

Chapter 3. The History of North American Rangelands

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Abstract:

North America's diverse grassland, savanna, steppe and desert ecosystems evolved in the absence of domesticated livestock. The arrival of cattle, sheep, goats, pigs and horses after 1492 transformed many ecosystems while enabling European soldiers, missionaries and settlers to conquer the continent. The decimation of indigenous populations by warfare, disease and economic dependency further transformed rangelands by removing Native management practices, especially the use of fire. The history of rangelands since then has been one of recursive efforts to commodify and territorialize rangeland resources—including wildlife, grass, soil fertility and the land itself—for market production and exchange. Many former rangelands have been lost altogether, by conversion to forest cover (due to fire suppression) or to agricultural uses (especially in the Great Plains), and invasive exotic plant species have radically altered large areas of rangelands in California, the Great Basin, and other regions. Nonetheless, North American rangelands remain both vast and invaluable for wildlife. The Western Range system of public land grazing leases, which emerged from the devastating overgrazing of the late nineteenth century, succeeded in stabilizing range conditions and linking land use and management across large landscapes of mixed ownerships. With accelerating urbanization, the rise of environmentalism, and structural shifts in the livestock industry since World War II, however, the Western Range has begun to unravel, exposing rangelands to development and fragmentation. Climatic variability in the form of droughts, floods and extreme fire conditions, more so than aridity per se, has frustrated efforts to extract value from rangelands from the outset, and climate change promises to amplify these phenomena going forward.

Keywords: ecological imperialism, fire, fur trading, livestock industry, environmentalism, urbanization, Western Range

3.1 Introduction: Rangelands and History

A comprehensive history of North America's rangelands has yet to be written. The volume that comes closest may be *The Western Range*, also known as Senate Document No. 199, which was a 620-page "letter" from the Secretary of Agriculture published in 1936. It was replete with facts, including historical facts for the period since about 1800, but it was motivated by a

pitched bureaucratic rivalry between the Agriculture and Interior Departments (see section 3.6), and it is by now quite dated. Historians generally organize their research by place or region rather than land type, and they may omit environmental issues altogether, while the vibrant sub-field of environmental history has rarely made rangelands a particular focus. Sociologists and political scientists have studied the political-bureaucratic dimensions of federal rangeland administration, and more humanistic or interdisciplinary scholars have explored rangeland conservation in relation to cultural identity and community values, but history is not prominent in these works. Textbooks in range science often include one or two historical chapters, but these usually focus on disciplinary or industry matters rather than the lands themselves. Finally, geographers have written historical accounts of range livestock production, and there are scores of monographs on the history of ranches and range livestock production in specific regions.

A proper history of rangelands involves more than assembling facts from this corpus of existing scholarship, however. The concept of rangelands itself must be examined and elaborated for analytically coherent historiographic use. Although *rangeland* is now typically defined trans-historically as a set of land types based primarily on vegetation and cover (see chapter 2), *range* has a history that is conceptually, ecologically and politically significant (Sayre 2017).

Etymologically, *range* dates to the late fifteenth century (immediately prior to European expansion) and derives from the Old French verb *renger*, which referred to the movement of herders and livestock across large, open areas. Some scholars still define rangelands this way, for example as “land where people have intervened to manage the vegetation with livestock for

economic gain” (Menke and Bradford 1992). Insofar as pre-Columbian North America lacked domesticated livestock, application of the term *range* before the early 1500s could be considered anachronistic (Bowling 1942; Crosby 1986). This is not simply of academic or terminological importance, moreover, because the arrival of cattle, sheep, goats, horses and other livestock was transformational. Their activities triggered widespread changes in ecosystems, as we will see, but the full effects went much further. Historian Richard White (1994, p. 238) is not alone in his view that, “Without domesticated animals, Europeans would have neither survived nor conquered” in the New World. Livestock performed work on several levels, enabling activities as diverse as cultivation, transport and warfare as well as representing ideals of civilization, property and land use (Seed 1995; Anderson 2004). This breadth of roles and capacities made range livestock production “the principal means whereby Europeans colonized and exploited the natural resources of sub-Saharan Africa, Australia, North and South America” (Grice and Hodgkinson 2002, p. 2). In short, by virtue of their intrinsic relation to livestock, rangelands are not simply sites of historical events, or places with histories; they are inescapably implicated in the conquest and settlement of North America by European- and African-descended peoples.

Put another way, North American rangelands are not static biophysical or evolutionary givens, but rather the product of intertwined social and ecological processes. These processes continue to operate, moreover, both on rangeland ecosystems and in how they are understood. Vegetation and land cover can change significantly over time, and parts of North America that are not classified as rangelands today, would once have met the current definition. In the Great

Plains, for example, more than 96 percent of the tallgrass prairies and three-fifths of the mixed-grass prairies have been plowed and replaced by croplands (Samson et al. 1998), removing them from rangeland status. Large areas of the northeastern and southeastern United States were savannas at the time of European contact, but they gradually transformed into closed canopy forests due to the removal of Native American fire management practices (Mann 2005; Noss 2013). In sum, range and rangelands have become “a residual category, comprising everything (other than ice-covered lands) that doesn’t fit into more specific types such as forest, urban, or cropland... they might best be understood as nonforested places where intensive economic activities have not (yet) taken root” (Sayre 2017, pp. 2-3). A history of rangelands must encompass and account for these losses.

This chapter presents a necessarily abbreviated history of North American rangelands from the immediate pre-Columbian period to the present. The focus is on how different groups of people have viewed, valued, used and altered these diverse lands, and the factors that have driven and shaped these changes. I hope to shed light on how and why North America’s rangelands are both vast and diminished, mythologized and marginalized, contentious and misunderstood. On the one hand, the history of rangelands has been a story of manifold losses—the conquest and dispossession of Native Americans, the wholesale destruction of beaver, bison, wolves, grizzly bears, pronghorn, elk, prairie dogs and other wildlife, widespread conversion to non-native vegetation, and the disappearance of millions of hectares for agriculture, industry and urban development. On the other hand, the rangelands that remain are nonetheless among the continent’s most ecologically intact landscapes: neither cultivated, irrigated, paved over nor

built up, they are put to human use and transformed thereby, yet also relatively natural—working wilderness, so to speak (Sayre 2005). It should be no surprise, then, that wildlife has been central throughout this history, whether as subsistence resources, commercial products, agricultural pests or conservation causes.

In a brilliant essay, Richard White (1994) approached the history of the American West as a transformation from “animals as people” (as many Native Americans understood them) to “animals as enterprise.” Expanding on many of White’s points, I interpret this transformation as a series of efforts to *commodify* and *territorialize* rangelands. Beginning with the first European expeditions, myriad public and private entities have worked to identify, locate, map, exploit, control and regulate rangelands’ diverse resources. Compared to other parts of the continent, however, rangelands have often proved recalcitrant to these efforts, even down to the present day. Initially this was due to Native American resistance, but a more lasting obstacle has been spatial scale: the extent of rangelands is vast, and the costs of control and extraction are high relative to most of the commodity values they yield (the exceptions being mining, oil and gas). Many historians have emphasized aridity as the defining feature of the American West (Webb 1931; Stegner 1954; Worster 1985). Equally important, however, has been the variability of rangelands over space and time: the unpredictable rainfall and droughts, fires and floods that attend rangelands from Mexico to Canada. This variability, exacerbated by climate change, is likely to be a hallmark of North American rangelands in the decades ahead.

3.2 The Late Indigenous Period

Beginning with mid-19th century writers and artists such as Henry David Thoreau, James Fenimore Cooper, Henry Wadsworth Longfellow and George Catlin, the conventional wisdom for generations of scholars was that North America was ‘pristine,’ ‘wild,’ and ‘natural’ at the time of European contact (Denevan 1992). In stark contrast to the humanly transformed landscapes of the Old World, the Americas were thought to have been thinly populated by Native Americans, whose societies had made little or no impact on the continents’ landscapes and ecosystems. This view has by now been thoroughly debunked and replaced by a three-part thesis: (1) Native peoples made widespread, significant and intentional impacts on American ecosystems (Dobyns 1981, 1983; Cronon 1983); (2) infectious diseases introduced by Europeans devastated Native populations, reducing their pre-contact numbers by as much as 90 percent and curtailing their ecological impacts proportionately, often well in advance of European peoples themselves (Crosby 1986); (3) Euro-Americans failed to recognize these facts, preferring to imagine an empty continent free for the taking and mistaking conditions circa 1750—when the total hemispheric population was still only about 30 percent of what it had been in 1492—as original, normative and timeless (Wolf 1982; Denevan 1992). The idea of America as untrammelled wilderness, then, is not only empirically false but theoretically flawed and ethically bankrupt—a self-serving delusion that legitimates settler colonialism and erases Native agency. All three parts of the thesis are directly relevant to the history of today’s rangelands.

