

1 Introduction

Since its inception 10,000 years ago, farming has been the most direct, extensive, and sustained interaction between human beings and the natural world. A farmer's basic job is to divert natural systems and processes to fulfill human goals. When farmers plow, plant, weed, and harvest a crop, they alter the plant community dramatically, destroying dozens or hundreds of species of plants in preference for a few that produce food or fiber. When they drain swampy land or irrigate arid fields, they intersect with and change hydrological systems. Farmers manage energy, directing sunlight, human and animal power, and fossil fuels to generate products useful to people. They shift nutrient flows through farm ecosystems, removing key elements such as nitrogen, phosphorus, and potassium in grains of wheat and corn, then restoring those elements with applications of manure or fertilizer. When ecologists study ecosystems, they describe and measure these same natural systems: energy flows, nutrient dynamics, biotic interactions, and hydrological fluctuations. Farmers spend their lives managing natural systems to achieve human ends.

This book is an agricultural and environmental history of the U.S. Great Plains from the advent of agricultural settlement around 1870 to the end of the twentieth century (Figure 1.1). Viewing farmers through the lens of ecological systems, it describes how people intersected natural processes and diverted them, directly or indirectly, to accomplish human goals. Those interactions changed over the course of a long century in the Great Plains. Although the chapters are arranged topically to address specific agroecological processes, they are populated by a cast of characters who lived and farmed in particular places at particular times. Top billing goes to Elam and Rachel Bartholomew, who ventured onto the low rolling plains of central Kansas in the 1870s to file a homestead claim, break sod, and convert a prairie ecosystem into a corn, wheat, and hog farm. They lived, worked, and raised a family that continued farming Kansas soil into the 1960s.

In Crosby and Lamb counties, Texas, William and Sallie DeLoach were typical transient farmers, moving from one rented cotton farm to another through the 1910s and 1920s, plowing, cultivating, planting, and harvesting, year in and year out. A later generation of west Texas

