When the Well Runs Dry:
The Value of Irrigation to the Western Kansas Economy

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Abstract

In western Kansas, irrigated crops production has given rise to one of the world's premier livestock production and food processing industries. Given current usage trends, however, portions of the Ogallala Aquifer will become effectively exhausted for irrigated agricultural use in the foreseeable future. Without irrigation, highly productive farmland in western Kansas will begin reverting to dryland farming. This research provides preliminary estimates of how the loss of irrigated agriculture might affect the western Kansas economy. An economic model is used to estimate the overall importance of agriculture in the northwestern, west central and southwestern regions of the state. An analysis provides estimates of the impacts of removing the additional value irrigation adds to crops production. Without irrigation, the economy would shrink by an estimated one-half billion dollars annually and about 1,800 jobs would be lost.

Introduction[1]

Despite a long period of national economic growth and expansion during the 1990s, many rural communities throughout the Great Plains continued to experience population out-migration and economic decline. This pattern has been evident throughout much of western Kansas. Yet, even there, a number of communities such as Garden City, Dodge City and Liberal have thrived and grown. In large measure, the relative prosperity can be attributed to the underground water resources which support irrigated agriculture, and in turn livestock production and meat packing. But, those water resources are finite, leading many to speculate about what lies ahead when pumping water for irrigation becomes financially prohibitive.

In this paper, we offer a glimpse of what may lie ahead by presenting the direct and indirect impacts associated with a scenario wherein the crops production associated with irrigated agriculture is removed from the region's economy and replaced by a dryland production regime. The analysis is partial insofar as we do not go beyond the reduction in crops production to speculate how this may further affect the livestock and meat packing industries. Additionally, we know that certain areas of western Kansas still have relatively abundant water supplies and can assume that water use technologies and efficiencies will continue to improve. Still, this cautionary tale presages what may lie ahead sooner for some areas and eventually for all should current use water trends continue unabated.

The paper continues with a discussion of the dwindling water resources and agricultural crops production in the Ogallala region of western Kansas. We provide estimates of the importance of agricultural production in the region through the use of a social accounting matrix of the region, an accounting system that comprehensively models the economy. To estimate the economic impacts of irrigated agriculture, we assume all value associated with the incremental increase in

[1] Special thanks to Leonard Bloomquist, Stephen White and Max Lu. Portions of the literature review draw on a research proposal jointly authored with them.

crops production for irrigated lands is lost. The social accounting matrix then projects the combined direct and indirect impacts to the economy.

Background

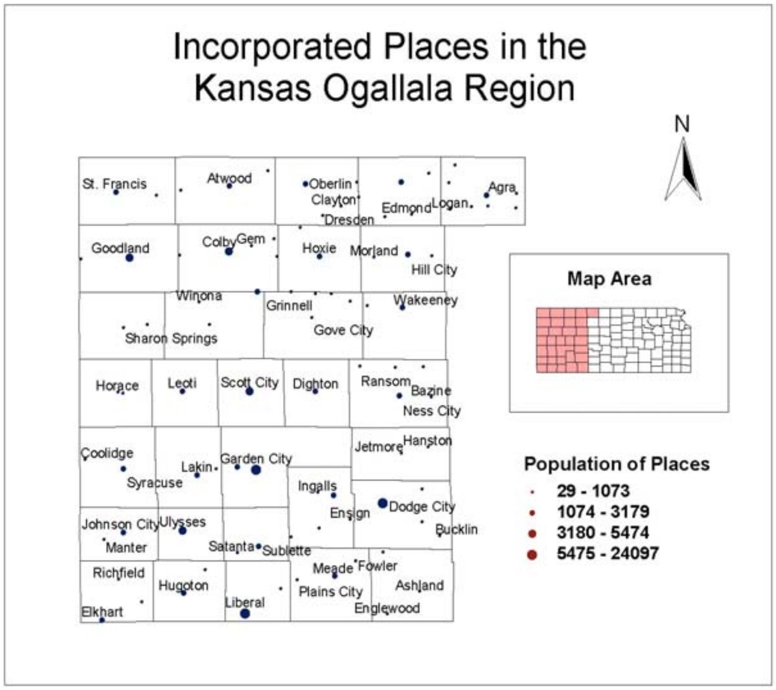
Overall, the 1990s was a good decade for many nonmetropolitan areas of America (Fuguitt and Beale; Johnson; Johnson and Beale 1994, 1998a,1998b). While those places having proximity to metropolitan areas or possessing natural amenities experienced population growth, many other remote, agriculturally-dependent, and “amenity-poor” rural communities continued to lose population. In rural areas of the Great Plains, population out-migration has been especially persistent and widespread (Albrecht; Rathge and Highman). For these places, persistent population loss has been associated with growing labor shortages, aging populations, rising poverty, and an increasing deficit of human capital resources necessary to maintain economic viability. Yet, even within these remote regions, some rural communities have experienced stability and growth in recent decades. Such has been the case in certain portions of the Ogallala Aquifer region of western Kansas.

The Kansas Ogallala region includes 32 western counties in Kansas that overlie the Ogallala and other water bearing aquifers. Agricultural production in the region includes both dryland and irrigated crops production and livestock ranching. The groundwater resources have spurred the development of intensive irrigated agriculture in the region. Its high-yielding feed grain production supports a large-scale feedlot industry, which in turn supports one of the world's premier beef packing industries (Broadway 1995, 2000; Bussing and Self; Drabenstott, Henry and Mitchell; Saito and Yagakaki).

The 2000 census showed that the region had a total population of 209,515 persons, residing in or near 91 incorporated places (Figure 1). Most of these are small farm communities. Three important exceptions are Garden City, Dodge City and Liberal, the major urban centers of the region, whose combined population accounted for just over one third of the region's total. Local businesses also have become increasingly concentrated in these urban centers, to the detriment of both small towns in the nonirrigated areas and in counties with high levels of irrigation but without a large urban center (Williams and Bloomquist).

