An Unremembered Diversity: Mixed Husbandry and the American Grasslands

KENNETH SYLVESTER AND GEOFF CUNFER

The Green Revolution of the 1960s brought about a dramatic rise in global crop yields. But, as most observers acknowledge, this has come at a considerable cost to biodiversity. Plant breeding, synthetic fertilizers, and mechanization steadily narrowed the number of crop varieties commercially available to farmers and promoted fencerow-to-fencerow monocultures. Many historians trace the origins of this style of industrialized agriculture to the last great plow-up of the Great Plains in the 1920s. In the literature, farms in the plains are often described metaphorically as wheat factories, degrading successive landscapes. While in many ways these farms were a departure from earlier forms of husbandry in the American experience, monocultures were quite rare during the early transformation of the plains. Analysis of a large representative sample, based on manuscript agricultural censuses and involving twenty-five townships across the state of Kansas, demonstrates that diverse production reached even the most challenging of plains landscapes.

Few modern natural disasters have cemented in the historical imagination the association between human settlement and environmental

KENNETH SYLVESTER is a historian in the Institute for Social Research at the University of Michigan. He served as principal investigator of the Grassland Settlement (Kansas) project between 2003 and 2007. His research focuses on historical population, environment, and land use change in the North American plains. He holds a PhD in history from York University and is the author of *The Limits of Rural Capitalism* (University of Toronto Press, 2001), a study of early settlement on the Canadian Plains.

GEOFF CUNFER is an environmental historian of the Great Plains in the Department of History and School of Environment and Sustainability at the University of Saskatchewan. He directs the Historical GIS Laboratory where he researches dust storms and wind erosion, material and energy flows in agricultural landscapes, and historical geography. He holds a PhD in American History from the University of Texas and is the author of *On the Great Plains: Agriculture and Environment* (Texas A&M University Press, 2005).

DOI: 10.3098/ah.2009.83.3.352

degradation like the Dust Bowl. Dorothea Lange's iconic photographs of migrants fleeing the plains are now part of the visual lexicon of the twentieth century (Figure 1). The 1930s drought and depression overturned the old story of national progress, replacing it with a narrative of misuse,

Figure 1. Dorothea Lange's caption for this image reads "Drought refugee's car on US Highway 99 between Bakersfield and Famoso, California. Note: the photographer passed twenty-eight cars of this type (drought refugees) between Bakersfield and Famoso, thirty-five miles, between 9:00 and 9:45 in the morning."

Source: Dorothea Lange, Nov. 1936. Reproduction number LC-USF34-009976-E, Prints and Photographs Division, Library of Congress.

collapse, and decline in the Great Plains. But that story of environmental degradation has become far too linear and simplistic. It rests, in particular, on a perception of historical farm practice that requires closer scrutiny. The standard narrative describes a wave of economic change in the early twentieth century that rapidly industrialized farm methods. One consequence, recognized by both critics and supporters of free settlement, was that markets and technology drove farmers to till marginal land beyond sustainable limits. Another purported outcome was that massive new farm machinery homogenized landscapes, replacing diverse native grasslands with fencerow-to-fencerow monocultures. However, closer to the ground the story remains more complex. Some farming areas in the Great Plains became increasingly monocultural, but a great many did not. An extensive and detailed reconstruction of farm practice shows that diverse cropping was common, persistent, and that it stretched into the heart of the semi-arid Dust Bowl.[1]

Monoculture is an important pillar in the story of environmental mismanagement. It is part of a long tradition in historical writing that views soil exhaustion as a basic American condition. With unbroken land available further west, American farmers could avoid the consequences of their own mismanagement by moving to the frontier. Although many historians have questioned the logic of this land ethic—suggesting in detailed local studies that a variety of farm practices aimed at community permanence—they have not overcome the general conviction that farmers followed a pattern of wasteful land use again and again. Reformers of almost every era have taken a generally dim view of colonial and early American practice, seeing the agricultural lands as unkempt and degraded. Although these were often patrician voices, the perception of land-exhausting farmers has stuck.[2]

Throughout the twentieth century, scholarship about Great Plains agriculture emphasized the early adoption of monoculture. Because the plains were relatively flat and treeless, compared to the hilly, forested east, they were well suited to mechanization. Industrial products, from steel plows for sodbreaking to mechanical binders for small grain harvests, saw early and widespread adoption in the grasslands. Farmers on the northern plains were some of the first—even before World War I—to use monstrous coal-burning steam tractors that required long, straight fields and plenty of room to turn around.[3]

The bonanza farms of the Red River Valley were the epitome of industrial, monocultural plains cultivation. In the late 1870s the Northern Pacific Railroad, desperate to drum up business for its bankrupt line across Minnesota and northern Dakota Territory, pioneered the immense industrial bonanza farm. The company purchased 113,440 acres along the Minnesota-Dakota border and hired Oliver Dalrymple to manage an enormous demonstration farm there. In his first year he planted 1,280 acres and harvested thirty-two thousand bushels of wheat. The publicity surrounding such a large harvest from one farm pulled settlers and speculators into the Dakotas, many of them hoping to imitate Dalrymple's success. Dozens of bonanza farms hired managers and employees on a business model, used the most modern equipment, and plowed staggeringly large acreages. During the early 1880s bonanza farms were successful, but by the end of the decade they were in decline, struggling with lower crop prices, higher land costs, and drought. The bonanza farms, while spectacular and widely publicized, were short lived and hardly representative of plains agriculture. Most of them subdivided and sold out to small farmers by the early 1890s.[4]

Even at the height of the bonanza boom most farm operations in North Dakota were small family-operated enterprises. Despite their exceptional nature, many histories present bonanza farms as emblematic of northern plains agriculture. Most narratives of the region describe these enterprises, emphasizing their industrial approach to farming and their single-crop devotion to wheat. In fact, the bonanza farms covered a very small portion of the plains and lasted for little more than a decade. They were not even as committed to monoculture as their reputation suggests. Oliver Dalrymple, for example, in his "Programme for Handling a Division of a Bonanza Farm," wrote:

> Crops should be diversified, rotated and sown early so as to be harvested earlier with cheaper labor, less expense, and in the long days. About half a section [out of five sections] should be sown in oats near buildings and threshed in the barn yard and out on green side for winter hay and forage. One section, or more, should be sown in barley early on best land to be harvested with $1 labor or thereabouts, in July and summer plowed. Corn to the amount of 80 acres should be put near buildings and harvested by hogs and horses, beginning August 15th.

The remaining 3,280 acres—about 2/3 of the farm—went to wheat.[5]

Agricultural reformers have always been quick to single out mechanization and monoculture as villains in plains farming. When the Great Depression coincided with drought and dust storms during the 1930s, New Deal activists blamed plains wheat farmers for creating the crisis, although they acknowledged misguided government policy had contributed to the problem. In particular, New Deal reformers argued that plains settlers had plowed land unfit for crops and planted it to wheat. This basic interpretation drove New Deal agricultural policy throughout the 1930s, when the Land Utilization Program purchased some ten million acres from destitute farmers and brought it into federal management for grazing. Franklin Roosevelt's Great Plains Committee, in its 1936 report, *The Future of the Great Plains,* developed the narrative:

> After 1910 powerful new influences were felt. The tractor, the combine and other power machinery enabled an individual to plant and harvest a much larger acreage than before. At the same time the cost of buying and maintaining this expensive equipment obliged him to secure a cash crop. The World War and the following inflation pushed the price of wheat to new high levels and caused a remarkable extension of the area planted to this crop. When the price collapsed during the post-war period Great Plains farmers continued to plant large wheat acreages in a desperate endeavor to get money with which to pay debt charges, taxes, and other unavoidable expenses. They had no choice in the matter. Without money they could not remain solvent or continue to farm. Yet to get money they were obliged to extend farming practices which were collectively ruinous. Wheat was the outstanding cash crop. As late as 1934 about 17,600,000 out of 44,800,000 harvested acres in the Great Plains were under wheat; in western Kansas in the same year over 6,000,000 out of 8,000,000 were given over to wheat.[6]

The themes of gigantism and industrialism are at the center of the narrative. Much later, in his history of the Dust Bowl, Donald Worster continued the critique, arguing:

> The grassland was to be torn up to make a vast wheat factory: a landscape tailored to the industrial age. Specialized, one-crop farming became the common practice, and business economics the standard of success or failure. Above all, the new-style sodbuster was an expansionist, feeling all the old land hunger of an opportunity-seeking democrat, but adding an intense

desire to make his new machines profitable that would have shocked Thomas Jefferson's agrarian idealism.

