and the Americas shaped the modern world we live in. American maize, potatoes, and cassava fed growing European and Asian populations, allowing the building of new cities and industries. European animals such as pigs, sheep, chicken, and cattle thrived in the Americas, allowing both Natives and Europeans to expand and change their cultures. But the most significant change of all was the largely accidental transfer of viruses and bacteria from Europeans to Americans, which caused the deaths of possibly 90% of the native American population.

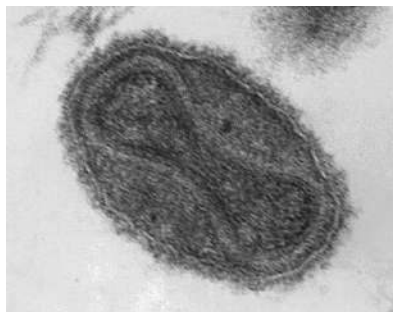


Figure 10.9: Variola major, the smallpox virus, magnified 370,000 times using an electron microscope.

When prehistoric Eurasians began living in close contact with the species they domesticated, the people changed as well as the animals. We’ve already noted how Europeans and some Africans developed a mutation that allowed them to digest cows-milk. Another change domesticated animals brought to humans, which was largely unrecognized by historians until recently, was disease. Most of humanity’s major diseases originated in animals and crossed from domesticated species to their human keepers. Whooping cough and influenza came from pigs; measles and smallpox from cattle; malaria and avian flu from chickens. The people who domesticated these species and lived with the animals for generations co-evolved with them. Animal diseases became survivable when people developed antibodies and immunity. Without inherited this protection, even a routine childhood disease such as chickenpox would be devastating.

Population Disaster

The introduction of a disease into an area without immunity is called a virgin soil epidemic. Such epidemics had happened in Eurasia, when the Romans spread smallpox into the populations they conquered, and in Europe when the expanding Mongols introduced bubonic plague. The Black Death killed probably half the population of Europe in the fourteenth century, reducing world population by over a hundred million. Virgin soil epidemics happened in the Americas when explorers and colonists introduced Eurasian diseases to native Americans who had been isolated for thousands of years. The Americans had no immunities, and even diseases that were no longer deadly to Europeans killed millions. The Eurasian diseases that attacked native populations

included smallpox, measles, chickenpox, influenza, typhus, cholera, typhoid, diphtheria, bubonic plague, scarlet fever, whooping cough, and malaria.

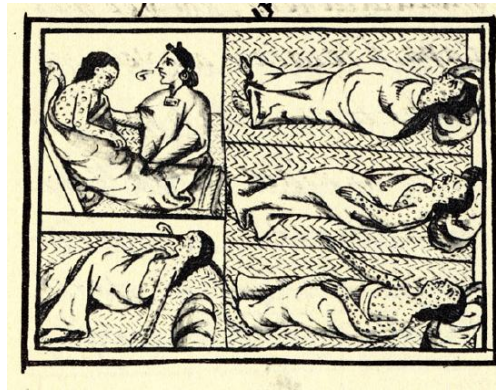


Figure 10.10: Illustration from the Florentine Codex, ca. 1540, showing Aztecs suffering from smallpox and transmitting the disease by coughing.

The impact of these Eurasian diseases on Americans was one of human history's most severe population disasters. Even the Black Death didn't kill as large a percentage of Europeans. For example, there were probably a million people living on the Caribbean island of Hispaniola in 1492 when the Columbus left his 39 sailors in La Navidad. By 1548, there were only 500 Natives left alive. The populations of other Caribbean islands were similarly wiped out. Whole civilizations disappeared, but this was not only a tragedy for the cultures that vanished. It began a cycle of violence that became central to American history. Because once there were no natives left to work on European sugar plantations, African slaves became crucial to the survival of the West Indies economy.



Figure 10.11: 1524 map of Tenochtitlán, newly conquered by Cortés and renamed Mexico City.

The greater population densities of Central and South America helped contagious diseases spread more quickly there. Heavily traveled roads in central Mexico actually spread disease beyond the areas that had been reached by Spanish explorers. Cities were wiped out that had never seen a white man. The population of the Aztec heartland dropped from about 25 million on the eve of the Spanish conquest in 1519 to just under 17 million a decade later. That means one out of every three people died in just ten years. After another decade the Aztec population was reduced to about 6 million. Three out of four people in the Aztec world disappeared in 20 years. Imagine writing a list of all the people you know, and then randomly crossing off three out of every four names.

By 1580, the Aztec empire had been hollowed out to less than 2 million people, from a starting point of 25 million. Isolated rural communities may have been a little luckier than central cities on trade routes, which were often completely emptied. The city of Zempoala, for example, held 100,000 Aztec citizens in 1519. There were only 25 native inhabitants in 1550.



Figure 10.12: Hernan Cortés's 1521 conquest of Tenochtitlán has traditionally been depicted as a heroic victory for Spain. Actually, Cortés was defeated and driven from the city. He only succeeded after a 2-month long smallpox epidemic weakened the Aztec defenders.

The Inca Empire in the Andes suffered the same fate. 90% of the South Americans died, and they started dying before the white men arrived, which caused confusion and dismay. When Pizarro crossed the Andes with his eighty conquistadors and 2000 pigs, he found social chaos. Huayna Capac, the Inca leader who had extended the empire into Chile and Ecuador, had died of smallpox. His two sons fought a brutal civil war for control of the empire, the younger son Atahualpa finally defeating and assassinating his older brother Huáscar. The war and the weakness of the reduced Inca population gave Pizarro the opportunity he needed to capture and kill Atahualpa in 1533, ending the Inca empire.

Hernando De Soto landed an expedition in Florida in 1539 and explored territory now in the states of Georgia, South Carolina, North Carolina, Tennessee, Alabama, Mississippi, and Oklahoma. Everywhere he went, the conquistador reported the land was "thickly settled with large towns." De Soto didn't stay. He died of fever in Louisiana in 1542, and the region wasn't visited again by Europeans until the French aristocrat, La Salle, traveled down the Mississippi River in 1670. Where De Soto had seen fortified towns, La Salle saw no one. The entire region was empty, and the French explorer traveled hundreds of miles without passing a single village. Historians were unaware until recently that the American south had once been heavily populated with natives before the arrival of contagious Spanish explorers and missionaries.

The destruction of native empires and the rapid disappearance of the American population was unplanned. The overwhelming success of the conquistadors was an unanticipated consequence of re-contact between two isolated descendant groups of the Eurasian plains hunters we discussed in Chapter One. Sixteenth-century Europeans had virtually no understanding of the causes of disease. They had no idea that exploring the Americas or carrying their animals to the New World would eliminate nine out of ten people in a population that had been the size of Europe's. But they knew how to take advantage of their enemy's misfortunes. The rapid destruction of American populations and cultures created opportunities for Europeans to colonize the Americas that they wouldn't have otherwise enjoyed. We'll take a closer look at this colonization in Chapter Three. But in the meantime, what happened to Europe?



Video10.2: Charles C. Mann: *The Impact of Europeans on America*. <https://youtu.be/Dcoz2tQc8-w>

Pieces of Eight

As previously mentioned, American staple crops were introduced in Europe, where they sparked a population boom. Many plant species developed by Americans are still crucial to the world economy, including not only maize, potatoes, and cassava, but tomatoes, sweet potatoes, cacao, chili peppers, natural rubber, tobacco, and vanilla. Quinine, a medicine made from the bark of the Peruvian cinchona tree, was effective treating malaria and helped open the tropics to European colonization. Eurasian plants like sugar, soybeans, oranges, bananas, and rice (which probably reached America from Africa along with enslaved women who were experts growing it) were also extensively cultivated in the Americas for shipment back to European markets. Exports of native and transplanted crops helped feed growing cities and freed up workers for Europe's new industries. Without American foods, there might have been no European industrial revolution.

The other American product rapidly sent across the Atlantic to Europe and across the Pacific to Asia was money. Although Europeans never found El Dorado, the legendary Indian city of gold, they did find a fair amount of gold. And they found even more silver. For example, the Bolivian city of Potosí, located in the Andes mountains at an elevation of 13,420 feet, is said to be the world's highest city. Potosí was established by the Spanish in 1542 on the site of a long-standing native mining village at the foot of the Cerro Rico, which is a literal mountain of silver. Potosí has a current population of about 165,000. That's almost identical to Potosí's population in 1660, when the mining city was larger than Seville, Madrid, or Rome, and when the combined population of all the North American colonies was only about 75,000. Spanish silver coins often called "pieces of eight" from the Cerro Rico and similar mines in Zacatecas, Mexico, were so plentiful that they became the international currency of Europe and much of Asia. Once again, without the money minted in Latin America, there might have been no global commercial boom to finance the industrial revolution. And Potosí's story isn't over yet. Although most of the silver was taken out of the mountain centuries ago, the Cerro Rico is still being worked by Bolivian children whose story is told in the award-winning documentary, *The Devil's Miner*, which you can view on the web if you're interested in learning more.



Video 10.3: The Devil's Miner Clips: <https://youtu.be/Mjs3ktoabF8>

As a result of the Columbian exchange, European colonists in the Americas frequently found fields waiting for their farmers and herds of game animals waiting for their hunters. In Central and South America, the Spanish built cities like Mexico City and Cusco right on top of the native cities they replaced. Since Spanish colonists were generally soldiers and very few Spanish women came to the early colonies, there was a lot of racial mixing. Most of the countries of Latin America are built on mixed or mestizo populations; so much so that it became important for the colonists to try to make distinctions between all the various types of people they believed made up their societies. Although these distinctions were initially used to uphold the power of the group at the top, in the long run many of these Euro-American populations have developed strong ethnic identities. A similar process happened to our north, in New France. There were only about twenty-five hundred French people in Quebec by 1663. Most of them were voyageurs, fur traders who went into the northern forests to make their fortunes. Voyageurs married local Indian women, and their Canadian descendants are now recognized as a distinct ethnic group called Métis.



Figure 10.13: An 18th-century Spanish “Casta” painting describing different varieties of racial mixing and suggesting the social consequences.

In the Dutch and English colonies that became the United States, the races kept mostly separate. Many settlers migrated with their entire families to settle the British colonies. But the racial segregation that developed in the colonies that became the United States was not inevitable. If the people who had settled the US had mixed more with the natives, genetically and culturally, would our culture and our relationship with our environment have been different?

Changing History

History changes when new evidence and new interpretations challenge long-held beliefs. But the process isn’t always easy. Historian Alfred W. Crosby first addressed the idea that disease was a factor in American history in a 1967 journal article called “Conquistadors y Pestilencia.” Crosby later said he “stumbled into environmental history through the backdoor of epidemiology.” Of course, there was no such field when he wrote, and Crosby helped create it.

“Conquistadors y Pestilencia” re-examines the Spanish conquest. “How did Hernán Cortés do it?” Crosby asked. “Well, he didn’t. Old World smallpox did.”

“When the isolation of the Americas was broken, and Columbus brought the two halves of this planet together, the American Indian met for the first time his most hideous enemy – not the white man or his black servant, but the invisible killers which these men brought in their blood and breath,” Crosby wrote in 1967. Over the next couple of years, Crosby expanded the article into a book whose title became the accepted name of this phenomenon: The Columbian Exchange.

Crosby tried for several years to interest publishers in his radical thesis, without success. He sent the manuscript to a dozen academic presses. The most memorable rejection letter Crosby received consisted of a single word, “Nonsense!” Crosby finally landed an unlikely publisher in 1971 when an antiquarian reprint press asked if he had anything book-length he’d like to see in print. The Columbian Exchange was published in 1972.

Reception of the book was favorable, although some of the reviewers failed to grasp Crosby’s point. One review in a major historical journal described disease decimating both old world and new world populations. Crosby didn’t say this, and it wasn’t true of the biological exchange he was writing about. Epidemics had indeed decimated European and Asian populations in the past. But not following 1492. The only disease that may have crossed from the new world to the old, Crosby had claimed, was syphilis. Although a killer, syphilis wasn’t immediately fatal, and it did nowhere near the damage to Europe that smallpox, plague, and other Eurasian diseases did to native American populations.

Over time, Crosby’s thesis attracted historians interested in biological and ecological issues, and The Columbian Exchange became one of the founding texts of a new field. Unlike mainstream historians, many of whom rejected the pessimistic conclusion of Crosby’s book, environmental historians were willing to consider the possibility that the Columbian exchange was not over. Crosby claimed the events of the sixteenth century were “simply an early phase in a slide toward worldwide biological homogeneity,” and that this process is “continuing, even accelerating.”

Further Reading

- Alfred W. Crosby, The Columbian Exchange: Biological and Cultural Consequences of 1492. 1972.
- Shawn William Miller, An Environmental History of Latin America. 2007.

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11: Colonial North America

The first European nations to establish themselves in the Americas in the sixteenth century were Spain and Portugal. Between the 1490s, when exploratory missions began in earnest, and 1588, when the Spanish Armada was defeated by the English navy, the Iberians ruled the Atlantic. As already discussed, Christopher Columbus was working for the Spanish when he established the first Euro-American settlement since the Vikings at La Navidad in 1492. His brother Bartolomeo founded Santo Domingo, also on Hispaniola, in 1496. In 1500, settlements were begun at Nuevo Cádiz and Santa Cruz, in what is now Venezuela. Hernán Cortés landed at Veracruz in 1519 and began his conquest of the Aztec Empire, and Francisco Pizarro crossed the Andes to take on the Incas in 1532. Although the conquistadors didn't understand the causes of the epidemics that decimated native populations, they had a strong belief in their own prowess and in their divine mandate. Portugal explored Newfoundland and Labrador (which is actually named after Portuguese explorer João Fernandes Lavrador), as well as Brazil, where they gained a permanent foothold. In 1502, a Portuguese expedition arrived at the bay of Rio de Janeiro. Among the crew in this expedition was a Florentine named Amerigo Vespucci, who published his bestseller *Mundus Novus* in 1504.



Figure 11.1: This 1899 image of “The First Thanksgiving, 1621” has both the Pilgrims and their Indian guests wearing inappropriate costumes. (Public Domain; Jean Leon Gerome Ferris).

Given the prominence of Italians such as Columbus, Cabot, and Vespucci among the explorers, why were Spain and Portugal first to colonize the new world? It's true they had sea power; but they also had a license. In 1494, Spanish-born Pope Alexander VI presided over the Treaty of Tordesillas, which divided the western hemisphere between Spain and Portugal. The Pope split the globe at 47.37 west longitude and gave everything west of that line to the Spanish and everything east of it to the Portuguese. As long as Europe remained united under the Catholic Church, people obeyed the Papal edict. The Protestant Reformation began in the first decades of the 1500s, sparking a series of wars between Catholics and Protestants. But it wasn't until nearly a century later that Protestant European nations became strong and unified enough to look west. The defeat of the Armada in 1588 was a turning point for seagoing Protestants. As soon as they were able, the English and Dutch sent explorers. The Catholic French, who had been left out of the original Papal planetary division, took advantage of the lapse of the Roman decree and did the same.

Although it is reasonable to suspect that European fishermen had been visiting the shores of northern regions near the Grand Bank fisheries for generations to dry their catches of cod and replenish their drinking water for the trip home, the first successful permanent European settlement on the North American coast was St. Augustine, established in 1585 in the Spanish colony of La Florida. The French followed nearly two decades later, building a fort in 1604 at Port Royal in what is now Nova Scotia and establishing Quebec in 1608. The English had tried settling people on Roanoke Island in 1588, but the colony had mysteriously disappeared by the time resupply ships returned to the area a few years later. The settlement may have been overrun by local Indians, but it is also possible that the abandoned colonists went to live with the natives when their food ran out and help failed to arrive from England. Throughout the early history of the English settlement, colonial authorities regularly tried to counter stories of poor English colonists choosing to live with the Indians with frightening tales of captivity and redemption. After losing both their people and their entire capital investment at Roanoke, the English tried settling the Chesapeake Bay region again in 1607. The Virginia Company, a joint stock company chartered by King James I in 1606, sent two expeditions to the explore the coast of North

America between the Spanish and French settlements. One established Jamestown forty miles inland on the James River; the other established the unsuccessful Popham Colony on the Kennebec River in Maine.



Figure 11.2: The *Universalis Cosmographia*, a wall-map printed in 1507 by German cartographer Martin Waldseemüller, was the first document to use the term America in honor of Amerigo Vespucci. (Public Domain; Martin Waldseemüller).

Between the Virginia Company's two colonies, the Dutch planted their first settlement at Fort Nassau in 1614, on the Hudson River near Albany, New York. Unlike England, Holland was also very active in South America, capturing a large portion of northern Brazil from the Portuguese and in 1600 conquering the Spanish city of Valdivia, on the remote Pacific coast in what is now southern Chile. Holland and England also competed in the Caribbean. Because the West Indies did not subsequently become part of the United States, the history of the Caribbean region is often left out of American history books. As we will see, this lapse is unfortunate. Trade with fellow Englishmen on islands such as Barbados, established in 1627, was a key to the survival of British colonies on the North American mainland.

Virginia and New England

The coastline where the Chesapeake expedition of the Virginia Company first landed was already occupied. Although disease in the century since first contact with Europeans had reduced populations in coastal North America (as shown in Charles C. Mann's brief video included in the previous chapter), Indians lived in villages fortified with high palisade walls. To avoid direct confrontation, the English chose an unoccupied piece of swampy ground upriver that the Indians had shunned. Jamestown was plagued with mosquitoes and other pests, but at least the natives didn't attack immediately. This was lucky, because the Virginia Company had sent a party consisting almost entirely of gentlemen. There were few soldiers and no farmers or tradesmen in the first settlement, since the had English expected to become rich trading with the natives. Even when they discovered there was no easy treasure to acquire, the Jamestown colonists still showed no interest in farming. As a result of their lack of preparation and stubbornness, 82 of the original 120 colonists died in the first nine months.

The English always remained acutely aware of the native presence, however. Indians are prominent on the 1624 map in Figure 11.3, which labels the land upriver as Powhatan territory and includes an illustration of Chief Powhatan sitting in his long-house and a formidable-looking Indian warrior. Powhatan commanded an effective army, which went to war with the colonists from 1610 to 1614. The chief's brother Opechancanough led in two wars against the English colony after the Powhatan's death in 1618. Chief Powhatan's daughter Pocahontas, whose marriage to Englishman John Rolfe had guaranteed the peace between the Indians and English, had died of disease a year earlier in London. Opechancanough's first war began in March 1622 when the Indians struck without warning, killing one third of the English settlers. The Indians, who lived in settlements that shifted with the seasons, apparently expected their opponents to move their colony to a new region, but this was not consistent with European ideas about land tenure. The colonists raided Indian settlements and burned native cornfields every summer for the next ten years and completed a six-mile long palisade in 1634 to protect the Virginia Peninsula. A peace treaty was negotiated in 1632, but a third

Powhatan war broke out in 1644 which ended only when the 92-year old chief, Opechancanough, was captured and assassinated in Jamestown.



Figure 11.3: Captain John Smith's 1624 map of Virginia, identifying the territories of various Indian tribes and featuring a formidable-looking Indian warrior on the right and an inset showing Chief Powhatan in his longhouse on the left. (Public Domain; Captain John Smith).

Although they had originally been aiming for the Carolinas, the Pilgrims arrived on Cape Cod in November 1620. Our Thanksgiving traditions memorialize the fact that the Pilgrims were unprepared for the severe climate they encountered, and nearly didn't make it through their first winter. But the stories don't always explain why the Pilgrims were so surprised by the frigid conditions of their new home. Part of their confusion was caused by popular reports such as Captain John Smith's bestseller, *The Generall Historie of Virginia*, New England, and the Summer Isles, which enthusiastically described the region as temperate and bursting with abundant sources of food available with little effort. The New England coastline where the English, French, and Dutch landed was at the same latitude as Southern Spain, and the British colonies in Virginia were at the same latitudes as North Africa. Seventeenth-century Europeans, unaware that warm ocean currents were responsible for the temperate conditions they enjoyed on the northeastern edges of Europe, mistakenly believed that latitude determined climate. This misconception continued until the 1770s, when Benjamin Franklin's Chart of the Gulf Stream (above) was first published in Europe and the American colonies. Note that Franklin includes the locations of George's Bank and the Grand Banks on his map. These fishing grounds remained of vital interest to both Americans and Europeans, and were actually mentioned in the treaties that concluded the Seven Years (French and Indian) War and the American Revolution.

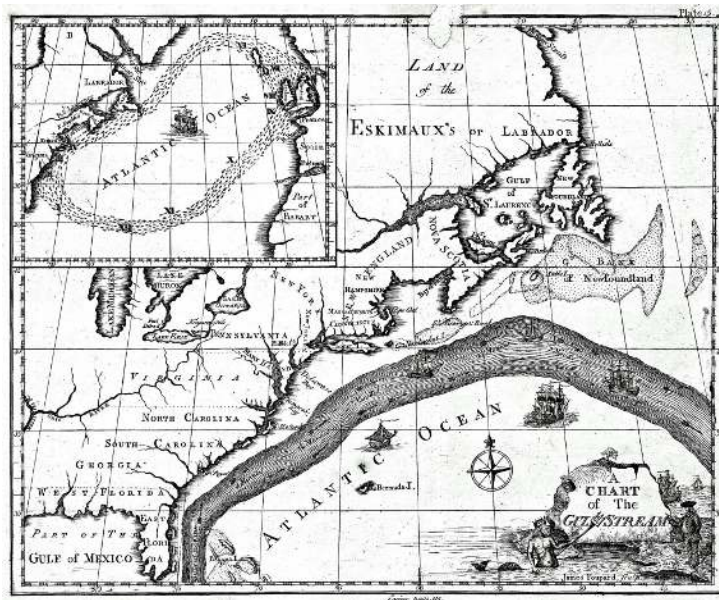


Figure 11.4: Benjamin Franklin's 1775 map describing the Gulf Stream for the first time. Note the inclusion of the Grand Banks and George's Bank fisheries, which were still vitally important to the economies of the colonies and their English rulers. (Public Domain; Benjamin Franklin).

The Puritans received a royal charter to establish a separate Massachusetts Bay Colony, and founded Boston in 1630. Between these two well-remembered dates, Peter Minuit established the Dutch colony of New Amsterdam in 1626 by purchasing Manhattan from Lenape natives who did not own or even actually live on the island. According to tradition, Minuit paid the Lenape with a trunk of trade goods said to be worth 60 guilders, or \$26 in modern money. While the facts of this story are probably true, calling this transaction a purchase ignores important cultural differences that affected the ways the parties understood the sale. Indian ideas of land ownership were much more fluid than those of the Europeans, and they probably perceived the trunk of goods as a symbolic gift rather than as a purchase payment. This type of misunderstanding recurred frequently and led to land disputes throughout early American history. William Penn is similarly remembered as purchasing the land that became Pennsylvania from the Lenape people who lived there, although in fact Penn traced his ownership of a tract of land including the entire state of Pennsylvania and most of Delaware to a personal grant from King Charles II, in repayment of political and financial debts the king owed Penn's father. The territory of New Amsterdam claimed by Holland was ceded to British control in 1674 and renamed New York after King Charles II's younger brother, who was known as the Duke of York until he became King James II of England. In the image of the 1660 Dutch town below, a windmill is visible just above the battery fortress. A canal extends toward the city wall that became Wall Street on the right, with pastures and farms expanding northward beyond it.



Figure 11.5: 1772 depiction of William Penn's "purchase" of Pennsylvania from the Indians. In fact, a territory larger than the current state was given to Penn personally by the King of England in repayment of a political debt. (Public Domain; Benjamin West).

Due to the long delay between the initial exploration of the Americas by the Spanish in the late 1400s and early 1500s and the establishment of English colonies in North America, English settlers sometimes brought back to America plants and animals they didn't realize were actually from the Americas. For example, when Scotch-Irish farmers were recruited to settle the New England frontier, they brought with them the seed potatoes (originally an Andean staple crop) that became a commercial crop in Maine. Turkeys, carried to Europe by Columbus and bred into varieties such as the "Black Spanish", were reintroduced in the English colonies a century later and crossed with wild native birds, resulting in a range of heritage breeds leading to the commercial turkeys of today. Europeans also discovered valuable North American species such as the beaver which became an important item of trade, especially in New France. Beaver felt was used to make hats for fashionable Europeans, and control of the beaver's habitat became an important element in territorial negotiations between the European nations claiming the New World.



Figure 11.6: The Dutch town of New Amsterdam in 1660. Note the windmill and canal. (Public Domain; Jacques Cortelyou).

Although they were delayed by events in Europe and began establishing serious colonies nearly a century after the Spanish and Portuguese, late arrival often worked to the North American colonists' advantage. In many cases, colonists found abandoned settlements, open fields waiting for their farmers, and park-like forests filled with game for their hunters. Disease, which had traveled much more quickly through the densely populated south, had finally struck in the north. Native populations in the coastal northeast were devastated by an epidemic that raged from 1617 to 1619, killing 95 percent of the Abenaki people and over 90 percent of the Massachusetts tribe. This emptying of the land was seen by English settlers as a gift of divine providence. Puritan minister Cotton Mather wrote that "The Indians of these parts had newly...been visited with such a prodigious Pestilence; as carried away not a Tenth, but Nine Parts of Ten (yea, 'tis said Nineteen of Twenty) among them...So that the Woods were almost cleared of those pernicious Creatures, to make Room for better Growth" (*Magnalia Christi Americana*, 1702). English colonists had

not deliberately wiped out the natives, but they were quick to take advantage of the open land and social chaos caused by the ongoing Columbian exchange.



Figure 11.7: 90% to 95% of Abenaki and Massachusetts Indians died in epidemics from 1617 to 1619, just before the arrival of English colonists. (Public Domain; Abenakis).

Not only were populations decimated and cultures thrown into chaos, but political and military balances were upset throughout the area of European settlement. For example, Squanto, the good Indian of our Thanksgiving tradition, was a member of the Patuxet tribe who had been kidnapped as a child by an English captain and sold into slavery in Spain. Squanto escaped and after many years made his way back to his homeland, only to find that his entire village had been wiped out by disease and that a new English village, Plymouth, had been erected on its ruins. Squanto's family and all his allies were dead, leaving him without a home and without support against his village's traditional enemies. Squanto, who had learned to speak English while a slave in Europe, allied himself with the Pilgrims and helped them survive their first winter partly because he had nowhere else to go. We shouldn't underestimate the social chaos caused by the deaths of more than nine out of ten people in the native world, especially when we're trying to understand why Indians reacted as they did to European colonists.