Over the past several decades, different parts of the Ogallala region have experienced varying rates of population growth and demographic change due to the irrigated agriculture development patterns and the associated value-added industries. During the 1990s, the region as a whole gained 7.5% in population, or 14,649 people. However, 46 of the 91 incorporated places lost population. Population decline was most acute in the smallest communities, with some of them losing as much as 30% over the decade. Irrigation also appears to be an important factor shaping rural demographic change in the region.

Figure 1. Incorporated Places in the Kansas Ogallala Region, Kansas



Irrigated areas have had faster population growth, younger median ages, and usually more success in retaining local youth. The thriving feedlots and beef packing industries have also attracted a substantial number of Latino and Asian immigrants to places like Garden City, Dodge City and Liberal (Benson; Broadway 1994). In comparison, the non-irrigated areas tend to have experienced persistent population loss and an aging of their populations. The shrinking population in many small towns of the region has created a very difficult situation for the people that remain.

That irrigation plays an important role in sustaining the rural population in the Kansas Ogallala region raises a concern about the long-term economic sustainability of its communities. The saturated thickness of the Ogallala Aquifer and the related usable lifetime of the groundwater vary considerably across the region (Figures 2 and 3). While some communities will have groundwater supplies available for many years to come, in other areas the economic depletion of the aquifer is complete or rapidly approaching. The future of many communities in the study area and in other parts of the High Plains Aquifer region may very well hinge upon their ability to adjust to the "planned depletion" of the aquifer.

Figure 2. Saturated Thickness of the High Plains Aquifer

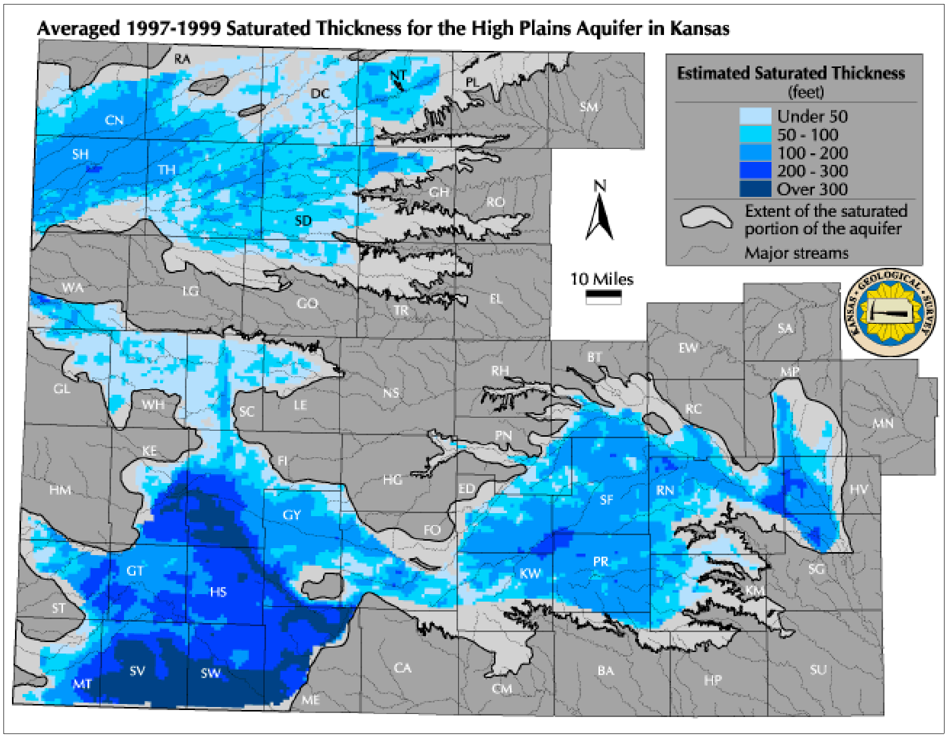
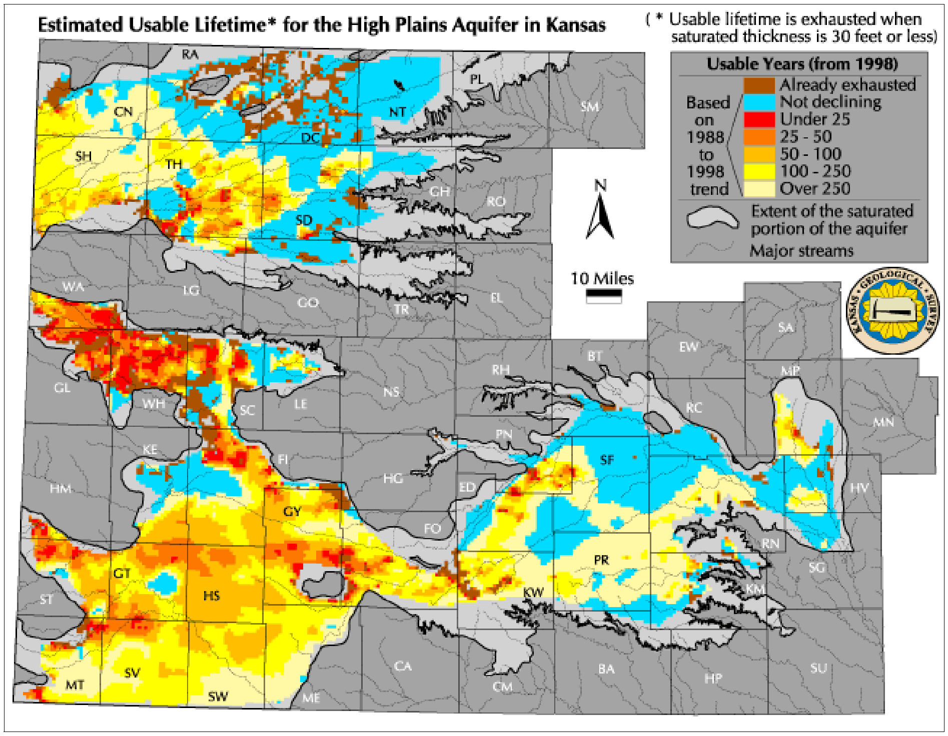