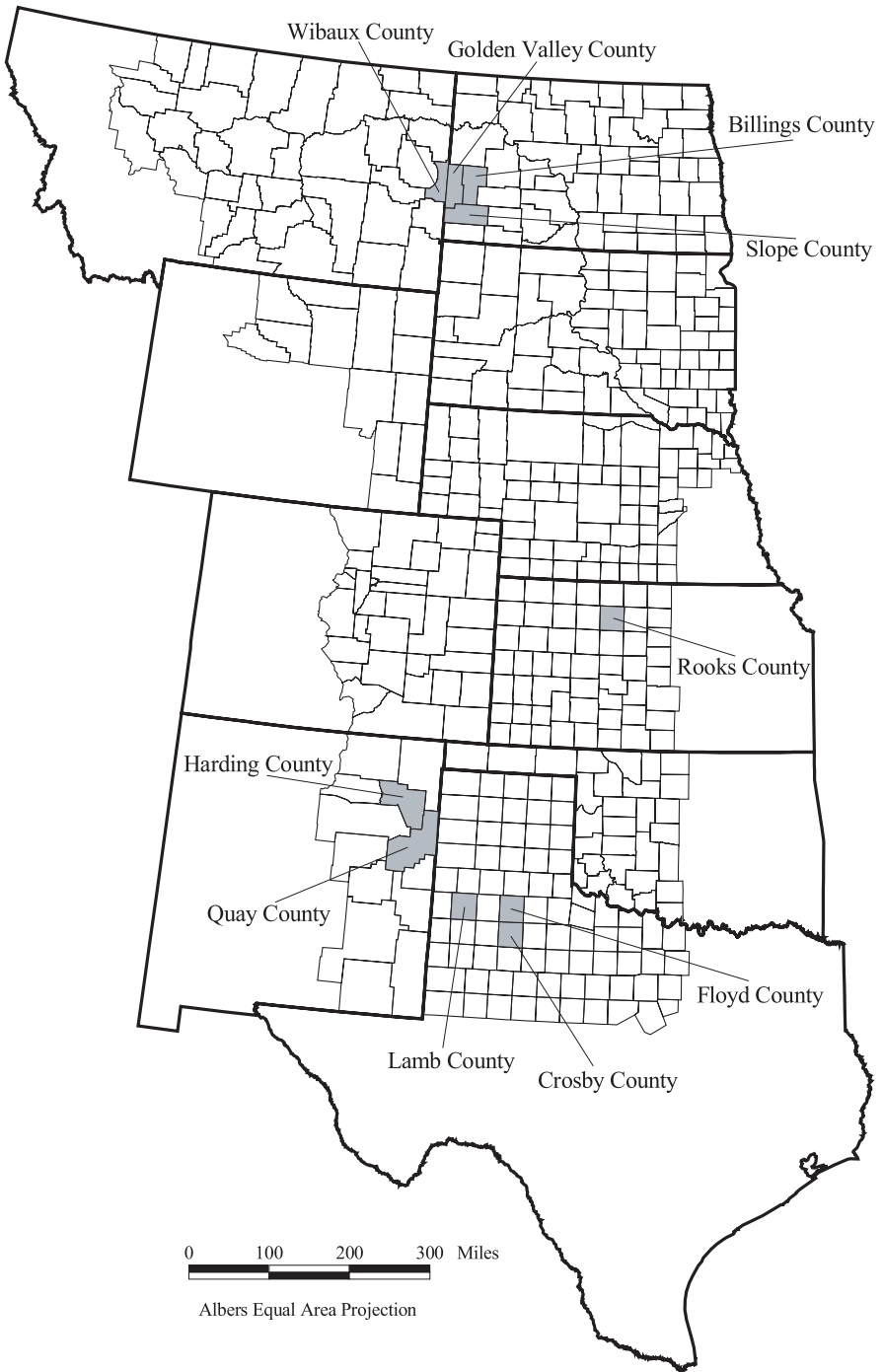


Figure 1.1. Case-study locations within the 450 Great Plains counties.

farmers, Ed and Alma Holmes, began their farm in 1930, then suffered through the ravages of drought and dust storms before joining the irrigation boom of the 1940s and 1950s that brought wealth and prosperity to the region for the first time. These families encountered the southern plains environment, altered it, and adjusted to it. To the north, in the badlands of western North Dakota, Catherine McKenzie participated in the final phase of homesteading, making a small farm in 1914, expanding it through the 1920s on a dry, cold landscape that could support only thirty cattle on 520 acres of pasture, then facing drought and depression in the 1930s. The experiences of these people, and the localities where they farmed, reveal the changing ways that Great Plains farmers for more than a century have negotiated a living with the great uncaring forces of climate, soil, water, and living things. Their individual stories, paired with systematic statistical information about their communities, reveal a history of people inserting themselves into the middle of ecological processes, adapting to those processes, and shifting them slightly toward human purposes.

The narrative of Great Plains history developed in the following chapters has three components: (1) rapid land-use adaptation in the several decades after 1870, (2) remarkable land-use stability from about 1920 to 2000, and (3) occasional rapid shifts to new agricultural methods that can be considered stable only in the medium term. First, there was a brief era, less than fifty years, of rapid adaptation to an unfamiliar natural environment. Farmers quickly learned which land could support crops and which would serve only as pasture for cattle. Within just a few decades they determined which crops were viable in the dry grassland. By about 1920 basic land-use patterns were well established from Texas and New Mexico to Montana and the Dakotas.

A second era, beginning about 1920 and continuing beyond 2000, was one of remarkable stability. Land use across the region changed very little for nearly a century. The patterns of crop and pasture have been so consistent across time and space, in fact, that it is not unreasonable to label American agriculture in the plains sustainable. This is an unconventional observation considering dramatic twentieth-century disruptions to the agricultural system: the adoption of tractors; the Dust Bowl; the development of synthetic fertilizers, chemical pesticides, and hybrid seed; and the implementation of massive federal subsidies. Nonetheless, none of those developments significantly altered basic land-use practices. For example, as devastating as the Dust Bowl was on the southern plains, basic land use there did not change. By 1945, less than five years after the end of the drought, farmers planted just

as much cropland as they had in 1930, and in the same places. The Dust Bowl was a temporary disruption in a stable system.

Proposing that land use has been stable on the Great Plains does not mean that nothing changed. The way that farmers mobilized resources, managed natural systems, and diverted energy, nutrients, or water toward human projects changed periodically. These changes were episodic, contingent, sometimes localized, and sometimes temporary. Some were dramatic, such as the shift from horses to tractors between 1915 and 1945 and the substitution of synthetic fertilizers for livestock manure after World War II. Others happened only regionally, such as the adoption of irrigation on the southern plains in the 1940s and 1950s. It is most instructive to view these changes as adaptations to shifting circumstances that were not smooth, predictable, or organized but that occurred in fits and starts, often with reluctance and doubt.