Land Management

Native Americans had lived in the areas Europeans colonized for about 11,000 years, since the glacier covering New England and the Great Lakes had retreated at the end of the last ice age. The natives had techniques and traditions that some Europeans studied closely. But for many settlers, Indian practices seemed strange and uncivilized. One reason Europeans misunderstood Native culture was that it was very different from European culture, especially in the way the Americans used the land and its resources. Unlike the urban empires the Spanish had found in Central and South America, many North American Indians lived in small, mobile communities. In what became the mid-Atlantic colonies and southern New England, natives didn't build cities. They moved with the seasons, from winter hunting grounds where they lived in single-family wigwams to summer farmlands where they occupied communal long-houses. In the spring, when fish species like shad and alewife were running upstream to their spawning grounds, coastal natives congregated around streams and rivers. From October to March, Indian men went into the deep forest to hunt beaver, caribou, moose, deer, and bear. The natives had no livestock, since most of the large mammals of North America had disappeared in the Holocene Extinction, leaving no species susceptible to domestication. So women gardened while men hunted and fished.

The crops Native American women cultivated are called the three sisters. Maize was planted in hills rather than rows. Beans planted around the maize plants climbed the cornstalks and their roots converted nitrogen from the air, enriching the soil. Squash or pumpkins planted between the hills shaded the soil and held back weeds. These intensively gardened plots were called tangles, and they produced remarkably high yields per acre. After a year or two of gardening in one location, native women would shift their plantings to another field, allowing soil fertility to recover naturally.



Figure 11.8: This 2009 commemorative coin recognizes the three sisters of Indian agricultural tradition and the role of women in farming. (Public Domain; United States Mint).

In the forests, North American natives regularly burned the understory to encourage new growth. Fire kept the forests open and created what ecologists call the edge effect, attracting game animals and boosting their numbers by providing abundant food. The hunters' paradise Europeans wrote so frequently about in promotional tracts to lure investors and settlers to the new world was neither a providential accident nor a natural feature of the land. Instead it was the result of deliberate native land and game management. But because most European settlers did not understand the ecology of their new home or native practices, many colonists believed Indian men were lazy and expected their women to support them. Indians, for their part, did not understand why Englishmen (who had been raised in a culture where hunting was a luxury sport practiced on enclosed reserves, not accessible to and often illegal for non-aristocrats) were unable let their wives manage the gardens and help support their families hunting the plentiful game the Indians managed in America's woodlands and rivers.

It has long been known that Indians used fire to clear land and to burn the understory of the forest. But historians have only recently begun to appreciate the vast extent of Indian burning. Great expanses of the eastern seaboard were cleared for farming and game management by annual burns. Fire kept forests open and encouraged the growth of foods preferred by wildlife, creating the park-like woodlands so admired by European settlers. Indians had practiced controlled burning for centuries, until eastern forests became full of fire-loving tree species like the slash pine, whose cones only open and release seeds when they are exposed to flames. Some scientists have even recently suggested that the Little Ice Age, which reached its coldest temperatures in the sixteenth and seventeenth centuries, may have been exacerbated by the destruction of the Indian cultures that had burned the Americas for so long. The abrupt end of Indian burning practices and the rapid regrowth of American forests removed so much carbon from the atmosphere that scientists now believe the elimination of Indian populations caused by the Columbian Exchange may have helped trigger a period of global cooling.

The mobile culture and land use traditions of Native Americans were so different from the lifestyles the settlers had known in Europe, that many colonists failed to notice that the Indians knew what they were doing until it was too late. By the early 1800s, coastal Indians had mostly disappeared due to disease and war, and forests had reverted to a more "natural" state that had been unknown during the centuries of Indian land management. Descendants of English settlers lamented that turkeys, deer, and other animals that had provided so much free meat for their ancestors were gone from the woods. The English had not hunted these species to extinction. There were simply no Indians managing the land to provide the high levels of food the abundant wildlife had depended on. In a famous account of his travels through New England, Yale president Timothy Dwight regretfully observed, "Hunting with us exists chiefly in the tales of other times."



Figure 11.9: Shooting passenger pigeons, 1875. (Public Domain; Smith Bennett).

Although most game species declined because Indians were no longer managing the land to support them, some species such as the passenger pigeon were actually hunted to extinction. However, the story of the passenger pigeon is more complicated than that description might suggest. Native to the northeastern region of the continent, pigeon populations that the Indians had prevented from expanding had exploded when there were no longer Indians managing the land, until the birds lived in flocks of several million. Opportunistic passenger pigeons took advantage of the abundant food sources like acorns left by Indian land management, once the Indians were no longer present to protect these resources and use the landscapes they had created. One flock, seen flying in the mid-nineteenth century in southern Ontario, measured a mile wide and three hundred miles long. The pigeons took fourteen hours to pass the people observing them. Passenger pigeons were shot and trapped throughout the seventeenth, eighteenth and nineteenth centuries, and as cities grew their habitats shrank. The last passenger pigeon, named Martha, died on September 1st, 1914.

The offshore cod fisheries, which had supported countless generations of Native Americans and Europeans, were also harvested to near extinction. Cod had dependably provided hundreds of tons of food each year for centuries, until severe overfishing at the end of the twentieth century caused a population collapse the species has not yet recovered from, and perhaps never will.

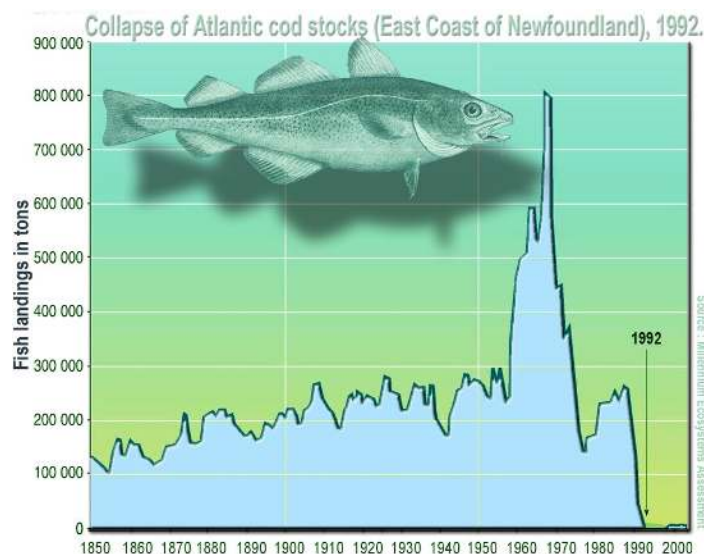


Figure 11.10: (CC BY-SA; Lamiot). (Public Domain; Charles Stanley Reinhart).

Another European misconception about Native Americans, often perpetuated in histories and contemporary traditions, was that Indians had no concept of ownership. Ironically, this belief is the reverse of the idea that Indians shared European concepts of property and payment which was used to justify the purchase of Manhattan and countless other parcels of Indian land. Both misconceptions spring from a mistaken attempt to fit Indian concepts into a format that makes sense based on Euro-American cultural assumptions, and both are inaccurate. Native cultures developed in response to experiences in the Americas that were quite different from those that had shaped European culture. Indians had different traditions about common use and private ownership, and their ideas about land use represented a relationship with the environment that Europeans misunderstood. When native people sold parcels of land to Europeans, for example, the earliest contracts and deeds usually specified that the sellers retained “usufruct” or usage rights to hunt and fish on the land, and even sometimes to set up temporary settlements as they moved across the region from season to season. Later, as the balance of power became less equal and shifted to favor Euro-Americans, the language of land contracts changed to reflect European ideas of ownership. As the Euro-American population grew, even where earlier contracts had preserved their usage rights, Indians were often prevented from exercising them. Natives also had a different concept of money and its role in social relations than their neighbors did. Living in a mobile culture that avoided encumbering possessions and valued reciprocity, Indians used wampum and trade goods not as mediums of exchange or symbols of wealth, but as ceremonial gifts to be given at feasts and gatherings to demonstrate and celebrate social relationships.



Figure 11.11: Misunderstandings over land ownership and constant colonial expansion led to a number of conflicts such as the Pequot War, 1634-1638, which ended with the elimination of the Pequot nation. (Public Domain).

Although many individual settlers probably tried to deal fairly with their Indian neighbors, the difference between European and native ideas of ownership and the rapid growth of the colonies made conflict virtually inevitable. Natives regularly moved to new locations as the seasons changed. They gardened in shifting fields. Colonists built houses and permanent villages, and fenced their fields. But although they claimed complete ownership of the parcels they occupied, the colonists let their cattle and pigs run loose over the countryside. Since the natives were not protecting their lands in ways the colonists recognized, such as with fences, the Euro-Americans believed (or at least argued) Indians had no idea of land ownership. The colonists were unaware that native practices had been created for a world without domestic livestock. When Indians treated European livestock like wildlife and shot a wandering cow, or when they killed pigs eating their un-fenced crops, the colonists demanded compensation for the destruction of their property. And of course, more colonists arrived every year. The Powhatan wars in Virginia (1610-46), the Pequot War in Connecticut (1637), the Dutch-Indian War in the Hudson Valley (1643), and the Beaver Wars (1650) all ended badly for the natives. Even King Philip’s War (1675), which is remembered as a disastrous, nearly-successful uprising by Massasoit’s son Metacomet, who had finally decided enough was enough, resulted in five times as many native deaths as European. By the conclusion of the French and Indian War (1756-63), northeastern natives were no longer a threat to European colonies.

Commerce

Although our histories traditionally portray the North American colonies as havens for freedom-seeking religious dissenters like the Pilgrims, Puritans, and Quakers, it is important to remember that the European interest in the Americas was always commercial. South American gold and silver enriched the treasuries of Spain and its trade partners. Caribbean sugar plantations were established by Portuguese and Dutch entrepreneurs and later taken over by Englishmen. American commodities such as tobacco, beaver pelts, and cod enriched merchants and investors on both sides of the Atlantic. Boosters of American colonization and investment insisted

that the new continents were filled with natural wealth just waiting to be exploited. And if a resource was scarce in Europe, that scarcity added to its value in America. American wildlife like beavers and even American trees commanded high prices in crowded European nations that had long ago cut down most of their own forests and killed most of their game. The British Navy marked all the tall pines of northern New England with “The King’s Arrow” because there were no longer trees available in Europe tall enough to make masts. It was illegal to cut the King’s trees, and according to New England folklore there are still some old trees deep in the Maine woods with the royal arrow dimly visible on their trunks.



Figure 11.12: Although often left out of US History, Caribbean islands like Barbados (farthest right) were key to the survival of the North American colonies. (CC BY-SA; Kmusser).

American colonists’ hopes and expectations for the new world included not only a place to build a new society, but a place where they could get rich. Even religious idealists such as the Pilgrims looked forward to opportunities for social mobility that had not been available to them in England. And right from the start, European colonies in North America were commercial. In addition to fishing, growing tobacco, and trapping beaver, the North American colonies benefited from the booming sugar economy of the Caribbean. Islands such as Barbados that had once been self-sufficient had begun by the mid-1600s to specialize in the highly profitable commodity at the expense of all other crops, so sugar planters looked to their neighbor colonies for food supplies. John Winthrop, the Puritan leader who helped establish Boston and who was Governor of the Massachusetts Bay Colony four times before 1650, sent his second son Henry to help establish Barbados in 1626. When Oliver Cromwell’s Civil War halted the flow of commercial shipping between England and the ten-year-old Bay Colony in 1640, trade with the West Indies saved Boston’s economy. Governor Winthrop’s younger son Samuel joined the growing community of New England merchants in the Caribbean sugar islands in 1647.

In the South, cultivation of the Virginia colony’s main cash crop tobacco for the European market required large amounts of inexpensive labor. At first, many of the workers used by tobacco planters were poor English men and women who had come to the colonies (sometimes willingly, sometimes not) as indentured servants. Later, when the supply of British workers was cut off by the English Civil War and then by the American Revolution, Southern planters began to rely on enslaved Africans, who were already being used on West Indies sugar plantations, to do the work. It is important to remember that the use of slave labor on tobacco, sugar, and later on cotton plantations was not an inevitable requirement of the commodity being grown, but an economic decision planters made based on their desire to produce large quantities at low costs for commercial markets. Although ultimately the argument over slavery in the United States became largely a clash of cultures between a paternalistic Southern aristocracy and a Northern commercial class committed to capitalism and wage labor, at their heart the decisions planters made to use slave labor were based not on environmental factors, but on profit-maximizing economic choices.

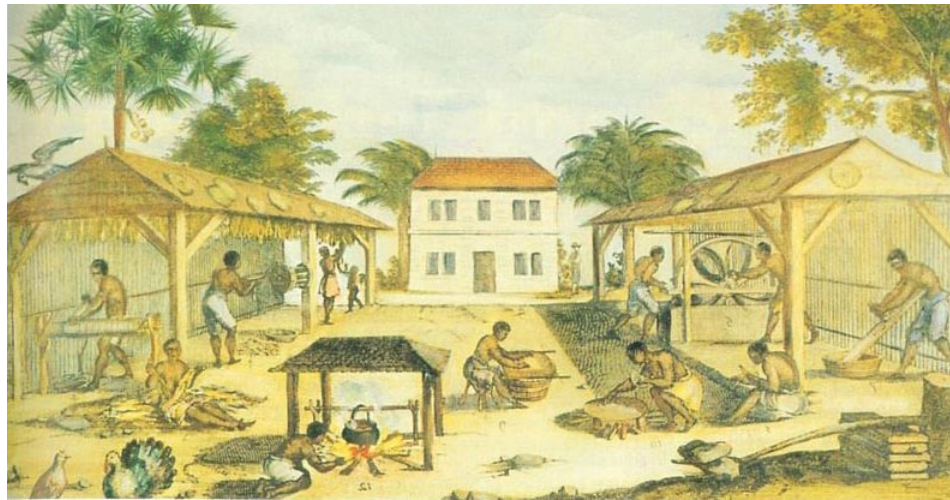


Figure 11.13: Slaves processing tobacco in Virginia, 1670. (Public Domain).

Europeans settling in North America not only brought ideas about the environment developed in their home countries, they brought a commitment to commodity export markets that helped shape their social and political structures and their ideas about the land they found. The North American landscapes that became English colonies had been carefully managed for centuries by the Indians living on them. The disappearance of the Indians and establishment of the colonies rearranged these landscapes in the image of the old world. Traditions and practices that had sustained native populations for thousands of years were lost when disease and war destroyed Indian cultures. It's interesting to speculate whether those practices would have been abandoned anyway, because the natives' mobile lifestyle was incompatible with the commerce and growth required by the rapidly expanding English colonies, or whether colonists encountering a more active, ongoing display of Indian land management might have made different choices for the American landscape.

Further Reading

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12: Frontier and Grid

Looking at Colonial North America, we noticed that many early English coastal settlements had been established on sites previously used by native Americans, who had disappeared due to disease or the social chaos caused by epidemics. As settlement moved westward, Euro-Americans were less likely to be able to take advantage of abandoned settlements and native improvements to the land. As time passed, fields and forests Indians had cleared and maintained with fire filled in again. And sometimes settlers farther west found natives still occupying their ancestral lands and unwilling to share with people they considered invaders. Many settlers tried to choose uncontested places to make their homes. They were not always successful, as the long string of nineteenth-century Indian Wars demonstrates.

The continent was large and the population density of native cultures was often much lower than that of the Euro-American settlements. Though there were always pioneers willing to take their chances in Indian Country on the frontier, many families moved to regions already considered to be well-established territory open for settlement. Although there were some notable exceptions, most of these regions were reasonably safe from Indians, who had already been pushed farther west. So for many settlers the idea of moving westward involved less Indian fighting and more clearing unoccupied land to make it productive for their new style of European-influenced American agriculture.



Figure 12.1: “Westward the Course of Empire Takes its Way” is a 20×30 foot mural painted in 1861 by Emanuel Leutze in the US Capitol Building. It represents the powerful allure the West held for American culture and the concept of Manifest Destiny.

The frontier has always been a powerful magnet for the American imagination. It is not well remembered in most of our histories, but one of the grievances that led to the American Revolution was colonial anger that the British had accommodated the Indian nations that had allied with them against France in the Seven Years War (1756-63) by limiting westward expansion of the colonies. The Cherokee Nation and the powerful Haudenosaunee (Iroquois Confederacy) had sided with the British against the French and against other native nations. But like the other natives, England’s Indian allies were alarmed by the inexorable growth of the colonies and wanted some assurance that their territories would be respected. In 1751, Benjamin Franklin had boasted that for every English baby born in Britain, two were born in America and soon there would be more Englishmen in the New World than in the old. The Iroquois, whose homelands included what is now western New York and Pennsylvania, saw their political stability and way of life threatened by expanding English settlement. So, as a reward for the Indians’ support and out of respect for the Confederacy’s undeniable military strength, the British government issued a proclamation establishing a western colonial boundary.

The Proclamation Line followed the Appalachian Mountains, cutting through western New York and Pennsylvania and creating an Indian Reserve stretching from the Great Lakes to the Gulf of Mexico.

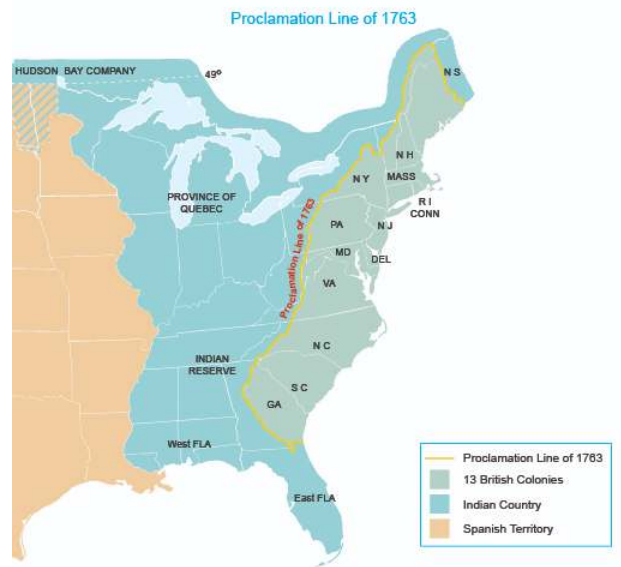


Figure 12.2: The British American colonies in 1763: This map shows the status of the American colonies in 1763, after the end of the French and Indian War. Although Great Britain won control of the territory east of the Mississippi, the Proclamation Line of 1763 prohibited British colonists from settling west of the Appalachian Mountains. (credit: modification of work by the National Atlas of the United States)

The English colonists were enraged. Many of their royal charters had given the colonies land grants extending to the Pacific Ocean. The colonists believed the Crown's acknowledgement of Indian claims to that territory was a betrayal of their futures. And for many, the issue was more than just symbolic. Anticipating growth, many Americans had begun investing in the territory beyond their settlements. Following the proclamation, wealthy land speculators like George Washington instructed their agents to begin buying as much Indian land west of the mountains as possible. Washington warned his partners to keep "this whole matter a profound secret." A lot of the surveying work Washington was famous for doing as a young man, he did on the wrong side of the Proclamation Line.

When the Sons of Liberty and the Continental Congress met in Philadelphia and drafted the Declaration of Independence, one of their many complaints against King George III was that he had unleashed "merciless Indian savages" against the colonists. Natives continued to resist when colonists appeared on their lands. Many Indians sided with Britain during the Revolution, seeing continued British control of the Americas as their best hope of retaining their land and sovereignty. Unfortunately for the natives, the colonists won their independence and barriers to westward expansion were swept away. At the Treaty of Paris in 1783, Britain relinquished its claim to all the territory east of the Mississippi to the United States. Although the new nation's economic fate still depended heavily on its being part of an Atlantic trading community dominated by England, the unconquered frontier to the west was a strong influence on American policy and culture.

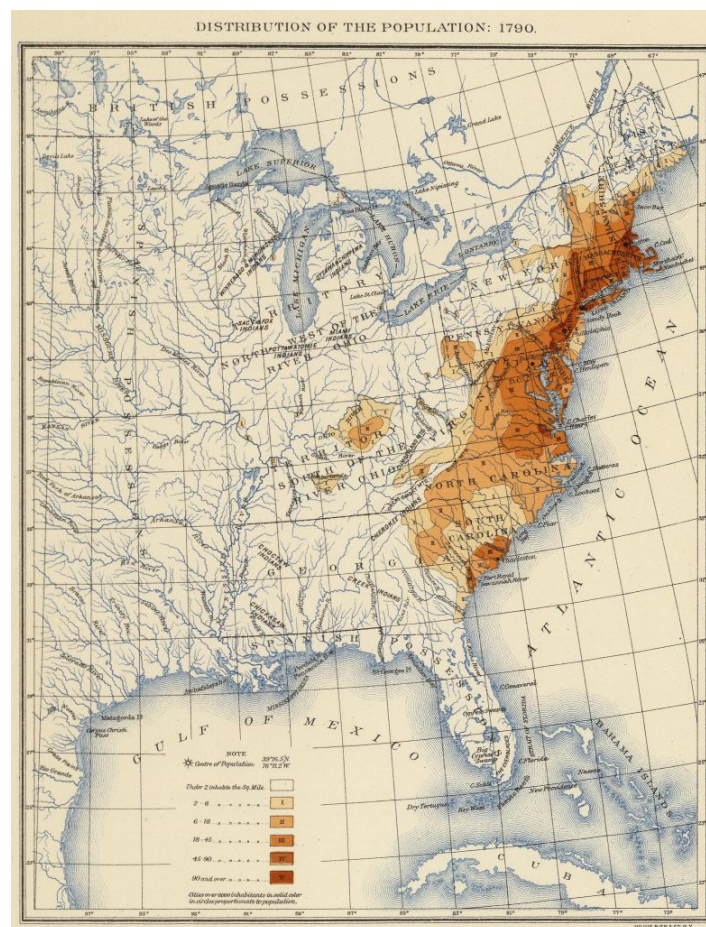


Figure 12.3: Map of population density in 1790, from the 1890 Statistical Atlas of the United States.

When the United States took its first national census in 1790, Americans discovered that half their population was under the age of 16. At the end of the eighteenth century, the American birthrate was higher than any birthrate ever recorded in a European nation. For comparison, it was more than double the highest birthrate achieved during the post-World War II baby boom. America's growing population needed an outlet. For example, the western Massachusetts hill-town Ashfield contained 130 families in the early 1800s. Most of the town's residents were farmers; even the town doctor kept a cow and raised hay to feed his horses. The average family had five children. Ashfield's largest families had eleven.

As the children of Ashfield and other young Americans grew up, they naturally looked westward. In contrast with the colonial Hudson River Valley, which had developed a feudal social structure of large estates and tenant farmers, and the tidewater South, which had developed an economy dominated by plantations worked by enslaved Africans, New England and the Middle Colonies had established a system of small-scale land ownership that continued after independence, creating large numbers of modest, self-sufficient farms. Yeoman farmers owned their land and fed their families and livestock from its produce. If farmers produced surpluses they would sell them, often to the town miller who would aggregate local products and resell them in Eastern cities. The cash farmers earned selling their surplus could be used to buy manufactured goods not available in the local economy, and sometimes even luxury items. Some farmers even grew specialty crops specifically for distant markets (Ashfield happened to specialize in peppermint). But their priority, if push came to shove, was feeding their families. And as those families grew, feeding everyone became harder to do.

Most farm families owned about 80 acres, and in a town like Ashfield much of that land was made up of wooded hills and rocky pastures, difficult to cultivate. While a hard-working farm family could feed itself, only one son could realistically inherit the farm and have enough tillable land to support a new family. Splitting a farm between all a family's children would leave no one with enough farmland to raise the next generation. The obvious solution was to pass the farm to one son, which meant that the rest of the children had to repeat the work of their parents and start a new farm. As local land filled up, those children looked west.

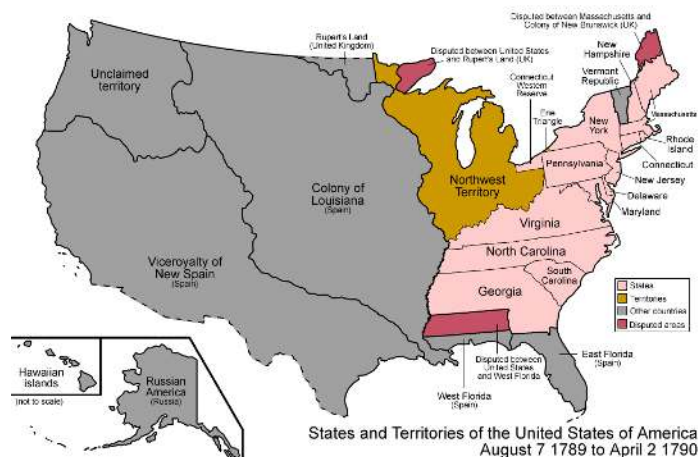


Figure 12.4

The new United States government made it easy for young families to start new farms. The Continental Congress appointed a committee that included Thomas Jefferson, to figure out how best to dispose of the land the nation had acquired in the 1783 Peace Treaty with England. Technically this territory belonged to the nation rather than to the thirteen new states; and since under the Articles of Confederation, Congress was not allowed to levy taxes, land sales were considered an appropriate way to raise funds to run the government. The result was The Northwest Ordinance, which created the Northwest Territory and specified the way western lands would be surveyed, parceled, and sold.

The Northwest Territory included lands that would become Ohio, Indiana, Illinois, Michigan, Wisconsin, and eastern Minnesota. The Ordinance decreed that townships would be standardized as six-mile squares divided into thirty-six lots, called sections, of one square mile each. Five of these sections would be reserved for government or public purposes, including lot number sixteen in the center of each township, which would hold a mandatory public school. With half the nation's population under age sixteen, free public education was considered a key to American progress, so public schools were built into one of the United States' earliest national laws.