Several large-scale farmers lent substance to the story. Ida Watkins, the "Wheat Queen" of Haskell County, Kansas, grew two thousand acres of wheat in 1926. Hickman Price, in the Texas Panhandle, operated twenty-five combines to harvest his 34,500 acre farm. John Kriss managed over thirty thousand leased acres in western Kansas and eastern Colorado in the 1930s and 1940s. Tom Campbell assembled one hundred thousand acres in his southeast Montana wheat farm, which began operation in 1918 and occupied fifty-two tractors, one hundred seed drills, twenty-one combines, eighty binders, and eleven threshing machines by 1929. While these farmers were far from typical of the region, they show up repeatedly as examples in historical accounts of Great Plains agriculture. Grassland farming never escaped a reputation for early and extensive single-cropping.[7]

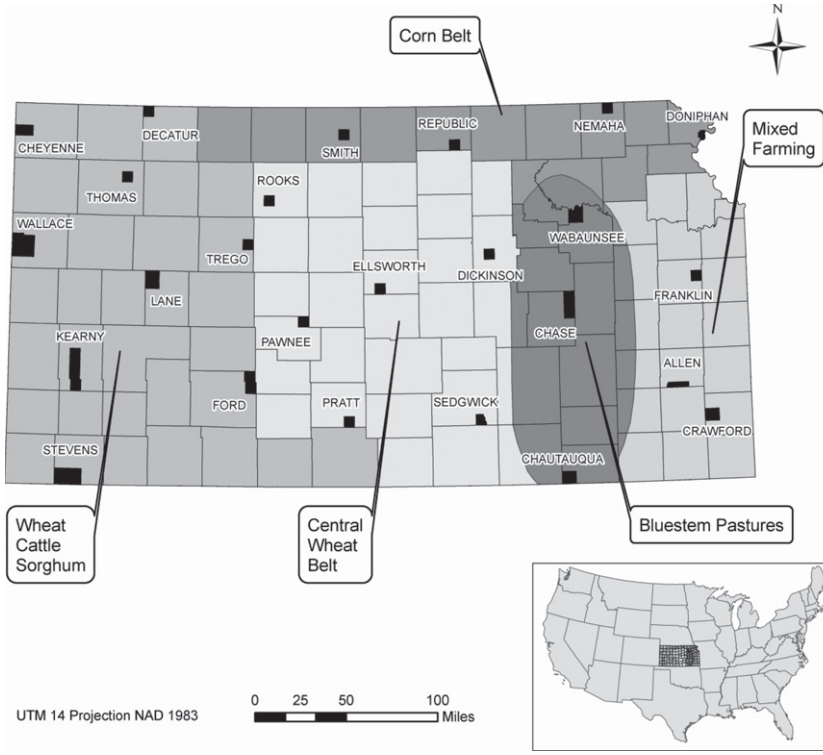
Recently, the larger narrative has come under increasing scrutiny. Much of the evidence in the literature is anecdotal, fueled by genuine concerns about the effects of modern agriculture. Rarely, however, are extrapolations based on thorough empirical research across diverse environments. Too much emphasis on the Dust Bowl, as Geoff Cunfer demonstrates in his recent monograph, obscures the rare nature of single-cropping in the Great Plains. Most farms in the region's four hundred fifty counties, he argues, were family-run enterprises that pursued a mix of land uses—of subsistence and commercial crops, livestock raising, haying, and pasturing. Blending individual case studies with county-level census data from the entire region, Cunfer concludes that it was this diversity that defined the region's agriculture over the thirteen decades he examined. This was not always the case. Plains settlement began with low levels of measurable land use diversity, and diversity declined in various places and at various times. But generally, land use diversity rose after frontier counties moved beyond initial settlement, when almost all land reported in the census was used as pasture for grazing animals. Then, as more farmers arrived, diversity increased and stabilized at high levels, beginning in the early twentieth century. Several questions remain, however. A key empirical question is whether the region-wide patterns reflect bottom-up practice. Were the diverse returns of counties composed of many diverse

farms or a mix of specialized single-crop farms? Another theoretical curiosity that drives this research is whether, by employing manuscript census reports about individual farms to peer inside counties, we can provide a better idea of why so many farmers pursued diversity across different environments.

Kansas was an obvious choice for this study. It is one of very few states in the nation to conduct its own agricultural and population censuses. This source made it possible to capture a large sample of individual farms over a long period of time—three or more generations. Also, the state contains significant natural variation within its borders, enough to capture dramatic differences in the plains environment. This study employs a nested design that uses data on twenty-five whole communities—every person and every farm—gathered from census manuscripts. The approach has several advantages. Most importantly, it avoids a danger with local studies that the choice of one or two areas fails to represent larger trends. The community dimension makes it possible to examine how much the context and internal changes influenced the trends visible from the census returns. This analysis divides Kansas into five major land use regions that were well known to observers on the eve of the depression. Twenty-five predominantly rural townships from all five land use regions provide a representative view of land use trends within each part of the state. The agricultural censuses themselves provide a wealth of information about land use on individual farms, including acres devoted to various crops, number of livestock, number of tractors and other machinery, tenure of ownership, and length of fences.[9]

The land use regions illustrated in Figure 2 reflect key east-west environmental variations in the central plains. Precipitation drives vegetation patterns in Kansas. In the western high plains, hardy shortgrass species, such as blue grama and buffalo grass, tolerant of drought, fire, and heavy grazing, dominate rangelands. In the central part of the state, higher precipitation supports a transition to mixed grass prairies, in the heart of Kansas wheat country. Native Americans farmed small fields here in floodplains long before European contact and settlement. Further east, a seventy-mile-wide corridor of bluestem tallgrass prairie, known as the Flint Hills, is punctuated by steep hills, and its thin, stony soils rest on limestone bedrock. Bounded on the north by the Kansas River and to the south by Oklahoma's state boundary, the bluestem grasses give way to a series of eastward-facing escarpments covered by bluestem prairie and

Figure 2. Sample Townships in Kansas by Agroecological Zone, 1930s.



SOURCE: Malin, *Winter Wheat in the Golden Belt of Kansas,* preface.

oak-hickory forest in the eastern fifth of the state. Finally, a tier of counties along the border with Nebraska that benefits from milder temperatures and heavier rains is known for its corn cultivation.[10]

The sample includes four townships from the Corn Belt, three each in the mixed farming and bluestem pastures zones, six from the Central Wheat Belt, and nine from the westernmost part of the state (see Table 5 for full list of townships). Table 1 highlights the distribution of farm observations in the sample across the five land use zones. As the counts in the last row illustrate, settlement in the western part of the state proceeded slowly. The higher representation of townships in the west was necessary for the number of farm observations to match more densely populated townships in the east. Eventually the townships selected in the west did

Table 1. Number of Farms in Sample, by Land Use Zone and Year, 1875–1940.