According to present scholarly understanding, Native Americans sustained many rangelands by conscious and willful actions, especially involving the use of fire (Stewart et al. 2002). Motivated primarily by subsistence needs, Native practices included sophisticated habitat management strategies for both plants and wildlife, as Anderson (2005, 2007) and Lightfoot and Parrish (2009) have shown in detail for California's diverse ecosystems. Writing about early colonial New England, Cronon (1983, p. 52) ventured the idea that "the Indians were practicing a more distant kind of husbandry of their own," one that did not involve keeping livestock. "Rather than domesticate animals for meat, Indians retooled ecosystems to encourage elk, deer, and bear. Constant burning of undergrowth increased the numbers of herbivores, the predators that fed on them, and the people who ate them both" (Mann 2005, p. 282). At a landscape scale, burning maintained a heterogeneous mosaic of habitat conditions while reducing the risks of dangerous wildfires (Fuhlendorf et al. 2008; Chapter 6, this volume). In specific locales, fire could favor desired plants for food or medicinal purposes, eliminate or reduce insect pests, or enhance conditions for hunting or self-defense; it could also serve as a means of hunting or warfare. In many settings, repeated burning shifted the structure and composition of vegetation communities away from trees and other woody plants and towards grasses and herbs. In this way, Native burning opened up forests and expanded bison habitat eastward from present-day Iowa and Illinois to New York and Georgia (Mann 2005). Noss (2013) argues that most of the longleaf pine forest of the southeastern coastal plains, from east Texas and Louisiana to Florida and northward through the Carolinas, was likewise maintained in savanna condition by repeated fires. Empirically and ecologically, it can be difficult or impossible to disentangle people from lightning as ignition sources, intentional from unintentional ignitions,

or resource management from other motives for burning; some scholars dispute the ubiquity of Native fire impacts in specific sub-regions of the western U.S. (Vale 2002). But allocating causality between the two poles of a nature/human binary may be beside the point. What matters is that both human and biotic communities were adapted to frequent, widespread burning. This may be especially true for rangelands, but it was not limited to them (Pyne 1982).

Stretching from Mexico to Canada, the Great Plains merit specific mention as North America's largest and most archetypical rangelands. Mann (2005, p. 282) contends that "Native Americans burned the Great Plains and Midwest prairies so much and so often that they increased their extent; in all probability, a substantial portion of the giant grassland celebrated by cowboys was established and maintained by the people who arrived there first." Adapted to fire and grazing, native prairie grasses sustained an estimated 20–30 million bison at the time of initial European contact (Flores 2016a). Plains Indians developed religious and cultural systems as well as livelihood skills and social practices that orbited around the enormous bison herds. "Many Plains tribes, it seemed, thought of bison in human terms—they had families and societies, opinions and memories" (Flores 2016a, p. 38). As the staple food of northern Plains tribes, pemmican figured prominently in myths, origin stories and rituals. Made from a complex mix of different bison fats, melted and poured into sacks of pulverized dried bison meat, pemmican would count today as a kind of miracle food: succulent, high in both fat and protein, and virtually non-perishable. A mature bison yielded about ninety pounds of pemmican, or one large, brick-like bag (itself made of bison hide); when consumed, pemmican provided some 3,500 calories per pound. Its invention in the northern Great Plains roughly 5–6,000 years ago

was “a key moment in the cultural history of the region, as pemmican’s massive energy stores and durability...encouraged longer-distance travel, warfare, the elaboration of plains trade patterns and greater food security” (Colpitts 2014, p. 10).

Linda Black Elk (2016, p. 3) writes that rangelands “are central to the lives of Indigenous peoples, and they have been so for millennia.” Native Americans, she explains, approach the land in terms of ecological interrelatedness, or the belief that “we, as human beings, are related to everything and everyone—from huge cottonwood trees to the cool wind, and from barking prairie dogs to the fertile soil.” Native peoples understood animals as “other-than-human persons with whom relationships were social and religious instead of purely instrumental... Indian religions made hunting holy and gave human-animal relations a depth and complexity largely lacking among Europeans. In hunting, some persons died so that others might live” (White 1994, p. 237). This worldview stands in stark contrast to the market and profit orientation that would infiltrate the Plains tribes and ultimately dispossess them over the course of the nineteenth century (see section 3.5 below). Notably, however, and unlike much of the rest of North America, the dominant plants of the Great Plains were not displaced by Old World species, even after the Native Americans who lived there had been conquered and their management practices discontinued. Crosby (1986, p. 290) observes that bison and perennial grasses “formed a tight partnership... each sustaining and perpetuating the other and fending off the entry of any great number of exotic plants and animals.” Cattle occupied the niche vacated by bison, and as Hart and Hart (1997, p. 10) point out, “much of the Great Plains before

European settlement looked about like it looks now,” dominated by native perennial grasses such as blue grama, buffalograss and galleta grass.

3.3 Fur Trading

The earliest sustained forays of Europeans into North America’s interior rangelands were motivated by “frontier capitalism’s insatiable appetite for killing wild animals” (Flores 2016a, p. 35)—that is, the commercial gains to be had from animals whose populations had in some cases erupted with the decline of Native American hunting pressure. In what might be termed “accumulation by extermination,” hunters and trappers pursued wildlife not for subsistence but for faraway markets, extracting just those parts that could be economically transported and sold, often leaving much of the carcass behind. Thus, did large portions of North America first encounter market forces, amplified by stark differentials of power, trade and geography. In many cases, fur trading incorporated Native Americans for their knowledge, skills and labor (Dolin 2010). Russian, British and American traders pushed sea otters on the Pacific coast to the brink of extinction between the 1780s and 1850, conscripting Aleut and Kodiak men to do the work and shipping the pelts primarily to China. Starting from the St. Lawrence Seaway and Great Lakes region, the northern beaver trade spread west of the Missouri River under French control in the mid-eighteenth century before passing into the hands of the British Hudson’s Bay Company after the Seven Years’ War. Meanwhile, a mix of Anglo-, Franco- and Mexican-American trappers worked the southern Rockies—often without the sanction of Spanish or Mexican authorities—sending furs eastward along the Santa Fe Trail. As competition between the Hudson’s Bay Company and the American Fur Company intensified in the early 1800s,

beavers disappeared entirely from large parts of their former range, with untold effects on watersheds. The slaughter stopped more or less by accident in the 1830s, after European hat makers secured advantageous terms for Chinese silk (a side effect of the opium trade) and beaver felt passed out of fashion, thereby collapsing prices (White 1994).

The literature on the demise of the bison is too large to review here, but a brief summary is warranted (White 1994; Isenberg 2000; Flores 2003, 2016a; Colpitts 2015; Cunfer and Waiser 2016). Market demand for bison hides—initially as robes and subsequently as leather for industrial belts—drove the trade. A period of wetter than normal conditions in the first two decades of the nineteenth century may have helped expand the bison population, while the forced relocation of some 87,000 Native Americans from the Southeast to the southern Plains increased the regional subsistence demand and the number of potential hunters. Before the railroad reached the Great Plains, most of the hunting labor was provided by Native American men, and Native women did virtually all of the work to process the hides into robes. Robes soon became a primary source of cash income, the mechanism by which “nineteenth century Native peoples all over the continent were snared into dependency by the global economy” (Flores 2016a, p. 40). Roughly 100,000 robes were exported annually through New Orleans in the 1820s, and nearly that many again through Saint Louis in the 1840s. “By 1840, commercial production had reached about ninety thousand robes a year on the northern plains, and trade robes represented about 25 percent of the total buffalo kill of the plains” (White 1994, p. 246). Drought conditions ensued, peaking in the decade after 1855 and culling bison numbers by perhaps as much as 40–60 percent; bovine diseases introduced by cattle may have added to the

mortality. With the railroad came professional Anglo-American hunters, who took more than four million bison from the southern Great Plains between 1872 and 1874, effectively eliminating the herd there. In the northern plains, where pemmican was the fuel for the Hudson's Bay Company's human-powered, waterborne transcontinental trade, the company used its monopoly to drive down the price it paid for pemmican, diminishing the real income of northern plains tribes and thereby impelling them to kill ever more bison, even as the herds dwindled (Colpitts 2015). By 1884, the northern herd, too, had been all but exterminated.