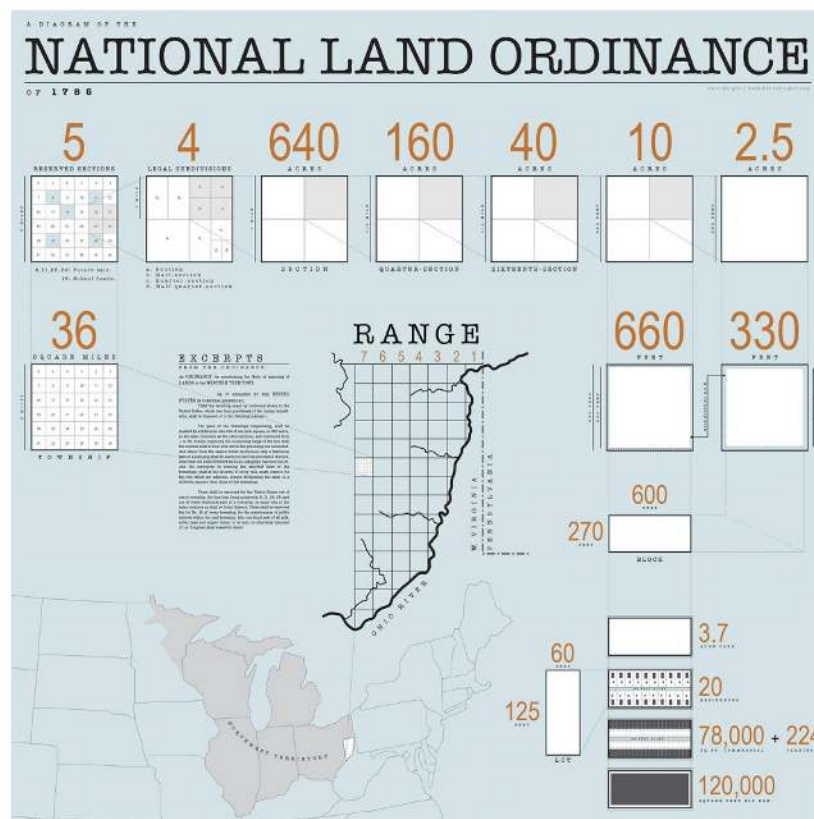


Figure 12.5: Diagram of the 1785 Land Ordinance showing how the method of subdivision can be applied from the scale of the country down to the scale of a single lot.

Each square-mile section contained 640 acres of land, which could be subdivided into quarter-sections of 160 acres each or half-quarter sections of 80 acres, which most people in the early nineteenth century considered the smallest size for a successful farm. In towns and cities, land could be subdivided down to 60 by 125 foot single family building lots. The price of the land on the frontier would remain low for most of the nineteenth century, beginning at \$1 per acre and later rising to \$1.25 per acre, although after the Specie Circular of 1836, payments at the Land Offices had to be made in cash rather than bank notes. In the cities, speculation could quickly drive land prices up, causing property bubbles like the one that inflated Chicago real estate values by 40,000 percent in the early 1830s, driving land prices to New York City levels before bursting in a storm of foreclosures in 1841.

Western New York and the territory just west of the Ohio River were among the first public lands to be surveyed and sold. Ashfield families like the Ranneys (whose family letters you'll read in the chapter supplement) followed the Mohawk Valley and made farms in territory that had previously been beyond the Proclamation Line, on land taken during the Revolutionary War from the Haudenosaunee. Like many forward-looking families, the Ranneys invested in frontier land in Michigan at the same time they were moving from Massachusetts to New York. Just a few years after the family moved west from Ashfield, several of the younger Ranney brothers moved farther west. But family ties held, and the Ranneys remained in close contact throughout their lives.

Settlers from Connecticut and New Jersey rushed into the Ohio River Valley, which was close to Virginia and Western Pennsylvania across the Appalachians and the old Proclamation Line. Ohio Valley land was prized because although it was difficult bringing wagon-loads of farm products across the Allegheny Mountains to market, the Ohio River began at Fort Pitt (Pittsburgh) and flowed into the Mississippi at what is now the southern tip of Illinois. Enterprising farmers could float their surplus grain down the rivers to the Spanish port of New Orleans, where merchants could put it on ships bound for East Coast Cities, the Caribbean, or even Europe.

Western New York filled quickly. Settlement of the Ohio Valley was equally rapid, and the Ohio Territory became a state in 1803. Many new Ohio farmers were from the middle states like Connecticut and New Jersey, whose original colonial charters had included parts of the Northwest Territory. As they left their settled homelands and cut new farms out of wild land, these Yankee farmers started a pattern that would repeat itself many times over the next century.

Pioneer Farmers

When many settler families arrived at the parcel they had often bought sight unseen from the land office, their new homestead was often trackless forest. Old growth woodlands covered most of the area between the Atlantic coast and the Mississippi, so this experience was repeated again and again. Before doing anything else, settlers moving to western Massachusetts in the 1760s, or western New York in the 1810s, or Michigan in the 1830s would need to build a shelter and clear enough land to raise the crops that would get them through the first winter and feed a few animals. Settlers often cleared fields by girdling trees, cutting a broad strip of bark to kill the tree. They planted corn Indian-style in hills between the standing deadwood. The following season, they cut and burned the dead trees, and after rotting a few years the stumps could be removed and the field plowed for wheat. A hardworking settler family could clear about 7 acres per year. The ashes from the burned forest provided nutrients for the soil and also potash for sale in the eastern cities. Potash was used to make soap, and was often the first product western settlers shipped back to eastern merchants.

Pioneer life was very hard work. In addition to clearing land, pasturing animals, and raising crops, settlers had to cut and split from thirty to forty cords of firewood per year for heating and cooking. Women spent much of their time cooking, which is a slow and tiring process when you do it over an open fire in a one-room cabin. In their spare time pioneer women raised their five children and wove cloth to make the family's clothing.

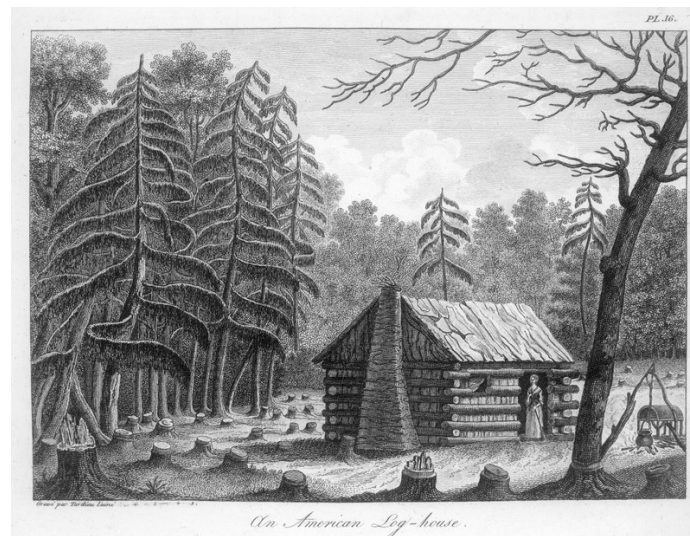
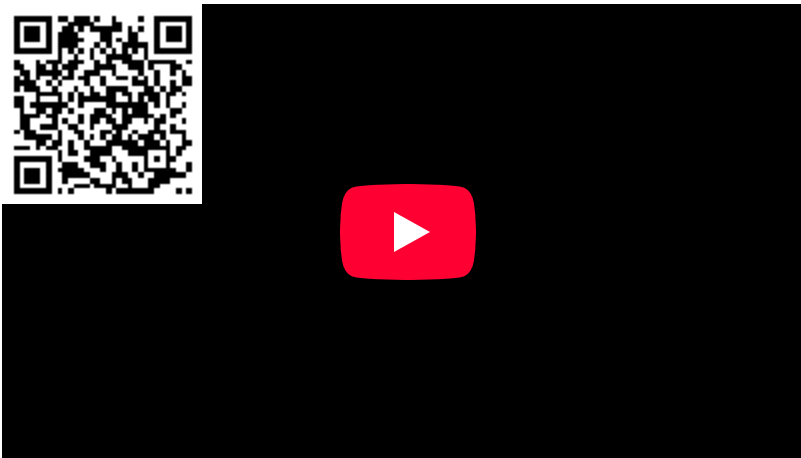


Figure 12.6: This image from an 1826 European account of travels in America accurately depicts frontier life. The fields are full of tree stumps and the pioneer wife is about as far as she ever gets from the open hearth where she spent her days cooking.

After a couple of decades, a successful settler family usually had 20 to 30 acres of improved land and a substantial woodlot to supply their annual firewood needs. Since the frontier had been surveyed into six square-mile townships on the grid, there was usually a village or town within walking distance, providing a school, social life and a small market for surplus goods. Merchants often took produce from farmers in payment for manufactured goods and supplies the farmers could not make themselves. The merchant shipped farm products to cities for consumption or export, and bought supplies of city goods on annual buying trips to sell in town. In addition, peddlers carrying baskets and trunks of small goods like sewing needles, buttons, and medicines traveled on foot throughout the states and the new territories, bringing goods and news to even the remotest farmsteads.

By the time the farm was well established the family was usually quite large. One son, usually the youngest, would inherit the farm in return for taking care of his parents at the ends of their lives. Youngest sons tended to inherit the farm in the northeastern states and the territories Yankee families settled, because the older sons would have grown up too soon for the parents to be ready to retire. The youngest stayed at home and took care of the aging parents in exchange for inheriting the family property. The older sons, who would usually be adults long before their parents were ready to give up working, inherited cash when there was an estate to divide, and they often moved farther west to establish their own farms while their parents were still alive.



Video 12.1: *US Population, distribution, and density 1790-1860.* https://www.youtube.com/watch?v=3teEFEJfN_Y

Free Soil and the Trail of Tears

The Northwest Ordinance, which was passed in 1787 before the U.S. Constitution was even ratified, opened the territory that would become Ohio, Indiana, Illinois, Michigan, Wisconsin, and Minnesota. In addition to establishing the grid and setting aside land for public schools, one of the most important elements of the Ordinance was that it prohibited slavery in the territories. This prohibition had a major impact on both the politics and the environments of the territories and states created by the Ordinance because it prevented the spread of large plantations based on slave labor and encouraged the style of small-scale land ownership and family farming we now associate with Thomas Jefferson's ideal of the independent yeoman farmer. Jefferson, a slave-owner who wrote eloquently about freedom and equality, was a living symbol of the young nation's moral struggle. Many northern farmers moving west came from old Yankee families with long traditions of sympathy for the abolitionist cause. Others understood that their small-farm produce would have difficulty competing in the market with farm products that had been produced using the unpaid labor of plantation slaves. Many western farmers joined Free Soil political groups that helped create the anti-slavery Republican Party (established in 1854 in either Ripon Wisconsin or Jackson Michigan by anti-slavery activists) and elect President Abraham Lincoln in 1860.

Thomas Jefferson's 1803 Louisiana Purchase had doubled the size of the United States and opened an even wider territory for expansion, extending all the way to what is now the Idaho border in the northwest. But ironically, it had also reopened the conflict over slavery in the territories. When compromises between free-state and slave-state delegates resulted in a U.S. Constitution that failed to abolish slavery, most Americans believed the "slave problem" would take care of itself. The importing of new slaves from Africa ceased in 1807, and opponents of slavery believed the slavery would become increasingly irrelevant as southern slave states were surrounded by new, free states on all sides. However, as territories gained statehood, it became clear to southern politicians that the balance of power would shift toward the abolitionists if slavery was prohibited in all the new states. The Missouri Compromise of 1820 attempted to retain the balance of power by admitting states in pairs: one free and one slave. When Kansas and Nebraska territories were preparing for statehood in the 1850s, the compromise was broken in favor of a scheme described by its proponents as "popular sovereignty." Under the Kansas-Nebraska Act of 1854, the populations of the territories would vote on whether to enter statehood on the free or slave side.

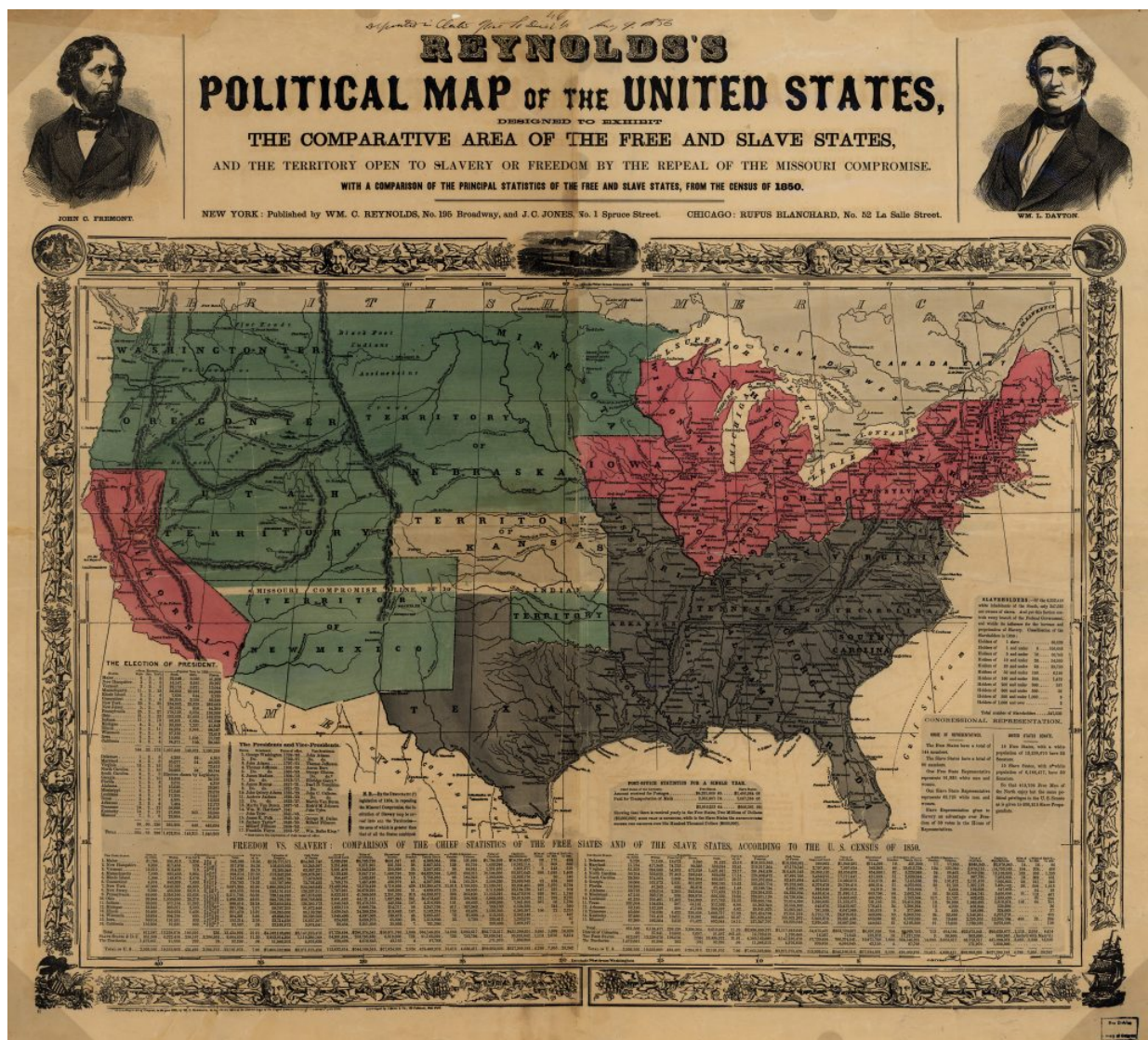


Figure 12.7: 1856 political map showing free states in pink, slave states in gray, and the Missouri Compromise line and Kansas in the middle. Note that the territory of Kansas extended to the Rocky Mountains and included the region around Pikes Peak, where there was a “Kansas Gold Rush” between 1858 and 1861.

Supporters of slavery immediately began trying to influence the election through bullying and intimidating residents. Abolitionists retaliated by sending over a thousand Free Soil settlers into the territory to swing the election their way—many armed with Sharps rifles reportedly supplied by New England preacher Henry Ward Beecher. Two separate territorial legislatures claimed to represent the will of the people, each claiming the other was the result of voter fraud. Two constitutions were written, one supporting and one opposing slavery. Vigilante groups on both sides terrorized and occasionally murdered their opponents. The conflict which became known as “Bleeding Kansas” was not resolved until the Civil War, when Kansas was finally admitted to the Union in January 1861 as a free state.

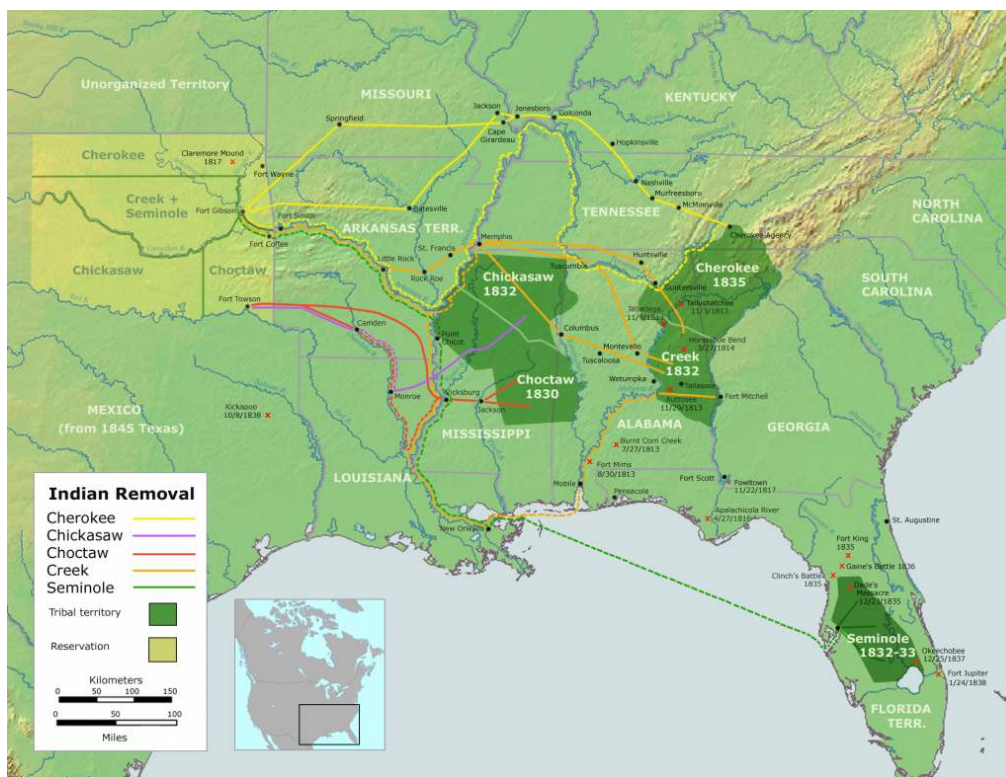


Figure 12.8: The Trail of Tears: Indian Removal 1830-1835

By 1810, after nearly a generation of westward expansion following the Northwest Ordinance, the Ohio and Cumberland River Valleys were beginning to look like the settled areas of the original eastern states. Cincinnati, Frankfort, and Nashville were becoming centers of commerce, as was Buffalo New York on the shore of Lake Erie. Saint Louis on the Mississippi and Detroit on the western end of Lake Erie were also growing, as people continued looking to the frontier for new opportunities. In the Southern States, westward expansion of the plantation system was challenged by the Cherokee, Creek, Choctaw, Chickasaw, and Seminole nations. The original policy of the U.S. government under President George Washington (and continued by Thomas Jefferson) had favored “acculturation” of the natives and their assimilation into American society. Impressed by American institutions, the Indians had adopted many of the elements of Euro-American culture including a two-house legislature, a legal system based on that of the United States, and even slavery. But Southern planters were not equally impressed by their Indian neighbors, and lobbied the government to remove the Indians and make western lands available for their own expansion. President Andrew Jackson, himself a Tennessee plantation owner, led a campaign for legislation to remove the Indians from their lands. The Indian Removal Act of 1830 passed in spite of stiff opposition, including that of Tennessee Congressman Davy Crockett, who spoke out against the bill. The new law was quickly judged unconstitutional by an 1832 Supreme Court decision (*Worcester v. Georgia*) that ruled in favor of the natives. But President Jackson ignored the court’s decision and the natives were removed to a region known as The Indian Territory, which later became Oklahoma, along the infamous Trail of Tears.

Transport and Commerce

Along with population pressure, one of the main factors accelerating western settlement was improving transportation technology. Although they were far from eastern cities and clearly understood the importance of remaining self-sufficient, many westerner settlers still considered themselves part of the Atlantic commercial world. Success beyond mere subsistence for a growing number of farmers depended on their ability to get their produce to eastern markets. The first phases of expansion had allowed farmers to use waterways like the Hudson River in New York and the Allegheny and Ohio Rivers in the Middle West, to float their surpluses to markets like New York City, St. Louis, and New Orleans. The growth of trade convinced Americans that transportation was the key to expanding the frontier. We return to this topic in greater detail in Chapter Six, but here is an early example. The Erie Canal, begun in 1817 and completed in 1825, opened not only western New York but the entire Great Lakes region to commercial shipping. Less than ten years after the canal opened, the last fulling mills that processed homespun cloth disappeared from the Mohawk Valley, as western New York farm wives jumped at the opportunity to reduce their workload by buying eastern textiles.

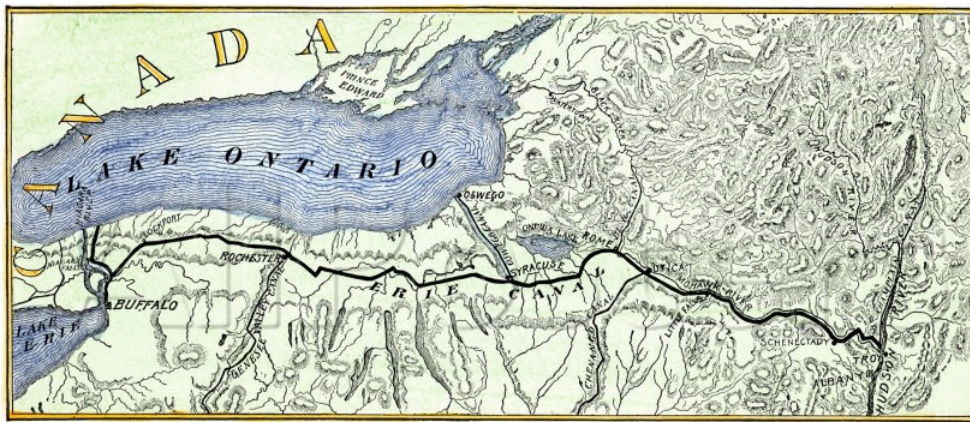


Figure 12.9: 1840 map of the Erie Canal connecting the Hudson River with the Great Lakes in western New York

By 1830, after nearly another generation of growth, the sons of farmers who had moved to the Ohio Valley and to western New York were on the move again. This time, their destinations were Illinois, Indiana and Southern Michigan. Cincinnati and Louisville were now major cities, and settlement was extending up the Missouri River as well as the Mississippi. Federal land offices sold most of the land between the original 13 states and the Mississippi during the first half of the 19th century. Beginning with the Northwest Territory, the land was surveyed and a grid of townships laid out. This pattern of well-organized settlement can still be seen in satellite images, or even from the windows of airplanes flying over the Midwest. The average size of a working farm today is closer to a full mile-square section than to the quarter or half-quarter section the original settlers had bought at the land office, but the grid pattern can still be seen from above. Farm technology like John Deere's 1838 steel plow and Cyrus McCormick's reaper, patented in 1837, helped western farms produce wheat for the commercial market. Bad harvests in Great Britain and wars in Europe provided high profits to exporters throughout much of the nineteenth century. More eastern farmers moved west, often selling old farms near growing cities and suburbs at profits that allowed them to buy substantially more land at cheaper western prices. The Land Office's typical price during the first half of the nineteenth century remained \$1.25 per acre.

By the middle of the nineteenth century, Midwestern farmers were solidly embedded in an international commercial network. Cincinnati, on the Ohio River, was packing so much bacon and salt pork that the city became known as Porkopolis. The end of Europe's Crimean War in 1856 cut grain prices by two thirds, helping to trigger the Panic of 1857 and a recession that lasted several years. Like it or not, American farmers settling the frontier were a key element of America's growing power in international commerce.

Families and Immigration

Historians (and novelists, and later screen-writers) have often claimed that pioneers moving West were forced to sever all their ties with homes and families, and strike out on their own. Some have even suggested that migration to the frontier wiped away all the trappings of "old world" culture and produced a new, distinctly American civilization. Many argue that the stresses of frontier life may have helped produce the individualism and focus on nuclear families considered such a distinctive part of the American character. The image of the independent American, and especially the cowboy, has become an important part of our national self-image. The concept of Manifest Destiny, that America had a special mission to spread the virtues of democracy across the continent, was the public expression of the idea that the American character was unique and superior.



Figure 12.10: In this image of Manifest Destiny called “American Progress” Columbia, personifying the U.S., leads self-reliant Americans westward while carrying a telegraph wire and a textbook, driving fleeing Indians before her.

It's quite true that it took courage and self-reliance to settle the Midwest or to travel all the way to the west coast, which before the completion of the transcontinental railroad in 1869 required a grueling month-long trip on foot or horseback across the continent or a dangerous ocean voyage around the Straits of Magellan at the bottom of South America. But remarkably, families managed to stay connected in spite of these distances. For example, the Ranneys, whose letters to each other you will have the opportunity to read in the chapter supplement, were a Scotch-Irish family who had arrived in Colonial Connecticut in the 17th century. Several brothers moved to Ashfield Massachusetts about 1790, and their sons moved on to Phelps in western New York in the 1830s. A few years later, several Ranney brothers and cousins moved on to Michigan. A couple of Ranneys went even further and had adventures in the Indian Territory, Kansas, and the California Gold Rush. But throughout the nineteenth century, the brothers kept in touch through frequent letter-writing, visited each other, and even did regular business with each other. Michigan Ranneys sold farm produce to their merchant brother Henry in Massachusetts, and family members regularly loaned money to each other across the miles. The important point is, many American pioneers continued to consider themselves part of extended families and diligently held onto family connections in spite of great distance and limited communications.

In addition to families extending themselves westward, immigrants from Britain and Europe joined the flow of farmers and farmers' sons to the frontier. America's poor diplomatic relations with England hampered immigration until after the conclusion of the War of 1812, but the end of hostilities opened the floodgates. Continuing wars in Europe and the social upheavals of the industrial revolution strengthened a flow of immigration that continued throughout the nineteenth century. In the late 1840s, nearly half the immigrants from Europe to the United States were Irish, fleeing the agricultural disaster known as the Irish Potato famine. Unlike the Andean Indians who had developed hundreds of varieties of potatoes for a wide range of purposes, Europeans grew only a few varieties bred from a small batch of imported seed potatoes. 350 years after the first potatoes had been brought to Europe by Columbus, most of the two million acres of potatoes grown in Ireland were a single variety, the Irish Lumper.



Figure 12.11: Brigid O'Donnell and her children, from an 1849 newspaper article about the Irish famine.