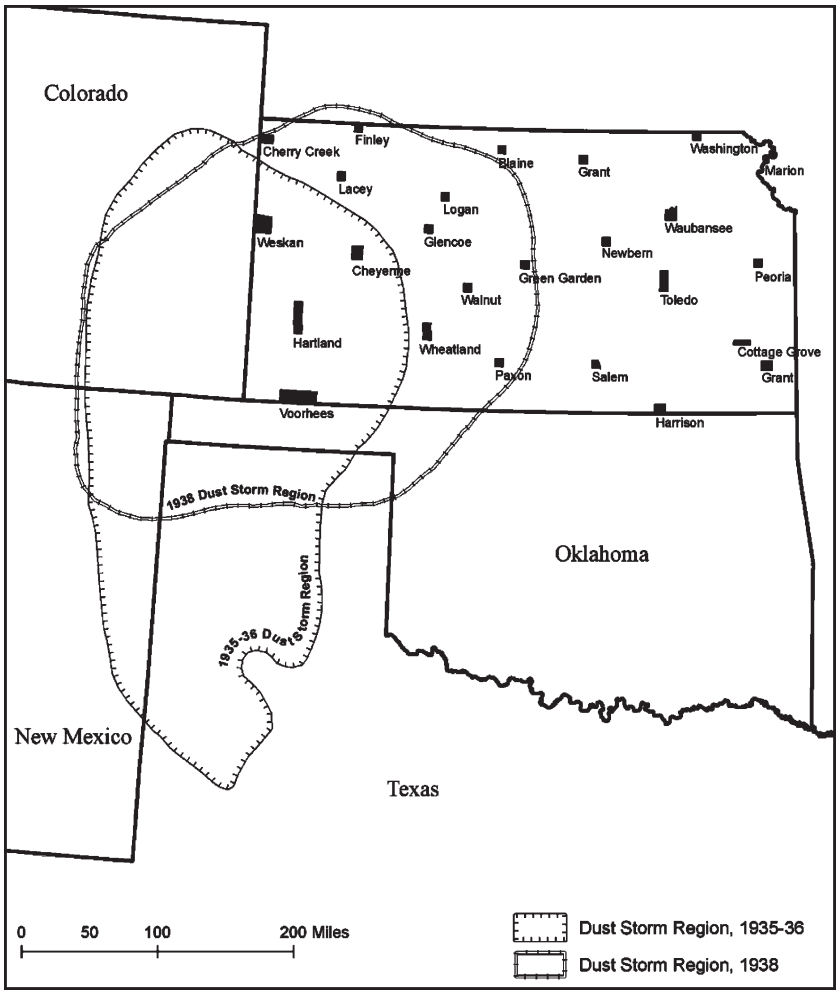
Land Use Zone	*1875*	*1885*	*1895*	*1905*	*1915*	*1920*	*1925*	*1930*	*1935*	*1940*	*Total*
Corn Belt	515	372	445	488	414	413	413	401	404	407	5,123
Mixed Farming	373	313	379	469	460	411	422	428	400	396	4,469
Bluestem Pastures	352	457	422	452	430	407	383	412	406	385	4,529
Central Wheat Belt	316	544	505	506	536	519	499	474	524	496	5,430
Wheat, Cattle, Sorghum	53	271	328	450	670	740	647	583	673	607	5,401
Total	1,609	1,957	2,079	2,365	2,510	2,490	2,364	2,298	2,407	2,291	24,952

catch up to overall operator populations in the eastern part of the state. The sample achieves balance among the five land use zones with the 1905 census, when the total sample population exceeded 2,300 farms. Subsequently, in the years leading up to the Dust Bowl, the sample slightly overrepresents farms in the far west. This has several virtues, not the least of which is better coverage of behavior in different micro-environments in the western part of the state. From an historical perspective, the sample also allows for direct observation of land use histories in several communities that lay in the areas hardest hit by wind erosion and dust storms. In the middle of the decade, four of the townships in the sample lay in the heart of the Dust Bowl. As the environmental disaster spread northward and eastward, half of all the townships in the sample were firmly in its grip (Figure 3).

This paper employs a diversity index similar to the one described in Cunfer's *On the Great Plains,* but uses it to track land use change at the farm level rather than at the county level. The index measures the balance of land uses on a given farm, computing the acres devoted to each type. Kansas's agricultural census schedules included eighty to ninety questions, posed to every farmer in the state. The key questions for present purposes asked how many acres farmers planted to which crops. Eight major land uses encompassed the key components of Kansas agriculture at the farm level: acreage devoted to wheat, corn, oats, rye, barley, sorghum, hay, and pasture. Farmers grew other minor crops; potatoes, sweet potatoes, broomcorn, and flax appear in the census returns, and there must have been a handful of others that were even rarer. Potatoes supported subsistence in the early years of settlement, but farms often reported them in fractions of an acre, an area that disappears alongside the scores of acres devoted to major crops. On a statewide scale none of these minor crops appeared in sufficient acreages to justify their inclusion in this index. While pasture is not a crop, grazing land was a significant component of most of the integrated crop and livestock farms in the sample.[11]

An individual land use category sometimes included multiple census line items. Different varieties of sorghum, for instance, were summed together to form a single component. Once it is clear how much land a given farm devoted to each category of land use, a diversity index borrowed from Jack P. Gibbs and Dudley L. Poston calculates the overall

Figure 3. Dust Storm Regions, 1935–36 and 1938.



SOURCE: Cunfer, *On the Great Plains,* 151.

evenness of the eight components. This analysis adds the sum of the acreage in all eight categories and then calculates the proportion of total land devoted to each individual use. The proportions are squared, then added together to create a diversity scale ranging from 1 to 0. A final calculation simply inverts and normalizes that scale to a range from 0 to 1, so lower diversity rankings have lower numbers, and higher diversity generates

higher numbers on the scale. Thus an index score of zero indicates the lowest diversity, equivalent to having all acreage in a single land use, while a score of one indicates highest possible diversity, with an equal number of acres in each of the eight categories. In this way each farm, at each time point, receives a diversity index score that indicates its relative farm diversity. The formulas used to calculate the index are:

1. *Farmland sum*

   $A = wheat + corn + oats + rye + barley + sorghum + hay + pasture$

2. *Raw diversity score*

   $$B = (wheat \div A)^2 + (corn \div A)^2 + (oats \div A)^2 + (rye \div A)^2 + (barley \div A)^2 + (sorghum \div A)^2 + (hay \div A)^2 + (pasture \div A)^2$$

3. *Farmland diversity index*

   $$C = 1 - \frac{(B - \frac{1}{N})}{1 - \frac{1}{N}}$$ in equation form,

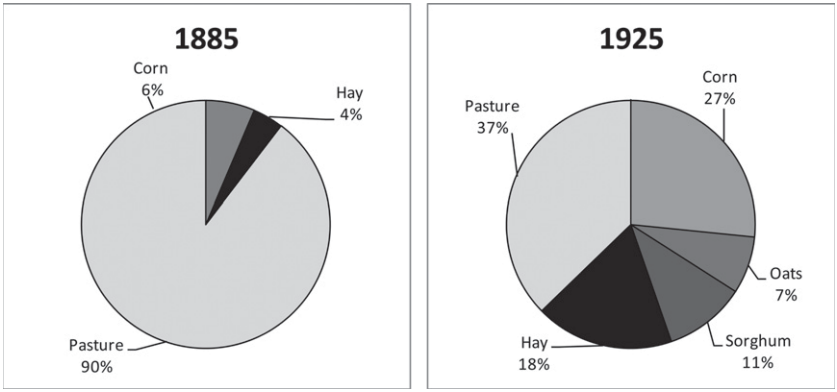
   Or, as you might represent the last step in a spreadsheet,

   C = 1-(B-(1/8))/(1-(1/8))

Equation 1 calculates the total acreage devoted to these eight land uses. Equation 2 sums the square of the proportions of land devoted to each use. Then equation 3 inverts the sum of the squared proportions, subtracting it from 1, after "normalizing" by the number of categories used to calculate the index. The normalization is calculated by subtracting ⅛ from the sum of squared proportions and dividing this number by the inverse of the same fraction or 1 – ⅛.[12]

To demonstrate how the diversity score is calculated, consider the returns from two years of reporting by David Cation, a long-time resident of Cottage Grove Township, Allen County, in eastern Kansas's Mixed Farming zone. Figure 4 shows the importance of each of the eight land use categories on the Cation farm at two different time points in its proprietor's career. In 1885 Cation was newly married and had just acquired a farm. His first crops were modest fields of hay and corn, with most of the farmland left to pasture. Toward the end of his career, in 1925, Cation's farm was far more diversified. Table 2 illustrates the diversity

Figure 4. Land Use on David Cation Farm, 1885 and 1925.



index calculation for these two time points. First, each reported land use type is added with the others to create a reported farmland sum. The proportions of each land use are calculated based on this denominator and the proportions squared. After the squared proportions are added together, the sum of squared proportions is inverted by subtracting this number from 1, after normalizing for the number of categories. In the case of the Cation farm, the 90 percent of reported land use devoted to pasture in 1885 brings the score down to 0.22 on the diversity index. In 1925 the balance evident in Figure 4 results in a higher index score of 0.85.

The example of the David Cation farm also illustrates the kind of information available in the Kansas agricultural censuses. In the eastern part of the state, where Cottage Grove Township, Allen County, lies, pasture and small grains were well-integrated features of farm management (Table 3). The soil in this part of the state is generally favorable, with open fields bounded by woodlands and hills, and dissected by marshes and streams. Rainfall, averaging between thirty-eight and forty-four inches per year, is more than adequate for a variety of crops. The Cation farm was a relatively new undertaking in 1885, when it first appeared in the census. The manuscript return illustrates how the complexity of farm life was not always captured neatly by the census questionnaires. In 1885 David Cation reported a total of 125 acres of land use activity and only 120 acres in his farm. Perhaps he was renting five acres of hay and did not consider it part of his farm. He was supposed to report farm size as the

Table 2. Diversity Index Calculation for David Cation Farm, 1885 and 1925.