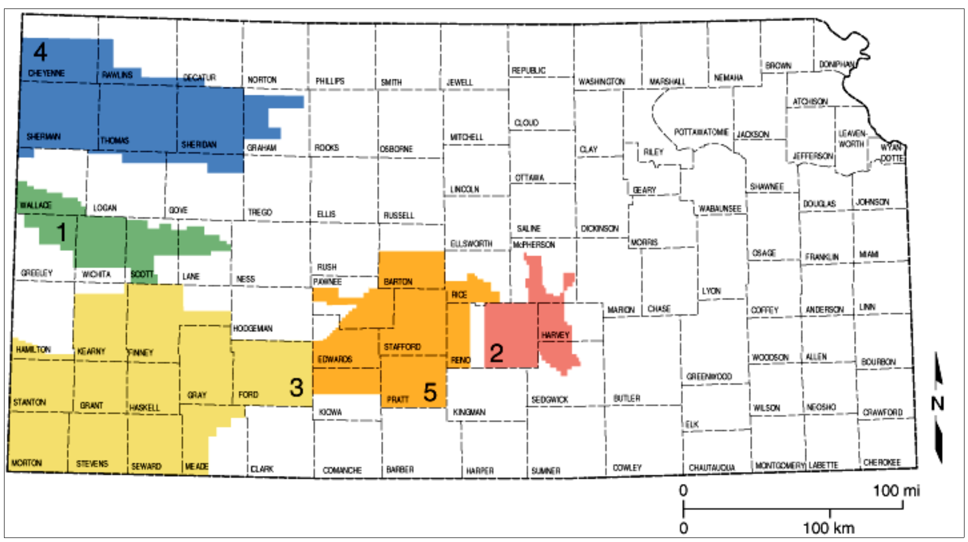
Figure 3. Estimated Usable Lifetime of the High Plains Aquifer



In response to concerns relating to the depletion of the Olallala and High Plains Aquifers, Kansas has established local units of government, called groundwater management districts, to provide water-use administration, planning, and information. Five groundwater management districts were created in the 1970s in the western and central parts of the state (Figure 4). The primary use of ground water in these areas is irrigation, although several districts also face issues of municipal supply.

For purposes of this analysis, we focus on the area encompassing Groundwater Management Districts 4, 1, and 3. These are part of the Ogallala Aquifer system, and are especially susceptible to depletion because their hydrologic characteristics do not allow replenishment in a time frame conducive to current usage patterns.

Figure 4. Kansas Groundwater Management Districts

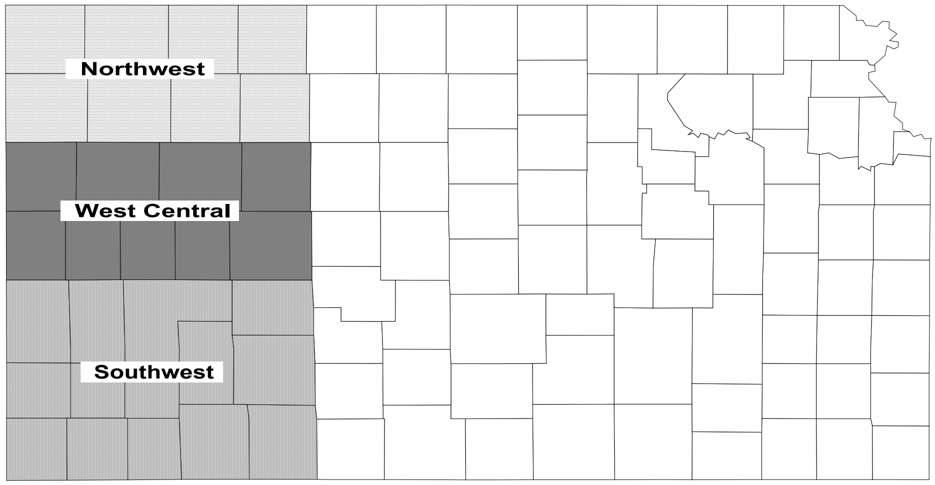


Crops Production in the Ogallala Region

For purposes of tracking agricultural production in the state, the Kansas Agricultural Statistics Service divides the state into nine agricultural statistics districts. The three western-most districts correspond closely to the groundwater management districts and serve as the focus for this study (Figure 5).

The three western agricultural districts are highly productive crops producers, especially for field corn and wheat. Examination of Figure 6 suggests the most productive areas correspond closely to areas with available groundwater.

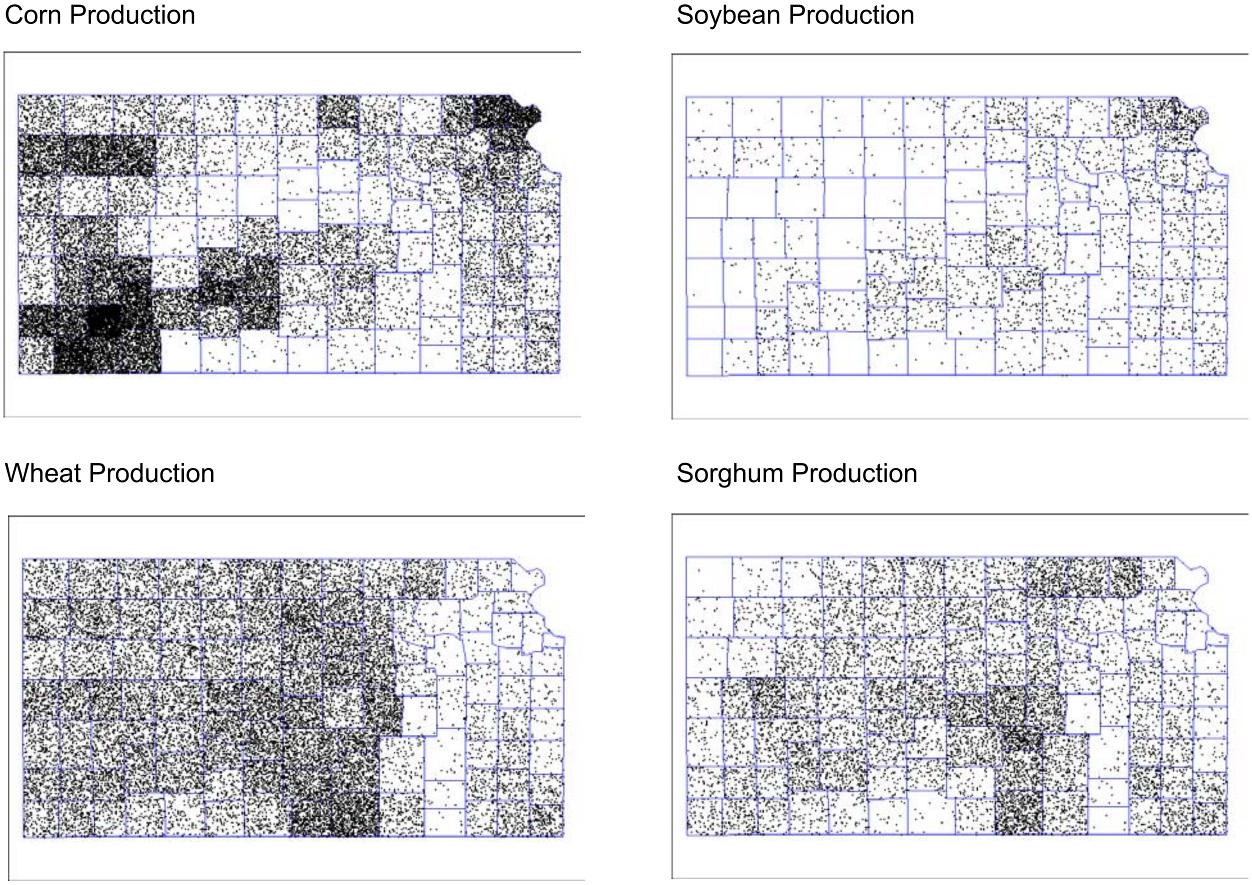
Figure 5. Western Kansas Agricultural Statistics Districts