Potatoes were so inexpensive to grow, reliable, and high-yielding that the population in Ireland had exploded by the early nineteenth century. From a starting point of about 1.5 million in 1600, Ireland's population grew by 600 percent in 200 years, reaching about 9 million people by the early 1800s. Of those 9 million people, four out of ten (or over 3.5 million people) ate no solid food but potatoes. Monoculture created vulnerability, because both Ireland's economy and a large part of the nation's food supply depended on a single crop. When the first reports of potato blight came in September 1845, the English landlords who owned most of Ireland's farmland were slow to react. In the next two months, the blight wiped out about three quarters of a million acres of potatoes. The following year was worse, and the landowners had made no efforts to plant other crops or even blight-resistant varieties of potatoes. The year after that was even worse. Over a million people died, and about a million and a half fled Ireland. By 1850, Irish immigrants accounted for more than half the populations of Boston, New York, Baltimore, and Philadelphia.

After 1850, immigration from Germany accelerated as Germans fled the chaos caused by their unsuccessful revolutions of 1848 and 1849. Over 42 million Americans of German descent were counted in the 2000 census, making German-Americans the largest ethnic group in America. While some of these German and the earlier Irish immigrants farmed, many became tradesmen, factory workers and laborers in Northeastern cities and in the newer cities of the northwestern frontier. Pittsburgh, Toledo, Milwaukee, Chicago, and Bismarck North Dakota were all noted in the 1900 census as having populations of between 50 and 75 percent "whites of foreign parentage." The black population, of course, was still largely trapped by slavery and its aftermath in the South. The slave economy is also cited as a major cause of low immigration to Southern states in the 19th century. Immigrant farmers or wage-workers from Europe had no place in a society where most wealth was held by aristocratic families and most of the work was done by plantation slaves and later by destitute share-croppers.

No Decline

For a long time, historians believed that at around the same time that the Civil War destroyed the plantation system in the South, transportation and western farms had killed agriculture in the old northeast. Western farms were larger, they said, and the land was more fertile and easier to work than the hilly, rocky, exhausted soils of the northeastern states. This belief influenced the Country Life policies of Progressives in the early 20th century and has lived on in current farm and environmental policy, as we will see in later chapters. But if we look more closely at the details, a different picture emerges.

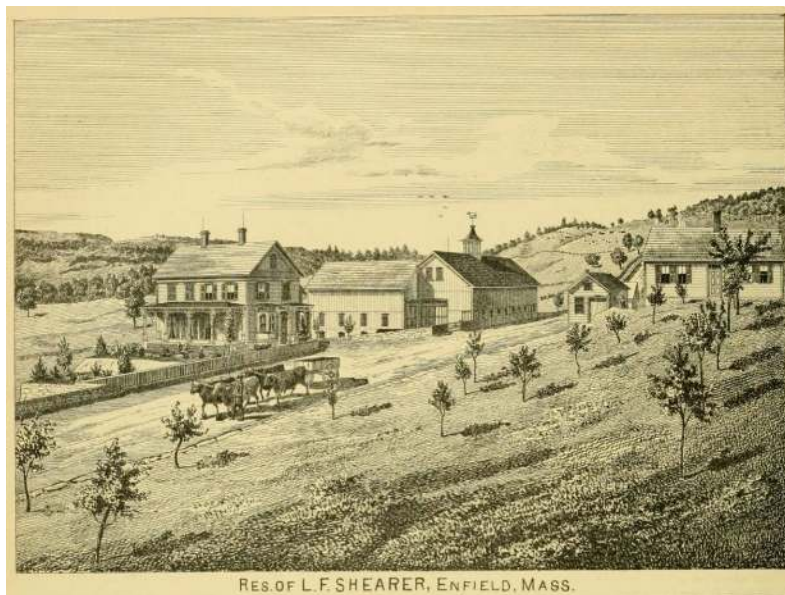


Figure 12.12: 1879 illustration of a prosperous Massachusetts farm, from a book celebrating local history and culture.

A closer look at data on land ownership and farm produce shows that New England farmlands continued increasing and forests continued shrinking until the final few years of the 19th century, by which time New England was over 90% deforested. This was long after the Midwest had taken over as the breadbasket of America, vastly outproducing the northeast in staple crops like wheat and corn. Hillside Yankee farm fields where it had always been difficult to grow wheat no longer had to try. They became pastures for Merino Sheep, which became a highly sought-after premium breed. Growing cities certainly lured people off eastern farms to work in factories like the textile mills of the Merrimack Valley which we cover in Chapter Five, but urban growth also provided a very lucrative market for farm products. And although eastern farmers with their small, steep, hillside fields could no longer keep pace with the Midwestern farmer in corn or wheat production, they could easily out-compete him on milk and hay. The bulkier and more perishable a product was, the greater the advantage for the local farmer. Eastern farmers became dairymen and grew hay to feed urban horses (before the age of cars and trucks, there were a lot of urban horses). Eastern truck farms grew fruits and perishable vegetables for nearby city people. As cities grew, the number of factory and office workers who earned wages rather than producing their own food increased dramatically. In the first US. Census after the Civil War, less than half of the people counted were listed as working in agriculture. This division of labor between people who grew their food and people who did not accelerated and ultimately created a new profession and a special class of people, American farmers, who were responsible for feeding the rest of us. This major shift in American culture also had major implications for the environment, as we will discover.

It's easy looking back from the present, when only a tiny proportion of Americans can claim to be self-sufficient, to romanticize the yeoman farmer or the pioneer. Many historians share this romantic perspective, and some even insist that nineteenth century farmers fled westward to avoid the degrading capitalism of the cities. However, except for a small number of nineteenth-century Americans who joined religious settlements or utopian communes, most of the settlers who moved west remained interested in the culture and commerce of the eastern cities. Like the Mohawk Valley farm wives who had abandoned home weaving as soon as the Erie Canal brought affordable eastern textiles to their doorsteps, most Americans who moved west tried to maintain a healthy balance between commerce and self-sufficiency. The terms of the negotiation have changed over time, but the challenge to find that balance is one we still face today.

Further Reading

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- Susan E. Gray, *The Yankee West: Community Life on the Michigan Frontier*. 1996.
- Malcolm Rohrbough, *The Land Office Business: The Settlement and Administration of American Public Lands, 1789-1837*, 1968. *The Trans-Appalachian Frontier*, 2008.

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13: Transportation Revolution

In this chapter we examine technological changes that improved Americans' ability to move people and goods, as well as the economic and political forces that helped shape the growth of transportation networks.

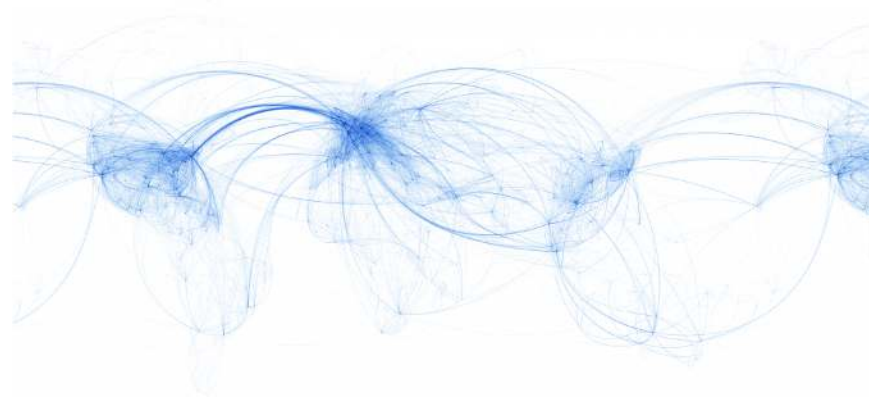


Figure 13.1: Although this may appear to be abstract art, it is actually a map of all regularly-flown air routes flown in 2009. (CC BY; Josullivan.59).

The transportation revolution in the United States began when Americans taking advantage of features of the natural environment to move people and things from place to place began searching for ways to make transport cheaper, faster, and more efficient. Over time a series of technological changes allowed transportation to advance to the point where machines have effectively conquered distance. People can almost effortlessly travel to anywhere in the world and can inexpensively ship raw materials and products across a global market.

But this technology is not ubiquitous, and it is not necessarily democratic. As a famous science fiction writer once said, the future is already here, it's just not very evenly distributed. Modern transportation infrastructure is controlled to a great extent by large corporations, but the benefits of transport are depended on by everyone. And transportation technology itself requires specific conditions such as abundant, cheap, portable energy in the form of fossil fuels, and public infrastructure created by our own and foreign governments, that even those large corporations depend upon but don't control.

When we think of transportation, it is natural to think first about going places. Getting on a plane in one hemisphere and getting off on the other side of the world is a life-changing opportunity which was unavailable to most people as little as a generation ago, and unthinkable two generations ago. But more crucial to our daily lives than the freedom offered by world travel is the cargo from the other side of the world that reaches us quickly in the holds of jets and more slowly but in almost unimaginable volume in containers on ships. The global transportation of foods, raw materials, and finished goods goes virtually unnoticed in our daily lives, but makes our contemporary consumer lifestyle possible.

Although even the early stages of the transportation revolution allowed people like seventy-year old Achsah Ranney, from Chapter Five's Supplement, to travel regularly between her children's homes in Massachusetts, New York, and Michigan, the more significant change was the ability of her sons and of other Americans to move freight from place to place. The ability to effectively ship food and other goods to where they were needed allowed people to stay put, and even to concentrate themselves in cities in a way they had never been able to do before. The growth of eastern cities depended just as much on the transportation revolution as did the building of new cities in the west.



Figure 13.2: Rapid, inexpensive transportation offers American consumers an incredible array of options from a global marketplace. (Public Domain; Raysonho).

As we have already seen, early Americans made amazing journeys with very primitive methods of transportation. The people who crossed Beringia and settled North and South America were able to cover startlingly long distances on foot. European explorers crossed dangerous oceans to visit the Americas in tiny ships. Human and animal power has been used extensively throughout American history, and is still used today to reach remote areas off the grid. But it is clear that improvements in transportation technology have been among the most powerful drivers of change in our history. And the transportation revolution has certainly changed our relationship with the American environment.

Technological improvements to ocean-going ships in the fifteenth century made European colonialism possible in the first place. Ships became bigger, faster, and safer. More people and goods could leave the safety of coastal waters and cross the oceans, and the places these improved ships connected became centers of trade, population, and wealth. This pattern of growth repeated itself as new technologies were developed to help Americans expand across the continent.



Figure 13.3: Virginia State Quarter commemorates the technology that allowed the establishment of the Jamestown colony in 1607. (Public Domain; US Mint).

As we have seen, American colonists depended on trade with England and with the sugar planters of the West Indies to make their outposts in New England and Virginia successful. But from the beginning of the American Revolution to the conclusion of the War of 1812, relations between the new nation and Britain were tense and trade suffered. If it had not found a way to ship people and goods to and from its own frontier, the United States would have remained a coastal nation focused on ports like Boston, New York, Philadelphia, and Charleston. The barely-remembered Whiskey Rebellion of 1791, when George Washington led United States troops against American farmers in western Pennsylvania, was really about transportation. Farmers west of the Appalachian mountains could not easily haul wagon-loads of grain to eastern markets, so they turned their harvests into a more portable product by distilling grain into whiskey. The farmers believed the government's excise tax on distilled spirits had been instituted to drive them out of the whiskey business for the benefit of large Eastern distillers. Since they had few other sources of income, the tax was a serious issue for westerners. Luckily, the incoming Jefferson administration repealed the tax in 1801 and increasing Ohio River shipping provided new outlets for western produce.

Roads and Rivers

On the eve of the Revolution, the only road that did not hug the east coast followed the Hudson River Valley into western New York on its way to Montreal (this was one reason colonial Americans seemed continually obsessed with the idea of conquering Montreal and bringing it into the United States). Less than thirty years later, riders working for the Post Office Department carried mail to nearly all the new settlements of the interior. The postal system's designer, Benjamin Franklin, understood that in order for

the new Republic to function, information had to flow freely. Franklin set a low rate for mailing newspapers, insuring that news would circulate widely in the newly-settled areas. But it was one thing carrying saddlebags filled with letters and newspapers to the frontier, and something else moving people and freight.

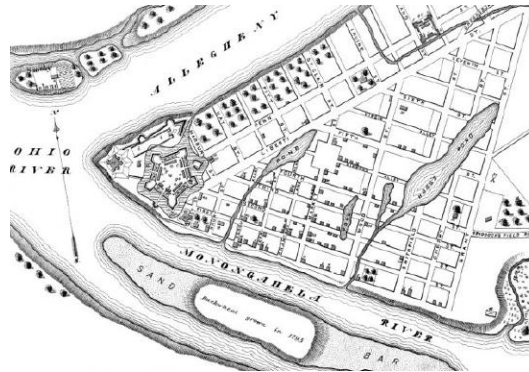


Figure 13.4: 1795 view of Pittsburgh, which grew at the point where the Allegheny and Monongahela Rivers join to create the Ohio River. (Public Domain; Samuel W. Durant).

Rivers were the first important routes to the interior of North America. The Ohio River, which begins at Pittsburgh and flows southwest to join the Mississippi, helped people get to their new farms in the Ohio Valley and then helped them carry their farm produce to markets. The Ohio River Valley became one of the first areas of rapid settlement after the Revolution, along with the Mohawk River Valley in western New York. The importance of river shipping is illustrated by the fact that over fifty thousand miles of tributary rivers and streams in the Mississippi watershed were used to float goods to the port of New Orleans. The dependence of western farmers on the Spanish port also explains why New Orleans was a considered strategic city by the United States in the War of 1812. Thomas Jefferson's 1803 purchase of the Louisiana Territory had actually begun as an attempt to buy the city of New Orleans, and Andrew Jackson's defense of the port during the War of 1812 was vital to insuring the success of western expansion.

Early westward expansion depended on rivers, and towns and cities built during this era were usually on a waterway. Pittsburgh, Columbus, Cincinnati, Louisville, St. Louis, Kansas City, Omaha, and St. Paul all owe their locations to the river systems they provide access to. Buffalo, Cleveland, Detroit, Chicago, and Milwaukee utilize the Great Lakes in the same way. These lakeside cities exploded after the Erie Canal opened a route from the Great Lakes to the Atlantic, and allowed New York to overtake New Orleans as the nation's most important commercial port. The 363-mile Erie Canal was so successful that another four thousand miles of canals were dug in America before the Civil War.

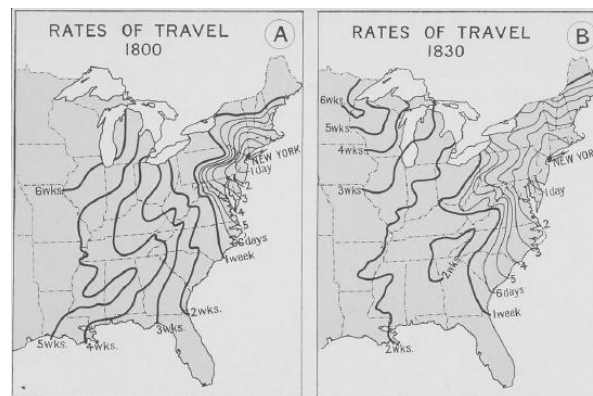


Figure 13.5: Travel time in 1800-1830 ((Public Domain; US Census adapted by Dan Allosso).

In 1800, it took nearly two weeks to reach Buffalo from New York City, a month to get to Detroit, and six grueling weeks of travel to arrive at the swampy lake-shore settlement that would become Chicago. Thirty years later, Buffalo was just five days away, Detroit about ten days, and Chicago less than three weeks. Horses pulled canal boats from towpaths on shore, eliminating the strain of travel for the boats' passengers. Floating along on calm water was infinitely more comfortable than spending weeks on a wagon, in a cramped stage coach, or on horseback. The number of people willing to make long trips increased accordingly. And the amount of freight shipped to New York, after the canal cut shipping costs by over ninety percent, increased astronomically. Goods flowed

along the Canal in both directions, offering life-changing opportunities. As mentioned previously, within ten years of the Erie Canal's completion, the last fulling mill processing homespun cloth in Western New York shut its doors. Women no longer had to spend their time spinning wool and weaving their own textiles to make their family's clothing. They could buy bolts of wool and cotton fabrics from the same merchant at the local general store who ground their family's grain into flour and shipped it on the Canal to eastern cities. With fewer demands on their time, many women were able to not only improve their own quality of life, but contribute to family income by taking in piece-work, raising cash crops, or keeping cows and churning butter for sale to their local merchants.

The Age of Steam

Steam technology changed the nature of transportation. Until steam engines were put on riverboats, shipping had depended on either wind and river currents or on human and animal power. Goods could easily be floated south from farms on the nation's rivers, but it was much more difficult and expensive to ship products against the rivers' currents to the frontier. Flatboats and rafts accumulated at downstream ports, and were often broken down and burned as firewood. Steam engines made it possible to sail upstream as easily and nearly as quickly as down, causing an explosion of travel and shipping that radically changed frontier life.

Steam engines were a product of early European industrialism. The first steam patent was granted to a Spanish inventor named Jerónimo Beaumont in 1606, whose engine drove a pump used to drain mines. Englishman James Watt's 1781 engine was the first to produce rotary power that could be adapted to drive mills, wheels, and propellers. Robert Fulton, an American inventor who had previously patented a canal-dredging machine, visited Paris and caught steamboat fever. Fulton sailed an experimental model on the Seine, and then returned home and launched the first commercial American steamboat on the Hudson River in 1807. The Clermont was able to sail upriver 150 miles from New York City to Albany in 32 hours. In 1811, Fulton built the New Orleans in Pittsburgh and began steamboat service on the Mississippi.

Although Robert Fulton died just a few years later of tuberculosis, his partners Nicholas Roosevelt and Robert Livingston carried on his business, and the age of riverboats was underway. Like Fulton's prototype and the Clermont, the New Orleans was a large, heavy side-wheeler with a deep draft. It was not the most efficient design for shallow water, and it did not take long for ship-builders to settle on the familiar shallow-draft rear-paddle riverboats that carried freight on the Mississippi and its tributaries well into the 20th century. The shallower a riverboat's draft, the farther upriver it could travel. Steam-powered riverboats soon pushed the transportation frontier to Fort Pierre in the Dakota territory and even to Fort Benton, Montana. Riverboats made it possible to ship goods in and out of nearly the whole area Thomas Jefferson had acquired in the Louisiana Purchase just a generation earlier. And steam-powered ocean shipping made the markets of Britain and Europe readily accessible to farmers and merchants in the middle of North America.



Figure 13.6: The Mississippi River's classic shallow-draft, rear-paddle riverboats at Memphis, 1906. (Public Domain; Detroit Publishing Co).

The other transportation technology enabled by steam power, of course, was the railroad. But railroads were even more revolutionary than steamboats. In spite of their power and speed, steam-powered riverboats depended on rivers or occasionally on

canals to run, but a railroad could be built almost anywhere. Suddenly, the expansion of American commerce was no longer limited by the routes nature had provided into the frontier.

America's first small railroads had actually been built on the East Coast before a steam engine was available to power them. Trains of cars were pulled by horses and looked a lot like stage-coaches on rails. But after Englishman George Stephenson's locomotives began pulling passengers and freight in northwestern England in the mid-1820s, Americans quickly switched to steam. The first locomotive used to pull cars in the United States was the Tom Thumb, built in 1830 for the Baltimore and Ohio Railroad. Although Tom Thumb lost its maiden race against a horse-drawn train, Baltimore and Ohio owners were convinced by the demonstration of steam technology and committed to developing steam locomotives. The railroad, which had been established in 1827 to compete with the Erie Canal, already advertised itself as a faster way to move people and freight from the interior to the coast. Adding steam engines accelerated rail's advantage over canal and river shipping.

Over 9,000 miles of track had been laid by 1850, most of it connecting the northeast with western farmlands. The Mississippi River was still the preferred route to market from Louisville and St. Louis south. But Cincinnati and Columbus became connected by rail to the Great Lake ports at Sandusky and Cleveland, giving the northern Ohio Valley faster access to New York markets. Detroit and Lake Michigan were also connected by rail, making the long steamboat trip around the northern reach of Michigan's lower peninsula unnecessary.

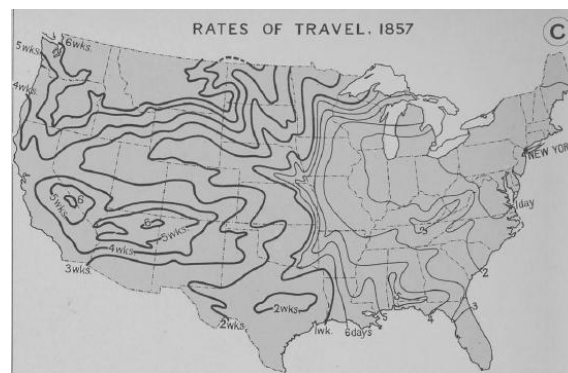


Figure 13.7: Travel time in 1857 (Public Domain; US Census adapted by Dan Allosso).

By 1857, rail travelers could reach Chicago in less than two days and could be almost anywhere in the northern Mississippi Valley in three. On the eve of the Civil War in 1860, Chicago was already becoming the railroad hub of the Midwest. The Illinois Central Company had been chartered in 1851 to build a rail line from the lead mines at Galena to Cairo, where the Ohio and Mississippi Rivers joined. Galena is also located on the Mississippi on the northern border of Illinois, but rapids north of St. Louis made transporting ore on the river impossible, illustrating the advantage of rails over rivers. A railroad line to Cairo, with a branch line to Chicago, would also attract settlers and investors to Illinois. Young Illinois attorney Abraham Lincoln helped the Illinois Central lobby legislators and receive the first federal land grant ever given to a railroad company. The company was given 2.6 million acres of land, and Illinois Senator Stephen Douglas helped design the checkerboard distribution of parcels that would become common for railroad land grants. The map below shows the extent of the land the government gave to the Illinois Central Company, which a few years later showed its gratitude by helping to finance Lincoln's Presidential campaign against Douglas.

The North's advantage over the Confederate South in railroad miles and the Union Army's ability to move troops and supplies efficiently had a definite impact on the outcome of the Civil War. In the years following the war, the shattered South added very little railroad track and repaired only a small percentage of the tracks the Union Army had destroyed during the war. While railroads languished in the South, rail miles in the North exploded. In 1869, the West Coast was connected through Chicago to the Northeast, when the Union and Central Pacific Lines met at Promontory Point Utah on May 10th. The building of a transcontinental railroad was made possible by the Pacific Railroad Act, which President Lincoln had signed into law in 1862.

Public or Private?

The Pacific Railroad Act was the first law allowing the federal government to give land directly to corporations. Previously the government had granted land to the states for the benefit of corporations. The Act granted ten square miles of land to the railroad companies for every mile of track they built. Land next to railroads always increased in value. The unprecedented gift of ten square miles of rapidly-appreciating land for every mile of track was a tremendous incentive to railroad companies to lay just as much

track as they possibly could. Decisions to build lines were frequently based on the land granted, rather than on whether or not railroad companies expected the new lines to carry enough traffic or generate enough freight revenue to pay for themselves. In the eighteen years between the original Illinois Central grant of 1851 and the completion of the transcontinental line in 1869, privately-owned railroads received about 175 million acres of public land at no cost. This amounts to about seven percent of the land area of the contiguous 48 states, or an area slightly larger than Texas. For comparison, the Homestead Act distributed 246 million acres to American farmers over a 72-year period between 1862 and 1934, but required homesteaders to live on and to farm the land continuously for five years or pay for their parcel. The justification for the residency requirement was that the government was concerned homesteaders would become speculators and flip their farms. Railroad land grants were made with no similar stipulations because railroad corporations were expected to sell the lands they were given at a substantial profit.

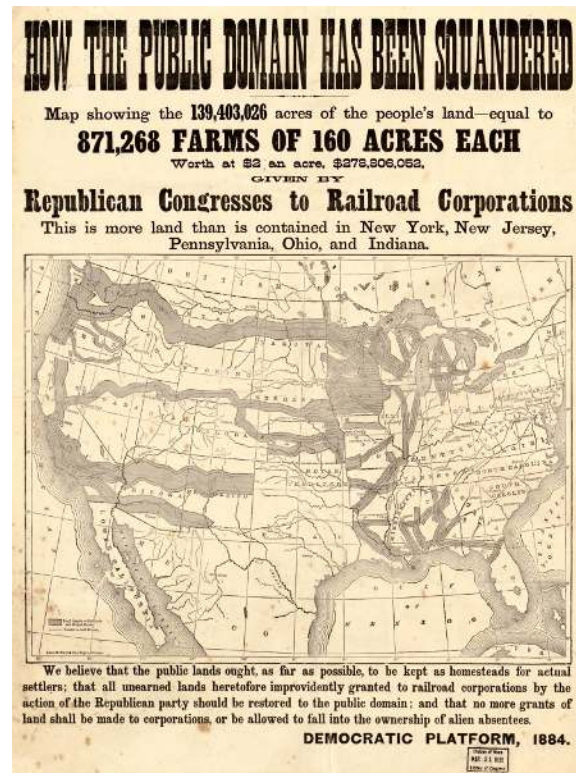


Figure 13.8: This 1884 political poster illustrates ongoing political dissent over the inordinate amount of land given to the railroads by the government. (Public Domain; Democratic Party).

It has often been argued that a national infrastructure project as large as a transcontinental railway could never have been built without government assistance. The West Coast and western territories needed to be brought into the Union, some historians have argued, and the only way to achieve this was with government-supported railroads. Ironically, the same people who make this argument usually also claim that it would have been disastrous for the government to have owned the railroads it had made possible with its legislation, loans, and land grants. An undertaking of this scope and scale, they say, requires that corporations be given monopolies and grants of natural resources and public credit. These arguments make it seem inevitable that giant corporations taking huge gifts from the public sector were the only way for America to move forward and build a rail network. However, history shows that this was not the only way a national rail system could have been built.