		1885			*1925*		
		land use (acres)	*land use / farmland (proportion)*	*proportion squared*	*land use (acres)*	*land use / farmland (proportion)*	*proportion squared*
	Wheat	0	0.000	0.0000	0	0.000	0.0000
	Corn	8	0.064	0.0041	25	0.266	0.0707
	Oats	0	0.000	0.0000	7	0.074	0.0055
	Rye	0	0.000	0.0000	0	0.000	0.0000
	Barley	0	0.000	0.0000	0	0.000	0.0000
	Sorghum	0	0.000	0.0000	10	0.106	0.0113
	Hay	5	0.040	0.0016	17	0.181	0.0327
	Pasture	112	0.896	0.8028	35	0.372	0.1386
A	Farmland Sum	125	1.000		94	1.000	
B	Sum of Squared Proportions			0.809			0.259
C	**Index score= 1-(B-(1/8))/(1-(1/8))**			**0.219**			**0.847**

Table 3. Farmland Diversity, David Cation Farm.

Year	*Age*	*farmland*	*farmland sum (8 land uses)*	*wheat*	*corn*	*oats*	*rye*	*barley*	*sorghum*	*hay*	*pasture*	*diversity index*	*horses*	*dairy cattle*	*beef cattle*	*swine*
1885	24	120	125	0	8	0	0	0	0	5	112	0.219	3	1	1	2
1895	34	40	43	0	10	10	0	0	0	3	20	0.766	6	2	0	5
1905	44	144	118	9	45	10	0	0	2	2	50	0.756	4	4	2	4
1915	54	144	117	0	40	9	0	0	12	0	56	0.729	8	4	1	4
1920	59	80	59	0	25	4	0	0	10	0	20	0.768	6	6	4	2
1925	64	147	94	0	25	7	0	0	10	17	35	0.847	4	4	3	0
1930	69	124	39	0	35	4	0	0	0	0	0	0.210	3	4	0	0

Land use reported in acres.

land under his management, whether rented or owned. This was not always clear to the census respondents. In 1885, at age twenty-four, David lived with his wife Jessie, age twenty-one, and their five-month-old daughter, Eva. Ten years later the balance of land use activity had grown, although the Illinois-born Cation reported a smaller farm. Twenty years later the farm appeared as its original size, and Cation pursued a corn and oats rotation. The arrival of sorghum added another fodder for the dairy cattle and horses that also increased in number. Sorghum, initially used mainly for household syrup production, is especially tolerant of drought and heat. By the 1920s it became a replacement feed crop for corn among dryland farmers like Cation. The diversity score reflects the balance between each of the reported land uses, staying in the low to mid-seventies, even as the size of the farm changed, yet again. Finally, at the end of his career, Cation retained only the corn and oats fields, perhaps leasing out his pasture and hay land, causing the diversity score to fall to the low twenties.

Two further examples, each from land use zones further west, illustrate how the index performs in other environmental settings. In the middle of the state, west of the Flint Hills, lies the Central Wheat Belt. The

area is well suited to wheat cultivation, with treeless, level terrain, permeable dark soils, moderate rainfall, and mild spring temperatures. Grain fills well, without rusting or lodging from excessive moisture. The farm of Roper W. Cook in Green Garden Township, Ellsworth County, Kansas, which first appeared in the census in 1885, illustrates the quick adoption of wheat (Table 4). Cook's farm had a relatively high diversity score (0.74) in 1885, but the measure declined as the farm expanded and concentrated more on wheat. In 1885 Cook's farm included fifty-two acres of wheat, thirty-five acres of corn, four acres of oats, and seventy-nine acres of hay and pasture, plus five horses, two dairy cows, six beef cattle, and twenty-six swine. But in the 1890s Cook expanded his wheat acreage dramatically, with predictable effect on his diversity score. As the new century began, Cook's corn plantings had shrunk to fifteen acres, while his wheat expanded to two hundred fifty acres. Gone were the swine reported in both previous censuses. In their place, thirteen horses and thirteen beef cattle signaled a different, more commercial, focus. Only a slight increase in pasture to one hundred thirty acres kept the diversity score from falling to zero. In the space of a generation, a diverse farm turned into an operation focused largely on wheat, and Cook, himself, an example of regional legend.

The last example illustrates the opposite trend. Even in the far western part of Kansas, in the semi-arid high plains, many settlers resisted

Table 4. Farmland Diversity, Roper W. Cook Farm.

Year	*Age*	*farmland*	*farmland sum (8 land uses)*	*wheat*	*corn*	*oats*	*rye*	*barley*	*sorghum*	*hay*	*pasture*	*diversity index*	*horses*	*dairy cattle*	*beef cattle*	*swine*
1885	36	240	170	52	35	4	0	0	0	4	75	0.764	5	2	6	26
1895	46	397	346	200	50	6	0	0	0	0	90	0.659	0	0	0	0
1905	56	396	396	250	15	0	0	0	0	0	131	0.561	13	2	11	0

Land use reported in acres.

specialization. Table 5 presents the land use history of George Thir, an Austrian immigrant, aged twenty-nine, whose homestead first appeared in the census in 1895. His ninety acres of farm land then in use represented just over half of his quarter section parcel (one hundred sixty acres). Most of Thir's cropland in Finley Township, Decatur County, situated near the Nebraska border, was in corn that summer, except for two acres devoted to sorghum and eight to spring wheat. His experiment in sorghum was part of a larger diffusion of the crop through the western part of the state, one that ultimately gave the region its appellation as a Wheat, Sorghum, and Cattle zone. In 1915 Thir planted more sorghum and less corn than he had before. The sizes of these crops suggest that they served as livestock feed. The Thir farm also sold one hundred dollars' worth of eggs in 1915 and reported seventeen dairy cattle, nine beef cattle, eight horses, and five swine. Twenty years after settling on his original quarter section farm, Thir's land holdings had grown to a full section (six hundred forty acres), and he cultivated two hundred acres of wheat. The war years did lead to more specialization. In 1915 Thir increased both his wheat acreage and his pasture land and added sixty-five acres of hay. But after the war his wheat acreage fell back to about one hundred acres, and his corn acreage increased steadily. Through the 1920s the

Table 5. Farmland Diversity, George Thir Farm.

Year	*Age*	*farmland*	*farmland sum (8 land uses)*	*wheat*	*corn*	*oats*	*rye*	*barley*	*sorghum*	*hay*	*pasture*	*diversity index*	*horses*	*dairy cattle*	*beef cattle*	*swine*
1895	29	160	90	8	50	0	0	0	2	0	30	0.654	3	1	0	1
1905	39	320	208	80	20	0	11	12	5	0	80	0.787	4	12	10	11
1915	49	640	525	200	20	0	0	0	10	65	230	0.738	8	17	9	5
1920	54	400	305	100	30	0	0	5	10	0	160	0.693	9	10	20	7
1925	59	400	355	120	40	0	0	15	10	10	160	0.762	9	6	15	10
1930	64	400	403	125	65	0	0	0	8	10	195	0.734	8	7	4	3

Land use reported in acres.

farm's diversity remained relatively high. By 1930 George Sr., age sixty-four, had begun to transfer the farm to his thirty-four-year-old son, George Jr. In spite of his farm's large size, Thir did not mechanize early. Instead it was his son, George Jr., who purchased the first tractor, reporting it in the 1935 census.

As we compiled the diversity index, the issue of how to treat cases like George Thir's emerged again and again. In 1930, for example, George Sr. informed the census enumerator that he owned four hundred acres but reported crop activity that totaled four hundred three acres. This included 205 acres in hay and pasture, 125 acres of wheat, 65 of corn, and 8 of sorghum. If he had responded in the way census officials intended, all of his land uses would have equaled the land in the farm. The issue gets murky because the census asked for an individual to report on assets often shared by fathers, sons, brothers, or other family members, and the only way for historians to disentangle the webs of obligation and ownership is to have access to detailed land records like deed registers and tax rolls. In George Sr.'s case, even though the difference between reported farm size and activity was small, the reported activity is still larger than the farm size.

