Do people leave when the wells go dry? An interdisciplinary model of environmental change and local development

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Over the 20th century the American Great Plains has experienced several boom and bust cycles influenced by ecological forces, the general social transformation of rural America and the process of global integration. During these changes, the High Plains Aquifer (Figure 1) remained the central natural resource of the region, providing water for irrigated corn (Figure 2) and value added agricultural industries, such as cattle feedlots and meat-processing. Nowhere in the Great Plains is this more true than in Southwest Kansas, where confined feedlots provide cattle for several of the world's largest meatpacking factories utilizing immigrant labor (Broadway and Stull, 2005). The story of Southwest Kansas highlights the significant differences in population trends based on the utilization of natural resources and the presence of hyperextractive local economies.

Figure 1. The High Plains Aquifer

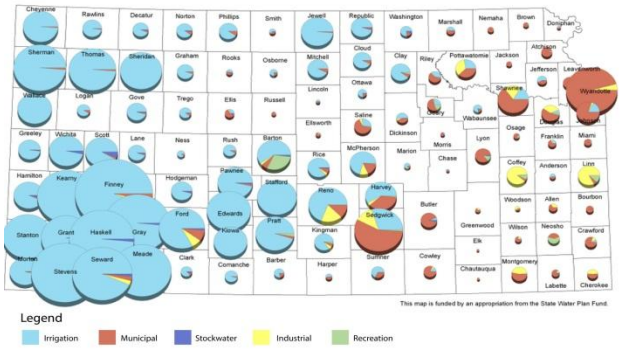

Figure 2. Water use in Kansas

This paper discusses the results from an interdisciplinary research project which investigated various scenarios of community development, natural resource use and their impact on population trends. What triggered this project was the fact that despite decades of economic boom, with minimal recharge, groundwater is a non-renewable resource. In certain regions there is less than twenty years of useable water left, signaling the end of demographic trends that have been very different from the general depopulation of the rural Great Plains.

Between 1900 and 2010, the population of Kansas increased from 1.5 to about 2.8 million people, growing approximately eight percent per decade. Historically, however, Kansas has experienced 5-10 percent less growth than the nation at any decade. In the 2000s, only nine of 105 Kansas counties saw population growth equal to or greater than the national growth rate. These were all urban (metropolitan) counties, and only three rural counties grew more than one percent between 2000 and

2010. Two-thirds of the Kansas counties had their population peak in 1930 or before (that is prior to the Great Depression), while one-third of them had experienced negative net migration in every decade since 1950.

There is a connection between rural depopulation and the dominance of large scale agriculture in the Great Plains, described by the theoretical construct of path dependence. Path dependence was first discussed by economists (David, 1985), but later it expanded to sociology, political science and geography (Mahoney 2000; Gartland 2005; Martin and Sunley 2006). From the perspective of regional development, path dependence is the spatial agglomeration of certain industries caused by an individual firm benefiting from locating near other firms in the same industry (Fujita and Thisse 2002). This leads to economic specialization, which can lock in a non-diversified development path. In Kansas, as well as elsewhere across the Great Plains, path dependence is manifested as agricultural dependence, which is closely connected to population decline.

The term agricultural dependence was described by Johnson and Rathge (2006) who argued that population decline in the Great Plains is connected to the fact that the region is one of the most productive agricultural land in the world, leading to dependence on agriculture with the relative lack of alternative employment possibilities. Thus, technological innovation resulting in higher food production with fewer farmers resulted in both continuous outmigration from the region and increasing population concentration in urban areas. Part of this trend can be attributed to the farm consolidation process where commercial farms account for an increasing share of agricultural sales and income. The "great agricultural transition" discussed by Lobao and Meyer (2001) captured the decline of family farming, as well as agribusiness concentration and the emergence of global commodity chains. This means that while farm consolidation typically results in increased production volume, it concurrently contributes to declining farm population, which in turn leads to declining demand for services, perpetuating the problems of the homogeneous labor structure (Rathge and Highman 1998).

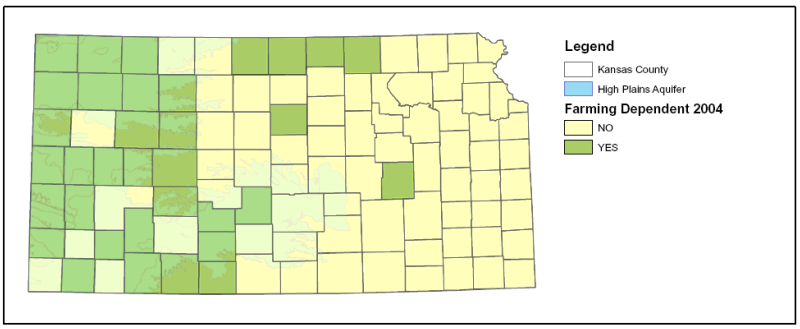

Figure 3. Farming dependent counties in Kansas

Farming dependent counties (those having 15% or more of the earnings coming from farming or 15% or more employed in farm occupations) in the Great Plains compared to the non-metropolitan US counties are significantly smaller in population (around 5,000 on average in 2000), and all had negative net migration between 1990 and 2000. Moreover, two-thirds of these counties are natural decrease counties as opposed to the 41 percent across rural America. In other words, farming dependent counties face significant problems with respect to community sustainability even when agricultural production is soaring.