There are numerous examples of rail systems built and managed by the public sector in foreign countries, especially during the nineteenth century when nearly every rail system outside the United States was state-owned and operated. However, for the sake of simplicity we will restrict the comparison to the United States. The Northern Pacific Railway, a private corporation chartered by Congress in 1864, built 6,800 miles of track to connect Lake Superior with Puget Sound. In return, the corporation was given 40 million acres of land in 50-mile checkerboards on either side of its tracks. Not only did the Northern Pacific rely on the government for land and financing, the railroad used the services of the U.S. Army to protect its surveyors and to move uncooperative Indians out of its way. When the Northern Pacific's proposed route cut through the center of the Great Sioux Reservation, established by the 1868 Fort Laramie Treaty, the corporation pressured the government to break the treaty. George Custer announced that gold had

been discovered in the Black Hills after an 1874 mission protecting Northern Pacific surveyors, and Washington let the treaty be disregarded by both the railroad and the prospectors. The Indians responded with the Great Sioux War of 1876, which culminated in the Battle of Little Big Horn, where Custer and his Seventh Cavalry were wiped out by Sitting Bull and Crazy Horse leading a force of Lakota, Cheyenne, and Arapaho warriors. But although the Indians won the battle, they lost the war. Less than a year later, Sioux leaders ceded the Black Hills to the United States in exchange for subsistence rations for their families on the reservation.



Figure 13.9: George Custer, railroad employee. Note the Northern Pacific (NPRR) stamp on the tent in this photo from Custer's 1874 mission providing security for railroad surveyors; during which Custer discovered gold in the Black Hills. (Public Domain; Custer Staghounds).

In contrast, Canadian-American railroad entrepreneur James Jerome Hill built his Great Northern Railroad line from St. Paul to Seattle during the last decades of the nineteenth century without causing a war and without receiving a single acre of free public land. The Great Northern bought land from the government to build its right of way and to resell to settlers. Hill claimed proudly that his railway was completed "without any government aid, even the right of way, through hundreds of miles of public lands, being paid for in cash." The Great Northern system connected the Northwest with the rest of the nation through St. Paul, using a web of over 8,300 miles of track. And because Hill only built lines where traffic justified them rather than adding track just to collect free land, the Great Northern was one of the few transcontinental railroad companies to avoid bankruptcy in the Panic of 1893.

Regardless of the ways they were financed and built, the proliferation of railroads caused explosive growth. Chicago was a frontier village of 4,500 people in 1840. When Lincoln helped the Illinois Central receive the first land grant in 1851, the city's population was about 30,000. Twenty years later Chicago was the center of a rapidly-growing railroad network, and the city held ten times the people. In 1880 Chicago's population was over 500,000, and ten years later Chicago had over a million residents. We will take a closer look at the changes railroads brought to Chicago in a Chapter Seven.

Internal Combustion

America's transportation revolution did not end with steamboats and railroads and was not limited to public transportation technologies. The development of the automobile ushered in a new era of personal mobility for Americans. Internal combustion engines were inexpensive to mass produce and much easier to operate than steam engines. With the development of automobiles and trucks around the turn of the twentieth century, it no longer required a huge capital investment and a team of engineers to purchase and operate motorized transportation. Even the workers on Henry Ford's assembly lines could aspire to owning their own Model Ts, especially after Ford doubled their wages to \$5 a day in January 1914.

Engineers had experimented with building smaller machines using steam engines, and there were several examples in Europe and America of successful steam-powered farm tractors, trucks, and even a few horseless carriages. But internal combustion engines delivered much greater power relative to their mass, allowing smaller machines to do more work. The first internal combustion farm tractor was built by John Froehlich at his small Waterloo Gasoline Traction Engine Company in 1892. Others began applying internal combustion to farm equipment, and between 1907 and 1912 the number of tractors in American fields rose from 600 to 13,000. Eighty companies manufactured more than 20,000 tractors in 1913. After an auspicious beginning, Froehlich's little Iowa company grew slowly and began building farm tractors in volume only after World War I. The Waterloo company built a good product, and was acquired by the John Deere Plow Company in 1918. Deere remains the world leader in self-propelled farm equipment.

The first internal combustion truck was built by Gottlieb Daimler in 1896, using an engine that had been developed by Karl Benz a year earlier. World War I spurred innovation and provided a ready market for internal combustion trucks that were much less expensive than their steam-powered rivals. By the end of the war gasoline-powered trucks had overtaken the steam truck market. Most large trucks now burn diesel fuel rather than gasoline, using a compression-ignition engine design patented by Rudolf Diesel in 1892.

Internal combustion trucks and tractors, like cars, allowed people to go farther, carry more, and do more work than had been possible using human and animal power. And they were much more affordable than comparable steam-based vehicles and easier to build at a scale that encouraged individual use and ownership. Trucking eventually challenged rail transport, especially after the development of semi-trailers and the Interstate Highway System. Although the first diesel truck engines only produced five to seven horsepower, they advanced quickly. Indiana mechanic Clessie Cummins built his first, six-horsepower diesel engine in 1919. The business bearing his name is now a global corporation doing \$20 billion in annual business, mostly in diesel engines. Cummins's current heavy truck engine is rated at 600 horsepower.



Figure 13.10: The Interstate Highway System today. (Public Domain; National Atlas).

While it is easy to focus on the inventions and technological innovations of the internal combustion era, we should not lose sight of the infrastructure improvements that made these innovations valuable. Without paved roads to run on, there would have been far fewer cars and trucks and their impact on society and the environment would have been much different. The biggest road-building project in American history was the construction of the Interstate Highway System, financed by the Federal-Aid Highway Acts of 1944 and 1956. Unlike the transcontinental railroad project of the 1860s, the Interstate Highway System was paid for by the federal government and the roads are owned by the states. The system includes nearly 47,000 miles of highway, and the project was designed to be self-liquidating, so that the cost of the system did not contribute to the national debt. In addition to the Interstate System, American states, counties, cities and towns maintain systems of roads totaling nearly four million miles, about two-thirds of which are paved.

Gasoline vs. Ethanol

The economic trade-off of internal combustion for the farmers and teamsters who first adopted it was that speed and power came at a price. Where horses and oxen were readily available in farm communities and were cheap to maintain, tractors and trucks were a substantial investment. And unlike horses and oxen, tractors and trucks needed to be fueled with petroleum that made them dependent on a faraway industry. However, this dependence was not inevitable. Henry Ford and Charles Kettering, the chief engineer at General Motors, had both believed that as engine compression ratios increased, their companies' engines would transition from gasoline to ethyl alcohol. We are all aware that the shift to ethanol did not happen, but why it did not is less well-known and may surprise you.

Most history books faithfully repeat the inaccurate story that Edwin Drake's famous 1858 oil strike in Titusville Pennsylvania came just as the world was running out of expensive whale oil. Actually, there was a thriving market for alcohol fuel in the mid-nineteenth century United States. Ethanol was price-competitive with kerosene, and unlike kerosene it was produced by many small distillers, creating widespread competition that would continue to drive down prices. Unfortunately for ethanol producers and fuel consumers, the alcohol fuel industry was wiped out when the Lincoln administration imposed a \$2.08 per gallon tax on

distilled alcohol between 1862 and 1864. A gallon of Standard Oil kerosene still cost only 58 cents, so kerosene took over the American fuel market. Of course, after kerosene became the only available fuel, Standard Oil was free to raise prices as it saw fit.

But ethanol still had its advocates. The very first American internal combustion engine, built in 1826 by Samuel Morey, had used grain alcohol because it was inexpensive and readily available. Nearly a century later, Henry Ford's Model T was designed to be convertible between kerosene, gasoline, and ethanol. General Motors chief engineer Kettering was convinced it was only a matter of time until ethanol became the fuel of choice.

So why aren't we all driving cars running renewable fuels? Part of the answer, as you have probably already guessed, is that Standard Oil made the auto industry an offer they couldn't refuse. The oil company used its vast distribution network to make gasoline available everywhere it was needed, and insured that the price was so low that competitors could not profit if they entered the market. Standard Oil pioneered the practice of pricing below their cost of production to run competitors out of the business. The profits of the company's many other divisions subsidized their short-term losses on gasoline. Predatory pricing was one of the principal charges made against the company in the 1911 antitrust case that resulted in the breakup of the Standard Oil Trust.



Figure 13.11: This 1904 political cartoon was one of many depicting Standard Oil as a predatory octopus attacking American institutions. (Public Domain; Udo J. Keppler).

But Standard Oil's predatory pricing does not tell the whole story of why we do not run cars on ethanol. The rest of the story, if anything, is even more sinister. It has long been known that using gasoline at high compression results in engine knocking. It was also well-known that ethanol did not knock. Charles Kettering at General Motors had argued for years that the "most direct route which we now know for converting energy from its source, the sun, into a material suitable for use as a fuel is through vegetation to alcohol." The technology was simple and Americans had been distilling alcohol fuels for generations. Unfortunately, Kettering worked for a corporation whose major shareholder was the Du Pont family, who also happened to own the largest corporation in the chemical industry. It would be impossible for DuPont to profit or for General Motors to gain a competitive advantage using alcohol fuels, since the distilling technology was universally available and the product was un-patentable. However, there was an extremely profitable alternative.

Tetraethyl Lead (TEL) was a lubricating compound that could be added to gasoline to eliminate knocking. General Motors received a patent on its use as an anti-knock agent, and Standard Oil was granted a patent on its manufacture which was later extended to include DuPont. The three companies founded Ethyl Corporation to market TEL and other fuel additives. Unfortunately, lead is a powerful neurotoxin, linked to learning disabilities and dementia. The federal government had misgivings about allowing lead additives, and in 1925 the Surgeon General temporarily suspended TEL's use and government scientists secretly approached Ford engineers seeking an alternative. In the 1930s, 19 federal bills and 31 state bills were introduced to promote alcohol use or blending. But the American Petroleum Industries Committee lobbied hard against them. Under intense industry pressure, the Federal Trade Commission even issued a restraining order forbidding commercial competitors from criticizing Ethyl gasoline as unsafe. By the mid-1930s, 90 percent of all gasoline contained TEL. Airborne lead pollution increased to over 625 times previous background levels, and the average IQ levels of American children dropped 7 points during the leaded-gas era. By the 1980s, over 50 million American children registered toxic levels of lead absorption and 5,000 Americans died annually of lead-induced heart

disease. When public concern continued to increase, the Ethyl Corporation was sold in 1962 in the largest leveraged buyout of its time. In the 1970s the newly-established Environmental Protection Agency finally took the stand other federal agencies had been afraid to take. The EPA declared emphatically that airborne lead posed a serious threat to public health, and the government forced automakers and the fuel industry to gradually eliminate the use of lead. TEL is now illegal in automotive gasoline, although it is still used in aviation and racing fuels. Unleaded gasoline is now used in all new internal combustion cars. But while pure ethanol has powered most automobiles in Brazil since the 1970s, most Americans continue to use a blend containing just 10% ethanol to 90% gasoline.

Global Cargo

Two additional forms of transportation became increasingly important as the twentieth century ended and the twenty-first century began. Commercial airplanes are only a little over a hundred years old and the first air cargo and airmail shipments were flown in 1910 and 1911. Air cargo was considered too expensive for all but the most valuable shipments until express carriers such as UPS and Federal Express revolutionized the shipping business in the 1990s. The global economy now measures air freight volumes in ton-miles. In 2014, the world shipped more than 58 billion ton-miles of goods. Air freight also allows perishable items like fresh fruits and vegetables to be transported across oceans and continents from producers to consumers. This is a big business. Over 75 million tons of fresh produce are air-shipped annually, worth more than \$50 billion.

For nonperishable items, container shipping has created a single global market. Standardized containers were invented by a trucker named Malcolm McLean, who realized it would save a lot of time and energy if his trucks didn't need to be loaded and unloaded at the port, but could just be hoisted on and off a cargo ship. McLean refitted an oil tanker and made his first trip in 1956, carrying fifty-eight containers from Newark to Houston. Current annual shipping now exceeds 200 million semi-trailer sized containers. Containers can be shipped by sea, rail, truck, and even air, allowing just-in-time operators like Wal-Mart to manage a supply chain that relies much less on warehoused inventory, and more on product in transit.



Figure 13.12: Two Post-Pamax class container ships in San Francisco Bay. (Public Domain; NOAA).

But just as shifting from horse power to a gasoline truck or tractor a hundred years ago involved economic trade-offs, shopping at Wal-Mart today introduces a new level of dependence. We not only rely on transportation systems and the fuels they run on, but also on supply-chain software, international trade agreements and currency fluctuations, and even on the political situations of faraway nations. As long as the costs of inputs like fuel and infrastructure like ports, highways, and open borders remains low, the global market is a great deal for the consumer and a source of immense profits to businesses and their shareholders. But a company like Wal-Mart is just as dependent on factors it cannot control as its customers are. If any of these factors change, who will bear the cost?

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14: Commodities, Centers, and Peripheries

Whenever people have achieved a surplus above and beyond mere subsistence, trade and the accumulation of resources have led to urbanization. Cities at the nodes of these trade networks have become centers of wealth, power, and culture. Artists and craftspeople often find patrons or markets for their work in cities, and government administrators and businesspeople often leave extensive records. So cities, both ancient and modern, are usually full of interesting information for historians.

But just because they offer so much information about the past, we should never suppose that cities were the only places that mattered. Often historians interested in culture, or politics, or social movements focus too much attention on the cities where art was displayed, where governments debated, and where workers demonstrated. This narrow focus can distort our understanding of the past by suggesting that everything that happened in the city originated in the city. In fact, cities have always been centers for the accumulation, processing, and consumption of resources that usually originate in the hinterlands that surround them.

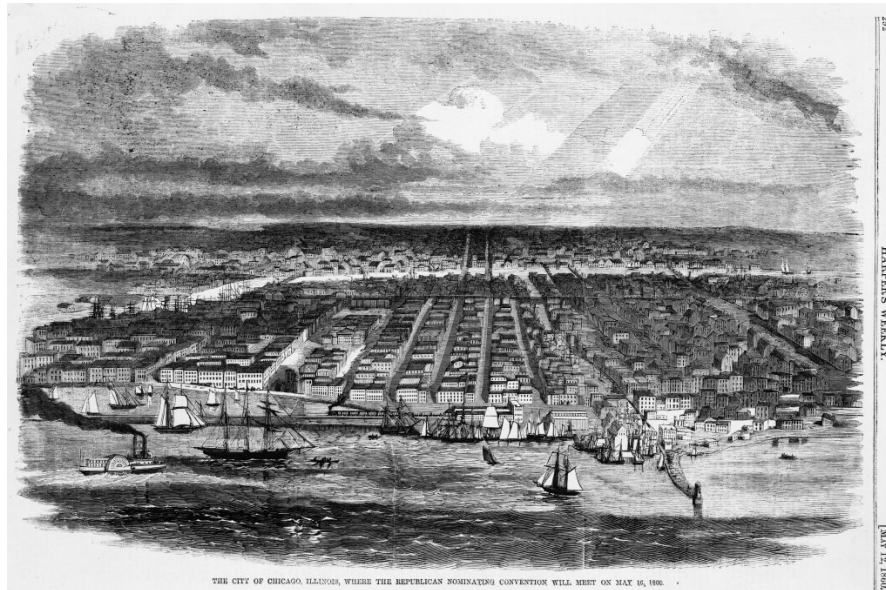


Figure 14.1: Chicago on the eve of the Republican National Convention that nominated Abraham Lincoln in 1860.

As transportation improved, the hinterlands that were the sources of raw materials could be farther away. Grain from upstate New York farms could float down Erie Canal and the Hudson River to New York City. Cotton from Southern plantations could become cloth in Lowell mills. And silver mined in Potosí could become money in London and Beijing. In each case, New York, Lowell, London, and Beijing were just as dependent as they had ever been on their hinterlands, even though increasing distance might seem to obscure the relationship. It is important, as the distances widen and interactions become more complicated, to be careful we do not lose sight of the economic lifelines tying the centers with the peripheries.

In this chapter we will consider the rise of new cities and new hinterlands as Americans pushed westward. The cities that developed on rivers, lakeshores, and at railroad junctions benefited from the advances in transportation discussed previously. But the transportation would have been pointless and the cities would have remained empty without the surrounding rural areas that supplied foods, fuels, and building materials. And the commodity agriculture, meat production, and forestry that developed alongside the cities we will consider in this chapter likewise depended on urban businesses and populations who were both the processors and often the consumers of their products.

Porkopolis

Recall how we previously observed difficult-to-ship grain west of the Appalachians become distilled into more portable whiskey by early Americans. This conversion into a commercial product for a distant market had been possible because there was more grain harvested than local farm families needed to survive, and also because rural people needed cash to buy things they could not make for themselves. Distilling whiskey not only made their surplus grain easier to transport, it increased the grain's value per pound, and it added variety and interest that plain grain or flour lacked. In modern business terminology, the farmers diversified and added value.

A similar increase in variety and value occurred when grain was fed to domesticated animals such as poultry, cattle, and pigs. Even in primitive conditions, most people prefer not to live by bread alone. In subsistence societies, domesticated creatures usually foraged for themselves or ate waste products not fit for humans. In some societies, animals have continued to occupy this default livestock niche (some contemporary food activists argue we should move back toward this approach). But in America, when there was a surplus, even foods that could be eaten by people were often fed to livestock. These animals became a luxury food for consumers and a living bank account for their owners. They stored the food energy of perishable surplus grains and vegetables in their flesh until there was a shortage, and then they were eaten. As time went on and surpluses became more dependable, meat became a commodity that farmers could raise and sell for cash.

Pigs are extremely efficient converters of surplus plant foods to meat. They are omnivores that grow quickly and are able to produce twice as much meat per pound of grain as sheep or cattle, which are ruminants and prefer grasses. A sow can be bred much earlier than a heifer, and will produce a litter of 6 to 12 piglets after only four months gestation. Pigs were a favorite of homesteaders and frontier farmers because they would eat anything. Pigs could be turned loose to forage for acorns and were a great help to farmers rooting up tree stumps to clear fields. And pigs became the frontier's first big meat product raised for city markets because unlike beef, their flesh is easily preserved by smoking or by salting.



Figure 14.2: Cincinnati Ohio in 1841 when it was known as Porkopolis. In the foreground is the Miami and Erie Canal, and in the distance is the Ohio River and Kentucky.

In the early 1800s, Buffalo New York and Cincinnati Ohio became centers of pork processing. Bacon and hams were smoked, and pork was salted and packed in barrels for storage and shipping. The earliest packers were merchants in frontier towns such as Chillicothe, Terre Haute, and Lafayette Indiana. As raising pigs for market became popular, farmers switched from the semi-wild razorback variety they had brought to the frontier, and began raising premium foreign breeds like the Suffolk, the Yorkshire, and the Poland China. Popular farm periodicals like *The Prairie Farmer* were filled with articles on the merits of different breeds and instructions on crossbreeding for improved results and hybrid vigor. Farmers became experts at calculating “the value of corn when sold in the form of pork,” which required them to know not only feeding yields and feed prices, but also to calculate transportation costs and risks, and to have some idea of the demand for their product in faraway markets. And as specialized processors built larger businesses in the cities, they needed access to capital.

The operating costs of a pork processor were high. Fixed costs of production were low, especially compared to eastern industries like textiles that required large factories and expensive machinery to operate. But a county pork processor might buy 6,000 hogs to pack in a season, which in the mid-1840s cost about \$45,000. A city packer processing 15,000 hogs would need over \$100,000 of cash or credit. Packing quickly became big business. By the 1830s America replaced Ireland as Europe's source of cheap processed food. By the early 1840s, U.S. bacon and ham exports reached 166 million pounds. Shipments of processed pork were made easier by the growth of the rail network, but packers quickly realized that trains carrying barrels of salted pork could just as easily carry live animals. Railroads led to the concentration of packing in big cities such as Cincinnati, Louisville, Chicago, and St. Louis. But even in the 1850s, when Cincinnati was known as Porkopolis and processed over a quarter million hogs each year, the big cities only accounted for 40 percent of the business. By 1877, the Midwest was processing 2,543,120 hogs a year. Storage of ice for summer use allowed what had once been a seasonal business to continue year-round. With the rise of ice-packing, some pork processors moved back to smaller cities. The big city packers took advantage of refrigerated shipping to branch out into beef.



Figure 14.3: Print showing four scenes in a Cincinnati packing house: "Killing, Cutting, Rendering, Salting." 1873.

Beef on Ice

One of America's forgotten industries that flourished during the nineteenth century was the ice business. Ice has been important throughout history, but in early America it was a luxury product costing hundreds of dollars per ton. Ice was traditionally cut from ponds or lakes in the winter, packed in sawdust, and stored in cellars or covered wells. In 1806, a 23-year old Harvard drop-out named Frederic Tudor bought a ship to carry a load of ice from his father's farm in Saugus Massachusetts to the Caribbean island, Martinique. After successfully delivering Massachusetts ice to Martinique, Tudor convinced the governments of Cuba and several other islands to grant him a monopoly on ice imports. By 1833, Tudor was shipping ice to Calcutta, India. After a four-month journey half-way around the world, his ship's cargo of 180 tons of New England ice had shrunk to only 100 tons, but Tudor still made a huge profit. Henry David Thoreau watched Tudor's workers cutting ice on Walden Pond, and remarked in his journal, "The sweltering inhabitants of Charleston and New Orleans, of Madras and Bombay and Calcutta, drink at my well." By 1865, two out of three homes in the Boston area had an icebox.

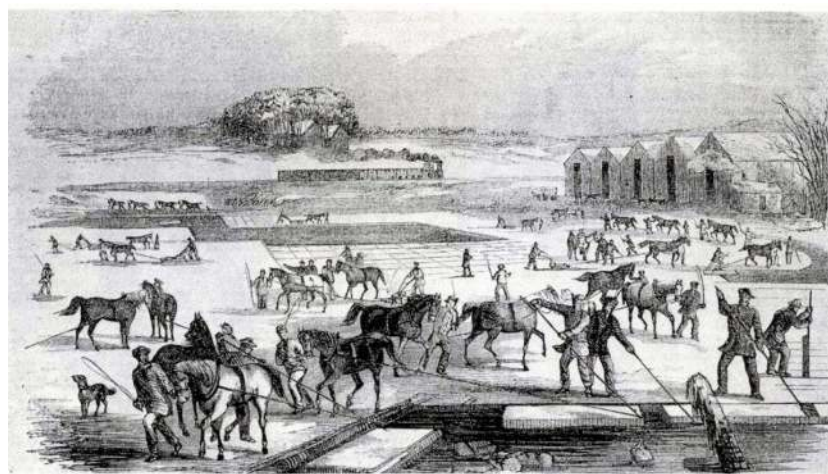


Figure 14.4: Ice harvesting at Spy Pond, Arlington Massachusetts, 1852, showing the railroad line in the background.

Like potash for soap and firewood for locomotive boilers, ice was something western settlers could quickly produce and sell for cash. Local entrepreneurs built icehouses near railroad lines and filled them from winter lakes. Midwestern pork packers like Gustavus Swift and Philip Armour saw an opportunity to expand their businesses. They were already shipping pork on ice, so why not ship chilled beef? Swift, Armour, and the other city packers contracted with icehouses along the rail lines, so their shipments could be kept reliably cold. Refrigerated rail cars first carried dressed beef from Chicago to Eastern cities in the late 1850s. But

local butchers resisted this invasion of their market for many years, insisting that their freshly-killed local meat was tastier and safer. In 1878, Gustavus Swift developed the first practical ice-cooled refrigerated boxcar, or reefer. But adoption of the new technology was slow, and after ten years live cattle still outweighed dressed beef on the rails by four to one.

Because eastern butchers resisted the introduction of dressed beef and railroad companies did not want to risk losing the revenue they earned shipping live cattle, corporations like Swift and Armour built their own fleets of reefer cars. By 1900 the packers owned over fifty thousand refrigerated freight cars and the old local butchers were overwhelmed by their shipments of inexpensive chilled meat. A few years later, a new generation of city butchers was forced by the government to give up slaughtering animals altogether and to begin selling Chicago dressed beef.

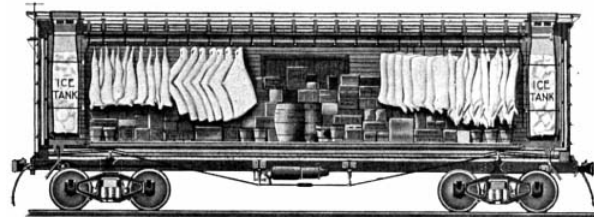


Figure 14.5: Early refrigerated “reefer” railroad car, ca. 1870.

Unlike pork, beef spoils rapidly when it is not refrigerated. The earliest solution to this problem had been to ship live animals to market, where they would be slaughtered as needed and their meat processed for immediate sale by local butchers. Cattle-raising grew in the first half of the nineteenth century from something done on semi-arid rangelands in California and Texas that were no good for crops, to a mainstream activity for midwestern farmers. Cattle grow much more slowly than pigs. But they are ruminants, which means they can eat not only the surplus grains that farmers fed to pigs, but field grass, hay, straw, and silage left over after wheat and corn was harvested.

Like pigs, cattle had been on the frontier from the earliest days of Euro-American settlement. Milk cows were common on family farms and oxen (neutered bulls) were preferred over horses as draft animals, due to their strength and endurance. When either of these animals came to the end of its productive farm life, they were slaughtered and eaten.

In the city, of course, there was less room for a family milk-cow. Although it was actually common in many cities for poor people to keep pigs that foraged the neighborhoods, urban cattle required large amounts of hay and had to be looked after. Many city-dwellers relied on dairymen for their milk and on their local butchers to kill and process their steaks and roasts. Herds of cattle were often walked across the plains in long cattle drives to a railhead where they would be loaded onto freight cars for shipment to distant cities. These animals might walk hundreds of miles from their rangelands to the railhead, resulting in tremendous weight loss. After arriving at their destinations, the cattle would have to be finished: fed for a while to regain their weight. And when they were processed by a local butcher, up to 60% of the animals’ mass would still have to be discarded as inedible waste.



Figure 14.6: A cattle drive in 1902. Steers often lost a large percentage of body weight during drives and shipping, requiring them to be finished or fed at their destination until they reached an acceptable slaughter weight.

Chicago beef packers saw an opportunity. Finishing and processing live animals shipped to eastern cities added to beef's cost. And local butchers often threw away parts of the carcass that could be rendered into marketable products, especially if they could be processed in large volume. But dressed beef was highly perishable and had to be sold quickly after processing. In spite of their fleets of reefer cars, corporations like Swift and Armour were often forced to sell dressed beef below its cost of production, in order to move the product before it went bad. The big meat packers turned this liability into an asset, buying the urban market with low prices and using the profits from other product lines to subsidize their losses. Prices for Chicago dressed beef were slashed to a level at which butchers could not match them with fresh meat. Eastern city customers naturally wanted the largest cut they could get for their dollar, and the Chicago packers made sure it was theirs. Gustavus Swift's instructions to his salesmen were, "If you're going to lose money, lose it. But don't let 'em nose you out."