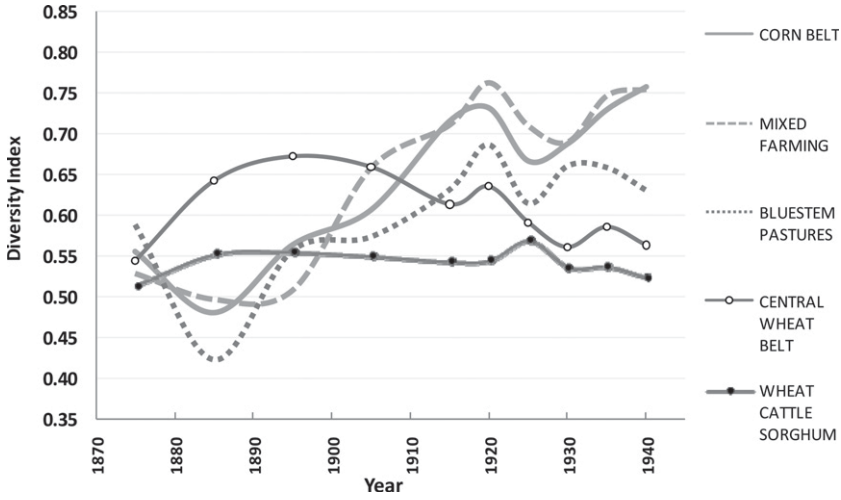
The state tried to be more specific about its single-operator definition on the questionnaire. In successive state censuses the question's phrasing grew more precise. In 1905 a question that had formerly asked simply about "Number of acres in farm" in 1885 and 1895 appeared as "Total number of acres in farm, whether owned or rented (including all outlying or separate meadow, pasture, woodlots, etc., pertaining thereto)." In 1925 the operational definition read "Total acres in farm (include land rented from others)"; in 1935 census-takers elaborated further, specifying that farmers should "exclude land rented to others." Nevertheless, no matter how specific the question became, some responses always defied the single-operator logic of the questionnaire. We had to decide how to treat these cases. In the sample, just under one-fifth of the 24,952 farm observations reported greater land use activity than total farmland. Generally, the discrepancies in the sample were modest—over five-sixths of the cases where crop acreage exceeded reported farm size had differences of less than 5 percent. From the state's perspective, this mismatch in reporting might even out over large geographic areas. Underreporting by renters might be balanced by the "overreporting" of owners. But for our purposes, at the farm level, the mismatch is too common to ignore.[13]

Therefore, to be cautious, we chose a denominator that embodies the state's intended definition of farm size, based on total reported activity. A sum of farmland that includes hay, pasture, and the combination of tilled crops listed above better captures the operational understanding of farm size. Below, an even more conservative estimate of crop diversity removes hay and pasture land from the sum of all crop activity and creates a denominator for the index based exclusively on the tillage system. This paper reports diversity results in both ways. Omitting hay and pasture betrays the broad structure of mixed husbandry because both were necessary features of farms that integrated livestock in meaningful ways. Nevertheless, even under the stricter definition, the temporal trends remain similar, although the magnitudes drop by ten to fifteen percentage points on the Gibbs-Poston scale.

We began with the working hypothesis, from the county scale analysis, that diversity was a function of time since settlement. In new areas, farms would begin at low levels of land use diversity, which would increase over a few decades. While the farm level data confirm that this was the case for some farms during the first years of settlement, they also show that diversity could be quite high from the very beginning. Moreover, even when the scores were averaged within agroecological zones, they produced counterintuitive results. The most surprising result was that diversity was higher in the semi-arid west at the start of settlement in the 1880s, than it was at a more mature stage, further east. Plotted as smoothed trend lines in Figure 5, average diversity scores in each agroecological zone also show stability in the western part of the state and growing diversity in the east. But diversity decreased distinctly in the Central Wheat Belt, while rising substantially in the eastern half of the state. The initially low diversity in the east is surprising. In the nineteenth century the cattle trade drove land use in the eastern part of the state, particularly the seasonal influx of Texas cattle driven to eastern Kansas to fatten in the tall grasses of the Flint Hills, before going on to market in Kansas City. Farmers there grew corn as an additional fodder. Over time, as farms turned to more cropping, wheat acreages increased to supplement farm incomes, and oats and sorghum acreages increased, adding to feed supplies in the Corn Belt, Mixed Farming, and Bluestem Pasture zones.

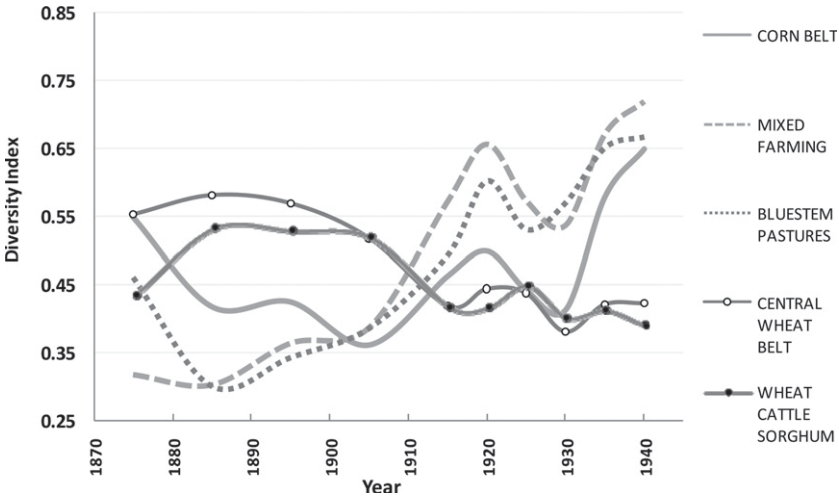
West of the Flint Hills, reductions in diversity after 1900 reflected both the growing scale of farming and the reduction of land devoted to

Figure 5. Mean Farmland Diversity Scores in Each Agroecological Zone, Kansas, 1875–1940.



pasture and hay. Landscapes in the Central Wheat Belt became more intensively cropped, whereas those in the far west generally retained the proportion of cropland and pasture necessary to sustain mixed operations for both crops and livestock. The contrast between the two western zones is clearer when hay and pasture are removed from the diversity index. With six instead of eight land use categories, the index reflects a measure of the balance within tillage systems (Figure 6). Besides an overall decline in the magnitude of diversity, the omission of hay and pasture amplifies the trends in each region. The broad comparison between each land use zone holds: the western part of the state was more diversified than the east in the late nineteenth century. Then in the early twentieth century tillage in the western regions became less diversified. Omitting pasture, the difference between the two western zones virtually disappeared. Both reached a lower plateau—with diversity scores in the range of 0.40. Farmers in western Kansas did not abandon corn, oats, barley, or sorghum. But wheat acreages did increase substantially, as farmers responded to the incentives of higher wartime grain prices. In the 1920s they chased after falling wheat prices to maintain farm incomes. This strategy was riskier for farmers in the Wheat Belt, with their smaller livestock holdings and pasture lands. Still, in many ways, the land use choices

Figure 6. Mean Tillage Diversity Scores (six categories) in Each Agroecosystem Zone, Kansas, 1875–1940.



of farmers in the east mirrored the adjustments of western farmers, as diversity rose and fell in concert. By the outset of the depression, all zones appeared to be moving in unison, pursuing less diversity during the late twenties, and then increasing in diversity during the drought years.[14]

Decomposing the change a little further, it is clear that the regional averages (presented in Figures 5 and 6) mask considerable local variation. Presented as township averages in Table 6, the eight component diversity scores illustrate that the local trajectories were not similar at each point in time. Whereas the eastern townships mirrored trends within their respective zones, responses in the west were all over the scale. In the Wheat Belt, townships started out using similar mixes of crops, hay, and pasture, with diversity scores in the low to high 0.60s. But following the high prices of the war years, practices moved in different directions, and the variation within the western regions increased. Scores fell as low as 0.39 in Pawnee County's Walnut Township, while remaining as high as 0.68 in Newbern Township, in Dickinson County. Low diversity in Walnut Township may have reflected its location in the heart of the Dust Bowl, but the drought only seems to have exaggerated a downward trend in place since settlement. By contrast, in Newburn Township, further east and outside the worst of the drought zone, farms felt the effects of the

Table 6. Mean Farmland Diversity Scores, by Township and Land Use Zone, 1875–1940.