In summary, the destruction of Native American peoples by disease, warfare, dispossession and dependency had significant ecosystem effects across North America, including its current and erstwhile rangelands. In Crosby's (1986) famous formulation, European conquest of the Americas was ecological imperialism, empowered by Old World crops, weeds, livestock, rodents, insects and pathogens to which neither Native Americans nor native American ecosystems were adapted. Forests filled in as fires became less common, and some prey species of wildlife grew more abundant, at least in the short term. As Mann (2005, p. 362) notes, "ecologists and archaeologists increasingly agree that the destruction of Native Americans also destroyed the ecosystems they managed... By 1800 the hemisphere was thick with artificial wilderness." The resulting bounty, perceived by many Anglo-Americans as limitless, served as a windfall for colonists, market hunters and merchants, as wildlife were converted *en masse* into commodities and shipped to urban centers around the world. "The nineteenth-century Great Plains was a slaughterhouse. In the years from the 1820s to the

1920s, this single American region experienced the largest wholesale destruction of animal life discoverable in modern history” (Flores 2016b, p. 6).

3.4 Livestock

Columbus brought horses, cows, goats, sheep, pigs and chickens on his second voyage to the Americas in 1493, and by 1512 a cattle industry had been established in the West Indies, whence animals were later shipped to Florida and the Mississippi valley (Bowling 1942).

Gregorio de Villalobos brought cattle to mainland North America in 1521, at what is now Veracruz, Mexico, where he founded the first of 233 *estancias* granted by the Spanish Crown over the ensuing century (Sluyter 2012). In 1540, the Coronado expedition set out from Compostela in what is now Nayarit, Mexico, with several hundred horses, 5,000 sheep and 150 cattle; the cattle may have been the first to enter the present-day United States, but it is doubtful that any were still alive when the expedition reached present-day Kansas two years later (Wagoner 1952; Wildeman and Brock 2000). Another Spaniard, Juan de Oñate, brought sheep, goats and cattle when he founded *Nuevo México* in 1598; by 1700, the Navajo had become expert livestock raisers (Weisiger 2009), and Spaniards in New Mexico were exporting surplus sheep to Old Mexico annually by the late eighteenth century (White 1994). Elsewhere on the continent, the French introduced livestock into the St. Lawrence valley in 1541, and the first English cattle arrived in 1611 at Jamestown, Virginia. The Carolinas would emerge as the source area for the development and expansion of Anglo cattle ranching in the Southeast, which spread through the coastal plains to Texas and scattered locations in the Ohio and lower Mississippi River valleys between 1650 and 1850 (Jordan 1981). In California, Spanish

missionaries introduced livestock from Mexico in the late eighteenth century, and *ranchos* multiplied rapidly there following the secularization of mission lands by the Mexican government in 1833 (Cleland 1941). Sheep were particularly important in the Pacific Northwest, where a range livestock industry developed after 1850, initially with animals from California and supplemented soon thereafter with breeds imported from eastern states via the Oregon Trail, although some Merino sheep are reported to have arrived by ship via Australia (Carman et al. 1892).

Some of the people who arrived in North America after 1492 came from places with significant rangelands, such as the Iberian Peninsula and North Africa, and they brought with them knowledge about how to raise livestock on the grasslands they found in the New World. Geographer Terry Jordan (1993) examined the development of range cattle production in North America on the basis of material culture and techniques of animal husbandry. He identified livestock systems that descended from the Old World and evolved in various ways as they diffused: a suite of overlapping Mexican systems that spread north and west from the Veracruz area; an Anglo-Texan system that blended traits from the American South and northeastern Mexico, spreading north and west from the Gulf Coast plains; and a Californian system, rooted in Spanish and Mexican practices, which expanded inland from the belt of missions, presidios and rancherias along the California coast. Such typologies are heuristic, and Jordan (1993, p. 308) cautioned that “Each cattle frontier was unique and far more accidental than predictable, the result of chance juxtapositions of peoples and places.” A more lasting contribution may be his demonstration of the pluralistic, not to say multi-cultural, makeup of early cattle ranching.

“The first Texas cowboys,” as White (1994, p. 243) notes, “were Indians,” and African-Americans, Native Americans, and Mexican-Americans were far more numerous among the cowboy work force of the late nineteenth century than depicted in Hollywood Westerns.

Extending Jordan’s efforts, Geographer Andrew Sluyter (2012) has documented the key roles of Africans and their descendants, including slaves and former slaves, in adapting techniques of animal husbandry, horseback riding, and the management of land and water to enable range livestock production in New Spain, Louisiana, the Caribbean, and parts of South America. Old World plants also played supporting roles in many regions, colonizing areas disturbed by livestock grazing and displacing native vegetation in places where large grazing animals had previously been absent. As Sluyter (2012, p. 5) explains:

Along with the cattle came grasses. Many millennia of association between livestock and grasses in Africa, Asia, and Europe ensured a greater symbiosis than that between the cattle and the grasses of the Americas. The non-American grasses were not only more palatable and nutritious, but the cattle preferentially propagated them, favoring them when grazing, carrying their seeds inland from the coast, and fertilizing them with manure.

Several African grasses spread through the tropics in Mexico, while Bermuda grass (also originally from Africa) colonized a subtropical belt from South Carolina to Texas. California’s native grasses were widely displaced by Eurasian annual species by the nineteenth century (d’Antonio et al. 2007).

The Great Plains were more resistant to Old World plant invasions, and the interior of the continent was not so quickly overtaken by Europeans or their livestock, with one exception.

Beginning in Santa Fe around 1630 (Haines 1938),

Indians spread horses rapidly and widely across North America. West of the Rockies, they transported the animal to the Snake River valley by 1700 and the Columbia Plateau by 1730. East of the Rockies, the horse reached the central Great Plains by the 1720s and western Canada by the 1730s... Indians used horses for transport, war, hunting, and more rarely, food. For most groups, a life without horses became unimaginable. (White 1994, pp. 238-239)

Empowered by horses, Native Americans stymied Spanish, Mexican and U.S. settlement of interior North America for centuries. “Rangelands were where native tribes succeeded the longest in resisting US conquest: the Comanche and others in Texas until 1875, the Sioux in the northern Great Plains until 1881, and the Apache in Arizona and New Mexico until 1886” (Sayre 2018, p. 342). From northern Mexico to Canada, and from the Great Plains through the Great Basin, tribes maintained complex and shifting relations of raiding, warfare, alliance and trade both among themselves and with European and Euro-American traders and settlers (Isenberg 2000; Blackhawk 2006; DeLay 2008; Colpitts 2015). Broadly speaking, tribes impeded state territorialization of rangelands, even while participating in the commodification of selected wildlife, livestock and animal products.

3.5 U.S. Expansion, Conquest and Settlement

Some 2,144,000 square kilometers of territory, including much of the Great Plains, came into nominal possession of the United States with the Louisiana Purchase of 1803. The U.S. annexed Texas in 1845, and Mexico ceded another 1,370,000 km², also largely rangelands, under the Treaty of Guadalupe Hidalgo in 1848, which ended the Mexican-American War. As just mentioned, however, effective conquest and settlement of most of this area did not take place until the closing third of the nineteenth century. Expeditions into the Great Plains led by Zebulon Pike (1806-07) and Stephen Long (1818-19) reinforced a widespread perception of the region as a wasteland or “Great American Desert” unfit for agricultural settlement, as the limited surface waters and near-total absence of trees failed to conform to European notions of a civilizable landscape. The Gold Rush drew migrants from around the world to California after 1848, and more limited commerce and migration took place along the Santa Fe, Oregon, and other stagecoach trails throughout midcentury. But Native American resistance and political gridlock over slavery stymied policies in support of interior western settlement up to the Civil War.

The post-war period, by contrast, witnessed dramatic transformations of rangelands in demographic, political-economic and biophysical terms. In 1862, with Southern representatives absent, Congress passed the first of the Homestead Acts; the same year, President Lincoln created the US Department of Agriculture (USDA). These would become the institutional foundations for settlement beyond the Mississippi River. Inspired by Jeffersonian agrarianism, the policy goal was settlement by as many independent, landowning families as possible, in

contrast to both the plantation South and aristocratic Europe; tacitly but effectively, the model settler was a white, male, Christian, English-speaking, American citizen (Carman et al. 1892; Sayre 2018). The Homestead Acts eventually transferred some 414 million km² of public land into private hands, nearly all of it for commercial agriculture, in parcel sizes that were generally too small for economical use as rangelands. Meanwhile, the USDA provided scientific know-how and support, not only for farmers but also for loggers and ranchers operating on those parts of the public domain that were never successfully privatized. The economic basis followed shortly after the war in waves of migration, mining, ranching, timber-cutting, farming and railroad building, all fueled by investment capital from the east coast and Europe. With the partial exception of California (Walker 2001), the West became a colonial hinterland of the East, serving both as a source of natural resources for industrial development and as a destination for surplus capital produced by that development. “Across the telegraph wires came the instructions and information that coordinated eastern financial markets and western production sites. Along the railroads traveled the raw materials of the West and the finished products of the East” (White 1991, p. 236). As both cause and effect of late-century boom-and-bust capitalism, the western frontier was prone to crises at all scales, from farm foreclosures and corporate bankruptcies to the international depressions of 1873 and 1893. But it nonetheless resulted in the territorialization of the region into a system of property, investments, and land use oriented to national and global market production.