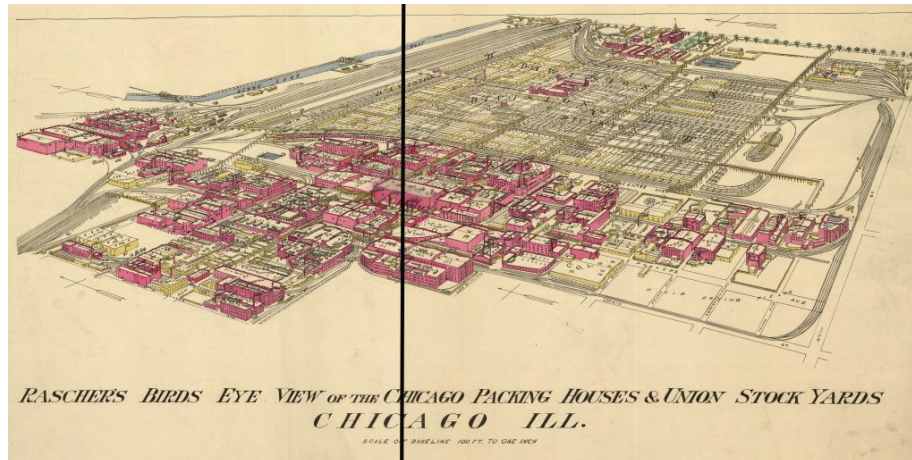


Figure 14.7: 1890 plan of The Chicago Stock Yards

The Jungle

Chicago's famous Union Stock Yards were opened in 1864, on 320 acres of swampy land southwest of the city. Animal pens were connected to the railroads with fifteen miles of track. The Yards processed two million animals in 1870, and by 1890 they were processing 9 million animals a year. By 1900, after an expansion, the 475-acre stockyard employed 25,000 people and produced over 80 percent of the meat sold in America. The Yards contained nearly 2,500 livestock pens that could house 75,000 hogs, 21,000 cattle, and 22,000 sheep at the same time. The Yards used 500,000 gallons of water daily and pumped the waste into the South Fork of the Chicago River in an area that quickly became known as Bubbly Creek. According to Chicago tradition, the creek still bubbles, nearly a hundred years later.

Growth of the Chicago meat packing industry was resisted by butchers, distrusted by consumers, and criticized by labor activists. Most Americans at the beginning of the twentieth century lived on farms or in small towns, and valued the face-to-face relationships that were still a big part of their commercial lives. And accounts of the Chicago meat packing industry were shocking. Upton Sinclair's 1906 novel, *The Jungle*, depicted the stockyards and packing plants as inhumane, unsanitary, and operated by corrupt businessmen who cut corners and victimized their immigrant workers. In a widely-read endorsement of *The Jungle*, famous author Jack London called the book "the Uncle Tom's Cabin of wage slavery."



Figure 14.8: Meat inspection on Swift's hog processing line, 1906.

Although President Theodore Roosevelt was suspicious of Sinclair and considered him a dangerous socialist, he commissioned an investigation that quickly confirmed Sinclair's sensational claims. The government report led directly to the Federal Meat Inspection Act of 1906, designed to ensure that meat products used as food were processed under sanitary conditions and were correctly labeled. This type of regulation had never been needed when Americans slaughtered and processed their own farm animals or bought their meat from local butchers who they knew and trusted.

Small local companies lived and died by their reputations in a way that large, remote corporations did not. Government regulation was considered crucial to enforcing safety and quality controls in the stockyards and packing plants of Chicago because it was impossible for consumers to make corporations accountable the way they could their local butcher. What had once been a face-to-face, personal interaction between a merchant and the small community he was a part of had become a faceless transaction in a national market. The personal accountability that was part of face-to-face local commerce disappeared. Consumers were scattered and hard to organize, while producers were few and powerful. Ironically, although businessmen like Swift and Armour may initially have been offended by what they considered government intrusion into their operations, regulation may have actually saved their businesses by creating consumer trust in their processed meats, especially after people had read *The Jungle*.

The Meat Inspection Act and the Pure Food and Drug Act that followed it in 1906 made State Governments accountable for inspecting meat sold inside their borders, and made the Federal Government responsible for meat sold across state borders or exported. The USDA also provided meat grading (Prime, Choice, and Select) as an optional service for a fee. But health and safety inspections were mandatory and were paid for by the government.



Figure 14.9: The Stock Yards in 1947.

Although meat packers such as Armour and Swift may not have welcomed inspectors, corporations actually received a valuable government service at taxpayer expense. USDA inspections cost the meat packers nothing, calmed the suspicions of consumers, and restored trust in the corporate brands. Local butchers, who had never needed government inspectors to convince customers that their shops were clean or their meat safe, found themselves at an extreme disadvantage after government inspectors began stamping sides of Chicago beef with dye stamps declaring the meat wholesome. When the new laws went a step further and declared butchers could not sell uninspected meat at all, and there were not enough USDA inspectors to visit every local slaughterhouse and butcher shop and certify them, local operators were forced to resell Chicago-packed meat or go out of business. Criticized for interfering in free enterprise with their mandatory inspections, the government had actually wiped out the Chicago meat industry's competition through regulation.

There are still a few local meat processors scattered about the Midwest to this day. We call them lockers, and they exist because some farmers still raise a few animals for their own family use, and because Midwesterners hunt deer. Lockers and their customers are not allowed to sell meat without USDA inspection, although a few of the larger lockers are beginning to offer inspection services to livestock producers who want to sell their meat to local customers. Lockers are also allowed to process uninspected carcasses for a fee, which has traditionally been their main business. Every package of meat cut for home use at a locker must be marked with a stamp reading "NFS", Not for Sale.

As a result of USDA regulations implemented a century ago, it is very difficult for local entrepreneurs to return to the business model of the pre-Jungle era, when customers knew their merchants and producers lived and died by their personal integrity and the quality of their products. Locavores and libertarians such as Virginia farmer-author Joel Salatin have criticized today's regulatory regime, claiming it unfairly protects global food corporations from competition by small producers. Critics of the current system suggest the global concentration of meat processing has gone too far, but the trend shows no signs of stopping. America's largest pork packer, Smithfield Foods, was recently purchased by the Shuanghui Group of China for nearly \$5 billion. And criticism of the wasteful and inhumane nature of modern corporate food processing is at least as intense as it was when Sinclair wrote *The Jungle*, as we will see in Chapter Eleven.

Lumber & Modern Homes

In addition to processing rural foods for national markets, urban industries depended on raw materials from their hinterlands. Eastern cities grew around industries like the textile mills along the Merrimack River, processing cotton from Southern plantations. Western cities surrounded by undeveloped country became conduits for the natural resources of the frontier. In addition to meat-packing, Chicago became a center of the lumber industry.



Figure 14.10: 1900 photo showing a raft of logs on its way to a lumber mill. Most of the logs reaching Chicago were floated across Lake Michigan.

Cutting trees in frontier forests was traditionally a winter activity, beginning each November after the harvest. Winter logging camps filled with Midwestern farmers or their sons, eager to supplement the season's farm produce with some cash earnings. Another reason logging was a winter activity was because it was difficult to get white pine out of the woods at any other time. Pine forests were often boggy, and sixteen-foot sections of tree trunk were easier to slide over frozen roads. Lumbermen stacked the logs on horse-drawn sleds they drove over iced logging trails. Logs were then piled beside frozen streams throughout the winter, waiting for the spring snow-melt that would carry the timber downstream to a lake. Most of the timber that made its way to Chicago was floated across Lake Michigan. Timber came from Michigan, Wisconsin, and as far away as Minnesota. In 1879, *The Lumberman* magazine reported that "There is not today a navigable creek in the state of Michigan or Wisconsin [or] Minnesota, upon whose banks, to the head waters, the better grade of timber is still standing within a distance of two to three miles."

One of the major markets for Midwestern lumber processed in Chicago was house-building. Dimensional softwood lumber of the kind we are familiar with today made a new style of construction possible. Hardwood-framed, post and beam construction required special skills. A new technique called balloon-framing allowed houses to be built by relatively unskilled carpenters. Early American houses had been built of local hardwoods and had often been constructed in community efforts like the barn-raising still held in traditionalist communities. Balloon houses were so easy to build that shoppers could buy them from mail order catalogs. In 1908, Chicago-based Sears Roebuck Company published its first *Book of Modern Homes and Building Plans*, which included 44 designs ranging in price from \$360 to \$2,890. Sears rail-shipped more than 70,000 catalog home kits between 1908 and 1940, in 370 designs. The ready-to-build kits included everything but concrete and bricks for their foundations. Competing regional and national companies sprang up, and the balloon construction style quickly became universal among American house-builders.

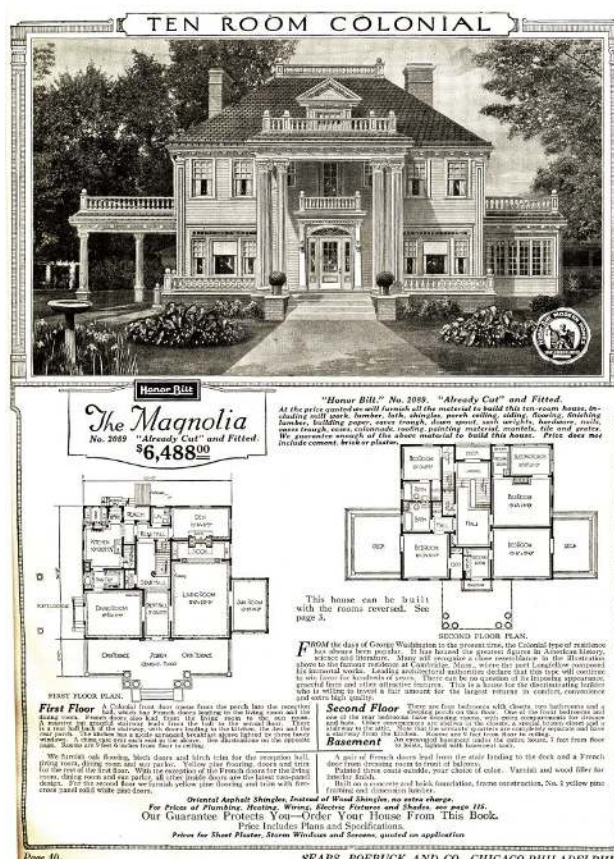


Figure 14.11: 70,000 Sears Modern Homes like this 1921 Colonial were shipped by rail to customers all over America.

Lumber production in the Great Lakes region peaked in the early 1890s and then fell sharply when the industry moved to the Pacific Northwest. The cut-over area covered several states, and the forest was usually clear cut. While removal of the Midwest's forests created potential new farmlands, the debris left by the cut-over first needed to be cleared. Clearing the branches and debris left when pine forests were cut was often accomplished with fire, leading to some of the worst forest fires in American history. But sometimes the environmental impact on remote, resource-producing hinterlands is harder to see than the growth and profit being generated in the processing cities. Contemporary media and history often celebrate the achievements of innovators and entrepreneurs in the centers, without counting the costs to environments, communities, and people on the peripheries. Our failure to charge these peripheral costs against the profits created at the center happens so frequently that, as mentioned in earlier chapters, economists have coined the term externality to describe it.

For example, while the Great Chicago Fire of 1871 made national news, a much larger blaze that had completely destroyed Peshtigo Wisconsin two days earlier did not. The Peshtigo fire, a direct result of the cut-over, killed 1,500 people in the town of only 1,700, or five times the number who died a couple of days later in Chicago. But unlike Chicago's fire, the Peshtigo disaster was largely ignored at the time and has been virtually forgotten by historians outside Wisconsin.



Figure 14.12: Birdseye view of Peshtigo Wisconsin as it was in September 1871 with a caption stating the town was “Destroyed by fire night of October 8th 1871.”

Similar disasters in the cut-over region included the Great Michigan Fire of 1881, when over a million acres burned, the Hinckley Minnesota fire of 1894, and the Cloquet Minnesota fire of 1918. The deaths and destruction caused by these fires were tangible costs of Chicago’s lumber industry. But they were faraway and external to the calculation of Chicago lumber corporations’ profits. The fires were a cost of doing business, but the cost was socialized while the profits were privatized. In a final irony, to the disappointment of would-be farmers, the boosters who advertised the cut-over as a promising new agricultural region were wrong. Cut-over pine-forest soils turned out to be thin and easily eroded in floods that became more frequent once there were no live tree roots left to hold the soil and absorb rainfall.

The Mill City

Chicago was not the only Midwestern city that depended on resource-rich hinterlands for its growth. During the early decades of American history, as we have seen, farmers grew wheat for home use and milled it at local grist mills. Surplus flour was packed in barrels by merchant millers and shipped to eastern markets. But as railroads made western farmlands more accessible, urban merchants built mills of their own and began buying unprocessed grain directly from farmers.

The creation of global markets, the building of national consumer brands, and the reduction of the farmer to a mere raw material supplier all happened simultaneously in the flour-milling business. Chicago was one center of this consolidation. Another was Minneapolis, home of the familiar brands Pillsbury and General Mills, whose Gold Medal Flour can still be seen on supermarket shelves across America.



Figure 14.13: The Falls of St. Anthony, Stone Arch Bridge and Minneapolis flour-milling district in 1895.

When farmers milled their grain locally and sold it close to home, people were able to buy flour from producers they trusted. The quality of the farmer's wheat and the care the miller took processing it into flour mattered. Even factors such as a farmer's reputation in the community or whether he paid his debts on time could influence a customer's buying decisions. Consumers bought from people they trusted, and often from people with whom they had long-term relationships. Farmers were also able to take advantage of long-term local relationships when it was time to sell their harvests. Producers had a bit more leverage, when they could negotiate with their miller and their customers face to face.

Personal accountability and face-to-face relationships were swept away when farmers began carting their grain to elevators by the railroad for shipment to big-city flour mills. The bulk elevator was an innovation developed in another mill city, Buffalo, in the late 1820s after the opening of the Erie Canal. Elevators allowed large quantities of grain to be handled rapidly and stored together. Wheat might still be hauled to the elevator by individual producers in bags with the farmer's name on it. But as soon as it was unloaded the grain went into bulk storage bins where it was mixed with everyone else's grain. A particular farmer's special attention to his fields, or to timing his harvest and drying and threshing his grain carefully, was lost along with his identity. Everyone's grain went into the same railroad cars and when the trains arrived in Minneapolis, it did not even really matter where they had come from. Trains from all across the Midwest converged on Minneapolis because its millers had developed a new technology called the rolling mill, and in the final decades of the nineteenth century the Mill City became the world leader in flour production.

When Minnesota became the 32nd state in 1858, the population of Minneapolis had been only about five thousand. The town had grown up around the Falls of St. Anthony, where the power of the first major waterfall on the Mississippi River was used to saw lumber and grind flour. By 1870, there were about 13,000 people in the growing city and large-scale flour mills had taken over the river in much the same way textile corporations had taken over eastern rivers. Twenty years later, when the flour-milling industry reached its peak, Minneapolis had grown to over 165,000 and the Mississippi was lined with corporate mills, connected by a dedicated Stone Arch railroad bridge crossing the river between them.

Grain production surged as farmers devoted more acres to easy-to-sell cash crops. As supply increased, the price farmers received at the elevator for a bushel of wheat fell from \$1.06 in 1870 to 63¢ in 1897, and corn dropped from 43¢ to 30¢. Farmers understood they were overproducing, but they also believed the game was rigged against them. Countless small farmers sold their grain to a few big corporations, and the farmers paid higher freight rates than the railroads charged their favored corporate customers.



Figure 14.14: Farmers resented a government they considered to be “of the monopolists, by the monopolists, for the monopolists,” as the caption of this 1889 political cartoon read.

To make matters worse, when farmers entered the market to buy equipment, they once again felt they were on the wrong end of a system that pitted wealthy city corporations against powerless rural folk. In 1902 Wall Street financier J. P. Morgan merged the McCormick Harvesting Machine Company, the Deering Harvester Company, and three smaller farm machine companies into the International Harvester corporation. After the biggest merger of its time, the farm equipment market consisted of 29 million farmers (38 percent of the American population), but only one \$120 million corporation they could buy harvesters from.

Economic imbalance between corporations in the center and farmers at the periphery led to political mobilization. Farmers joined groups like the National Grange, began cooperatives to sell their produce and to buy equipment and supplies, and helped create the Populist political movement. The People’s Party never won a Presidential election, although their candidate, William Jennings Bryan, served as Secretary of State to Woodrow Wilson. But they elected several Midwestern Governors and dozens of Congressmen. Populists were key to the passage of the Sherman Antitrust Act and to its application against monopolies. In 1914, following the breakup of Standard Oil, International Harvester became the next target of an antitrust suit (it survived).

The pattern of urban processing centers depending on resource-producing hinterlands repeated as Americans moved westward. This was not the only way growth could have occurred in America. It was the result of legal, political, and cultural choices. Enabled by transportation and encouraged by demand from urban consumers, products such as meat, lumber, and flour that had once been produced locally and used by customers who knew the producers, became standardized commodities in national markets. As these markets expanded, large corporations benefited from their access to capital and their ability to create national brands like Sears Modern Homes, Swift Premium Bacon, and Gold Medal Flour. But another, sometimes hidden factor in this change was the government’s role in subsidizing these central processors by ensuring product safety and establishing standards of quality. And the effectiveness of concentrated economic power when it is pitted against small, scattered and often disorganized opponents should not be underestimated.

Recognizing how quickly America changed from a society of farmers and small-town people doing business with neighbors, to an impersonal national and ultimately global market where billions of consumers buy from a few immense corporations is crucial to understanding the present. The centers are now global, and the periphery now includes most Americans. New technology and new markets helped the American West grow, and led to our society of prefabricated homes and processed foods. But in the long run, the centers accumulated more economic and political power than the periphery. City corporations gained the upper hand, partly by business and technical innovation, but partly by ignoring external costs at the periphery and by taking advantage of government subsidies. That is, economic and political power have helped some people benefit more than others from this change. The point is not that change should not have happened, but that if we understand what actually happened, we may be better equipped to consider where we go from here.

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- Joel Salatin, Folks, This Ain't Normal: A Farmer's Advice for Happier Hens, Healthier People, and a Better World. 2011.
- Upton Sinclair, The Jungle. 1906.

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15: Green Revolution

In the last few chapters, we have seen Americans spread across the continent. Beginning with the original thirteen colonies, the history of the United States often seems to be a straightforward story of expansion westward. After a Revolution motivated partly by the colonists' resistance to the Crown's restrictive Proclamation, citizens of the new nation took full advantage of opportunities provided by the Northwest Ordinance, the Louisiana Purchase, the Mexican-American War, and the Oregon Treaty, to seek their fortunes on the frontier. Expansion was achieved partly by hardworking farmers, ranchers, and miners on the countryside, and partly by urban wage-workers and businesses in new western cities. These pioneers were aided by capital from eastern and overseas financial markets, by improving transportation networks, and by eastern city workers and capitalists who processed and consumed the products of fields, forests, and mines.



Figure 15.1: Harvesting wheat in Idaho. (Public Domain; USDA).

But not all the significant movement in American History was east to west. The growth of eastern cities depended on resources acquired on the frontier, so the flow of raw materials like farm products, timber, and minerals (which we will examine in Chapter Twelve) from west to east was vitally important to the nation's growth. The ideal of Manifest Destiny was as much about securing access to these resources as it was about planting the stars and stripes from sea to shining sea. And sometimes, important changes actually originated in the west, and expanded eastward.

The expansion and growth of both the West and the East depended on the ability of farmers to continue producing food for the nation's growing population and for export. The biggest single factor in the continuing farm bonanza was soil fertility. In the 1840s, German chemist Justus von Liebig discovered that the chemicals nitrogen, phosphorus, and potassium were essential to plant growth. Farm soils naturally lose fertility unless fields are given time to regenerate between crop plantings or amendments are added. Liebig announced that instead of leaving fields fallow for years between crop plantings, farmers could amend the soil with the chemicals plants needed. We will examine each of these chemicals, beginning with the element often considered the most important soil amendment, nitrogen. During the crucial period when America's commercial farmers became increasingly responsible for feeding the growing nation, nitrogen came from the west.

Green Manure, Guano, Caliche

When early settlers cut and burned forests to build farms, the thin soils of the forest floors received an initial productivity boost from leaf mulch and from the ashes of burned trees. This fertility was exhausted in a few years unless the farmer rotated crops and pasture or added manure to the soil. The prairie soils later settlers found farther west were deeper and more fertile than eastern forest soils. Tallgrass prairies grew from the Canadian border to Texas, and as the name suggests, some of their grasses grew six to nine feet tall. When Laura Ingalls's parents told her not to stray too far onto the prairie in the Little House books, it was because they were afraid of losing her in the tall grass.

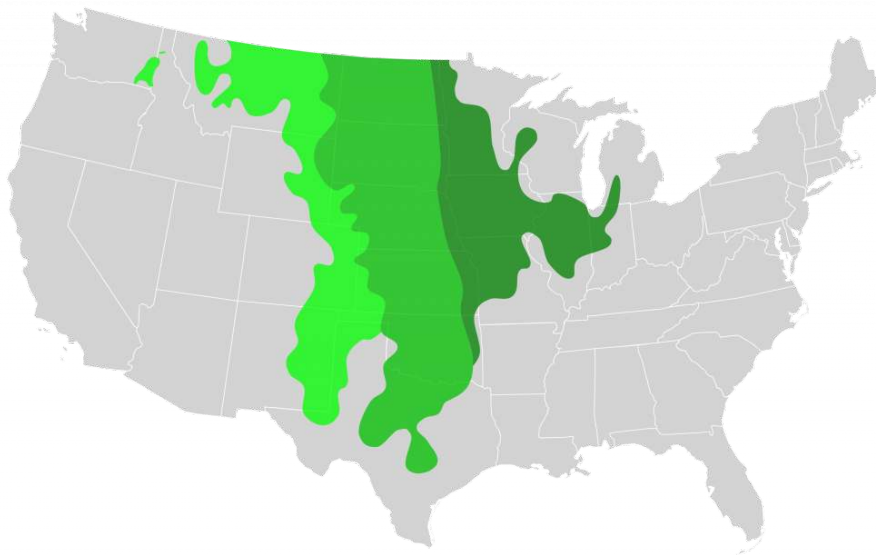


Figure 15.2: American Prairies. (CC BY-SA; Howpper).

In addition to being tall, the prairies were deep. After millennia of growth and decay, prairie vegetation had left a layer of humus up to ten feet deep. The roots of perennial grasses took advantage of this depth, drawing water and nutrients from well below the surface. When settlers arrived with their new John Deere cast-steel plows, they only managed to turn over the top foot or so of this organic layer. But even so, the prairie offered some of the richest soils American settlers had ever seen. Western farmers wrote their families and friends back east boasting of the land and the great yields they got farming it.

In the long run, even the most fertile soils will be depleted after years of growing annual crops that don't return any nutrients. Smaller farms were able to spread manure from livestock, but as their cultivated fields grew from a few acres to a few hundred, most farmers found there was just not enough manure to spread. Commercial farmers, who specialized in growing wheat or corn for the market, began planting their fields with the cash crops every year rather than rotating grain planting with pasture planting for grazing animals that would return at least some manure to the land. A new source of fertility was needed to prevent the agricultural balloon from deflating. The solution was alfalfa, a crop farmers called Chili Clover.



Figure 15.3: In addition to being a green manure, alfalfa is a high-protein animal feed. (CC BY-SA; Gary D Robson).

It has long been known that in addition to spreading manure, planting legumes is an effective method of returning nitrogen to the soil. Although nitrogen is the most common element in Earth's atmosphere, atmospheric nitrogen is very stable and unreactive. Plants cannot use nitrogen until it has been converted to nitrogen oxides, nitrates, or ammonia. Legumes have evolved a symbiotic relationship with Rhizobium bacteria which live in nodules on the plants' roots and break the bonds of atmospheric nitrogen. When

legumes are grown on a field and then plowed under, the nitrogen accumulated in the plants enters the soil and becomes available for the next crop. One of the most effective legume crops used as a green manure is alfalfa.

Alfalfa is native to Eurasia, where Siberian horse tribes began feeding it to their animals over three thousand years ago. Cortés and Pizarro brought alfalfa to Mexico and Peru in the early 1500s and the aggressive species quickly spread to across Central and South America. When English colonists planted alfalfa, which they called lucerne, the plant did poorly in the cool, acidic soils of the Atlantic colonies. After this early failure the plant was forgotten by American farmers. But a Chilean miner introduced alfalfa to California during the Gold Rush. The climates of Chile and California are nearly identical, and the Chili Clover thrived in western pastures, renewing soils and providing ten times the nutrition of regular grasses for the growing dairy herds of California. Impressed by alfalfa's success in California in the early 1850s, the U.S. Patent Office mailed out thousands of packets of alfalfa seed to farmers across the country. Alfalfa plantings spread eastward from California as the plant was quickly adopted by farmers in Utah, Colorado, Kansas, and Nebraska. Today, the Chilean import is so common in American fields, almost no one remembers it was not a native species.

But some farmers lacked the patience to rotate cropping with pasture, or were unwilling to accept the idea that a significant portion of their farms would be fallow each year. They preferred to amend their soils rather than waiting for fertility to regenerate naturally. But as mentioned, few farmers had access to enough manure to supplement all their soil. The first commercial fertilizers were made from guano, the droppings of seabirds living on islands off the western shores of South America. Guano comes from the Quechua Indian word *Wanu*, which means any excrement used as a soil additive in farming. The advantage guano had over locally-available manure was that it was dry, light, and highly concentrated. Natives of the Andes have mined guano on the coast and islands for at least 1,500 years, according to archeologists. Spanish colonial records noted that Inca rulers considered protecting the cormorants that were the main source of guano so important, that disturbing the birds' nesting areas a capital offense. Guano was carried from the coast up into the Andes on the backs of llamas, for use on the terraced farms surrounding highland cities like Machu Picchu.



Figure 15.4: Workers mining guano on a Peruvian island, 1860. (Public Domain; unknown).

Although surrounded by ocean, the islands off the western coast of South America are arid. Like the deserts they face on the mainland, some experience no annual rainfall at all. Seabirds such as cormorants and pelicans have lived on these islands by the millions, for thousands of years. Over that time, they've left literal mountains of droppings, which due to the lack of rain have simply piled up. The guano contains 8 to 16 percent nitrogen, 8 to 12 percent phosphorus, and 2 to 3 percent potassium, which makes it an excellent fertilizer without any mixing. It simply needs to be chopped off the mountain, ground up, and spread on fields.