Land Use Zone	*Township*	*County*	*1875*	*1885*	*1895*	*1905*	*1915*	*1920*	*1925*	*1930*	*1935*	*1940*
Corn Belt	Marion	Doniphan	0.57	0.50	0.53	0.53	0.67	0.66	0.46	0.63	0.60	0.67
	Washington	Nemaha	0.63	0.62	0.62	0.66	0.78	0.78	0.77	0.77	0.84	0.84
	Grant	Republic	0.59	0.25	0.46	0.61	0.73	0.80	0.79	0.73	0.76	0.74
	Blaine	Smith	0.52	0.53	0.63	0.63	0.67	0.69	0.66	0.60	0.69	0.78
Bluestem Pastures	Toledo	Chase	0.62	0.49	0.55	0.58	0.64	0.72	0.66	0.66	0.67	0.62
	Harrison	Chautauqua	0.54	0.30	0.65	0.58	0.63	0.66	0.63	0.67	0.66	0.61
	Wabaunsee	Wabaunsee	0.66	0.45	0.51	0.56	0.63	0.68	0.55	0.66	0.65	0.64
Mixed Farming	Cottage Grove	Allen	0.52	0.57	0.67	0.61	0.69	0.80	0.77	0.67	0.76	0.79
	Grant	Crawford	0.59	-	0.50	0.68	0.75	0.80	0.79	0.74	0.77	0.74
	Peoria	Franklin	0.47	0.40	0.31	0.69	0.68	0.66	0.53	0.65	0.71	0.75
Central Wheat	Newbern	Dickinson	0.55	0.67	0.77	0.80	0.77	0.76	0.76	0.73	0.75	0.68
Belt	Green Garden	Ellsworth	0.60	0.68	0.60	0.52	0.44	0.54	0.56	0.47	0.44	0.49
	Walnut	Pawnee	-	0.63	0.58	0.54	0.50	0.46	0.48	0.38	0.36	0.38
	Paxon	Pratt	-	0.63	0.68	0.70	0.57	0.67	0.55	0.42	0.45	0.49
	Logan	Rooks	-	0.63	0.66	0.70	0.55	0.58	0.57	0.60	0.65	0.61
	Salem	Sedgwick	0.53	0.61	0.67	0.62	0.68	0.67	0.57	0.61	0.69	0.62

Continued

Land Use Zone	*Township*	*County*	*1875*	*1885*	*1895*	*1905*	*1915*	*1920*	*1925*	*1930*	*1935*	*1940*
Wheat, Cattle, Sorghum	Cherry Creek	Cheyenne	-	0.08	0.55	0.62	0.66	0.70	0.69	0.70	0.76	0.75
	Finley	Decatur	-	0.48	0.42	0.66	0.72	0.60	0.65	0.58	0.68	0.63
	Wheatland	Ford	0.35	0.72	0.74	0.64	0.67	0.64	0.57	0.42	0.38	0.53
	Hartland	Kearny	-	-	0.52	0.32	0.12	0.38	0.48	0.48	0.49	0.38
	Cheyeene	Lane	-	0.39	0.54	0.53	0.44	0.52	0.48	0.52	0.42	0.43
	Vorhees	Stevens	-	-	0.39	0.25	0.49	0.54	0.60	0.57	0.58	0.40
	Lacey	Thomas	-	0.39	0.51	0.64	0.75	0.42	0.46	0.52	0.57	0.52
	Glencoe	Trego	-	-	0.55	0.58	0.58	0.60	0.62	0.49	0.60	0.61
	Weskan	Wallace	0.53	-	0.55	0.47	0.48	0.44	0.57	0.58	0.51	0.52
		Mean	0.55	0.53	0.58	0.61	0.64	0.65	0.63	0.62	0.64	0.63

drought but did not follow the same downward path. There diversity scores remained in the mid to high 0.70s between 1895 and 1935.

Local variation was greatest in the dry Wheat, Sorghum, and Cattle zone. Townships dominated by immigrant farmers provide two examples of opposing trajectories within that land use zone. In Cherry Creek Township, Cheyenne County, in the far northwestern corner of the state, land use diversity rose steadily throughout the period, in spite of significant increases in farm size. By contrast, similar increases in farm size in Wheatland Township, Ford County, just northeast of Dodge City, were associated with the opposite trajectory. Diversity scores there fell from highs that reached 0.72 and 0.74 in 1885 and 1895, to a low of 0.38 in 1935. Cherry Creek was settled mainly by German Lutherans, who had migrated to the United States from villages in Bessarabia (in what is now Moldova) north of Odessa, Ukraine. Judging by dates of immigration reported in the population census, most arrived in Kansas in the mid-1890s. Wheatland Township was home to German Catholic immigrants who arrived earlier, in the 1870s and 1880s.[15]

The diversity of Georg Isernhagen's land use is representative of many immigrant farmers in northwestern Kansas. Originally from northern Germany, he married into the Zweygardt family, part of the core Russian-born but ethnic-German community in Cherry Creek. Isernhagen recalled that after leaving Germany in 1905 he worked on road crews and rail gangs before seeking a homestead in Cheyenne County. By the time of the 1910 census, Isernhagen, twenty-nine, and Elizabeth Zweygardt, twenty-two, were married and had one child. Twenty years later the 1930 census shows five children at home, three sons and two daughters, the eldest nineteen years old; the farm had grown to six hundred eighty acres (Table 7).[16]

As he acquired more land and expanded the size of his wheat fields, Isernhagen increased the proportion of land devoted to pasture, corn, and barley. During the 1930s drought, he experimented with additional corn and barley and then devoted more land to pasture and sorghum. He recalls that this strategy suited the land in Cherry Creek, where the tablelands of the Republican River watershed are broken by arroyos and gullies. When a dust storm killed the wheat crop, the farmers in his district "worked with might to put their wheat fields to corn." His farm was also situated near a creek:

Table 7. Farmland Diversity, Georg Isernhagen Farm.

Year	*age*	*farmland*	*farmland sum (8 land uses)*	*wheat*	*corn*	*oats*	*rye*	*barley*	*sorghum*	*hay*	*pasture*	*diversity index*	*horses*	*dairy cattle*	*beef cattle*	*swine*
1915	34	460	340	90	20	0	0	30	10	0	160	0.734	8	5	4	3
1920	39	520	412	135	40	0	0	20	5	7	205	0.723	10	6	3	3
1925	44	520	516	240	40	0	0	25	6	5	200	0.714	11	2	11	11
1930	49	680	679	285	150	0	0	20	10	9	205	0.780	8	7	12	10
1935	na	840	660	170	200	0	0	50	30	10	200	0.848	7	10	22	4
1940	na	840	616	184	80	0	0	30	22	0	300	0.746	na	8	na	na

Land use reported in acres.

> In contrast to the dried upland [in 1934 and 1935], the creeks and river showed green grass on both sides. Everybody wished such land in the bottom. We, the settlers on creeks and rivers were envied by many. We had no need of green spectacles to deceive our cows. The grass was even lush. The pastures in the bottoms were filled with horses and cattle from the dried up pastures upland.

The Isernhagens used the bottomlands to feed livestock that remained an important part of their farm. In 1920, with a young family, Georg and Elizabeth tended ten horses, six dairy cattle, three beef cattle, and three hogs. By 1935 the family still kept seventy-two chickens and three swine for their own needs, and had increased the dairy herd to ten head, and the beef cattle to twenty-two head, while reducing the number of horses—two mature animals and three colts. Like many of their recently arrived neighbors, the Isernhagens practiced diversified farming that integrated cropping and livestock.[17]

In Wheatland Township, Ford County, by contrast, most farms lie on rich flatland soils north of the Arkansas River and east of Dodge City. Small streams flow into the Arkansas through dark earth horizons, but erosion remains slight. None of the gullying that typifies the Republican

River basin alters the flat terrain, and sandy soils occur only in narrow creek beds. In Wheatland, family farmers like Herman Issinghoff practiced very diverse farming. First appearing in the census in 1885, Herman and his wife, Maria, reported they both were born in Germany and their four children in the United States—the first three in Ohio and the youngest in Kansas. Herman's oldest son, Johan, was thirteen in 1885, and the family's modest cropland was devoted to a mix of wheat, corn, oats, barley, sorghum, and hay (Table 8). Diverse plantings continued through the first generation of farming. When Herman acquired additional pasture, around 1905, it was to graze a much larger herd of beef cattle. Originally, in 1885, Herman's livestock holdings included two horses, two milk cows, fifteen beef cattle, and three swine, but by 1905 he reported owning forty-four beef cattle in addition to ten dairy cows, eight horses, and one pig. During World War I pasture acreage declined as Herman reduced his livestock numbers and moved into wheat. By 1920 there were only four horses, two dairy cattle, seven beef cattle, and ten swine on the Issinghoff farm, now much smaller than at its peak in 1905. When son Harry took over the family farm around 1925, the father's preferences almost vanished. Harry only returned to a more mixed practice in 1940, when he reintroduced barley. The depression years were hard on his operation. Livestock holdings were down. Two dairy cattle plus one hundred fifty chickens and eighteen turkeys raised during 1940 suggest things were very different for Harry.