3.5.1 The Open Range and the Cattle Boom

The most legendary face of frontier expansion on North American rangelands, and the force behind its breakneck speed, was the Cattle Boom, which swept across the Great Plains in near lockstep with the decimation of the bison. It was actually two, overlapping and intersecting booms. One commenced immediately after the Civil War and was essentially bovine mercantilism: over the ensuing two decades, some 5.2 million ownerless, semi-feral Longhorn cattle that had built up in Texas during the war were rounded up and trailed north to urban markets, military forts, Indian reservations, and railhead towns, where they fetched prices as much as ten times what they cost (Webb 1931; Paul 1988). This was the boom of mythic cowboys, cattle trails and stampedes (McCoy 1951). The second boom picked up steam in the mid-1870s and effectively swallowed the first boom by the early 1880s. After smaller western banks failed in the 1873 panic, larger eastern firms and investors from as far away as Scotland jumped in to capitalize on high regional interest rates, free grass on unfenced rangelands, and surging national and international demand for beef (Dale 1930; Atherton 1961). This boom was the capitalist, financialized ‘Beef Bonanza’ (Brisbin 1881) of cattle barons, overnight fortunes and aristocratic pretensions. “[T]he Western range cattle industry during the last two decades of the nineteenth century was operated basically on borrowed capital” (Gressley 1966, p. 145), including some \$45 million from Great Britain by the 1880s and another \$284 million from the eastern US by the end of the century (Frink 1956; Graham 1960). Ahead of the homesteaders, with millions of hectares open to the first taker,

Every man was seized with the desire to make the most that was possible out of his opportunities while they lasted. He reasoned that there was more grass than his own

cows could possibly eat. There was plenty of stock water for five times as many cows as were now on the range. There was no rent to pay, and not much in the way of taxes, and while these conditions lasted every stockman thought it well to avail himself of them. Therefore all bought cows to the full extent of their credit on a rising market and at high rates of interest.” (Bentley 1898, p. 8)

Bank loans, mortgages and stock issues compelled ranchers to produce for the market, both to secure credit and to repay debts. In the 1870s, responding to the demands of the nascent packing industry as well as the admonitions of their faraway investors, cattle producers began to cross their Texas Longhorns with “improved” British breeds such as Herefords and Shorthorns, which yielded higher quality cuts of meat, especially when finished on corn. The perfection of cheap barbed wire in 1874 facilitated controlled breeding, but it also increased ranchers’ costs and was illegal to install on the public domain, creating much uncertainty and sometimes violent conflict over informal ‘range rights.’ Meanwhile, the Union Stock Yards of Chicago and its Big Four meat processors (Armour, Swift, Morris, and Schwartzschild and Sulzberger (S&S)) pioneered advances in slaughtering and refrigerated transport that drove processing costs down, democratizing beef consumption and boosting demand. But the processors also used their monopoly position and outright collusion to exert downward pressure on prices paid to farmers and ranchers (Virtue 1920; Pacyga 2015; Specht 2019). This prompted further herd expansion, along the lines described by Bentley above. “Economy, culture, and ecology all combined to create conditions that led to an explosion in the numbers of cattle” (White 1991, p. 220).

The boom collapsed from the combined effects of over-expansion and bad weather. Drought in the southern Great Plains killed large numbers of livestock in 1883-84; many owners shipped their herds north and west in search of pasture, only to see them wiped out by severe winter storms in 1886-87. As of 1888, “[m]any thousands of animals were lying dead all over the range, starved and frozen; the survivors were riding in boxcars to the stockyards for rapid liquidation by their owners” (Worster 1992, p. 41). The last ripples of the boom washed across New Mexico and Arizona, where cattle numbers exploded between 1885 and 1891 and collapsed in the drought of 1891-93 (Sayre 1999). Coupled with the 1893 depression, it was an ecological-economic crisis. Scores of cattle companies went bankrupt. Vast areas of rangeland were reduced to dirt, triggering acute surface and gully erosion, altering fire regimes, and initiating widespread, long-term vegetation changes across the Southwest (Cooke and Reeves 1976; Bahre and Shelton 1996). Comparably severe vegetation changes would unfold across large parts of the northern shrub/steppe over the ensuing century (Sayre 2017). The fact that cattle grazing is routinely included among the official causes of decline for wildlife listed as threatened or endangered in the West is often due to impacts inflicted long ago.

3.5.2 Landownership

The mosaic of public, private and other landownership types¹ that characterizes North American rangelands today, dating from this period, can be loosely arranged by the availability

¹ Other landownership types include provincial and first nations lands in Canada; tribal and state lands in the US; and communal and indigenous lands in Mexico. The details of the three countries’ landownership systems exceed the space available here, so I focus on the US case for simplicity. It is worth noting that enormous areas of

of water and fertile soil, interacting with government policies and market forces.² The driest, highest, and/or least fertile areas defied settlement altogether and remained in the public domain, eventually passing into the administration of the USDA's Forest Service or the Department of Interior's Bureau of Land Management (see Section 3.6). Important exceptions occurred where desert or semi-desert lands could be put under large-scale irrigation following passage of the 1902 Newlands Reclamation Act, such as in the Gila and Salt River valleys of Arizona, the Imperial and Sacramento-San Joaquin valleys of California, and the Palouse prairies of eastern Oregon and Washington. Here rangelands were lost to cultivation, often attended by speculation or fraud and ending up in the hands of large private landowners (Reisner 1987).

At the opposite end of the spectrum, in the wettest parts of the Great Plains, the soil was among the most fertile on Earth but there was generally too much water, or it was distributed in space and time such as to limit cultivation. The installation of drainage tiles—permeable pipes buried below plow depths to accelerate spring drying—spread rapidly across Illinois and Iowa in the 1870s and '80s, often underwritten by banks or speculators who then sold the lands to prospective farmers (Prince 1997). Extending a model first developed in the Ohio Valley in the 1830s, the resulting farms used livestock to consume their copious corn harvests and convert them into moveable, saleable commodities (Hudson 1994). The aggregate result was a

rangelands in northern Mexico were privatized and sold to American capitalists in the late nineteenth century, facilitated by the Porfirio Diaz regime; revulsion at the land-grabbing helped to motivate the Mexican Revolution (Hart 2002).

² Texas is a partial exception in terms of landownership, because it entered the union in possession of its unsettled lands and disposed them to private owners on terms other than the Homestead Acts, resulting in a near-total absence of federal lands today. In terms of farming and ranching as land uses, however, it broadly resembles neighboring states.

self-reinforcing cycle: farmers bought drained land on credit, and abundant yields pushed corn prices down, prompting farmers to cultivate ever more acres to cover their debts. As the tall-grass prairie disappeared under the plow, calf production was displaced westward into the drier, mixed- and short-grass prairies of the western Great Plains (Dale 1930).

Intermediate on the spectrum were higher elevation valleys with mountain streams subject to diversion onto fertile floodplains. In these settings—scattered throughout the Great Basin, Rocky Mountains and Southwest—homesteaders successfully settled the flattest, most fertile fraction of the landscape and left the surrounding mountains and uplands in public ownership (Scott et al. 2001). Over time, the private lands became increasingly devoted to pasture or hay crops for winter feeding to herds of livestock that grazed on the surrounding public lands in the warmer months (Starrs 2000).

Finally, the most nettlesome cases were those where dry farming was possible in some years but not others, especially the Southern Great Plains and the belt of lands lying between the 100th and the 102nd meridians (Stegner 1954; Worster 1977). With about 50 cms of average annual precipitation, these lands appeared arable enough to induce land rushes among immigrant homesteaders hungry for farms of their own; by 1890, six million people inhabited the Great Plains. But these areas also periodically experienced multi-year droughts that devastated crops, bankrupted settlers and exposed the plowed fields to severe wind erosion. By the 1930s, one-third of the southern Great Plains—some 13.4 million hectares of former short-grass prairie—were sod-busted, setting the stage for the infamous Dust Bowl. Many failed

homesteads reverted to public ownership either by tax default or through the New Deal's Rural Resettlement Administration.

With minor adjustments, the aggregate outcome for US rangelands was the pattern of landownership and land use still visible today: near-total conversion to private ownership and crop agriculture east of the 100th meridian, and a complex mosaic to the west. As of 1940, some 16.1 percent of the seventeen Western states was farmland, ranging from three percent or less in Nevada, Utah, New Mexico and Arizona to just over half of Kansas and North Dakota (Stoddart 1945). Nearly all of the other 83.9 percent remained rangeland, roughly half private and half in public ownership, but unevenly distributed, with the public rangelands skewing towards higher, drier, and generally less productive areas (Secretary of Agriculture 1936).