Prussian explorer Alexander von Humboldt visited the islands around 1802, and publicized guano's value as a fertilizer throughout Europe. Seeing a lucrative business opportunity, Europeans and Americans fell on the area in a guano rush, and by the middle of the century several nations had enlisted the work of Chinese peasants in a Pacific labor system that has been compared with the slavery of the Atlantic world. Although the Chinese workers were technically free, many had been tricked into labor contracts promising work in California. Once they reached the guano islands and realized they had been duped, there was no way off. Over a hundred thousand Chinese workers were imported to the islands in the second half of the nineteenth century.

Guano was so profitable that the U.S. Congress passed a Guano Islands Act in 1856. The law provided an incentive for American sailors to find and claim undefended islands for America by giving the discoverer exclusive rights to the guano recovered. Islands claimed under the Guano Islands Act include parts of the Hawaiian chain, Midway Atoll, part of American Samoa, and several islands still disputed with Colombia. The guano islands off the western coast of South America were so valuable that two wars were fought over them. Chile and Peru fought Spain in the Chincha Islands War, 1864-66, and defeated the Spanish Empire. Then, Spain's claim had been successfully set aside, Chile took many of the guano islands from Peru, along with the nitrate fields of the Atacama Desert, in the War of the Pacific, 1879-83.



Figure 15.5: The Atacama Desert, now controlled by Chile, is the driest place on Earth. (CC BY-SA; Diego Delso).

After about 1870, guano was overtaken as a source of nitrogen by nitrate-rich desert soils called Caliche. These soils were discovered in the Atacama desert, a region regarded as the driest place on earth that lay partly in Chile, partly in Peru, and partly in Bolivia. When all three nations rushed to extract and process the Caliche, Chile challenged its northern rivals for the nitrate fields. Chile's victory in the War of the Pacific extended its border northwards to encompass the Atacama desert, including all the coastal territory that had belonged to Bolivia. Many ethnic Bolivians living around the port city of Arica still dream of throwing off the Chilean yoke and winning their country access to the Pacific again.

Defeating its northern neighbors in the War of the Pacific made Chile the undisputed power on the west coast of the Americas and generated an economic boom. The nitrate Chile monopolized was valuable both as a fertilizer and as a key ingredient in explosives and munitions. But mining and processing nitrate from Chile's desert soil required much more capital than digging guano. Chile attracted British investors, and soon joint ventures began shipping a million tons of nitrate per year out of the South American desert. Production grew steadily until 1914, when World War I created new incentives for Britain's enemies to find an alternative to Caliche nitrate.

Fritz Haber was the German chemist who in 1911 developed the high-pressure method of extracting nitrogen from the atmosphere that is used today to produce nearly all the nitrogen used in industry and agriculture. Carl Bosch, working for German chemical company BASF, scaled up Haber's laboratory experiment to industrial production. In 1914, BASF produced 20 tons a day for the war effort. After the war, production of synthetic nitrate fertilizer quickly cut prices by more than half, and annual Chilean caliche shipments dropped to less than a third of their 2.5 million ton pre-war volume. Haber and Bosch were each awarded Nobel Prizes for their work in chemistry.

The Haber-Bosch process requires not only extreme high pressures to extract atmospheric nitrogen, but a great deal of energy. Approximately five percent of the world's production of natural gas is required to produce about 500 million tons of ammonia each year. But the results have been spectacular. The application of concentrated nitrogen to farm fields increased production even over

the yields that had been achieved using guano and nitrate, causing a global explosion of crop yields known as the Green Revolution. By 2010, the Haber-Bosch process produced 133 million tons of ammonia annually, about three quarters of which was applied as fertilizer. Corn yields per acre increased five-fold, and other staple crops such as rice saw increases of three or four times. Historian of technology Vaclav Smil estimates that if crop yields had stayed where they were in 1900, by the year 2000 farm fields would have needed to cover at least half the land on the ice-free continents in order to feed the world's population, rather than the fifteen percent they now occupy. Another way of putting Smil's point is that nearly half the people alive today would probably starve, without the Haber-Bosch process.



Figure 15.6: Clara Immerwahr, 1870-1915. (Public Domain; unknown).

Although he won a Nobel Prize and worldwide admiration for his work leading to nitrogen fertilizers, Fritz Haber's legacy is clouded with tragedy. In addition to the nitrate Germany required for munitions, Fritz Haber's other contributions to the German war effort were the chlorine-based chemical warfare agents used against allied troops in World War I and a cyanide-based pesticide called Zyklon A that was a direct predecessor of the poison used against prisoners in the concentration camps during World War II. Haber's wife, Clara Immerwahr, was also a scientist and was the first woman ever to receive a Ph.D. from the University of Breslau. Immerwahr killed herself with her husband's gun when she discovered he had supervised the first successful use of chlorine gas at the battle of Ypres in 1915. Their son Hermann emigrated to the U.S. and committed suicide in 1946 after discovering that his father's invention had been used to kill millions of their fellow German Jews. Fritz Haber did not live to see Zyklon B used in the concentration camps. He died while moving to Palestine in 1934.



Figure 15.7: A modern ammonia fertilizer production plant. (CC BY-SA; Sharon Loxton).

The Haber-Bosch process is an effective way to synthesize nitrogen as long as energy costs remain low, but it is not the only way to make nitrogen fertilizer. As mentioned earlier, nitrogen fixating soil bacteria and symbiotic microbes living on legumes fix nitrogen

from the atmosphere without any additional energy inputs. And there are other chemical processes that can be applied on industrial scales. Some of these industrial processes are much less energy-intensive than the Haber-Bosch. For example, a hydro-electric plant in Norway used its surplus energy to make ammonia for fertilizer from 1911 to 1971, using a process that had actually been developed before Fritz Haber made his discovery. But in spite of these alternatives, almost all the nitrogen used in commercial fertilizer is currently produced through the Haber-Bosch process. As a result, fertilizer prices tend to follow natural gas prices, and ammonia-based fertilizers will probably continue to be made using the high-energy process until energy costs rise substantially.

Phosphorus and Potassium

The second element Liebig discovered was crucial to plant growth is phosphorus. Unlike nitrogen, which makes up seventy-eight percent of Earth's atmosphere, phosphorus is a mineral. Traditional agriculture recycled phosphorus by returning manure to fields as fertilizer. During the green revolution, most of the phosphorus applied by the world's farmers has been superphosphate, a concentrate manufactured from a raw material called phosphate rock. Phosphate rock is a sedimentary mixture of minerals deposited in earlier geological eras on the bottoms of ancient oceans. Guano was also rich in concentrated phosphate, and after the Atacama Desert became the main source of nitrates, much of the guano remaining on the Pacific islands was used to produce phosphate fertilizer. The deposits currently used to make fertilizer contain about thirty percent phosphorus.

Although mineral phosphorus is plentiful in the Earth's crust, known deposits of sedimentary phosphate rock are finite. Estimates of the concentrated phosphorus remaining vary, and depend on assumptions about yet to be developed technologies for discovering and recovering the mineral. Some scientists believe phosphorus production may peak around 2030, and then decline as exploitable reserves are exhausted. Like nitrogen, inexpensive and plentiful phosphorus has boosted crop yields greatly. Eighty percent of the phosphate rock mined each year goes to produce fertilizer. Phosphorus shortages would create serious threats to world food supply, which could impact global security. But since phosphorus is still available in animal and human waste, a shift back toward applying manure to agricultural fields would greatly reduce demand for superphosphate. Recognizing the growing value of the chemicals contained in our waste, some urban sewage treatment operations have begun producing concentrated phosphorus fertilizers from city sewer sludge.



Figure 15.8: A train loaded with phosphate rock mined in the background hills. (CC BY-SA; Dennis Jarvis).

Potassium, the third vital plant nutrient, is actually named after the potash that early American colonists made from trees they burned to clear their fields. Ashes were soaked in water, and then the water was evaporated in cast iron pots to produce lye (potassium hydroxide) and potash (a mixture of potassium chloride and potassium carbonate). Wood ashes yielded about ten percent potash by weight, and by clearing a few acres of trees each year as they expanded their cultivation settlers could also produce a product they could sell for cash. As previously mentioned, the first patent issued by the United States in 1790 was for a "new apparatus and process" for making potash.

Like phosphorus, commercial potassium fertilizers are manufactured from sedimentary deposits mined at the sites of ancient inland seas. Current world production is dominated by two cartels, but known reserves total more than three hundred times annual production, so the element is not considered strategic.

Hazards

One of the problems associated with using concentrated soluble nitrogen, phosphorus, and potassium (NPK) in agriculture is that uptake by crops is less than 50 percent. In the old days of ten-foot deep prairie soils, this would not have been a problem. Organic matter binds elemental nutrients, and then decays slowly and releases the nutrient chemicals into the soil gradually over many seasons. The deep root systems of perennial grasses stored nutrients in biomass. And the chemistry of organic soils and the microscopic insect, bacterial, and fungal life-forms that thrived in those soils held onto the rest. However, in the shallow-plowed fields of modern farms, the root systems of annual crops are not deep enough to catch and hold nitrogen, phosphorus, and potassium as it runs off with the water. And much of the soil life that once thrived in farm fields and pastures has been eliminated by pesticides, herbicides, and fungicides.

In spite of the additional food produced to support growing world population, the green revolution has been criticized by environmentalists for ignoring the problems created by fertilizer runoff. Excess agricultural fertilizer contributes nearly half of the nutrients that are currently poisoning American streams and rivers. Fertilizers entering the watershed encourage algal blooms. When these prolific mats of single-celled plants die, the decaying algae traps dissolved oxygen, creating hypoxic dead zones. The dead zone in the Gulf of Mexico has shrunk somewhat from its 2002 peak of 8,500 square miles. But excess fertilizer continues to flow down the Mississippi into the ocean.



Video 15.1: A YouTube element has been excluded from this version of the text. You can view it online here:
https://youtu.be/rK_mEHqx7rw. Video from NOAA, Public Domain

The green revolution has also been criticized by less developed nations for increasing poor people's dependence on technological solutions created in the faraway laboratories and factories in the United States and other industrialized nations. In many cases, development loans from organizations like the World Bank are tied to spending on products from the donor nations. Critics argue this benefits the donors more than the recipients and puts poor farmers at risk when they become dependent on new technologies and then fail to earn enough with their crops to pay rising prices for seeds, fertilizers, and pesticides. Farmers in developing nations have been encouraged with generous loans to invest in expensive capital equipment they cannot afford when the loans disappear. Since the 1990s, more than a quarter million farmers in India have killed themselves because they cannot escape the cycle of debt created by their green-revolution involvement in high-tech agriculture.

Dust Bowl

In America, the early green revolution that began with the use of guano, potash, and nitrate led to bonanza farming and the extension of agriculture onto marginal lands. The Russian Revolution and World War I at the beginning of the twentieth century reduced European farm production and drove up the price of American grain in international markets. Marginal high plains grazing lands like those of western Kansas and Nebraska, Oklahoma and northwestern Texas were put under the plow. Cropland in this region doubled between 1900 and 1920, and then tripled again between 1925 and 1930.



Figure 15.9: Dust storm approaches Stratford Texas in April 1935. (Public Domain; George E. Marsh).

Plowing fields for annual corn and wheat planting is such a common farming practice, it seems normal. On the high plains, perennial grasses had evolved to find water deep in the soil and hold onto it. Plowing exposed the soil to the sun and wind, and cut the roots that trapped moisture and bound the soil together. Worse, generations of American farmers who had been taught to depend on plentiful commercial fertilizers, had forgotten the value of humus. Since Justus von Liebig had focused their attention on soil chemistry in the 1840s, most soil scientists had promoted the idea that chemical nutrients were the important thing, and that soil itself was just an inert medium. Although the prairie settlers discovered when they moved westward had been rich in living organic material, the farms built on those original soils relied on imported chemicals rather than on nutrients produced by biological activity in the soil. Many farmers even burned off the stems and stalks left after each harvest. Then the soil blew away.

The western edge of the prairie was actually a completely different ecosystem from the eastern edge by the Great Lakes, but the change in climate was very gradual. Although many farmers moving west to convert the high plains rangeland to cultivation failed to notice it, rainfall was scarcer and the wind blew harder. Those who did notice were mollified by the assurances of experts that “rain followed the plow.” But of course that was just boosterism and wishful thinking: rain did not follow the plow. Between 1933 and 1935, drought struck the area. Actually, dry conditions returned after a few years of unusual wetness that had been taken by hopeful farmers and optimistic boosters as the region’s permanent climate. Over half a million people were left homeless when their topsoil blew away.

In a single storm, beginning on November 11, 1933, topsoil from Oklahoma was blown all the way to Chicago, where over 12 million pounds of it fell on the city like snow. Like alfalfa, guano, and nitrate in the nineteenth century, America’s topsoil was traveled from west to east. On Black Sunday, April 14, 1935, dust storms were reported from the Canadian border to Texas. Newspaper reporters throughout the affected area wrote that they could not see five feet through the blowing dust. The agricultural disaster that became known as the Dust Bowl caused an exodus from the high plains region that should never have been put under the plow. But the disaster was not just agricultural. Of 116,000 refugee families surveyed on their way into California, only four out of ten were farmer families. A full third of the heads of families who fled Oklahoma, Kansas, Nebraska, and Texas were white collar professionals. When the farms blew away the whole region was wiped out.



Figure 15.10: An Oklahoma farmer and his two sons in 1936. (Public Domain; Arthur Rothstein).

Alarmingly, less than a century later the lessons of history have been forgotten and much of the Dust Bowl region is again under the plow. The wheat-fields of Kansas, Texas, Oklahoma, and Colorado produced 411 million bushels of grain in 1933, just before the drought began. The Dust Bowl disaster cut production by three quarters, but by 2012, the region was once again producing 700 million bushels of wheat. This time, farmers have taken advantage of irrigation.

The Ogallala is one of the world's largest aquifers, stretching from South Dakota to West Texas. Farmers have been drawing water from it for over fifty years. But the aquifer, which was charged with water over centuries before American farmers arrived, is not an unlimited resource. Sections of West Texas and Kansas have already run out of water, and irrigation is still accelerating. In just seven years between 2001 and 2008, farmers used about a third of the water that was taken from the aquifer during the entire twentieth century. The rate of depletion far exceeds the rate of recharge, even in the occasional rainy years. If the aquifer is emptied and irrigation becomes impossible on the high plains, American grain production will be reduced by 700 million bushels per year. Farmers will have no choice but to replant perennial prairie grasses and convert the plains back to rangeland, if they hope to prevent the soil blowing away again. The question is, will American agribusiness change willingly and thoughtfully before a crisis, or out of desperate reaction after the crisis strikes?

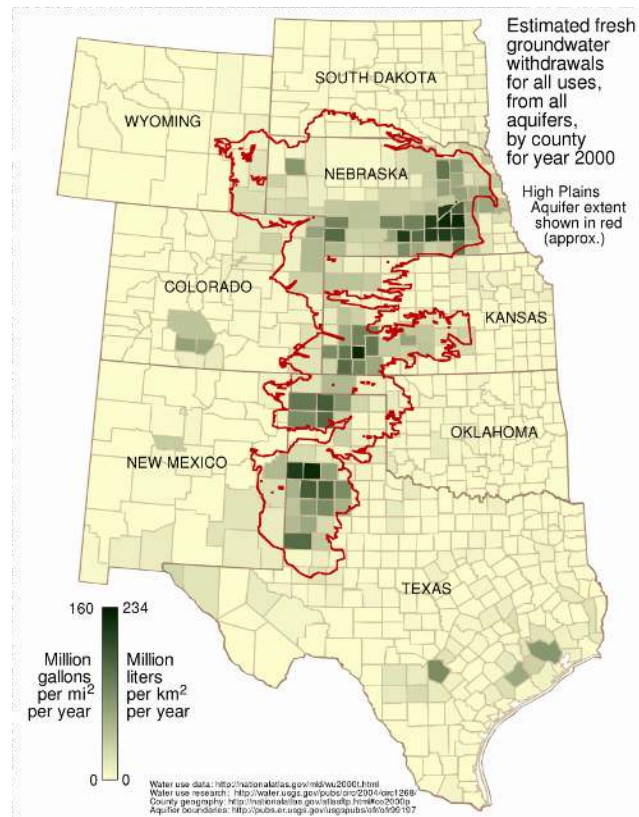


Figure 15.10: The Ogallala Reservoir. (Public Domain;).

Further Reading

- Edward Dallam Melillo, Strangers on Familiar Soil: Rediscovering the Chile-California Connection. 2015.
- Vaclav Smil, Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production. 2004.
- Donald Worster, Dust Bowl: The Southern Plains in the 1930s. 1979.

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16: Commons, Mills, and Corporations

Along with their traditional European ideas about culture, farming, and social organization, the English men and women who colonized North America brought with them a legal tradition known as the Common Law. English Common Law is a set of legal principles dating back to the Middle Ages. In this tradition the sources of the law and its authority are not royal decrees or legislative acts, but rather the accumulation of judges' decisions on specific cases. Murder, for example, is a Common Law crime in Britain. It never required an Act of Parliament to declare murder illegal. Government can influence the Common Law, however; as it did when the British Parliament changed the mandatory sentence for murder from the death penalty to life imprisonment. The interaction between legislation and Common Law is important in American Environmental History because throughout most of the nineteenth and early twentieth centuries our relationship with our environment has been shaped less by legislative deliberations than by routine court decisions that have created a series of legal precedents regarding property, usage rights, and liability.



Figure 16.1: The grist mill at the Wayside Inn, Sudbury Massachusetts.

The detached, somewhat alienated relationship modern Americans have with our physical environment and America's culture of large corporations that often seem above the law actually developed together, because many of the most successful early corporations radically changed their physical environments. The Common Law America inherited from England contained a long list of precedents that guided judges in arbitrating between the claims of people whose interests conflicted. Some of these precedents dated back to the Roman Empire, giving judges clear guidance in deciding the rights and responsibilities of individuals. But as American commerce and industry became more complex, the law came to grips with the fact that society was not made up only of individuals. Even though Americans had left behind the royalty and hereditary nobility of British society, there were still some tasks that seemed too big for individuals to accomplish separately. Towns raised militia when needed, and the national government commanded an army and a navy and collected customs duties at ports. The States ran criminal and civil courts. But who was going to build colleges, hospitals, and bridges? As America grew there were institutions and services that society needed but that no individual had the resources to create on their own.

Early America's answer to the challenge of projects too big for individual action was incorporation. Corporations during the colonial period had been quasi-public organizations given a royal charter to do a particular job. The Virginia Company and the Massachusetts Bay Company had both been royally-chartered corporations. They earned profits for their shareholders, but they also had (or at least they claimed to have) important social functions that transcended mere business. Without this social dimension, businesses—even very large ones—were normally organized as partnerships or sole proprietorships. State legislatures in early America continued the English tradition and chartered corporations to do particular tasks in the public interest. Colonial governments had begun this practice very early in American history, when the Massachusetts legislature established Harvard College in 1636 and then chartered the Harvard Corporation, North America's first corporation, in 1650.



Figure 16.2: Image of “the Colleges at Cambridge” or Harvard in 1790.

Corporate influence on the environment actually begins with this original American corporation. In 1640, Massachusetts’ colonial legislature gave Harvard College a license to run a ferry between Boston and Charlestown across the Charles River, to raise money to pay the school’s operating expenses. 145 years later, when the State of Massachusetts granted a corporate charter to the Charles River Bridge Company, to build the first bridge across the river in 1785, the new charter specified that the bridge company had to pay the Harvard Corporation £200 per year to compensate the college for the revenue the old ferry operation would lose to the new bridge.

The Charles River Bridge was a privately-operated toll bridge. Although it had originally been conceived as a public corporation that would provide a social benefit, the bridge company was wildly successful. The corporation had been capitalized at \$50,000, meaning that \$50,000 had been raised to build the bridge by selling shares to investors. Once built, the bridge collected \$824,798 in tolls between 1786 and 1827. Although the original plan had been to eliminate the tolls once the bridge had paid for itself, the shareholders decided to continue profiting from their monopoly. So they voted to continue charging tolls and paying the profits out to themselves as dividends on their shares.



Figure 16.3: 1789 illustration of the Charles River Bridge

Enriching a few wealthy corporate shareholders at the expense of everyone else was not what Massachusetts legislators had intended when they had granted the corporation a charter to build a bridge that would monopolize river crossing. But although the Charles River Bridge Company had violated the spirit of their agreement with the State, it had not actually broken any laws. So the legislature chartered a new corporation, the Warren Bridge Company, to build a second bridge across the river, right next to the

Charles River Bridge. Learning from their mistake, the legislature made sure the new charter specified that the Warren Bridge Company would only be allowed to collect tolls for six years or until the bridge paid for itself, whichever came first. Then ownership would revert to the Commonwealth and the bridge would become toll-free.

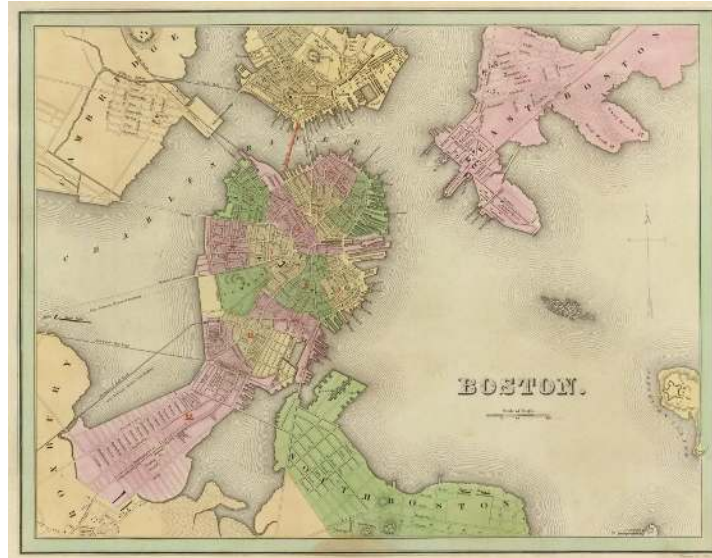


Figure 16.4: 1838 map of Boston, showing the competing Charles River and Warren Bridge (highlighted in red)

Outraged by the challenge to their privileged position as monopolist of foot and wheeled traffic across the river, the Charles River Bridge Company sued the Warren Bridge Company, claiming their 1785 charter had granted them a perpetual monopoly on traffic across the river. As the legislature that authorized the new bridge had expected, the Charles River Bridge Company's revenues disappeared as travelers chose to pay the lower tolls on the Warren Bridge. The lawsuit failed in Massachusetts courts and the aggrieved plaintiffs took their suit all the way to the U.S. Supreme Court. In spite of hiring famous orator Daniel Webster to argue their appeal, the Charles River Bridge Company lost. The court's decision reflected the justices' agreement with lower court judges' belief that the profits of the corporation and the interests of its shareholders were less important—and legally came second—to the State's authority to charter corporations to meet public needs. Even so, the tremendous profits taken by Charles River Bridge shareholders during the period of their government-granted monopoly and their ability to push their lawsuit to the highest court signaled the beginning of a change in the way corporations viewed their roles in society and the responsibilities that went with their public charters.

Streams and Mills

Although by chartering a bridge corporation to connect Boston and Charlestown, Massachusetts had legislated a solution to an environmental problem, most early environmental issues were of smaller scale. So they were typically handled locally, by reference to Common Law. In pre-industrial America, lakes, rivers, and streams were considered community resources. This was another inheritance from feudal England, where peasants had shared fields (often owned by noble landlords) and had grazed their animals on common pastures. Early New England towns and cities were often built around a central Common which served as a meeting-place for militia as well as a pasture for grazing cattle and sheep. Like town Commons where all residents could let their animals graze, rivers, streams, and coastal fisheries were understood to be shared resources. Waterways were important means of transportation; often the only way to move people and supplies to and from remote back-country settlements. And rivers were vital food sources for many Euro-Americans, just as they had been for the Indians before the colonists arrived.

Fish such as Alewife, Herring, Shad, and Atlantic Salmon migrated from the ocean into rivers to spawn each spring. The annual run happened at a critical time of year, when supplies of food stored for winter use were often beginning to run out, and provided a common resource that was open to all. Fish from rivers and lakes were an important part of annual subsistence food supplies for many poorer Americans. The annual runs had been a major source of springtime nutrition for native and Euro-Americans for several centuries. But from the earliest period of European settlement, there were other uses for rivers that could conflict with free travel and fishing. Colonial and early American settlements used a great deal of timber for building and grew a lot of wheat for home use and for sale. So every settlement needed mills.

When towns were chartered in colonial times and in the early national period, organizers usually offered a reward of free land and sometimes even cash incentives to anyone willing to start a grist mill or a sawmill in the new town. Heavy mill machinery would have to be carried to the town-site and assembled, and then operating the mill required some expertise and took valuable time away from building a house and clearing fields. It made sense for new communities to offer some type of bounty to attract millers, since everybody in town would need lumber and flour, but no individual needed or could easily afford to build a private mill.

The idea that some projects were too big for everybody to do individually and that it made sense to share expensive, seldom-used tools is ancient. Today economists call these types of goods natural monopolies. Sawmills and grist mills, although they were frequently owned and run by individuals, clearly existed for the common good. Very few individual farmers grew enough wheat or needed enough lumber to justify building a private mill for their sole personal use. And no miller could afford the expense or expect to recover his investment in land, building, and machinery without the market provided by the rest of the townspeople. So millers received special incentives, and in return the mills would be open to everyone at affordable rates. There was a social contract involved in this activity that everyone understood.

The earliest homes in a new township were typically log cabins. But it's difficult to build large structures using logs. Early town records usually show a rapid shift from log houses and barns to frame construction as soon as a sawmill opened in a town. Sawing lumber for a small project could be done by hand, if necessary. And small mill-wheels could be turned by animals like horses or oxen. But producing enough lumber for a large house or barn or driving a large millstone required much more power. So any township site that included a stream with a decent fall of water was considered a prime location for a settlement.