The adaptations made by plains farmers are comparable to the ecological concept of unstable equilibrium. The classic theory of ecological succession developed in the 1930s proposed that disturbed ecosystems go through a series of vegetative stages until a final, permanent climax ecosystem emerges. Rejecting that conception as too mechanistic, ecologists now suggest that unstable equilibrium better represents a contingent world. After a disturbance, succession occurs unpredictably, with uncertain outcomes that are determined by an ever-changing environment, one in which disturbance is a routine part of the process rather than the exception. Great Plains farming evolved in a similar fashion, with one generation reaching an accommodation between natural imperatives and human desires that could be sustained for the medium term, but not forever. When external or internal circumstances changed, farmers adjusted their agricultural system, often dramatically, but not necessarily permanently.

This study of human interaction with nature over 130 years is representative of the contingent, always-shifting nature of humanity's relationship to the broad world. Human adaptation to environment is never permanent, because people change and environments change. No system is ever "sustainable" forever. Sustainability, at its best, can only mean a temporary state of equilibrium and a willingness and ability to change again in the future. People are like any other species of animal or plant—affecting the environment, being affected by it, and always evolving. People are fully part of nature, not separate from it in any ecological sense. Farmers developed successful ways to engage in modern agriculture on the plains that lasted for several decades before some constraint or opportunity intervened to shift the system to a new

state of medium-term equilibrium. Thus farmers maintained a stable land-use pattern that fit the environment by periodically changing the ways they farmed to fit changed circumstances.¹

The base unit of analysis in this study is the land. How did people use the land, how did they change it ecologically, and how did those uses shift across space and time? The focus is not primarily economic, demographic, or social, although all of those factors connect to land use. That land use on the Great Plains has been stable does not imply that society, technology, or economy on the plains has been stable. An important story of Great Plains history is that the rural population in the region rose dramatically for fifty years, from about 1870 to 1920, and has declined steadily ever since. Thousands of churches closed, schools consolidated, and communities dispersed during the twentieth century. One could make a compelling argument that the Homestead Act was a failure if its goal was to spread a strong, prosperous American society across the continent. From many points of view agrarian society and demography on the plains proved unsustainable, but that is not the primary focus of this work. Here the issue is the land and how people have used it, which has changed little since about 1920 and shows no sign of faltering.

Because land is the focus, this book is especially concerned with acreage. In many places it describes land-use patterns as a percentage of total county area. Rooks County, Kansas, for example, home to Elam and Rachel Bartholomew, devoted about 50 percent of its acreage to crops, the other half to pasture, throughout the twentieth century. That fact says nothing about the economic viability of the agricultural system or the 1990 population of Rooks County, which was only half that of 1910. What it does say is of interest, however. Drive through Rooks County, and crop farming dominates the senses. Cropped fields are prominent, trucks and trains haul grain out of the county every summer and fall, and the tallest buildings, by far, are the grain elevators that store millions of bushels of wheat and sorghum. Crop agriculture clearly dominates the economy and the lives of most residents. But this fact can be misleading if the question relates to land use. It is important ecologically to remember that roughly half the land area in the county has never felt the plow. Some 200,000 acres there are not covered by solid stands of wheat but by a much more diverse mixture of native plants and complex ecosystems. Along field edges, on hill-tops, in creek valleys, and in stretches of pasture where soils are unsuited to cropping, natural biodiversity persists. Nature there is changed, surely, by the effects of grazing, by the invasion of nonnative plants,

by eradication of animal species. But paying attention to acreage reminds us that Rooks County is not one big wheat farm, even after a century of industrial agriculture.

It is an important contention of this work that the Great Plains retains a considerable amount of ecological diversity, especially plant diversity. On the eastern edge of the plains only about half of the land, county by county, has ever been plowed for crops. In the central plains about one-third is plowed, with two-thirds remaining as grazed native grassland. Where the western plains counties wash up against the front range of the Rockies, 80 to 90 percent of most counties are in pasture, not crops. Across the entire region only about 30 percent of the land was ever plowed. The remainder, some 270 million acres, is native prairie. Those enormous stretches of pasture are not undisturbed, of course, but neither are they utterly destroyed. There is a reservoir of natural diversity in the Great Plains that coexists with the modern agricultural system.

This study begins with a basic historical question: What is the nature of the interaction between people and the natural world? Much of environmental history has focused on the margins of this interaction, concentrating on the history of wilderness, where human involvement is minimal, or on urban environments and badly polluted landscapes, where people have dramatically transformed nature. Agricultural land is a broad, geographically extensive middle ground where natural forces remain predominant but where people work to exert their influence on natural systems. Agriculture is the central realm in which human beings negotiate daily with the living and nonliving forces of their environment. The Great Plains represents one of the largest agricultural landscapes in the United States, a place where nearly all land is in agricultural use of one sort or another. It is a prime candidate for a study of the interaction between humans and the environment.