3.6 The Western Range

By 1890, North American rangelands were enfolded into a market-oriented, continent-spanning “cattle-beef complex” that encompassed Midwestern corn farms, cattle ranches across the West, Chicago packing plants, and refrigerated railroad meat distribution to cities throughout the East (Specht 2019). The first stirrings of the conservation movement were beginning to be felt in Washington, D.C.: Inspired by the near-extinction of the bison, widespread clear-cutting of forests, and the destruction wrought by the Cattle Boom, prominent eastern scientists such as William Hornaday (1889) were openly condemning market forces for the annihilation of wildlife and their habitats. (In 1900, Congress would pass the Lacey Act, the first federal law regulating interstate traffic in wildlife.) Out West, most of the land suitable for dry farming had

been claimed under the Homestead Acts and plowed—it was no longer rangeland at all.

Hopeful settlers would continue to file entries into the 1930s, but it was already evident that large areas would remain in (or revert to) the public domain for lack of reliable water and/or arable soil, and that in many cases their chief value was in fact a public one, as timber sources and watersheds for downstream settlements.

How should these lands be administered and managed? Congress answered this question in a series of loosely coordinated steps for different subsets of the federal domain. Rangelands fell principally into two of these: areas withdrawn under the Forest Reserves Act of 1891, and the residual public domain (Calef 1960; Voigt 1976; Rowley 1985).³ Both were administered by the Department of Interior's General Land Office (GLO), and both were already being grazed by livestock. But they would follow quite different paths after 1894, when the GLO, facing pressure from conservationists, banned all grazing on the Forest Reserves (Rowley 1985). The move set off a political skirmish that ricocheted across the continent for the next half-century and ultimately reterritorialized the open range, replacing it with a system of exclusive leasehold tenure for private livestock producers to utilize the forage in fenced allotments of public rangelands. This system can be termed the Western Range, after the landmark 1936 USDA report of the same name (see below).

³ That is, lands not withdrawn for other purposes such as the military, Indian Reservations, national parks, and lands granted to states. All of these categories included rangelands, but this fact was generally incidental to their administration.

It was the dawn of the Progressive Era, and the debate over the Forest Reserves was waged in the language of science and the public good. The Senate asked the National Academy of Sciences to appoint a committee, which borrowed the words of John Muir (“hoofed locusts”) to condemn livestock—especially sheep—for damaging the forests (NAS 1897). Cattle and sheep producers complained, and the USDA enlisted its premier botanist, Frederick Coville, to study the matter. Coville (1898) conducted a detailed survey in the Cascade Mountains of Oregon and systematically refuted the Academy’s claims, and five years later he sat on the second Public Lands Commission,⁴ convened by President Teddy Roosevelt. “The great bulk of the vacant public lands throughout the West,” the commission wrote, “are, and probably always must be, of chief value for grazing” (Coville et al. 1905, p. xx). Some 300 million acres were “theoretically open commons, free to all citizens,” but in practice were subject to “tacit agreements” that were routinely violated. “Violence and homicide frequently follow,” often between cattle and sheep producers. The commission’s conclusion was an early articulation of the Tragedy of the Commons:

The general lack of control in the use of public grazing lands has resulted, naturally and inevitably, in overgrazing and the ruin of millions of acres of otherwise valuable grazing territory. Lands useful for grazing are losing their only capacity for productiveness, as, of course, they must when no legal control is exercised. (Coville et al. 1905, p. xxi)

⁴ The first such commission was convened in 1879; its members included Clarence King and John Wesley Powell. Their report (Williamson et al. 1880) used the term “pasturage lands” to refer to rangelands, and noted that they were the least valuable lands, per acre, in the public domain, but also for that reason the most accessible to ordinary citizens with minimal capital (Sayre 2017).

The commission's report led directly to passage of legislation that transferred the Forest Reserves to the USDA and created the US Forest Service to manage them. The law further authorized the Secretary of Agriculture to lease these lands to livestock producers and to charge them a fee for that use, as well as to stipulate terms and conditions for management. With a stroke of Roosevelt's pen, his close friend Gifford Pinchot, head of the USDA's Division of Forestry, was suddenly in charge of some 94 million acres of land.

There is a large literature on the history of the Forest Service, but relatively little of it focuses on rangelands (but see Rowley 1985). Grazing wasn't the new agency's primary concern, after all: forests and timber, fire protection, and watersheds were all higher priorities. Western settlement had been attended and abetted by a proliferation of federal government entities tasked with developing scientific knowledge and information about the nation's land and natural resources. The goal in virtually every instance was to increase the output and efficiency of commercial agriculture for the benefit of settlers. At a time when European scholars and universities dominated the sciences, however, rangelands were an afterthought. Unlike forests, mines and farmlands, there was no established science for "unimproved" pastures and ranges. Basic taxonomic investigations of western U.S. range grasses only began in the 1880s, and the first formal program dedicated to "grass and forage plant investigations," the USDA's Division of Agrostology, wasn't founded until 1895. American plant ecology was born in large measure into this vacuum. Charles Bessey, Frederic Clements, and their students and successors at the University of Nebraska dominated the field well into the twentieth century (Tobey 1981),

producing an applied “science of empire” (Robin 1997) to address the needs of western rangelands.

That rangeland science unfolded under the administration of the Forest Service was more or less accidental, but also consequential. The goals of the Western Range were those of Progressive Era conservation, distilled in Pinchot’s words as “the greatest good of the greatest number for the longest time” (Pinchot 1947). But in practice, this elegant utilitarian motto was rather contradictory. “The greatest good” effectively meant the greatest economic output, measured in profits and embodied in livestock, but no one knew how to calculate such an optimum. Even seemingly simple tasks such as mapping and measuring forage resources posed staggering logistical challenges, and highly variable interannual rainfall, on top of widely divergent range conditions, made relations with lessees perennially contentious, especially regarding stocking rates. “The greatest number” meant as many lessees as possible, but this too depended on forage production, and having too many risked repeating the errors of the open range period. To cull the pool, the Forest Service required permittees to own nearby private land sufficient to support their herds through the winter (“commensurate property”), effectively disqualifying poorer, non-landowning producers—many of whom were from minority groups (Sayre 2018). Finally, “the longest time” was an imponderable criterion. No one knew if rangelands could recover from acute overgrazing, or how long it might take, although the Public Lands Commission had confidently asserted that “Lands apparently denuded of vegetation have improved in condition and productiveness upon coming under any system of

control which affords a means of preventing overstocking and of applying intelligent management to the land” (Coville et al. 1905, p. xxi).

In theory, exclusive access and security of tenure gave lessees a rational self-interest in conserving range resources on their allotments. But realizing exclusive access ran counter to maximizing profits. It required either the employment of full-time herders or the construction of fences, and both were prohibitively expensive. To study the matter, Pinchot and Coville sponsored an experiment in 1907-09, with an outcome that was predetermined: the high cost of fencing could be justified economically provided that it rendered herders unnecessary and thereby reduced producers’ labor costs. But herders also protected livestock from wolves, grizzly bears, and the like, so eliminating herders would also require the West-wide elimination of predators. The Forest Service was already actively engaged in predator control on its lands, and in 1914 Congress authorized and funded the USDA’s Bureau of Biological Survey (BBS) to do so throughout the West (Cameron 1929). Between 1915 and 1920, the BBS reported killing 128,513 predatory animals by hunting and trapping, and an unknown but probably larger number by poisoning. Wolves and grizzly bears were extirpated from large parts of their former ranges. Similar campaigns were launched against prairie dogs and a long list of other “pests,” numbering in the hundreds of millions. Meanwhile, most of the fences needed to demarcate grazing allotments would not be built until the Civilian Conservation Corps subsidized the effort with a massive supply of cheap labor during the Depression (Sayre 2017).

The effects of the Western Range on rangeland ecosystems were mixed. The number of cattle and sheep grazing on the National Forests spiked during World War I, and the agency faced continuous resistance from lessees and livestock associations about stocking reductions. But over time, control of numbers and seasons of use were gradually achieved, and some indications of range recovery could be found, at least relative to the still unregulated, open range of the remaining public domain. Probably the greatest impacts of the new system, though, would not become evident till decades later. As early as 1920, the Forest Service had evidence that grazing reduced the incidence, intensity and spread of wildfires—and fire protection had become the agency’s foremost concern since the politically embarrassing “Big Blow-up” of 1910 (Pyne 1982). Grazing for fuels management became *de facto* policy within the agency by the end of the 1920s. New stock roads, bridges, and water systems served both to open up access to additional forage for lessees and to expand the footprint of fire protection, and static stocking rates ensured heavy grazing (relative to forage production) during drier years, when fire risks were high (Sayre 2017). In the long-term, however, the effects of fire suppression included much denser forest stands, compositional shifts, and greater susceptibility to catastrophic crown fires.