Additional detail relating to county and regional commodity production is shown in Table 1. The three districts combined to annually produce about a half-billion dollars worth of corn and another $375 million worth of wheat on average.

A fairly high percentage of this value is directly attributable to irrigation. Estimates of the value of irrigation are provided in Table 2. These values were derived by calculating the incremental increase in production for irrigated crops over the levels of dryland production in each of the counties. The values reported are inflation-adjusted five-year averages. This estimation technique assumes that without irrigation, the land would have produced the same crop under dryland conditions with correspondingly lower yields.

Figure 6. Selected Kansas Crops Production, 2000



Note: each dot represents 15,000 bushels. Source: Kansas Farm Facts, 2001

Economic Impact of Agriculture - A SAM Analysis

As a descriptive tool, social accounting matrix (SAM) analysis can be thought of as an accounting system that comprehensively accounts for financial flows in a region at a point in time. As an analytic tool, SAM analysis represents transactions between economic sectors and institutions (households, enterprises, government). Given these interpretations, the SAM model can be used to assess the impacts of alternative policies and economic events in the regional economy.

The simplest and most efficient way to represent the interaction between economic sectors and institutions within a region and with the rest of the world is through a transactions table. A transactions table is a square matrix that identifies all of the economic entities within a region, including production sectors, households, business enterprises, and governments. It includes accounts to represent their purchases, sales, taxes, savings and trading relationships between each other and with the rest of the world. The SAM describes the full circular flow of economic transactions occurring in the economy. It comprehensively accounts for all types of economic transactions, thereby allowing a wide range of impact and policy analyses.

To conduct the analyses of the economic impact of irrigation, the IMPLAN system was used to construct a SAM for each of the three regions calibrated to 2000, the most recent year for which data were available (Minnesota IMPLAN Group). Within the SAMs are a variety of information about the regional economies during 2000. Several descriptive items were extracted from the SAMs and are reported in Table 3.

Industry sales serve as the broadest measure of economic activity, and can be thought of as a gross regional product. Employment figures represent estimates of total employment, including all full- and part-time jobs. Several measures of regional income are reported. Labor income represents employee compensation (salaries and wages) plus proprietary income from farming and small business proprietorships. Total income is the broadest income measure and represents the total wealth controlled by households, enterprises of all types and governments in the region.

In 2000, the eight northwestern counties accounted for about $2 billion worth of economic activity, 27,000 jobs and nearly $1 billion in total wealth. The nine west central Kansas counties had about the same total value of economic activity, about 18,000 jobs and over a half-billion dollars total wealth. The 14-county southwestern region, which includes the major urban cities, is the largest region, by far. In 2000, the southwestern region accounted for nearly $13 billion in economic activity, about 88,000 jobs and $3.5 billion in total wealth.

Considering the distribution of economic activity across the economic sectors in each of the regions, agriculture plays an important role. Across the regions, agriculture was typically the first or second largest source of sales. Other sectors, however, typically serve as primary sources of income and jobs. Trade, services and government (including schools) are other important sources of economic activity. The importance of meat packing in the southwestern district is observed in the in the manufacturing sector.

When considering questions relating to the relative contribution of different economic entities, direct measures of sales, jobs and income provide one indication. It’s well known, however, that different economic sectors, households, and other entities are closely tied such that activity in one area of the economy “ripples” to affect other economic sectors and entities. More precisely, there are two primary sources for the “ripple effect.” The first arises from businesses buying and selling to one another during the process of producing goods and services. The second source of impact arises from households spending labor income for typical household goods and services. This household spending tends to broadly distribute the economic impact of an event. For example, if a meat packer gets a new order for $1 million worth of meat, the firm will call in more labor who, in turn, will spend their wages on a wide variety of goods and services.

A SAM can be used to measure the ripple effect of individual economic sectors. This is done by creating economic multipliers for each of the industry sectors. Multipliers are estimated for households, as well, to capture the effects of household spending.

To estimate the total "economic impact" of the industry and household sectors, it's important to distinguish between the various sources of impact. To be fair, distinctions should be made between the impact that arises as a result of interactions between entities exclusively *within a region* and the interactions between regional entities and the *rest of the world*.

For this analysis, we only consider economic activity associated with non-local demand for locally-produced goods and services as well as other income attracted to the region from non-local sources. It's the capacity to draw income/revenue from outside the region that creates impact beyond that which would otherwise normally occur. Thus, to complete the analysis of the impact of agriculture (and other sectors), we multiply the regional multiplier matrix by a vector representing final demand (money coming from outside the region).