The question of human relationships with nature is not new in American or in Great Plains history. Around the turn of the twentieth century a number of prominent historians explored that interaction and built a narrative that was optimistic and progressive. In their story hearty men and women encountered the wilderness of North America, struggled with it mightily, and eventually tamed nature (and Indians) in a process that built a strong national character while instilling beneficent social and political institutions. Frederick Jackson Turner's frontier thesis put the struggle between human beings and nature at center stage.² He viewed the outcome of that interaction as a steadily pro-

gressive improvement during the first four centuries of Euro-American history.³

Walter Prescott Webb represented this progressive, Turnerian, assessment of human interactions with the environment in his monumental work *The Great Plains*.⁴ The alien landscape that pioneers found in the center of the continent at first stymied their efforts at westward expansion. The wide-open spaces, aridity, and lack of forests challenged the pioneers' ability to survive until those very environmental characteristics forced social, technological, and institutional adaptations that allowed Americans to fit into their new home on the Great Plains. The adaptations forced by nature created a strong, vibrant, successful American culture unique from that of the wetter, tree-clad East. The progressive interpretation of human interactions with the environment is deeply rooted in the popular consciousness.

Writing at the same time as Webb, James Malin developed a complex interpretation of grassland history. Alone among historians of his generation he understood the new science of ecology and grasped its connection with human history. Focusing on Kansas, Malin carefully developed demographic models of migration and settlement, traced the introduction and adaptation of new crops, and borrowed the concept of possibilism from European historians to explain human interaction with prairie ecosystems. He proposed that even though nature imposed limits on human activities, it left open an infinite range of possibilities, and the creative human mind could overcome any natural obstacle. Always a curmudgeon, Malin railed against New Dealers who said Kansas should never have been plowed. Creative people had always found innovative solutions to problems in the past.⁵ This book is deeply indebted to Malin's legacy, especially to his careful use of census data, his attention to both history and ecology, and his perception that people lurched from one adaptation to the next in unpredictable ways.

A more recent generation of historians has been pessimistic in its assessment of human contacts with nature. Most environmental historians present a declensionist narrative of American history after 1492. From this perspective the human contact with nature in North America has been anything but beneficent. The stories start with an idyllic wilderness. People—generally people of European descent—then moved into that pristine environment and degraded it. Ecological conditions declined through time and, in some cases, led to disaster. Donald Worster's *Dust Bowl: The Southern Plains in the 1930s* exemplifies the declensionist approach.⁶ In Worster's narrative, farmers moved into an

environment where native grasses, occasional droughts, and high winds coexisted in an ecological climax. Driven by a capitalist profit motive, farmers plowed up too much of the prairie, so there was insufficient grass in place to hold the soil down when the 1930s drought inevitably arrived. The result was the Dust Bowl, one of the three worst ecological disasters in human history, according to Worster. The declensionist narrative first appeared among New Deal reformers who aimed to adjust land use and agricultural economics on the Great Plains, arguing that farmers should never have plowed them in the first place. Whereas the progressive narrative is full of glory and optimism, the declensionist view describes ignominy and ecological failure. The latter perspective is shared by most environmental historians and by most environmental activists.

The present work proposes that the interaction between people and the rest of nature is much more complex and ambiguous than either a progressive or a declensionist narrative allows. People are a part of nature, not separate from it in any measurable way. Just like other species, we are embedded in natural systems, we work to manipulate those systems to our advantage, and we encounter natural restraints that we cannot transgress. Farmers on the southern plains, in the long term, are stuck with the eighteen inches of rainfall, on average, that the heavens deliver. They cannot get more from nearby or distant rivers, and the underground water table is fed only by that same rainfall. Farmers must either adapt their land use to that hydrological system or stop farming. The ways that people manipulate natural systems are complex, temporary adjustments and readjustments to constantly changing natural and human circumstances. The trajectory is neither steadily upward nor steadily downward, but a series of temporary stages of land-use equilibrium, each of uncertain duration.