Kansas has 34 farming dependent counties, mostly in Western Kansas, over the High Plains Aquifer (Figure 3). Occurring parallel with the emergence of farming dependence was the decline of farm population. In 1950, almost a quarter of the state's population (about 450,000 people) lived on farms. By 2000, this declined to 4 percent, or about 100,000 people. This change was also a textbook case of farm consolidation when the number of farms declined about 50%, while the average farm size doubled between 1950 and 2000.

While the idea of the Buffalo Commons (Popper and Popper 1987), a proposal to leave the landscape void of humans and return it to the buffalo, did grab public imagination and became a symptom of decline, it also oversimplified the heterogeneity of the Great Plains. Stephen White (1994) in the early 1990s pointed out that there are oases in the Ogallala desert, and groundwater availability can make a difference in local development trajectories. However, as the Poppers argued, the area's arid environment can only sustain certain types of land uses in the long-term. Development patterns that exceed the capacity of the land and water resource to sustain it or development patterns that cannot afford to import the necessary resources to sustain production are doomed to failure.

Irrigation in Kansas is highly dependent upon water from the High Plains Aquifer. While irrigation is only one component of the interlinked economies of the state, it is a good indicator of the natural resource base on which the different fortunes of places are built. The question though is what happens when the water runs out? Southwest Kansas places that have experienced significant changes in demographic trends are the same ones capitalizing on large remaining aquifer reserves. They are utilizing water for irrigation, livestock and meat processing at a much higher rate than other aquifer areas in Kansas. If the saturated thickness reaches the minimum threshold established via policy or energy prices climb high enough to significantly challenge profit margins, the economic structure based on water availability could lose its foundation.

In this sense, Southwest Kansas is sitting on a demographic time bomb. Because of the aquifer, these counties were able to avoid the general trend of rural depopulation, but such fortune, especially if built on a non-sustainable resource does not last forever. This study focuses on development scenarios that are connected to population predictions. It utilizes a unique interdisciplinary framework, in which separate models of various dynamic components of the big picture (such as groundwater, agronomy, economics and demography) are put together to make an experimental assessment of natural resource use and population trends. This paper discusses not only the scenarios and the results, but also the theoretical and methodological challenges of linking population models to environmental change, particularly in an interdisciplinary context.

References

Broadway, M. J. & Stull, D. D. (2005), 'Meat Processing and Garden City, KS: Boom and Bust', *Journal of Rural Studies* **22**, 55-66.

David, P. (1985), 'Clio and the Economics of QWERTY', *American Economic Review* **75**, 332-337.

Fujita, M., and J. Thisse. 2002. *Economics of agglomeration: Cities, industrial location, and regional growth*. Cambridge; New York and Melbourne: Cambridge University Press.

Gartland, M.P. 2005. "Interdisciplinary Views of Sub-optimal Outcomes: Path Dependence in the Social and Management Sciences." *Journal of Socio-Economics* 34:686-702.

Johnson, K. and R. Rathge. 2006. "Agriculture Dependence and Changing Population in the Great Plains." Pp. 197-218 in: *Population Change and Rural Society*, edited by W. Kandel and D. L. Brown. Dordrecht: Springer.

Lobao, L. and K. Meyer. 2001. "The Great Agricultural Transition: Crisis, Change and Social Consequences of Twentieth Century US Farming." *Annual Review of Sociology* 27:103-24.

Mahoney, James. 2000. "Path dependence in historical sociology." *Theory and Society* 29:507-48.

Martin, R., and P. Sunley. 2006. "Path Dependence and Regional Economic Evolution." *Journal of Economic Geography* 6:395-437.

Popper, D. E. and F. J. Popper. 1987. "The Great Plains: From Dust to Dust." *Planning* 53:12-18.

Rathge, R. and P. Highman. 1998. "Population Change in the Great Plains. A History of Prolonged Decline." *Rural Development Perspectives*, 13:1.

White, S. E. 1994. "Ogallala Oases: Water Use, Population Redistribution, and Policy Implications in the High Plains of Western Kansas, 1980-1990." *Annals of the Association of American Geographers* 84:29-45.