The changes that young farmers like Harry Issinghoff faced were among the most intense adjustments in the early twentieth century. As this research has begun to illustrate, not all were pulling in the same direction. But the life histories of these farm families can form the basis for a new understanding of plains agriculture—one in which there was more continuity with older mixed husbandry. Indeed, farmers like David Cation, Roper Cook, George Thir, Herman Issinghoff, and Georg Isernhagen all shared in these cultural inheritances, bringing varied traditions of mixed husbandry to the most challenging of plains environments. The evidence of diversity outlined here shows that while they did not always move toward the same blend of land uses, monoculture was far from common practice.

This exploration of the persistence of diversity points to several conclusions. Life course phenomena encouraged family farmers to avoid risk

Table 8. Farmland Diversity, Herman Issinghoff (1885–1920) and Harry Issinghoff (1925–1940) Farms.

Year	*First Name*	*age*	*farmland*	*farmland sum (8 land uses)*	*wheat*	*corn*	*oats*	*rye*	*barley*	*sorghum*	*hay*	*pasture*	*diversity index*	*horses*	*dairy cattle*	*beef cattle*	*swine*
1880	Herman	39	80	4	0	3	1	0	0	0	0	0	0.429	2	2	2	0
1885	Herman	44	80	63	20	10	10	0	10	3	10	0	0.910	2	4	15	3
1895	Herman	54	240	105	45	25	15	0	0	10	10	0	0.824	3	5	5	2
1905	Herman	64	576	550	125	25	17	0	11	10	6	356	0.601	8	10	44	1
1915	Herman	74	676	356	100	60	20	0	0	20	6	150	0.810	5	2	10	2
1920	Herman	79	560	389	200	20	23	0	15	25	6	100	0.752	4	2	7	10
1925	Harry	47	320	290	130	5	0	0	0	15	0	140	0.643	10	4	3	0
1935	Harry	na	400	351	240	10	0	0	0	15	6	80	0.546	2	6	15	5
1940	Harry	na	320	262	157	0	0	0	30	35	0	40	0.670	na	2	na	na

Land use reported in acres.

by diversifying production and preserving some of the subsistence activities that had supported their families in generations past. Families also clearly responded to market signals, expanding wheat acreages during the war years to meet overseas demand, and just as quickly diversifying in the postwar years to escape the trap of low wheat prices. Some joined the market frenzy of the late 1920s, but in other environmental settings, where reserves of good earth were not available for crop production because of poor soils or hilly terrain, diverse husbandry remained common.

The implications of this study for plains and environmental history are important. Agriculture's impacts were not minimal, quite the contrary. But the transformation from diverse prairie to monoculture was never as complete as agricultural reformers imagined during the 1930s crisis. Kansas agricultural census returns paint a portrait of diverse grain and livestock farms where more than a third of the land remained in native pasture or meadow. These were not the single crop enterprises of regional legend.

Monoculture as myth is something of a straw man, then. It exists, in part, because scholars have projected very real concerns about industrial agriculture today into a more distant past. But the perception of monoculture is also a product of the region's own self identity and boosterism. Striving to represent itself as the breadbasket of the nation, its boosters emphasized the technical achievements of plains farming in an age of scientific agriculture. Innovations may have been local and incremental but boosters presented the growing size of farms and their mechanization as the true signs of progress.[18]

The detailed land use record undermines the notion that monoculture was widespread. Agriculture changed the Great Plains, but understanding its pace, extent, and impact requires more investigation. This paper presents a new window on the history of land use in the grassland. It demonstrates a method for analyzing censuses to address questions about land stewardship, not just economic life. Agricultural censuses were, after all, economic documents. They did not pose direct questions about the care of the land, about how farmers rotated crops, about how they designed and sized fields or managed pastures, meadows, streams, or wetlands. The evidence calls for a substantial revision of the narrative of agricultural and environmental change. If Kansas farms in the heart of the

Dust Bowl remained diverse, the expansion of monoculture is a phenomenon with more recent origins than we have imagined.

NOTES

1. Funding for this study comes from the National Institute of Child Health and Human Development, National Institutes of Health, Grant # HD044889, 2003–2007.

Linda Gordon, "Dorothea Lange: The Photographer as Agricultural Sociologist," *Journal of American History* 93 (Dec. 2006): 698–727.

The positive story of the spread of American institutions and communities extends back to the work of Frederick Jackson Turner, *The Frontier in American History* (New York: H. Holt, 1921) and Walter Prescott Webb, *The Great Plains* (New York: Ginn and Co., 1931). The counter-narrative appeared in The Great Plains Committee's *The Future of the Great Plains* (Washington, DC: GPO, 1936), but received its most elegant treatment in Donald Worster's seminal work *Dust Bowl: The Southern Plains in the 1930s* (New York: Oxford University Press, 1979). Many interpretations have since repeated the central thrust of Franklin Roosevelt's analysis—that many parts of the plains should never have been opened to agricultural settlement. Among others, see, R. Douglas Hurt, *The Dust Bowl: An Agricultural and Social History* (Chicago: Nelson Hall, 1981); John Opie, *Ogallala: Water for a Dry Land* (Lincoln: University of Nebraska Press, 1993); and Theodore Steinberg, *Down to Earth: Nature's Role in American History* (New York: Oxford University Press, 2002).

Deborah Fitzgerald, *Every Farm a Factory: The Industrial Ideal in American Agriculture* (New Haven: Yale University Press, 2003), acknowledges the diversity of agriculture around the United States but argues that, increasingly in the 1920s, farming followed a path of development within an overall logic of industrial growth.

2. Avery Odelle Craven, *Soil Exhaustion as a Factor in the Agricultural History of Virginia and Maryland, 1606–1860* (1926, repr., Columbia: University of South Carolina Press, 2006); Clarence H. Danhof, *Change in Agriculture: The Northern United States, 1820–1870* (Cambridge: Harvard University Press, 1969); Fred A. Shannon, *The Farmer's Last Frontier: Agriculture, 1860–1897* (1945, repr., New York: M. E. Sharpe, 1989); Allan G. Bogue, *From Prairie to Corn Belt: Farming on the Iowa and Illinois Prairies in the Nineteenth Century* (Chicago: University of Chicago Press, 1963); David B. Danbom, *Born in the Country: A History of Rural America* (Baltimore: Johns Hopkins University Press, 1995); Gilbert Fite, *Cotton Fields No More: Southern Agriculture, 1865–1980* (Lexington: University Press of Kentucky, 1984).

For grounded studies of sustainable farming practices in particular communities, see, Brian Donahue, *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven: Yale University Press, 2004); Warren R. Hofstra, *The Planting of New Virginia: Settlement and Landscape in the Shenandoah Valley* (Baltimore: Johns Hopkins University Press, 2004); Jack Temple Kirby, *Poquosin: A Study of Rural Landscape and Society* (Chapel Hill: University of North Carolina Press, 1995). The literature about agricultural improvement movements includes T. H. Breen, *Tobacco Culture: The Mentality of the Great Tidewater Planters on the Eve of the Revolution* (Princeton: Princeton University Press, 1985); David F. Allmendinger Jr., *Ruffin: Family and Reform in the Old South* (New York: Oxford University Press, 1990); Steven Stoll, *Larding the Lean Earth: Soil and Society in Nineteenth-Century America* (New York: Hill and Wang, 2002).