Another product of the Western Range was Aldo Leopold, who joined the Forest Service fresh out of the Yale School of Forestry in 1909. For a brief period in 1914-15, he worked in the Office of Grazing for the Southwestern Region, where he encountered the concept of carrying capacity. “The discovery would reverberate through his work for the rest of his life” (Meine 1988, p. 136), shaping his interpretation of predator-prey interactions on the Kaibab plateau

and informing his landmark textbook, *Game Management* (Leopold 1933). He was deeply involved with state hunting regulations, and he came to see hunters and private land owners as important allies in advancing conservation. Finally, he was among the first to question the wisdom of unrestrained fire suppression. Based on his observations in the Southwest, he wrote: “Until very recently we have administered the southern Arizona Forests on the assumption that while overgrazing was bad for erosion, fire was worse, and that therefore we must keep the brush hazard grazed down to the extent necessary to prevent serious fires. In making this assumption we have accepted the traditional theory as to the place of fire and forests in erosion, and rejected the plain story written on the face of Nature” (Leopold 1924, p. 6).

The Forest Service had come into being in 1905 with political support from sheep and cattle producers and their well-connected livestock associations, who had been persuaded that they had more to gain than to lose in paying fees to secure exclusive access to forage on the forests (Steen 1977; Rowley 1985). But for the lower, drier, and generally less productive lands that remained in the public domain, it would take another generation before such a coalition could be forged (Merrill 2002). Inspired by the success of the Mizpah-Pumpkin Creek Grazing District in Montana (Muhn 1987), livestock producers agreed to support the Taylor Grazing Act of 1934, which applied fencing and leases to the GLO’s 155 million acres of grazing lands. But it did not transfer those lands to the USDA, and in the years surrounding its passage an extraordinary bureaucratic struggle took place, largely behind the scenes. Secretary of Interior Harold Ickes lobbied President Franklin Roosevelt to reverse the earlier transfer and restore the National Forests to Interior, which he proposed to rename the Department of Conservation (Merrill

2002). Secretary of Agriculture Henry Wallace parried Ickes's efforts, however, arguing that the new Taylor Grazing Districts belonged in the care of the Forest Service (notwithstanding the near-absence of forests on those lands): *The Western Range* (Secretary of Agriculture 1936) was a 620-page briefing paper-cum-lobbying effort, mustering every piece of available evidence to support the contention that National Forest rangelands had improved since 1905, while the other 600 million acres of the nation's grazing lands had remained degraded or worse.

Roosevelt was reported to side with Ickes at first, but in the end, he did nothing, leaving the Western Range divided between two agencies with distinct land bases, institutional cultures and legislative mandates. The Bureau of Land Management did not receive an organic act to guide its management authority until 1976, when the Federal Land Policy and Management Act directed the agency to practice sustained multiple use.

3.7 Environmentalism and (Ex)urbanization

The post-World War II period saw the politics of rangelands fracture along new fault lines even as the Western Range consolidated. Range conditions on the Taylor Act lands generally improved by the late 1950s, then remained unchanged for the next quarter-century (Hadley et al. 1977). The new grazing districts were administered initially by the Division of Grazing, then the Grazing Service, and finally by the Bureau of Land Management, which absorbed and extinguished the GLO in 1946. The bureaucratic reorganizations reflected more than internal adjustments, though, as the new lessees and their livestock associations mounted a bid to devolve the new grazing districts into state, county or private ownership. Thus, was the modern Rangeland Conflict born: The cattle and wool growers provoked the ire of Bernard DeVoto,

editor of *The New Republic*, who penned a series of articles denouncing their effort as a “land grab” and recasting the American cowboy from hero into despoiler of the nation’s patrimony. DeVoto struck a chord with conservationists and everyday citizens in the East and also out West—he himself was a Utahan and prolific Western historian—and the episode signaled a lasting shift in the politics of public lands grazing. As the environmental movement grew out of the 1960s, helping to motivate passage of the Clean Air Act (1963), the National Environmental Policy Act (1970), the Clean Water Act (1972) and the Endangered Species Act (1973), ranchers and environmentalists increasingly saw each other as diametrically opposed. More recently, the demands of the Sagebrush Rebellion of the 1970s and ‘80s and the Malheur National Wildlife Refuge occupation in 2016 were remarkably similar to those of the livestock associations in DeVoto’s day.

Progressive faith in science to resolve political problems lingered, but it began to falter on the rangelands themselves. The discipline of range science, which had grown up as a step-child within the Forest Service, found greater professional autonomy after the Depression as employment opportunities multiplied in the BLM, the Soil Conservation Service, and the academy; in 1948, a new Society for Range Management came into being, cleaving away from forestry and agronomy. According to the scientists, controlling and reducing stocking rates was supposed to lead to range restoration, based on Frederic Clements’s (1916, 1920) theory of plant succession and Arthur Sampson’s (1919) influential adaptation of Clementsianism to range management. And indeed, stocking rates have declined on both Forest Service and BLM lands. But shrub encroachment persisted in large areas: juniper throughout much of the region,

mesquite in the Southwest, and sagebrush in the Great Basin. Severe drought in the 1950s exacerbated fears that conditions were worsening. Facing pressure from lessees not to cut stocking rates, the USDA launched large-scale projects to restore grasses by mechanically or chemically removing shrubs, treating hundreds of thousands of acres with little or no long-term success; indeed, the grasses that were seeded included a number of non-native species that later became problems in their own right (Sayre 2017). The role of fire suppression in ongoing vegetation change, meanwhile, was scrupulously avoided for decades, with the Forest Service sometimes actively preventing publication of fire research in prominent journals (Pyne 1982).

Demographic and technological changes have strongly affected rangelands and livestock production since the mid-20th century. Air conditioning, interstate highways and cheap energy enabled rapid suburban growth nationwide, especially in California and the Southwest. Population stagnated or decreased throughout the Great Plains, except in and around larger urban areas, as the labor demands on farms and ranches declined and young people migrated to cities for work. The average household grew smaller in terms of people, but larger in terms of house and parcel size; nationwide, the area of exurban development (4-16 hectares/household) increased five-fold, from 5 percent to 25 percent of the conterminous US between 1950 and 2000 (Brown et al. 2005). Residential development sidesteps the ecological dependence of agriculture on fickle rainfall, capitalizing instead on warm climate, expansive views and low market prices for agricultural land. In the eight interior Western states, total farm and ranch acreage peaked in 1964 at 268 million acres and declined by an average of roughly one million acres per year through 1997. Some 1.6 million acres of grazing land went

out of production (including public lands) every year in the 1990s; over the period 1982-1997, about 45 percent of lost grazing land was converted to urban uses (Knight et al. 2002).

Livestock production has also changed dramatically, albeit mostly on former rangelands converted to agriculture. Post-war surpluses of ammonia from decommissioned munitions factories flooded the market with cheap fertilizer in the late 1940s and '50s, and new chemical pesticides also came online. When applied to new hybrid varieties of corn and sorghum, the chemical inputs sent yields skyrocketing throughout the Plains states; cheap grain, in turn, opened up profit opportunities in concentrated livestock feeding (Nall 1982; Corah 2008; Ogle 2013). As feed lots concentrated in the southern Great Plains, processing plants gravitated towards them, taking advantage of non-union workforces and technological advances in slaughter to reduce costs and increase scale (Skaggs 1986; Stanley 1994). Declining margins have driven consolidation in farms and ranches through the US, with mid-sized operations decreasing dramatically (MacDonald 2018).

3.8 Conclusion

The aggregate effect of all these trends has been to marginalize rangelands *as rangelands* still further than before, ecologically, economically, socially and politically (Sayre et al. 2013). The Western Range system of leases, for all of its other weaknesses, did succeed in linking the management and use of private and public lands together in large, relatively contiguous parcels; as the Public Lands Commission reasoned, security of tenure would incentivize conservation as long as the “chief value” of the land was for grazing. As of 2000, some 110

million acres of private lands were dependent on federal grazing permits for at least some of their forage (Gentner and Tanaka 2002). Now, however, private land values exceed what livestock production can justify nearly everywhere and often by wide margins, and nearly all ranches depend on off-farm income or wealth to remain solvent (Torell et al. 2004). The greatest threat to rangelands and their biodiversity is no longer livestock grazing but weed invasions, fragmentation and development (Hansen et al. 2005).

Historians have long emphasized the aridity of rangelands in the western United States as a key factor in the nation's settlement, as it defied the Jeffersonian, yeoman farmer model embedded in the Homestead Acts. This thesis requires modification in light of more recent scholarship, however. Biophysically, many North American rangelands (such as the Great Plains) were more resilient to Old World plants and livestock than other biomes, and it was their climatic variability, rather than aridity *per se*, that resulted in the greatest obstacles to Euro-American settler colonialism. Climate change is now increasing variability throughout the West, magnifying the challenges of drought, floods, fire, and water provision for urban, exurban, and rural areas alike. The lessons to be learned from the history of North American rangelands will only grow more salient, then, as more and more places come to experience comparable degrees of variability.