Both the progressive and the declensionist explanations of people's interaction with their environment are ideologically driven and lack rigorous empirical analysis. The human relationship with nature is more complex than either approach allows. Successive episodes of temporary equilibrium, rather than growing improvement in human control of nature or a steady degradation of the environment, best describe the past. Temporary equilibrium means an accommodation between natural imperatives and human desires that is sustainable in the medium term but far from permanent. An example of this process is the choice farmers made about how to mobilize power on farms. Through most of the settlement era farmers relied on horses to supply power for nearly all farm tasks, from plowing, planting, and cultiva-

tion to harvesting and hauling produce to market. That choice had indirect ecological consequences for farmers. Among other things it meant that they had to plant part of their land in feed and forage crops for work stock and also that they had an on-farm source of fertilizer in the form of manure. After 1915 farmers began to exchange their horses for tractors. That choice had different ecological consequences. Between 1915 and 1945 farmers moved from one stage of temporary equilibrium to another in regard to motive power. The transition required a negotiation between natural forces (soil fertility, for example) and human considerations (such as cash flow and labor costs). By 1945 horses did little farmwork; tractors were nearly universal. Farmers had achieved a new equilibrium based on imported fossil-fuel energy and a cash economy, and they maintain that equilibrium today. But the future is open ended, and when conditions, either human or natural, change (as they always do) farmers will have to adjust again, moving toward a new state of temporary equilibrium.

The topic of human interaction with nature in the realm of agriculture is broad, and this study addresses only some of the relevant issues. It evaluates the mobilization of motive power for farming, plant diversity in farm country, and the manipulation of nutrient cycles and water systems. There are many other aspects of the agricultural system that bear investigation. But these are some of the key human and natural systems in the equation, and this work constitutes an example of new methods for using historical sources to address a fundamental question in environmental history.

The primary historical sources that form the foundation of this study—censuses, diaries, newspapers—are not new to scholars. Regional archives throughout the nation hold collections of rural newspapers. The newspapers of small communities, where agriculture was the center of the economy for farmers and townspeople alike, reveal important farm issues of the time: who was buying tractors, how the wheat crop fared, what the price of fertilizer was, or which were the best current techniques for irrigating cotton. Local papers illuminate the land-use, agricultural, and environmental concerns of farmers, and they are widely available for long stretches of time.

Newspapers provide nuanced detail about very specific places. The core source for this study, however, provides a broad, general view of the entire region, but in a comprehensive and systematic way. The series of agricultural censuses conducted by the federal government between 1850 and 1997 are the foundation of new historical methods employed here. This source is the richest record of land-use practices

in the United States and should be central to much environmental history. Every ten years from 1850 to 1920, and about every five years since then, the government has surveyed farmers throughout the nation and asked them for detailed information about how they use their land. Nineteenth-century censuses included the number of acres planted in particular crops, the amount of production from them, and the number of livestock present on farms. Eventually, censuses included more information, from number of tractors, trucks, and combines to the amount of government subsidies to the amount of cropland fallow, idle, irrigated, or failed. Modern agricultural censuses include thousands of items. These data are published for every county in the United States for a period spanning 150 years. Most research libraries contain copies of the agricultural censuses where historians can pore through pages of land-use information county by county. The utility of this deep record of agricultural land use has improved dramatically in recent years through the efforts of the Great Plains Population and Environment Project based in the Inter-University Consortium for Political and Social Research (ICPSR) at the University of Michigan. That project systematically assembled many of the census data from the ten Great Plains states into a database. For all of the counties in Texas, New Mexico, Oklahoma, Kansas, Colorado, Nebraska, Wyoming, Montana, and the Dakotas, hundreds of items from each of the censuses conducted between 1870 and 1997 are now available for analysis.⁷ These data are the source for the tables, charts, and maps in this book, unless otherwise indicated. The Great Plains Database is the key primary source for this study, but the present work only scratches the surface of possible uses. The potential of the agricultural census for historical land-use analysis is enormous.

Data collected in the agricultural censuses are ideal for exploring land-use questions in a way that is both local (because farm information is available for individual counties) and regional (because farm information is available for all counties). Still, county-level data lack a certain amount of both precision and human empathy. This study depends also on diaries and farm journals that bring the experiences of specific families into conjunction with the broader land-use trends illuminated by the census. The daily, weekly, and seasonal records kept by Elam Bartholomew, William DeLoach, and Ed Holmes put a human face on broad developments occurring around them. Actual land-use decisions were taken by individual families, one at a time, and not by entire counties of aggregated farms, and journals remind us of that fact.