Table 4 shows the share of economic activity associated with various industry sectors and household income groups. Three types of shares are shown: total sales, total income (generated from regional production), and household income (income from all sources). Households are split into nine income classes.

To interpret the information in the table, read down the column. For the industry sectors, the values represent the share of total sales (total income and household income) associated with external demand for the goods and services produced by that sector. For the household income groups, the values represent the share of total sales (total income and household income) associated with externally-generated income for each household income class.

In the case of northwestern Kansas, about 84 percent of total sales were associated with industry production of goods and services. About 16 percent was associated with household income transfers from outside the region. Agricultural production was closely associated with about 40 percent of all sales in the region, after taking into account all the direct and indirect linkages. It was associated with about 30 percent of total income from production and 17 percent of all household income in the region.

Among the interesting findings of the analysis are those associated with the household income column and the household income classes. Reading down the household income column, only about 60 percent of household income comes from regional production activity. This is to say that only about 60 percent of regional household income comes from working within the region. The rest of the income comes from sources outside the region. These sources include Social Security payments, pension payments, non-local investment income and government transfer payments, such as commodity support payments. Few realize the significance of federal government transfer payments to household well-being.

In the area of the table representing household income classes, the share of regional economic activity associated with the receipt of non-local income is shown. Between perhaps five and 15 percent of total regional sales is dependent on that income. About ten to 15 percent of all income in the region generated by regional industries is dependent on outside income transfers. And, 30 to 40 percent of total household income comes from non-local sources.

Note the differences observed across the income class groups. The larger percentages observed in the classes in the lower income classes up to about $40,000 or $50,000 suggests these are the income groups that have the largest relative impact on local economic activity. In general, the middle income groups will have the largest relative impact on regional economic well-being, followed by the lower income groups. The highest income groups will typically have a lesser relative impact. This finding is particularly relevant to rural areas where we have observed long-term trends of population out-migration and the bifurcation of the income distribution, where high income households are controlling greater shares of wealth and households tend to be clustering at the low and high ends of the income distribution (Stauber).

In general, the results across the regions confirm the importance of agriculture to the area's economy. Only in southwestern Kansas with its meat packing industry does the impact of another sector approach that of agriculture. Thus, it is appropriate to be concerned about that which threatens the region's economic base. Such is the case with the dwindling supply of irrigation water.

Economic Impacts of Irrigation

To estimate the economic impact of irrigation and imply potential losses should it become economically unavailable, we shocked our multiplier matrix with a vector of reductions to food grains, feed grains, and oil seed crops accounts equal to the value of irrigated crops. This effectively assumes the lands devoted to irrigated cropping would grow the same crop regime under dryland conditions. This implies the simplifying assumption that reverting to dryland production does not affect acreage devoted to any specific crop. It also incorporates the appropriate notion that there are alternative productive uses for the land. Table 5 estimates the impacts across several dimensions of the private economy and Table 6 estimates the impacts to the public sector.

Reviewing the water depth and availability information presented earlier, recall that the west central region is currently at greatest risk of running out of economically available irrigation water in the relatively near-term. The northwest region is at risk in the relative mid-term, and the southwest region is at risk in the long-term. Within each of these regions, specific areas are at greater or lesser risk. For our analysis, we simply eliminated all of it. This, then, represents a gross worst-case scenario in present terms, and does not take into account any future adjustments in technologies or efficiencies, or the future value of money. While such simplifying assumptions raise legitimate questions regarding analysis validity, we believe there is relatively greater value to raising questions about potential future conditions while there remains time to make rational policy choices. The estimates are only intended to create awareness about the direction of impacts and their potential scale and scope.

Looking first at the west central region, the direct loss of value associated with irrigation was about $27.5 million annually. When all the direct and indirect effects are counted, the total annual loss to the economy was estimated to be about $36 million worth of sales, $10 million in all types of income and about 300 jobs. While concentrated in the agricultural sector (including agricultural services where many closely-allied jobs are located), the impacts were widely spread throughout the economy to many interconnected sectors.

In northwestern Kansas, the direct reduction in sales associated with irrigated agriculture was assumed to be about $57 million annually. There, total annual activity declined by about $76 million, about $27 million in all type of income were lost and the number of jobs declined by about 700. The southwest has the largest irrigation values. The assumed loss was over $237 million annually. The associated impacts totaled an annual reduction of about $320 million in economic activity, nearly $75 million in all types of income, and about 775 jobs were lost.

Across the entire region, if all irrigated agriculture returned to dryland farming, the potential impact could approach one-half billion dollars in total annual economic activity, 1,800 jobs, and $110 million in all types of income lost. For perspective, this would represent a permanent annual reduction of between about one and three percent of the economy, depending whether we're considering levels of sales, employment or income.

While our analysis spreads out the impacts across broad sectoral categories, in reality we know the impacts would be somewhat more concentrated. Within agriculture, for example, the impacts would be concentrated among irrigators and support services. In manufacturing, food processing industries would be most severely affected. It also should be pointed out that the employment impact estimates are somewhat over-stated insofar as many of the people affected would likely find alternative ways to make a productive living within the region. Still, some portion of the reported impact would be realized.

Finally, recall that the SAM is a comprehensive accounting system that includes all financial flows, Thus, we have information relating to taxation that allows us to estimate impacts to the public sector (Table 6). While these represent general estimates that reflect average relationships within the very broad sectors examined, they do provide some sense of scale that may be helpful to note.

For our analysis, we assume government revenues are generated though the process of creating new income or spending it. Thus, we measure revenues associated with various types of income (employee compensation, proprietary income and corporate income) and spending (household expenditures and indirect business taxes). Both the federal and state/local governments gain revenue in this way. When totaling the impacts associated with reductions in activities closely allied with irrigated agriculture, we estimated the federal and state/local governments would loose approximately $7 million from the northwestern region, $2.5 million from the west central region, and $19 million from the southwestern region.