References

- Anderson MK (2005) *Tending the wild: Native American knowledge and the management of California's natural resources*. University of California Press, Berkeley CA
- Anderson MK (2007) Native American uses and management of California's grasslands. In: Stromberg M, Corbin JD, D'Antonio CM (eds) *California grasslands: ecology and management*. University of California Press, Berkeley CA pp. University of California Press, Berkeley CA
- Anderson VD (2004) *Creatures of empire: how domestic animals transformed early America*. Oxford University Press, New York
- Atherton LE (1961) *The cattle kings*. Indiana University Press, Bloomington
- Bahre CJ, Shelton ML (1996) Rangeland destruction, cattle and drought in southeastern Arizona at the turn-of-the-century. *Journal of the Southwest* 38:1–22
- Bentley HL (H (1898) *Cattle ranges of the Southwest: a history of the exhaustion of the pasturage and suggestions for its restoration*. USDA Farmer's Bulletin No. 72. Government Printing Office, Washington
- Black Elk L (2016) Native science: understanding and respecting other ways of thinking. *Rangelands* 38:3–4. <https://doi.org/10.1016/j.rala.2015.11.003>
- Blackhawk N (2006) *Violence over the land: Indians and empires in the early American West*. Harvard University Press, Cambridge MA
- Bowling GA (1942) The introduction of cattle into colonial North America. *Journal of Dairy Science* 25:129–154

In press—final manuscript version

Brisbin JS (James S (1881) *The beef bonanza; or, how to get rich on the plains*. J. B. Lippincott & Co., Philadelphia

Brown DG, Johnson KM, Loveland TR, Theobald DM (2005) rural land-use trends in the conterminous United States, 1950-2000. *Ecological Applications* 15:1851–1863.
<https://doi.org/10.1890/03-5220>

Burton HT (1928) *A history of the JA Ranch*. Press of Von Boeckmann-Jones, Austin TX

Calef W (1960) *Private grazing and public lands*. University of Chicago Press, Chicago

Cameron J (1929) *The Bureau of Biological Survey: its history, activities and organization*. The Johns Hopkins Press, Baltimore, MD

Carman EA, Heath HA, Minto J (1892) *Special report on the history and present condition of the sheep industry of the United States*. USDA-Bureau of Animal Industry, Washington, DC

Cleland RG (1941) *The cattle on a thousand hills: Southern California, 1850-1870*. The Huntington Library, Los Angeles

Clements FE (1916) *Plant succession: an analysis of the development of vegetation*. Carnegie Institution of Washington, Washington, DC

Clements FE (1920) *Plant indicators: the relation of plant communities to process and practice*. Carnegie Institution of Washington, Washington DC

Colpitts G (2015) *Pemmican empire: food, trade, and the last bison hunts in the North American Plains, 1780–1882*. Cambridge University Press, New York

Cooke RU, Reeves RW (1976) *Arroyos and environmental change in the American South-West*. Clarendon Press, Oxford UK

- Corah LR (2008) ASAS centennial paper: development of a corn-based beef industry. *Journal of Animal Science* 86:3635–3639
- Coville FV (1898) Forest growth and sheep grazing in the Cascade mountains of Oregon. USDA-Division of Forestry Bulletin No. 15. Government Printing Office, Washington DC
- Coville FV, Hatton JH, Potter AF, Roosevelt T (1905) Report of the Public Lands Commission with appendix. Senate Document No. 189. Government Printing Office, Washington, DC
- Cronon W (1983) *Changes in the land: Indians, colonists, and the ecology of New England*. Hill and Wang, New York
- Cronon W (1991) *Nature's metropolis: Chicago and the Great West*. W. W. Norton, New York
- Crosby AW (1986) *Ecological imperialism: the biological expansion of Europe, 900-1900*. Cambridge University Press, New York
- Cunfer G, Waiser B (2016) *Bison and people on the North American Great Plains: a deep environmental history*. Texas A&M University Press, College Station TX
- Dale EE (1930) *The range cattle industry*. University of Oklahoma Press, Norman, OK
- D'Antonio CM, Malmstrom C, Reynolds SA, Gerlach J (2007) Ecology of invasive non-native species in California grassland. In: Stromberg M, Corbin JD, D'Antonio CM (eds) *California grasslands: ecology and management*. University of California Press, Berkeley CA
- DeLay B (2008) *War of a thousand deserts: Indian raids and the U.S.-Mexican War*. Yale University Press, New Haven CT
- Denevan WM (1992) The pristine myth: the landscape of the Americas in 1492. *Annals of the Association of American Geographers* 82:369-385

- Dobyns HF (1983) Their number become thinned: native American population dynamics in eastern North America. University of Tennessee Press, Knoxville, TN
- Dobyns HF (1981) From fire to flood: historic human destruction of Sonoran Desert riverine oases. Ballena Press, Socorro NM
- Dolin EJ (2010) Fur, fortune, and empire: the epic history of the fur trade in America. W.W. Norton & Co, New York
- Flores D (2003) The natural West: environmental history in the Great Plains and Rocky Mountains. University of Oklahoma Press, Norman OK
- Flores D (2016a) Reviewing an iconic story: environmental history and the demise of the bison. In: Cunfer G, Waiser B (eds) Bison and people on the North American Great Plains: a deep environmental history. Texas A&M University Press, College Station TX
- Flores DL (2016b) American Serengeti: the last big animals of the great plains. University Press of Kansas, Lawrence, KS
- Frink M (1956) When grass was king; contributions to the Western Range Cattle Industry Study. University of Colorado Press, Boulder CO
- Fuhlendorf SD, Engle DM, Kerby J, Hamilton R (2008) Pyric herbivory: rewilding landscapes through the recoupling of fire and grazing. *Conservation Biology* 23:588-598
- Gentner BJ, Tanaka JA (2002) Classifying federal public land grazing permittees. *Journal of Range Management* 55:2–11. <https://doi.org/10.2307/4003256>
- Graham R (1960) The investment boom in British-Texan cattle companies 1880–1885. *Business History Review* 34:421–445. <https://doi.org/10.2307/3111428>
- Gressley GM (1966) Bankers and cattlemen. Knopf, New York

In press—final manuscript version

Grice AC, Hodgkinson KC (2002) *Global rangelands: progress and prospects*. CABI Publishers, Wallingford UK

Gulliford A (2018) *The woolly West: Colorado's hidden history of sheepscapes*. Texas A&M University Press, College Station TX

Hadley RF, Dasgupta B, Reynolds NE, et al (1977) Evaluation of land-use and land-treatment practices in semi-arid western United States. *Philosophical Transactions of the Royal Society of London B* 278:543–554. <https://doi.org/10.1098/rstb.1977.0061>

Haines F (1938) The northward spread of horses among the Plains Indians. *American Anthropologist* 40:429–437

Hansen AJ, Knight RL, Marzluff JM, et al (2005) Effects of exurban development on biodiversity: patterns, mechanisms, and research needs. *Ecological Applications* 15:1893–1905. <https://doi.org/10.1890/05-52213>.

Hart JM (2002) *Empire and revolution: the Americans in Mexico since the Civil War*. University of California Press, Berkeley CA

Hart RH, Hart JA (1997) Rangelands of the Great Plains before European settlement. *Rangelands* 19:4–11

Hornaday WT (1889) *The extermination of the American bison, with a sketch of its discovery and life history*. Government Printing Office, Washington DC

Hudson JC (1994) *Making the corn belt: a geographical history of middle-western agriculture*. Indiana University Press, Bloomington IN

Isenberg AC (2000) *The destruction of the bison: an environmental history, 1750-1920*. Cambridge University Press, New York

In press—final manuscript version

Jordan TG (1993) North American cattle-ranching frontiers: origins, diffusion, and differentiation. University of New Mexico Press, Albuquerque NM

Jordon TG (1981) Trails to Texas: southern roots of western cattle ranching. University of Nebraska Press, Lincoln NE

Knight RL, Gilgert WC, Marston E (2002) Ranching west of the 100th meridian: culture, ecology, and economics. Island Press, Washington, DC

Leopold A (1933) Game management. C. Scribner's Sons, New York

Leopold A (1924) Grass, brush, timber, and fire in southern Arizona. *Journal of Forestry* 22:1–10

Lightfoot KG, Parrish O (2009) California Indians and their environment: an introduction. University of California Press, Berkeley CA

MacDonald JM (2018) CAFOs: farm animals and industrialized livestock production. In: Oxford Research Encyclopedias, Environmental Science.