3. James C. Malin's *Winter Wheat in the Golden Belt of Kansas: A Study in Adaption to Subhumid Geographical Environment* (Lawrence: University Press of Kansas, 1944), 49–54, portrays early agriculture as successive corn and wheat booms in the 1870s and 1880s, followed by the introduction of more livestock and other crops in the 1890s. Worster's *Dust Bowl* presents the single-crop frenzy as a product of growing mechanization and demand during World War I. The single-crop interpretation still holds wide currency in the literature. See, for example, Clinton L. Evans, *The War on Weeds in the Prairie West: An Environmental History* (Calgary: University of Calgary Press, 2001); Bonnie Lynn-Sherow, *Red Earth: Race and Agriculture in Oklahoma Territory* (Lawrence: University Press of Kansas, 2004); Bill Waiser, *Saskatchewan: A New History* (Calgary: Fifth House, 2005).

4. Robert C. Williams, *Fordson, Farmall, and Poppin' Johnny: A History of the Farm Tractor and its Impact on America* (Chicago: University of Illinois Press, 1987); Shannon, *Farmer's Last Frontier,* 67, 154–61; Hiram Drache, *The Day of the Bonanza: A History of Bonanza Farming in the Red River Valley of the North* (Fargo: North Dakota Institute of Regional Studies, 1964); Charles Carleton Coffin, "Dakota Wheat Fields," *Harper's New Monthly Magazine* 40:358 (1880); John Stewart Dalrymple, *Oliver Dalrymple: The Story of a Bonanza Farmer* (Minneapolis: privately printed, 1960).

5. Dalrymple, *Oliver Dalrymple,* 37.

6. Geoff Cunfer, "The New Deal's Land Utilization Program in the Great Plains," *Great Plains Quarterly* 21 (Summer 2001): 193–210; R. Douglas Hurt, "Federal Land Reclamation in the Dust Bowl," *Great Plains Quarterly* 6 (Spring 1986): 94–106; Edward G. Grest, "The Range Story of the Land Utilization Projects," *Journal of Range Management* 6 (Feb. 1953): 44–50; H. H. Wooten, "The Land Utilization Program, 1934–1964: Origin, Development, and Present Status," *Agricultural Economic Report No. 85* (Washington, DC: GPO, 1965); Great Plains Committee, *The Future of the Great Plains,* 4.

7. Worster, *Dust Bowl,* 87, 92–93; Donald Worster, *Under Western Skies: Nature and History in the American West* (New York: Oxford University Press, 1992), 99; Richard White, *"It's Your Misfortune and None of my Own": A New History of the American West* (Norman: University of Oklahoma Press, 1991), 230–31; H. Craig Miner, *Harvesting the High Plains: John Kriss and the Business of Wheat Farming, 1920–1950* (Lawrence: University Press of Kansas, 1998); Fitzgerald, *Every Farm a Factory,* 135–37.

8. Geoff Cunfer, *On the Great Plains: Agriculture and Environment* (College Station: Texas A&M University Press, 2005), 69–85.

Published agricultural census data at the county level are available in Inter-university Consortium for Political and Social Research, *Great Plains Population and Environment Data: Agricultural Data, 1870–1997 [United States],* Computer file (Ann Arbor: University of Michigan [producer], 2005, Inter-university Consortium for Political and Social Research [distributor], 2005–06), ICPSR04254-v1, 22.

9. For a discussion of the sample, see, Kenneth M. Sylvester et al., "Demography and Environment in Grassland Settlement: Using Linked Longitudinal and Cross-Sectional Data to Explore Household and Agricultural Systems," *History and Computing* 14:1,2 (2006): 31–60.

10. James Malin first popularized the five-way regional land use scheme (used in this paper to describe general trends) when he included a 1930 experiment station map in the preface of his 1944 monograph, *Winter Wheat*. The map is a simplified version of Figure 18, Foster F. Elliot, "Types of Farming in the United States," Kansas State Experiment Station *Bulletin No. 251* (1930). A. W. Küchler, "Potential Natural Vegetation of the Conterminous

United States," *American Geographical Society Special Publication No. 36* (New York: AGS, 1964).

Francisco Vasquez de Coronado encountered horticultural villages in central Kansas during his 1542 expedition, as did French explorer Etienne Véniard de Bourgmont in 1722. See, Elliot West, *The Contested Plains: Indians, Goldseekers, and the Rush to Colorado* (Lawrence: University Press of Kansas, 1998); William Brandon, *Quivira: Europeans in the Region of the Santa Fe Trail, 1540–1820* (Athens: Ohio University Press, 1990).

11. In the mid-1950s geographer John C. Weaver developed an innovative method to identify what he referred to as "crop-combination regions" in the Corn Belt and parts of the Great Plains. The approach is similar to the one employed here in its use of agricultural census data and its attention to the relative percentage of land devoted to various crops. As with Cunfer's *On the Great Plains,* Weaver used county-level data and argued that many parts of the Midwest had diverse crop assemblages in the first half of the twentieth century (although he also identified western Kansas as a wheat monoculture region). Weaver used a sum of squares method to weight the relative importance of specific crops to local crop assemblages, whereas this study applies a concentration index to derive a single measure of the balance of land uses on individual farms. See, Weaver, "Changing Patterns of Cropland Use in the Middle West," *Economic Geography* 30 (Jan. 1954): 1–47; Weaver, "Crop-Combination Regions in the Middle West," *Geographical Review* 44 (Apr. 1954): 175–200; Weaver, "Crop-Combination Regions for 1919 and 1929 in the Middle West," *Geographical Review* 44 (Oct. 1944): 560–72.

12. Jack P. Gibbs and Dudley L. Poston Jr., "The Division of Labor: Conceptualizations and Related Measures," *Social Forces* 53 (Mar. 1975): 468–76. This measure is identical to the widely used Herfindahl index in economics. The US Justice Department relies on this measure to track market concentration. The index may also be normalized to adjust for the number of firms in a given market. In this paper we use the same process to normalize the index for both eight and six categories of land use. On the Herfindahl index, see, Albert O. Hirschman, "The Paternity of an Index," *American Economic Review* 54 (Sept. 1964): 761. See, Cunfer, *On the Great Plains,* 252–55 for a more detailed discussion of the diversity index.

13. The phenomenon also derives from heaping in the reported data. Farm operators often rounded crop acreages to the nearest 10. When added together, these acreages can exceed reported farm size.

14. 1. $cropland\ sum = wheat + corn + oats + rye + barley + sorghum$

2. $raw\ diversity = (wheat \div cropland\ sum)^2 + (corn \div cropland\ sum)^2 + (oats \div cropland\ sum)^2 + (rye \div cropland\ sum)^2 + (barley \div cropland\ sum)^2 + (sorghum \div cropland\ sum)^2$

3. $cropland\ diversity = 1 - \{raw\ diversity - [1/6 \div (1 - 1/6)]\}$

Fitzgerald, *Every Farm a Factory,* 17–21; Worster, *Dust Bowl,* 88–90.

15. Cheyenne County Historical Society, *The History of Cheyenne County, Kansas* (Dallas: Curtis Media Corporation, 1987); Lee F. Pendergrass, ed., *Memoirs of Pioneers of Cheyenne County, Kansas: Ole Robert Cram, Georg Isernhagen, Nancy Moore Wieck* (Fort Hays: Fort Hays State University, 1980), 57–92; Ford County Historical Society, *Dodge City and Ford County, Kansas, 1870–1920: Pioneer Histories and Stories* (Dodge City: Spearville News, 1996), 56–57, 160–64, 169–71, 177–79, 183–84, 206–208, 316–17, 332, 336–38, 359–61.

16. National Archives and Records Administration, *1910 Federal Census of Population: Manuscripts Schedules,* T624, Reel Nos. 469, 473, 474, 477, 478, 480, 484, 485, 492, 494, 495, 497, 498, 499, 501, and 502; and *1930 Federal Census of Population: Manuscript Schedules,*

T626, Reel Nos. 692–95, 698–703, 705, 707, 713, 715–17, 719, 723–25. Although this paper does not make systematic use of demographic data, a major aim of the project was to gather population census information for all residents of the study townships and link the population information to the agricultural schedules. For a discussion of the data availability and linking methods, see, Sylvester et al., "Demography and Environment."

17. Pendergrass, ed., *Memoirs of Pioneers of Cheyenne County,* 79.

18. Contemporaries were often caught in the contradiction, as the state simultaneously promoted specialization and the benefits of diverse production. Two treatises that take diversity as a given in farm practice come from the work of University of Illinois agronomist Cyril George Hopkins. See, Hopkins's *Soil Fertility and Permanent Agriculture* (Boston: Ginn, 1910) and V. M. Hays et al., *For Better Crops* (Chicago: International Harvester Co., 1911).