Discussion and Conclusions

In this research project, we reviewed information relating to the declining supply of underground water resources in the Ogallala Aquifer region of western Kansas. These resources currently support a highly productive irrigated crops production system which, in turn, provides the basis for a very valuable food processing industry. This crops-livestock-food processing system has in many ways helped several areas of western Kansas combat long-term trends toward the decline of Great Plains rural communities. Thus, it's hard to overstate what these resources have meant to the region.

We know, however, that current usage patterns will eventually lead to a situation where it will become economically infeasible to pump water for agricultural irrigation. The time frame wherein that will occur ranges from the relative near term to many, many years away, depending where in the region the activity is located. Nevertheless, there is considerable and justifiable concern for what it will mean to the region to lose access to this resource. This analysis attempted to provide general estimates of what the agricultural sector and irrigation in particular contribute to regional economic activity. Further, it attempted to provide preliminary estimates of what might happen should irrigated crop land be converted to a dryland cropping system.

Utilizing an economic accounting system of the region, we estimated that the overall agricultural sector is closely associated with about 40 percent of regional sales (gross regional product), about 30 percent of income generated through regional production and about 20 of total household income. By most standards, this is an extraordinary level of dependence on an industry sector. It might be better were the region more economically diverse, but such things aren't readily altered.

We analyzed a scenario where the incremental additional value of irrigated crops was removed from the economy. Such a scenario involved the simplifying assumption that all of the value was instantly lost. Measuring the impact, we estimated the loss to the economy to be about three percent in total regional sales, two percent of employment, and one percent of household income. This translates into about $500 million in total sales, 1,800 jobs, and over $100 million in regional income. These are permanent annual reductions.

These estimates may be considered conservative insofar as we did not take into consideration possible interactions with livestock production or food processing. It's certainly possible that as livestock feed availability declines, the cost of obtaining it increases, and the cost of producing meat animals increases. This could place the region at a relative competitive disadvantage with other crops/livestock-producing regions, and the level of processing activity could stagnate or decline. Such impacts, however, are only speculative given the scope of this analysis.

Certainly, the impacts we identified should not be interpreted as portending the demise of western Kansas communities. But, several things do become clear. The loss of water resources in western Kansas will have negative and continuing impacts to all sectors of the economy and the people who live there. It will have a lasting impact that's felt beyond the region in terms of the contributions the region makes to broader levels of government. This suggests the issue of declining water supplies needs to remain a core concern to the agricultural community, industry leaders, university researchers, and state and local policy makers.

Secondly, local leaders within the region need to continue efforts to diversify the local economic base. The substantial dependence on agriculture creates jeopardy, whether in the form of water access, disease, or even terrorism. Obviously, this point is not lost on local leaders and the solutions defy easy remedy. Still, leaders should maintain their sense of urgency in their efforts to foster new engines of regional economic growth.

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Table 1. 1997-2001 Average Annual Value of Production for Selected Commodities in Western Kansas, 2001$

County & District	Corn	Sorghum	Hay & Pasture	Soybean	Sunflower	Wheat
Cheyenne	9,820,580	217,358	1,987,894	581,154	1,655,272	11,737,478
Decatur	9,140,410	2,288,658	2,988,874	442,873	364,280	11,372,549
Graham	4,896,612	4,225,413	2,643,773	0	0	8,520,156
Norton	7,972,000	3,220,886	2,863,977	0	153,069	9,430,047
Rawlins	7,340,574	2,280,305	4,798,314	0	793,650	14,350,013
Sheridan	27,989,640	3,608,232	3,030,917	0	0	12,178,219
Sherman	23,789,353	1,002,926	2,368,010	1,326,966	4,323,669	16,747,363
Thomas	32,428,191	3,945,497	1,674,302	1,967,745	1,448,865	19,317,134
Other Counties[1]	0	1,851,414	0	1,496,809	681,557	0
Northwest	123,377,364	21,082,729	22,356,063	7,186,531	9,290,259	103,352,944
Gove	7,545,985	7,180,313	2,301,636	408,121	0	12,104,978
Greeley	2,783,092	2,189,751	621,681	0	241,855	15,727,063
Lane	2,929,254	5,142,899	526,043	396,659	207,313	11,794,372
Logan	5,751,333	3,481,452	1,075,139	0	326,989	11,158,285
Ness	873,751	4,795,048	2,433,853	0	161,806	13,148,601
Scott	11,560,736	10,032,684	787,350	357,667	107,650	14,974,926
Trego	1,969,453	4,099,466	2,602,662	0	0	9,887,040
Wallace	11,371,705	671,925	1,378,642	0	1,167,036	7,320,303
Wichita	11,148,120	6,134,923	1,933,146	0	468,792	14,514,907
Other Counties[1]	0	3,300,536	0	1,349,862	769,793	0
West Central	57,933,433	44,812,131	13,660,157	2,899,745	3,451,234	110,630,613
Clark	428,404	1,758,892	2,788,695	0	0	5,129,557
Finney	34,249,726	7,509,650	25,119,034	2,213,686	333,525	19,398,837
Ford	18,712,852	8,516,373	8,286,467	1,577,940	52,079	16,454,881
Grant	19,982,356	2,517,066	6,392,146	0	328,763	9,831,729
Gray	40,329,391	7,134,596	13,846,190	2,025,052	0	15,609,334
Hamilton	3,701,389	3,988,647	4,373,724	0	0	13,249,825
Haskell	51,388,290	2,329,235	2,556,758	1,347,035	360,170	12,412,063
Hodgeman	2,641,788	3,681,382	1,994,495	245,173	0	10,547,857
Kearny	17,359,871	3,110,230	13,934,175	297,429	51,320	11,076,483
Meade	30,721,190	3,273,107	3,265,103	1,678,420	25,941	8,562,809
Morton	6,481,157	3,762,358	1,493,816	0	73,655	8,864,593
Seward	20,425,099	2,736,613	7,066,217	1,004,251	28,937	5,634,804
Stanton	25,493,727	3,082,366	2,062,634	0	109,740	12,968,819
Stevens	39,393,494	5,479,105	6,245,217	316,448	273,546	9,242,740
Other Counties[1]	51,908,863	1,691,154	0	646,692	674,270	0
Southwest	311,357,565	60,596,941	99,424,687	13,312,727	2,631,488	158,984,375
Western KS	492,668,189	126,491,801	135,440,437	23,399,003	15,372,981	372,967,932

[1] Other counties includes values that had been suppressed from individual county totals.