<https://doi.org/10.1093/acrefore/9780199389414.013.240>

Mann CC (2005) 1491: New revelations of the Americas before Columbus. Alfred A. Knopf, New York

Martin PS (1973) The discovery of america: the first americans may have swept the western hemisphere and decimated its fauna within 1000 years. *Science* 179:969–974.

<https://doi.org/10.1126/science.179.4077.969>

McCoy JG (Joseph G, Worrall H (1951) Historic sketches of the cattle trade of the West and Southwest. Long's College Book Co, Columbus, OH

McGregor AC (1982) Counting sheep: from open range to agribusiness on the Columbia Plateau. University of Washington Press, Seattle WA

In press—final manuscript version

Meine C (1988) Aldo Leopold: his life and work. University of Wisconsin Press, Madison, WI

Menke J, Bradford GE (1992) Rangelands. *Agriculture, Ecosystems & Environment* 42:141–163.

[https://doi.org/10.1016/0167-8809\(92\)90024-6](https://doi.org/10.1016/0167-8809(92)90024-6)

Merrill KR (2002) Public lands and political meaning: ranchers, the government, and the property between them. University of California Press, Berkeley CA

Muhn JA (1987) The Mizpah-Pumpkin Creek Grazing District: its history and influence of the enactment of a public lands grazing policy, 1926-1934. Montana State University, Bozeman MT

Nall GL (1982) The cattle-feeding industry on the Texas high plains. In: Dethloff HC, May IM Jr. (eds) *Southwestern agriculture: pre-Columbian to modern*. Texas A&M University Press, College Station TX

NAS (1897) Report of the committee appointed by the National Academy of Sciences upon the inauguration of a forest policy for the forested lands of the United States to the Secretary of the Interior. Government Printing Office, Washington DC

Noss RF (2013) *Forgotten grasslands of the South: natural history and conservation*. Island Press, Washington DC

Ogle M (2013) *In meat we trust: an unexpected history of carnivore America*. Houghton Mifflin Harcourt, New York

Pacyga DA (2015) *Slaughterhouse: Chicago's union stock yard and the world it made*. University of Chicago Press, Chicago

Paul RW (Rodman W (1988) *The far west and the great plains in transition, 1859-1900*. Harper & Row, New York

- Perramond E (2010) Political ecologies of cattle ranching in northern Mexico: private revolutions. University of Arizona Press, Tucson AZ
- Pinchot G (1947) Breaking new ground. Harcourt, Brace, New York
- Prince HC (1997) Wetlands of the American midwest: a historical geography of changing attitudes. University of Chicago Press, Chicago
- Pyne SJ (1982) Fire in America: a cultural history of wildland and rural fire. Princeton University Press, Princeton NJ
- Reisner M (1987) Cadillac desert: the American West and its disappearing water. Penguin Books, New York
- Remley DA (1993) Bell Ranch: cattle ranching in the southwest, 1824-1947. University of New Mexico Press, Albuquerque NM
- Robin L (1997) Ecology: a science of empire? University of Washington Press, Seattle
- Rowley WD (1985) US Forest Service grazing and rangelands. Texas A&M University Press, College Station TX
- Sampson AW (1919) Plant succession in relation to range management. USDA Bulletin No. 791. Government Printing Office, Washington, D.C
- Samson FB, Knopf FL, Ostlie WR (1998) Grasslands. In: Status and trends of the nation's biological resources, vol. 2. US Geological Survey, Reston, VA
- Sayre N (1999) The cattle boom in southern Arizona: towards a critical political ecology. Journal of the Southwest 41:239–271
- Sayre NF (2002) Ranching, endangered species, and urbanization in the Southwest: species of capital. University of Arizona Press, Tucson AZ

Sayre NF (2005) Working wilderness: the Malpai Borderlands Group and the future of the western range. Rio Nuevo Publishers, Tucson AZ

Sayre NF (2017) The politics of scale: a history of rangeland science. The University of Chicago Press, Chicago

Sayre NF (2018) Race, nature, nation, and property in the origins of range science. In: Lave R, Biermann C, Lane SN (eds) The Palgrave handbook of critical physical geography. Palgrave Macmillan, Cham Switzerland. https://doi.org/10.1007/978-3-319-71461-5_16; [10.1007/978-3-319-71461-5](https://doi.org/10.1007/978-3-319-71461-5)

Sayre NF, McAllister RRJ, Bestelmeyer BT, et al (2013) Earth stewardship of rangelands: coping with ecological, economic, and political marginality. *Frontiers in Ecology and the Environment* 11:348–354. <https://doi.org/10.1890/120333>

Scott JM, Davis FW, McGhie RG, et al (2001) Nature reserves: do they capture the full range of america's biological diversity? *Ecological Applications* 11:999–1007. <https://doi.org/10.1890/1051-0761>

Secretary of Agriculture (1936) The western range. Government Printing Office, Washington DC

Seed P (1995) Ceremonies of possession in Europe's conquest of the New World, 1492-1640. Cambridge University Press, Cambridge UK

Skaggs JM (1986) Prime cut: Livestock raising and meatpacking in the United States, 1607-1983. Texas A&M University Press, College Station TX

Sluyter A (2012) Black ranching frontiers: African cattle herders of the Atlantic world, 1500-1900. Yale University Press, New Haven CT

Specht J (2019) Red meat republic: a hoof-to-table history of how beef changed America.

Princeton University Press, Princeton, NJ

Stanley K (1994) Industrial and labor market transformation in the U.S. meatpacking industry.

In: McMichael P (ed) The global restructuring of agro-food systems. Cornell University Press, Ithaca NY

Starrs PF (2000) Let the cowboy ride: cattle ranching in the American West. Johns Hopkins

University Press, Baltimore MD

Stauder J (2016) The blue and the green: a cultural ecological history of an Arizona ranching

community. University of Nevada Press, Reno NV

Steen HK (1977) The U.S. Forest Service: a history. University of Washington Press, Seattle WA

Stegner W (1954) Beyond the hundredth meridian: John Wesley Powell and the second opening

of the West. Houghton Mifflin, Boston

Stewart OC, Lewis HT, Anderson K (2002) Forgotten fires: Native Americans and the transient

wilderness. University of Oklahoma Press, Norman OK

Stoddart LA (1945) Range land of America and some research on its management. Utah State

Agricultural College, Logan UT

Stoddart LA, Smith AD (1955) Range management, 2nd ed. McGraw-Hill, New York

Tobey RC (1981) Saving the prairies: the life cycle of the founding school of american plant

ecology, 1895-1955. University of California Press, Berkeley CA

Torell LA, Rimbey NR, Harris L (2004) Current issues in rangeland resource economics. Utah

Agricultural Experiment Station Research Report 190. Utah State University, Logan, UT

Vale TR (2002) Fire, native peoples, and the natural landscape. Island Press, Washington, DC

Virtue GO (1920) The meat-packing investigation. *Quarterly Journal of Economics* 34:626–685.

<https://doi.org/10.2307/1885160>

Voigt W (1976) *Public grazing lands: use and misuse by industry and government*. Rutgers

University Press, New Brunswick, NJ

Wagoner JJ (1952) *History of the cattle industry in southern Arizona, 1540-1940*. University of

Arizona, Tucson AZ

Walker RA (2001) *California's Golden Road to Riches: Natural Resources and Regional*

Capitalism, 1848-1940. *Annals of the Association of American Geographers* 91:167–199.

<https://doi.org/10.1111/0004-5608.00238>

Webb WP (1931) *The Great Plains*. Grosset & Dunlap, New York

Weisiger ML (2009) *Dreaming of sheep in Navajo country*. University of Washington Press,

Seattle WA

White R (1994) *Animals and enterprise*. In: Milner CA, O'Connor CA, Sandweiss MA (eds) *The*

Oxford history of the American West. Oxford University Press, New York

White R (1991) *"It's your misfortune and none of my own": a history of the American West*.

University of Oklahoma Press, Norman OK

Wildeman G, Brock JH (2000) *Grazing in the southwest: history of land use and grazing since*

1540. In: Jemison R, Raish C (eds) *Livestock management in the American Southwest:*

ecology, society, and economics. Elsevier Science, Amsterdam and New York

Williamson JA, King C, Britton AT, Donaldson T, Powell JW (1880) *Report of the Public Lands*

Commission. US Government Printing Office, Washington DC

In press—final manuscript version

Wolf ER (1982) Europe and the people without history. University of California Press, Berkeley
CA

Worster D (1979) Dust Bowl: the southern plains in the 1930s. Oxford University Press, New
York

Worster D (1985) Rivers of empire: water, aridity, and the growth of the American West.
Pantheon Books, New York

Worster D (1992) Under western skies: nature and history in the American West. Oxford
University Press, New York

Young JA, Sparks BA (1985) Cattle in the cold desert. Utah State University Press, Logan, UT