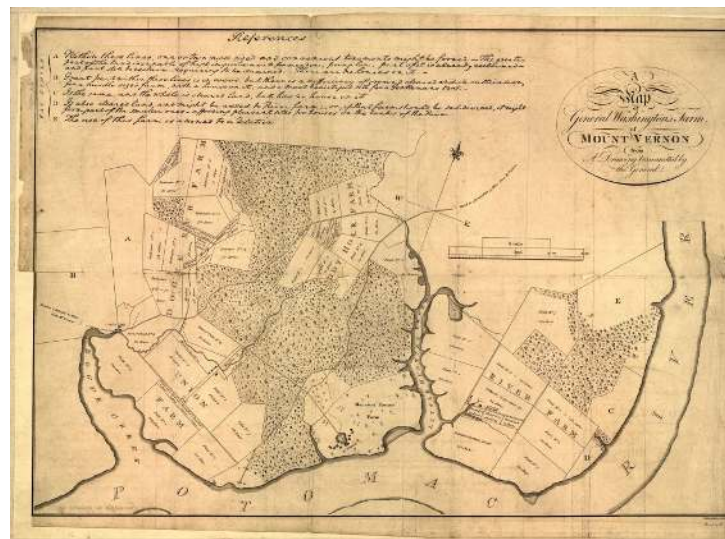


Figure 16.5: George Washington's 1801 drawing of Mount Vernon, which he envisioned as a self-contained, self-sufficient miniature society with its own farms, pastures, workshops, and mills.

The mill operators who ran sawmills and grist mills were seen as providing a necessary service to the whole society. Their mills were usually private in the sense that they were owned by individuals rather than by the town government. But they were public in the sense that they were open to everybody, rather than existing to serve only a single family's needs. Millers were also often involved in combining local farmers' harvests and in selling flour to cities back east. They provided a widely-needed public service, because very few families in the northeast and the Yankee west produced enough grain individually to justify the expense of traveling east to sell their flour. The situation was considerably different in the South, where large plantations often operated their own mills. Planters such as George Washington and Thomas Jefferson often tried to build self-sufficient, free-standing societies on their properties, with their own mills, workshops, and even small factories. The self-contained nature of plantations (enabled by the low cost of slave labor and the ability of plantation owners to minutely direct all aspects of their slaves' lives) is one reason the story of industrialization takes place in the Northeast and the Yankee West rather than in the South. Outside the plantation economy, people needed mills and millers needed to be open to the public in order to have enough work to be profitable. So the benefit went both ways.

The streams and rivers that early American millers used for power did not belong to them. At some township sites, a river's volume and fall were large enough that a miller only needed to divert a little water into a channel called a millrace, to power the mill's

wheel. In other places, a partial or a full dam was required to generate enough force to turn a wheel. When a miller needed to build a dam and change the natural flow of the stream, he was responsible and legally liable for the effects of his dam on people upstream and downstream from him.

Dam Breaking

With so many people depending on rivers for transportation, food, irrigation, and drinking water, changing a river's flow was often controversial. A mill pond might flood a farmer's field upstream or cut off water to a farm or another mill downstream. A dam might prevent fish from running upstream to their spawning grounds, endangering not only one year's food supply but future fish populations. The issue was considered so serious and the stakes so high that it was actually legal in early America for people who felt they had been injured by a mill's dam to go ahead and break the dam. If their farmland had been flooded or if the flow of water to a downstream farm or mill was cut off, the injured party could break the dam and restore the flow of water while the dispute was being settled in court. People were legally entitled to restore the stream to its original condition until society decided the fairest solution for everyone. The common law approach to water rights was so ancient that it was expressed by a Latin phrase that had been used in the Roman empire two thousand years earlier, *aqua currit et debet currere, ut currere solebat*: water flows and ought to flow, as it has customarily flowed. Any human-made change to a river's natural state could be challenged, because everyone had equal rights to the river.

In addition, mill dams in early America were often seasonal structures that would be partially broken each year to allow freshets of snowmelt to pass by without flooding and damaging the area. Dams were also often taken down to allow the fish to run upstream in the spring. And flour milling or sawing lumber was seasonal work in many small towns, so mill races and ponds did not need to be permanent and always in use.

In early American towns, mills and their dams were well-understood technologies that had existed for many generations, authorized by the townspeople and used for the common good. The mills and their technology existed in a social system that emphasized their status as shared resources for community use. There was a reciprocal give and take between people who had different interests in the society, both in social customs and in common law. Millers were given special incentives to move to new towns and help them grow. In return, they were responsible for keeping the mills running and available to everybody, and for responding to their neighbors when they changed the flow of streams in ways that caused problems. In return, many millers enjoyed what amounted to a local monopoly on sawing wood and grinding flour. Although other millers were rarely prohibited from opening competing mills, there was only so much need and there was only so much water power. But there were always new towns needing millers, so common customs and common sense were effective ways to regulate early mills.

Textile Factories

As new technology was developed and as the pace of change accelerated, this common law, common-sense social contract began to break down. One of the specific events that accelerated this change was a visit to Scotland in 1810 and 1811 by a pair of prosperous Boston merchants named Nathan Appleton and Francis Cabot Lowell, who toured the textile mills at New Lanark. These woolen mills on the River Clyde southeast of Glasgow were run by an innovative industrialist named Robert Owen, and were the largest completely water-powered mills in Great Britain. Owen's textile operation employed so many people that the company had built an entire community around the factories to house the mill-workers and their families.



Figure 16.5: The Clyde River and New Lanark in 2009

Robert Owen and his partners had bought the mills in 1799 from David Dale, Owen's father-in-law. Sensitive to the negative social changes that industrial growth had brought to other parts of Britain, Owen built schools for the children of his workers and social organizations for the families. He put an end to the long-standing custom of forcing workers to buy only from the company store and tried to make New Lanark a real, living town. Owen's partners had objected to his philanthropy, claiming that healthy, happy, well-educated workers did not really boost the bottom line. Rather than fight with them, Owen simply bought his partners out.

Appleton and Lowell returned to America and immediately began the Boston Manufacturing Company (BMC) in 1813 on the Charles River in Waltham, Massachusetts. At that time there were already twenty-three other mills on the Charles, but the BMC was something different. Appleton and Lowell's mill was a completely water-powered textile factory on the model of New Lanark. The Boston Associates also followed Owen's example in social engineering, and began building complete industrial cities in New England. Nashua, Manchester, and Concord on the Merrimack River grew from small agricultural towns to large textile cities. Lawrence and Lowell were built from the ground up as textile factory cities. Young people throughout the region, especially the daughters of farm families, flocked to these new industrial centers for the relative independence of factory employment. But the Boston Associates not only created cities and filled them with industrial wage workers. They helped change the way all Americans understood their environment.

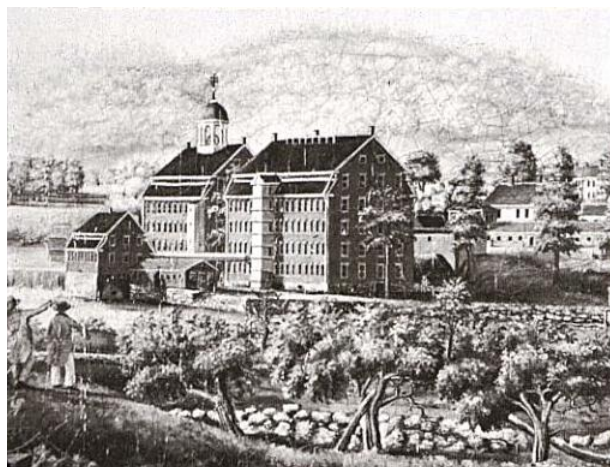


Figure 16.6: The Boston Manufacturing Company's first textile factory on the Charles River in Waltham Massachusetts, 1813.

The BMC's textile mills employed mostly young women, aged 15 to 30. Between 1840 and 1860, the number of mill girls working in the Massachusetts textile industry rose from about ten thousand to over a hundred thousand. For context, the population of New England's largest city, Boston, was about 93,000 in 1840 and 178,000 in 1860. By 1848, Lowell was the largest industrial city in America.

When the BMC opened their first mill, only seven out of a hundred Americans lived in cities. By the middle of the nineteenth century, the nation's urban population was approaching twenty percent, with a lot of help from the mill girls. Some of the women were immigrants, but most had come from farm families. A hundred thousand young women moved to the city to work twelve hours a day in the textile mills. In spite of harsh work conditions and low pay, many of these women were experiencing personal freedom for the first time, and liking it. Most never went back to the countryside. As cities like Lowell, Lawrence, and Manchester grew around the mills, they created a new American population group, the urban wage-worker. The mill girls and other factory workers lived a different life and had very different concerns from those of the families they'd left behind in the countryside. Although they joined the new labor movement and were often critical of the mills they worked in, the mill girls' lives became tied to the wellbeing of the industry that employed them.

Too Big to Fail

The creation, financial viability, and even the continued existence of new industrial cities like Lowell depended completely on the Boston Manufacturing Company's profitability. Prosperity for Lowell's citizens relied on the success of the business that paid their wages. The BMC was too big to fail. Over time, it was only natural for the city's dependence on its creator and main employer to transform the way people understood the public good.



Figure 16.7: The Merrimack River Watershed

At the height of its power, the BMC controlled the entire Merrimack River from its source in Lake Winnepesaukee to its outflow in the Atlantic. The Boston Associates decided how much water would be let out of the New Hampshire lake and built dams to control the flow along the entire river so that all of the Merrimack's water power was available to power the turbines of the BMC's textile factories. River transportation, fishing, and all other competing uses of the Merrimack's water were considered secondary to the BMC's water-power requirements.

How did this happen? How did one corporation gain control over what only a generation earlier had been universally understood as a common good, a shared resource open to everyone? There was no bill presented in Congress. No elected representatives voted for this change in social priorities. If the issue had been debated in the legislature, things might have gone differently. Instead, the decision to grant control of one of the region's major natural resources to a single corporation happened very slowly and under the radar, through a series of legal changes stemming from court decisions and reinterpretations of contract law.



Figure 16.8: Lowell Massachusetts as seen from Dracut, 1834.

It is important to remember that the public benefited from early corporations. The social good provided by natural monopolies explains why communities chartered corporations and allowed them to inconvenience or even injure the interests of individuals, in the same way towns allowed their local millers to occasionally flood a field, as long as the miller compensated the injured farmer for the loss. It was an issue of the public good coming before the private good. And corporations had public responsibilities: in exchange for special treatment (usually some form of a natural or legislated monopoly) the corporation was expected to act in the public interest. How did that all change between then and now?

The first step was a gradual shift in the interpretation of the mill laws. In every state there were laws that regulated how disputes over water rights would be addressed by the courts. Before the nineteenth century, the common law approach to water rights had been expressed by that Latin phrase, “water flows and ought to flow, as it has customarily flowed.” In Massachusetts, the mill laws dated from 1713 and they only allowed the property of other landowners to be compromised by mills “for the public good.” But as time went on and case after case was brought before Massachusetts courts, judges began to rethink the phrase public good. As the users of water power grew from village grist and sawmills to textile factories, the judges began to see industry itself as a public good. By the time the Boston Associates were building entire cities from the ground up and providing employment that supported hundreds of thousands of Massachusetts families, it was difficult to argue there wasn’t a public interest in the BMC’s success, even if the profits of the enterprise were restricted to just a few shareholders.

Because textile factories used water power, even if it was on a much larger scale, Massachusetts judges tried to regulate them using mill laws that had been designed to settle the types disputes that applied to village sawmills and grist mills. Not only did the scale of the BMC’s operations make this legal treatment inappropriate, the judges lost sight of the fact that the Boston Manufacturing Company was a private corporation operating for the profit of its shareholders, while village mills had operated for the public good. Thus, through a series of judgments, mostly in lower courts, the BMC was allowed to redefine its relationship with society and with the environment. As a result, so slowly that almost no one noticed at the time, the nature of corporations themselves changed and the idea of a social contract for the public good was lost.

The Boston Associates were not the first textile operators in New England. When Samuel Slater had opened America’s first textile mill in 1793 on the Blackstone River in Pawtucket Rhode Island, he had organized his company as a partnership. But as business opportunities grew, the idea of incorporation changed. Between 1800 and 1809, only fifteen corporate charters were given to Massachusetts manufacturers. In the next ten years, the number jumped to 133. Corporations gradually stopped presenting themselves as public-spirited foundations operating institutions such as hospitals and colleges in the public interest. They became more like the business corporations we would recognize today, whose missions are clearly understood to be building share price and returning a profit to their shareholders. But because incorporation had once been about providing public services in exchange for special privileges, the new corporations frequently retained their special privileges, even after they had stopped providing public services.

Evading Responsibility

Along with the legislated monopolies many enjoyed, one of the special privileges corporations coveted was limited liability. Rather than being held responsible for all the damages that might be caused by a potentially dangerous business such as a textile mill, shareholders only risked the amount they invested. This not only helped firms raise more money, it allowed businesses to take bigger risks, since the worst that could happen in case of a disaster would be that the company would be forced to declare bankruptcy. Shareholders would lose only the money they had spent to buy company shares; their other assets could not be taken to compensate the victims of their company's risky behavior.



Figure 16.9: 12-year old textile mill worker

Once again, it is important to remember that the reinterpretation of business law and contracts that allowed these changes to happen was not done by elected representatives in legislative debate, but by lawyers and judges who were often friends, relatives, and investors of the new textile industrialists. They shared not only an interest in the mills' success, but a cultural orientation that made it easy to see the textile industry itself as a public good to be protected.

The most environmentally-damaging change caused by the New England textile industry, in the long run, was the gradual elimination the idea of common resources. First, legal reinterpretations separated the old mill laws from an idea of common good and used them to arbitrate property disputes of people who owned land beside rivers. Next, lawyers working for the textile corporations and judges sympathetic to their interests subverted the common law understanding of equal rights to water resources and shared responsibility for their upkeep. Finally, industrialists and their allies in the courts actually eliminated the idea that waterways were a community resource, so the flow of the river could be treated as a commodity that could be bought and sold by individuals. They did this by creating a water power company called the Proprietors of the Locks and Canals (PLC) which invented a concept called mill-power, that they sold to the textile mills.

Mill-power was an accounting tool: a number that measured the work that could be done by river water pushing the textile factories' turbines. Although it had been a long-standing tradition that running water should never be considered private property, mill-power evaded that restriction. It was just a measurement invented by the PLC for accounting purposes. While the courts might have rejected the sale of the river by one corporation to another, there were no laws preventing the PLC from selling mill-power to BMC factories along the Merrimack River.

The immediate effect of reducing the physical Merrimack River to nothing more than an input into an accounting calculation was that the rest of society (who were unaware this was happening and in any case had no interest in buying mill-power) was no longer involved in these transactions. Society had not been prevented from participating, but the sale of the river had been hidden from the public and transacted in such a way that it made no sense for them to participate. But as a result, everyone who did not own a turbine suddenly lost access to the river and no longer had any say in its use. Worse, once a market price had been established even people with riverside property could be bought out, and by accepting a settlement payment could be effectively silenced forever.

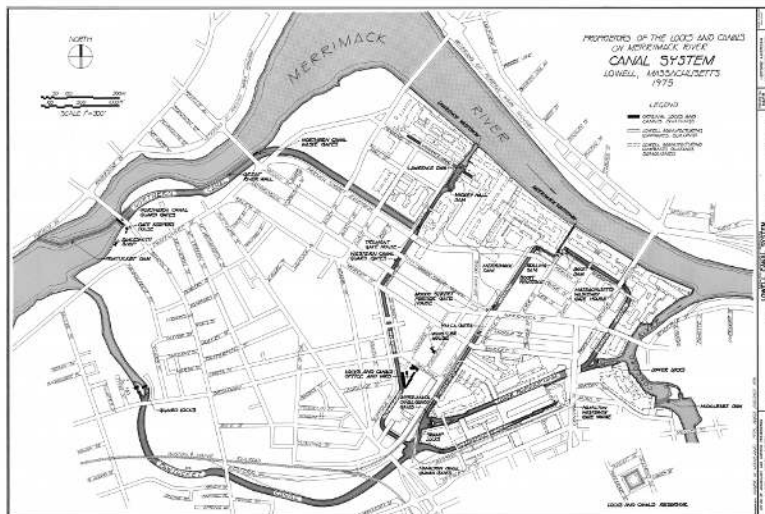


Figure 16.10: The PLC Power Canal System. By measuring and selling mill power rather than water, the BMC avoided confronting laws and traditions prohibiting private ownership of the river.

There were never any bills introduced into the Massachusetts or New Hampshire legislatures, allowing citizens to debate whether control or ownership of the Merrimack River should be handed over to the corporation begun by Nathan Appleton and Francis Cabot Lowell. Appleton himself was elected to the U.S. Congress in 1842, and although Lowell died in 1817 at age 42, his son Francis Cabot Lowell Jr. became a U.S. Congressman and a Federal Judge. In 1850, the BMC's textile empire earned \$14,000,000 in annual revenue, which was half the combined Gross Domestic Product of Massachusetts and New Hampshire. BMC profits were high because they were the largest supplier of cotton fabric in the market and because they had been able to control their costs by keeping the mill girls' wages low. After an unsuccessful strike, mill workers formed the Lowell Female Labor Reform Association in 1845 to fight for higher wages, lower rents in company-owned boarding houses, and a ten-hour day. A Legislative Committee looked into the mill girls' demands and decided it was not the state's responsibility to set work hours. Another important source of BMC profits was the low price of raw cotton, which of course was produced on Southern plantations by people who didn't have to be paid at all.

When the PLC and the BMC gained complete control, shad and the salmon were no longer able to swim up the Merrimack River to breed. New Englanders lost a food source that had sustained generations every spring. The BMC was sued for damages by fishermen and residents along the river. In 1848 the corporation settled these lawsuits with payments totaling \$26,000 to the plaintiffs. In return for a one-time cash payment, the plaintiffs and their descendants relinquished all future claims against the corporation. In other words, for \$26,000 the destruction of a major New England fishery was settled once and for all. The fish were gone for good, but the only people compensated were a handful of plaintiffs in a single lawsuit. When the case was settled the issue was considered permanently closed. No one else would be allowed to sue for damages in the future, even though a resource that had always been available for common use had disappeared. This result illustrates not only how much power goes along with controlling a revenue stream worth half the economy of two states, but also how difficult it can be setting a one-time economic value on long-term environmental changes.

Was the destruction of the habitat of the salmon, shad, and of the other animal species that depended on those fish worth \$26,000? Was the elimination of a major seasonal food source for rural working-class people in the region worth \$26,000? How long would it take until people had spent \$26,000 buying food to replace the fish they could no longer catch in the river? No one knew, because the questions were never asked. The public had become divided into groups that no longer shared common interests. Whether there were fish in the river was not a question that particularly concerned factory employees or many other residents of cities like Manchester, Lowell, or Lawrence, whose lives now revolved around urban wage-workers' concerns such as work hours, rent in company dormitories, prices at the company store, and factory conditions. For the first time in America there was a population of working people that was permanently separated from direct contact with the land, and from the people who lived and worked on it. As we will see in later chapters, the separation of the American working class into urban and rural groups with different concerns had a profound impact on both social justice and the environment.



Figure 16.11: The BMC's Lowell Mills employed so many people and had such a large economic impact on the entire New England region that it was very difficult to hold the corporation accountable for its actions in any substantial way.

Externalities and Alternatives

In addition to privatizing the Merrimack River, the textile industry polluted it. In a sense, it did not matter that the fish could no longer run up the river. They would not have been able to survive the water and residents would not have been able to eat them. By the middle of the nineteenth century, the BMC's mills and bleacheries were producing over fifty million yards of colored and printed fabric annually. The residues from production processes included dyes, bleaches, sulfuric acid, lime, and arsenic. Since there was no law against it, these residues were all dumped into the river. It was a widely-accepted belief that the running water of streams and rivers purified waste thrown into them, although no one really understood why. It is actually true that the microorganisms in water can digest and neutralize a reasonable quantity of (especially organic) waste. Unfortunately, the mills and the new cities the BMC had created overwhelmed the Merrimack's ability to renew itself. Some mills actually discovered that river water could only be used for dyeing dark-colored fabrics because the water was too stained to use on whites and lighter shades.

Fish were regularly killed in large numbers up to two miles downstream from the mills' outlets. A state commission advised the public against drinking river water downstream from Lowell on the Merrimack and pronounced the Nashua River unfit for drinking along its entire length. But the commissioners, pressured by their industrial sponsors, concluded that cleaning up the river or preventing further contamination would be too expensive, and recommended taking no action.

Although the Lowell mills and their canal power system had been meticulously engineered, the same could not be said for the city the BMC had created. Lowell grew haphazardly. As late as the 1870s, the city had no general sewage system. Cesspools leaked into ground water, contaminating the wells scattered throughout the city that provided Lowell's residents with drinking water. Deaths in Lowell from typhoid fever, a water-borne disease, peaked in the 1870s and exceeded typhoid deaths in Boston through the end of the century, even though by 1900 Boston had five times Lowell's population. In 1878 the Massachusetts legislature was forced to respond to public pressure, and passed "An Act Relative to the Pollution of Rivers, Streams, and Ponds Used as Sources of Water Supply." Ironically, bowing to industry pressure, the lawmakers exempted the Merrimack River from the law's pollution-control provisions.

The New England textile industry is usually remembered in history books as an enormous achievement. The Boston Manufacturing Company was indeed wildly successful, and created a model for American industrialism. Some of that praise is deserved. Nathan Appleton and Francis Cabot Lowell, and the men who led the BMC after them, pioneered industrial organization and built cities for New England and fortunes for themselves. But often when we celebrate progress we forget the cost.

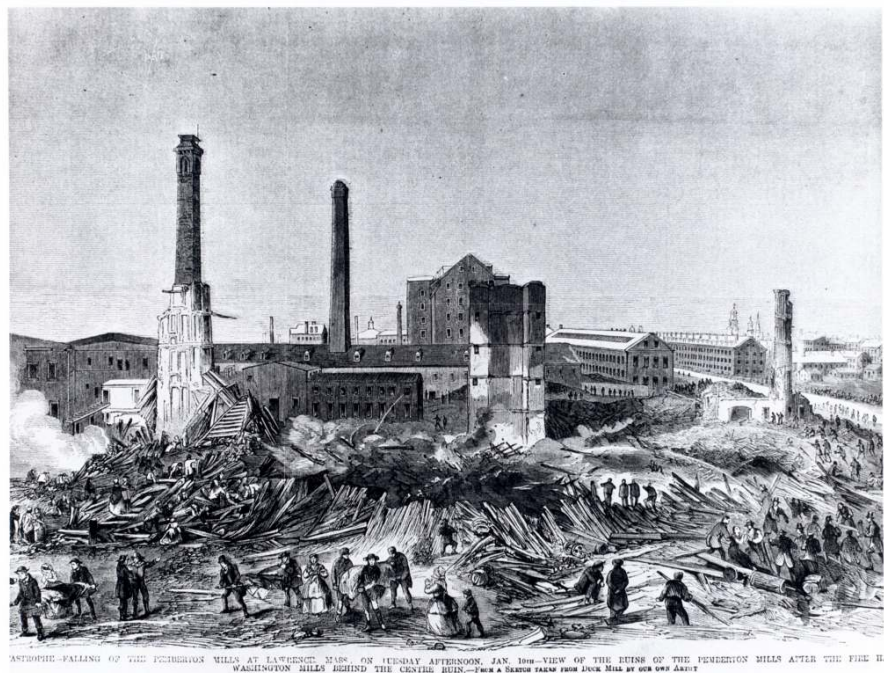


Figure 16.12: Illustration of the entirely preventable Pemberton Mill disaster, January 1860.

Water pollution was not the only danger the textile industry posed to the public, however. In January 1860, the five story Pemberton Mill in Lawrence collapsed with about 800 workers inside. The firm had been sold recently and its factory building filled with newer, heavier machines. 700 looms had been updated, and a business that had been near failing seemed to have been turned around with great success. The collapse killed 145 workers, mostly women, and left 166 seriously injured. In an investigation after the accident, the collapse was declared the result of preventable factors such as the overloading of the floors with heavy equipment, overcrowding, and even gross negligence in the original construction of the mill buildings. The disaster rallied some activists in the fight for workplace safety. But there were never any consequences for the people who owned and ran the factory. Life just went on. The Pemberton Mill's owner bought out his partner and built a new factory on the site of the old one. After his death, the new factory was inherited by the owner's sons. The building is still a prominent landmark of Lawrence.

Avoidable disasters such as the Pemberton Mill's collapse add human costs that are difficult to quantify. But even setting these considerations aside, how much of the success and profit attributed to the Boston Manufacturing Company and the other mills of the Merrimack River Valley was the result of not having to count the costs their operations imposed on the environment and on people like New England mill girls and Southern plantation slaves who had been written out of the equation? In a sense, the privatization of profits and socialization of costs that allowed the textile industry to dominate the New England economy was just another special privilege given to a corporation by society, in spite of the broken social contract that no longer asked the corporation for anything of comparable social value in return. If economists and historians accounted for all the social and environmental costs, then how profitable was the Boston Manufacturing Company really? We will return to this idea, which economists call externality, in later chapters.



Figure 16.13: Public opinion did not favor the mill owners after more than 300 women were killed or wounded. But there were no legal consequences.

The development of the New England textile industry illustrates how subtle, often unnoticed changes in laws and customs accumulated over time to create the world of global corporatism we live in today. Through a combination of becoming too big to fail and slowly changing the way the law understood the concepts of common resources and social responsibility, corporate industrialists turned the waters of the Merrimack River, one of New England's most valuable natural resources, into a steady flow of profits for the BMC and its owners. Changes begun in the New England textile industry lead directly to the ways we understand corporations, shared resources, and social responsibility today. But we should never conclude that the way things ended up was inevitable. The present is the result of hundreds of decisions, big and small, that people made along the way. To illustrate that point, we return to the beginning of this story, to Robert Owen.

Robert Owen organized a modern industrial city from the ground up in New Lanark. Appleton and Lowell learned from Owen that social engineering on a grand scale was possible, and they returned to New England inspired and followed Owen's example in Waltham and then along the Merrimack River. What did Owen do after meeting Appleton and Lowell? Owen became the father of the British cooperative movement. In addition to being a wildly successful entrepreneur and capitalist, Owen promoted a system of corporate welfare that his critics, then and now, called socialist. Owen, however, embraced the term.

Robert Owen tried to improve the society his father-in-law had created around the textile factories, by building schools and by taking care of the health and welfare of his workers. New Lanark became a model of humane industrialism and socially responsible urban planning. But that wasn't enough for Owen. After his success in Scotland, Owen wondered how much farther he could go. So he sold his interest in New Lanark and moved to Indiana, where he founded a cooperative community called New Harmony. Like Appleton and Lowell, Robert Owen seems to have experienced an "Aha!" moment when he realized how much power he held to change society and perhaps even to change people. But unlike the Boston Associates, who built a textile empire that made them millionaires, Owen chose to do something different with that power. Robert Owen's decision suggests that as hard as they sometimes may be to see, history often comes down to a series of human choices.

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