Table 2. 1997-2001 Average Annual Increment of Additional Value and Share of Total Value of Production for Irrigated Crops in Western Kansas, 2001$

County & District	Corn		Sorghum		Soybean		Wheat	
	$	%	$	%	$	%	$	%
Cheyenne	5,458,876	55.6	44,556	20.5	435,966	75.0	126,125	1.1
Decatur	1,196,433	13.1	23,358	1.0	349,571	78.8	26,636	0.2
Graham	763,375	15.6	30,754	0.7	0	0.0	23,766	0.3
Norton	845,569	10.6	14,845	0.5	0	0.0	12,968	0.1
Rawlins	1,766,865	24.1	29,989	1.3	0	0.0	13,388	0.1
Sheridan	11,879,217	42.4	22,227	0.6	0	0.0	173,524	1.4
Sherman	13,027,269	54.8	78,294	7.8	1,112,720	83.9	839,003	5.0
Thomas	15,028,589	46.3	68,114	1.7	1,521,900	77.3	316,941	1.6
Other Counties	0	0.0	9,125	0.5	672,094	44.9	0	0.0
Northwest[1]	49,026,644	39.7	255,974	1.2	4,361,418	60.7	1,433,770	1.4
Gove	1,321,025	17.5	25,925	0.4	258,089	63.2	65,870	0.5
Greeley	2,143,572	37.1	78,774	3.6	0	0.0	339,766	2.2
Lane	1,131,299	38.6	102,742	2.0	310,218	78.2	153,339	1.3
Logan	1,840,516	32.0	42,528	1.2	0	0.0	51,973	0.5
Ness	247,781	28.4	44,655	0.9	0	0.0	49,549	0.4
Scott	4,187,959	36.2	95,940	1.0	288,694	80.7	285,823	1.9
Trego	239,670	12.2	12,921	0.3	0	0.0	17,118	0.2
Wallace	5,897,715	51.9	79,854	11.9	0	0.0	344,352	4.7
Wichita	5,500,731	54.2	238,389	3.9	0	0.0	995,120	6.6
Other Counties	0	0.0	22,635	0.7	609,108	45.1	0	0.0
West Central	21,427,520	37.0	840,030	1.9	1,910,099	65.9	2,446,879	2.2
Clark	235,906	55.1	35,190	2.0	0	0.0	57,112	1.1
Finney	20,882,260	61.0	482,134	6.4	1,954,270	88.3	1,880,962	9.7
Ford	10,721,524	57.3	517,481	6.1	1,378,122	87.3	216,841	1.3
Grant	12,922,242	64.7	797,818	22.7	0	0.0	1,782,702	18.1
Gray	25,698,832	63.7	402,813	5.6	1,805,926	89.2	964,868	6.2
Hamilton	1,792,905	48.4	139,823	3.5	0	0.0	65,826	0.5
Haskell	34,360,129	66.9	267,494	11.5	1,142,439	84.8	1,799,705	14.5
Hodgeman	1,374,435	52.0	237,055	6.4	210,250	85.8	372,202	3.5
Kearny	9,521,444	54.8	77,789	2.5	239,470	80.5	482,463	4.4
Meade	20,670,672	67.3	702,409	21.5	1,505,585	89.7	685,880	8.0
Morton	4,364,074	67.3	425,148	11.3	0	0.0	511,625	5.8
Seward	14,392,138	70.5	609,384	22.3	852,074	84.8	704,102	12.5
Stanton	17,497,935	68.6	390,800	12.7	0	0.0	1,082,646	8.3
Stevens	26,542,521	67.4	772,748	14.1	195,569	61.8	1,630,146	17.6
Other Counties	38,891,508	74.9	20,404	1.2	468,488	72.4	0	0.0
Southwest	202,161,209	64.9	5,593,143	9.2	8,819,920	66.3	11,689,927	7.4
Western KS	272,625,373	55.3	6,659,147	5.3	15,091,437	64.5	15,570,576	4.2

Table 3. Structure of the Western Kansas Economy, 2000$

Northwestern KS	Industry Sales (millions)	Employment (number)	Labor Income (millions)	Total Income (millions)
Agriculture	527.659	4,802	57.989	138.742
Mining	86.414	513	9.977	26.270
Construction	156.369	1,539	46.532	52.816
Manufacturing	110.513	601	15.628	21.628
TCPU	196.984	1,043	39.634	82.318
Trade	226.518	5,709	97.568	156.934
FIRE	207.342	1,342	33.633	141.570
Services	238.884	6,272	121.18	140.238
Government	169.249	5,078	124.919	143.796
Totals	1,918.955	27,008	547.863	903.341
West Central KS				
Agriculture	1,185.386	5,102	70.822	144.880
Mining	25.539	147	2.524	7.010
Construction	75.807	871	18.758	21.933
Manufacturing	77.640	357	9.906	14.271
TCPU	171.607	998	34.357	72.311
Trade	160.133	3,410	69.202	112.002
FIRE	143.812	898	22.265	98.597
Services	118.377	2,883	52.163	64.528
Government	115.236	3,772	85.252	96.959
Totals	2,073.618	18,606	366.510	632.580
Southwestern KS				
Agriculture	2,862.490	9,583	143.538	279.128
Mining	346.191	1,619	43.374	121.316
Construction	568.447	5,721	170.208	195.565
Manufacturing	5,106.713	14,385	475.014	601.067
TCPU	1,103.779	4,160	180.392	386.911
Trade	798.593	17,524	348.333	562.066
FIRE	639.094	3,778	104.006	440.715
Services	818.606	15,990	367.139	443.197
Government	529.080	15,082	414.214	473.757
Totals	12,769.623	88,425	2,251.053	3,500.371
Western KS Total	16,762.196	134,039	3,165.426	5,036.292

Table 4. Share of Total Economic Activity Associated with Industries and Household Income Groups by Region in 2000