Farm journals, newspapers, and other local primary sources have

long served as a basis for case studies of agricultural land use. Community studies are extremely effective in illuminating the complexity of farm practices at the local level.⁸ This work began as a series of three case studies of rural communities in the Great Plains. The sites represent three significant variations on agricultural land use in the region. Rooks County, Kansas, fits the pioneer homesteading stereotype with the establishment of a solid dryland farming regime. Golden Valley and Billings counties, North Dakota, represent a variation on the homesteading theme, in which the federal government reversed its land-distribution process and incorporated public grazing lands into the agricultural system.⁹ Crosby, Floyd, and Lamb counties, Texas, on the hot, dry southern plains represent the expansion and contraction of irrigated agriculture from the Ogallala Aquifer. In each case the community-study approach refines broader regional trends in land-use practices. But in the end the methodological innovation in this work relies upon county data in the agricultural censuses as the essential primary source for analyzing the interaction between farmers and their natural environment.

The county is a reasonable size to conceptualize farm systems and their change through time. The fact that consistent data are available for all 450 counties in the Great Plains means that with the aid of Geographic Information Systems (GIS) mapping and spatial analysis software, it is possible to characterize land-use change across the entire region. GIS is a powerful tool for understanding and illustrating geographical information and changing land use through time, but one that is underused by historians.¹⁰ The long time span of the agricultural censuses means that it is possible to analyze and illustrate multiple details of agricultural land use across the United States for more than a century.

With the agricultural census as a primary document and the use of GIS technology there is great potential for analyzing interactions between humans and nature in agriculture on a regional scale. The long time frame, county focus, and national coverage of the agricultural censuses mean that researchers can measure and estimate the environmental consequences of multiple land-use changes. Changes in cultivation techniques, fertilizer regimes, and technology, to name only a few, are susceptible to systematic evaluation. This work illustrates the technique by evaluating changes in crop and plant diversity, the causes of the Dust Bowl, and the development of irrigation in Texas.

The resulting narrative of Great Plains land-use change is more complex and ambiguous than those of either progressive or declensionist

historians. The key to this story is a perspective that makes people directly part of the natural world, rather than distinct from it. The separation between people and environment is pervasive in our culture and hard to avoid. Studying only the edges of human interaction with nature reinforces the perception of a division. Wilderness studies focus on land without any human presence and draw clear distinctions between natural order and human disturbance. Histories of human destruction of natural features, from coal mining to deforestation to river pollution, put human beings on top, implying that people are so powerful as to be beyond nature. All of these studies are important in their own right, for they remind us of the potentials and dangers of human choices. But they leave out a broad middle ground that is neither wilderness nor toxic waste dump. Within that landscape—which, after all, composes much more of the earth's surface than either uninhabited or utterly devastated locales—people and the rest of nature engage in routine interactions. To understand the central character of those interactions, it is necessary to address farming in all of its intricacies.

What emerges from this study is a story of ongoing negotiation between changing human desires and capabilities on the one hand, and living and nonliving environmental forces on the other. To the extent that the discipline selects humans as the central characters in its story, history implies a dichotomy between people and the rest of the world. But it is more accurate to perceive *Homo sapiens* as simply one contending force in a milieu of multiple contending forces, each with its own goals or, at least, trajectories. Looking at history from this viewpoint results in a narrative of sequential, medium-term land-use adaptations to ever-changing environmental conditions. Each stage of temporary equilibrium is an accommodation between the desires of people and the forces of other, nonhuman, parties. Each changes in its own way and at its own rate until, after some uncertain length of time, people adjust their land use to meet new realities. Some of those eras last longer than others and some are more destructive to competing parties than others, but there is no clear trend in the history of the Great Plains toward either environmental catastrophe or an ideal, infinitely sustainable land-use regime. For example, many have predicted social and economic collapse when irrigators finally deplete the Ogallala Aquifer on the southern plains. That outcome seems unlikely. Instead, farmers will adjust again, in unpredictable ways, to changed circumstances, just as they have done at least twice in the last century.

This historical view of human interaction with agroecosystems has implications for the current effort to develop “sustainable” agriculture.

That effort is worthy to the extent that it brings factors beyond farm income to the fore, especially natural factors that policy makers sometimes ignore. But the ultimate goal of an agricultural system that, once set in motion, will continue to be evenly productive without damaging any other species or natural system is unrealistic. At least, there is no example of such a system in Great Plains history. The story of human interaction with nature is a rather routine minor tragedy of mundane errors and missed opportunities ameliorated by occasional successes and a measure of hope for the future. A story of ups and downs, of uncertain eras of equilibrium followed by periodic adjustment to ever-changing circumstances is less glorious than some histories, less pessimistic than others, but altogether more human and more plausible.