	Northwest Kansas			West Central Kansas			Southwest Kansas		
Industry	**Total Sales**	**Total Income**	**Household Income**	**Total Sales**	**Total Income**	**Household Income**	**Total Sales**	**Total Income**	**Household Income**
Agriculture	40.2	30.5	17.2	42.9	26.5	18.7	40.9	30.6	19.4
Mining	5.2	4.3	2.4	0.4	0.3	0.2	0.5	0.6	0.3
Construction	12.1	10.9	7.6	2.4	2.4	2.1	8.6	10.0	7.4
Manufacturing	2.0	1.4	0.9	2.7	2.4	1.8	29.0	23.1	15.7
TCPU	6.5	6.4	3.7	4.8	4.7	3.6	2.4	3.0	1.8
Trade	2.0	2.8	1.7	3.8	4.3	3.2	1.0	2.0	1.3
FIRE	1.3	1.8	0.9	2.5	3.1	2.2	0.5	1.0	0.5
Services	1.5	1.8	1.3	4.3	5.5	4.0	1.1	1.8	1.4
Government	12.9	20.1	14.2	32.1	44.2	33.9	6.5	15.1	11.8
Subtotal	83.7	79.9	49.8	95.8	93.4	69.7	90.4	87.0	59.6
Households									
< $5k	1.6	2.0	4.6	0.3	0.5	2.2	0.8	1.1	3.2
$5-$10k	1.5	1.8	4.2	0.3	0.5	2.2	0.6	0.8	2.3
$10-$15k	3.3	4.0	9.5	0.8	1.2	5.2	1.9	2.5	7.1
$15-$20k	3.2	4.0	9.4	0.7	1.1	4.7	1.6	2.1	6.2
$20-$30k	2.9	3.6	8.9	0.7	1.1	5.0	1.8	2.5	7.4
$30-$40k	1.5	1.9	5.0	0.5	0.8	3.8	1.2	1.6	5.5
$40-$50k	1.2	1.4	4.1	0.4	0.6	3.2	0.9	1.2	4.2
$50-$70k	0.7	0.8	2.4	0.2	0.4	2.2	0.5	0.7	2.6
$70k+	0.5	0.6	2.0	0.2	0.3	1.9	0.4	0.5	2.1
Subtotal	16.3	20.1	50.2	4.2	6.6	30.3	9.6	13.0	40.5
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5. Estimated Direct and Indirect Annual Reductions in Regional Economic Activity Associated with Conversion to Dryland Agriculture (2003$)

	Total Sales	Employment	Labor Income	Total Income
Northwestern KS				
Agriculture	-59,645,596	-502	-5,614,306	-17,411,196
Mining	-672,069	-4	-70,670	-195,336
Construction	-810,126	-14	-471,394	-518,534
Manufacturing	-544,454	-4	-103,302	-141,517
TCPU	-3,117,548	-21	-759,429	-1,327,980
Trade	-5,715,134	-96	-2,411,378	-3,943,942
FIRE	-3,303,128	-26	-497,488	-2,250,457
Services	-2,302,139	-46	-1,042,941	-1,254,112
Government	-594,361	-4	-122,357	-187,147
Totals	-76,714,873	-710	-11,103,571	-27,240,360
West Central KS				
Agriculture	-29,171,796	-221	-2,006,545	-6,298,657
Mining	-172,611	-1	-17,056	-47,381
Construction	-163,139	-3	-83,891	-94,126
Manufacturing	-450,940	-3	-69,020	-97,620
TCPU	-1,720,436	-13	-420,990	-737,426
Trade	-2,077,792	-31	-876,360	-1,434,217
FIRE	-1,294,595	-9	-198,784	-882,868
Services	-764,894	-16	-323,373	-400,987
Government	-207,933	-1	-44,781	-59,057
Totals	-36,030,309	-299	-4,106,988	-10,058,525
Southwestern KS				
Agriculture	-249,395,456	-1,439	-11,800,743	-34,258,580
Mining	-3,294,845	-15	-411,960	-1,153,681
Construction	-3,113,061	-54	-1,765,392	-1,969,475
Manufacturing	-4,729,325	-28	-862,842	-1,201,050
TCPU	-14,856,527	-98	-3,756,733	-6,632,418
Trade	-18,809,006	-275	-7,945,459	-13,004,066
FIRE	-14,704,132	-99	-2,324,548	-10,138,093
Services	-9,605,984	-164	-4,165,541	-5,308,457
Government	-1,737,376	-10	-447,351	-634,436
Totals	-320,291,413	-775	-33,526,298	-74,345,985
Western Kansas	-433,036,595	-1,784	-48,736,857	-111,644,870

Table 6. Estimated Direct and Indirect Annual Reductions in Federal, State and Local Government Revenues Associated with Conversion to Dryland Agriculture (2003$)

	Employee Compensation	Proprietary Income	Household Expenditures	Enterprises (Corporations)	Indirect Business Taxes	Total
Northwestern KS						
Federal Government (Non-defense)	-696,425	-206,772	-955,691	-666,473	-1,294,783	-3,790,143
State/Local Government (Non-education)	-10,694	0	-284,734	-96,245	-2,831,209	-3,222,882
Totals	-707,150	-206,772	-1,210,425	-762,718	-4,125,995	-7,013,057
West Central KS						
Federal Government (Non-defense)	-264,966	-76,493	-363,939	-182,790	-489,356	-1,377,544
State/Local Government (Non-education)	-4,373	0	-111,347	-26,397	-1,006,952	-1,149,069
Totals	-269,351	-76,493	-475,286	-209,187	-1,496,308	-2,526,625
Southwestern KS						
Federal Government (Non-defense)	-2,556,482	-513,585	-2,983,106	-1,643,585	-3,310,536	-11,077,294
State/Local Government (Non-education)	-28,037	0	-909,717	-237,350	-6,932,942	-8,108,046
Totals	-2,584,625	-513,585	-3,892,823	-1,880,935	-10,243,478	-19,115,446
Western Kansas Totals	-3,561,126	-796,850	-5,578,534	-2,852,840	-15,865,781	-28,655,128