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## The U.S. Great Plains, Change, and Place Development

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# **The US Great Plains, Change, and Place Development**

Lisa M.B. Harrington

Our citizens being so prone to rambling, and extending themselves on the frontiers, will, through necessity, be constrained to limit their extent on the west to the borders of the Missouri and the Mississippi, while they leave the prairies, incapable of cultivation, to the...Aborigines of the country.

—Zebulon Pike, *Exploratory Travels through the Western Territories of North America*

Zebulon Pike considered the prairies and Great Plains region of the United States unsuitable for agriculture and a desirable natural barrier the spreading of the nation's Anglo-Americans too sparsely across the continent (Pike, 1811). His assessment proved incorrect, with settlement coming to the region in spite of the sometimes difficult environment, and in spite of Stephen Long's label of "The Great American Desert" broadly plastered over early maps (Long and James, 1823). Although there was a strong pull drawing settlers across the region to Oregon and California in the 1840s and 1850s, homestead claims only really began in the Plains states in early 1863,<sup>1</sup> shortly after passage of the Homestead Act of 1862. With the coming of the railways and promotional activity to settle the region, increasing numbers of settlers were attracted from other parts of the country, and from overseas.

Over the past century, residents of the Great Plains have made significant changes in agriculture and resource use. However, the region continues to be open and generally sparsely settled (Webb, 1931), and the basis of its economy has been agriculture ever since the arrival of American and European settlers. Although the region has continued to be agricultural in nature and dependent on natural resource use, neither agriculture nor communities remain static. Economy and agricultural production respond to stresses and opportunities, including changes in climate, resource availability, economic conditions, and government policy. This chapter presents the changing conditions of a subregion and a specific place embedded within the larger region (space) of the Great Plains. From a general overview of the Great Plains, through a discussion of a portion of its High Plains subregion, and ending with a specific Kansas community, the focus is on general economic and environmental conditions. While some places within the larger space of the North American Great Plains/prairie region may find the wherewithal to succeed in the longer term—by capitalizing on local features and local entrepreneurial strength—these are likely to be exceptional in a large and relatively sparsely populated region.

## **The Great Plains Region**

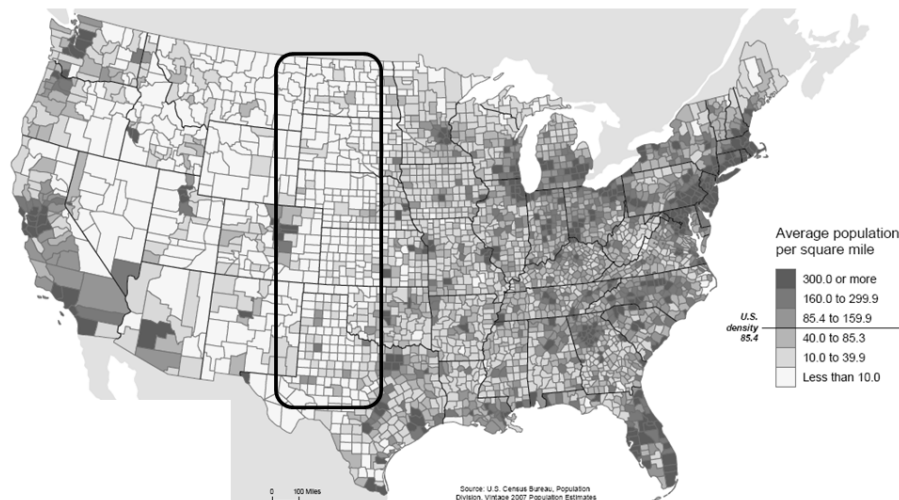
### **Environment and Population**

John Wesley Powell's report on the "arid lands" of the United States (1879), though focused on more western states, included western portions of the Great Plains. He noted that agriculture would be dependent on irrigation, and that this would require "the use of the large streams" (11). Large streams are a rarity across the Great Plains, and where streams cross state boundaries there is a high level of state-to-state competition for water resources (see Harrington and Harrington, 2005). The characteristic flow regime of many streams has been changed from perennial to ephemeral as a

result of withdrawals of alluvial groundwater for irrigation (Sophocleus and Wilson, 2000; Worster, 2004). The region is known for extremes in weather and a high level of interannual variability in precipitation (Kincer, 1923; Skaggs, 1978; Rosenberg, 1986).

Government policies, including homestead legislation, railroad grants, agricultural subsidies, and environmental programs, have played important roles in the settlement and use of the land of the Great Plains. Growth occurred during a period of boosterism, relatively small farms (given the Plains reality), and relatively high rainfall. However, much of the 20th century, continuing into the 21st, has been a period of adjustment to changes in the reality of technologically-based farming, expanding farm sizes, and diminished labour needs (Easterling *et al.*, 1993; Fitzgerald, 2003; Hart, 2003; Wishart, 2006).

In general, the region has fewer than ten people per square mile (Fig. 1), and many parts of the Great Plains achieved their population highs in the late 1800s to early 1900s. For example, the population of McHenry County, North Dakota, peaked at 17,627 people in 1910; there were 5,987 residents in 2000, and the county was estimated to have lost another 9.3% between 2000 and 2006 (US Census Bureau, 1995b, 2008b). Grant County, Nebraska, reached 1,486 for the 1920 census and recorded 747 in the 2000 census; the 2006 estimate was down to 660 (US Census Bureau, 1995a, 2008b). Some authors have found these population declines “disturbing” (Rathge and Highman, 1998), and the trend has led others to question the longterm viability of the Great Plains as a working landscape (Popper and Popper, 1987),<sup>2</sup> although others have seen it as simply an adjustment to reduced labour and household size requirements as farm and ranch sizes have increased (Hudson, 1996). As noted by Mather (1972), the most-travelled routes across the Plains states run east to west; the region lacks strong north-south connections. For most US residents, the Great Plains is seen as an area to fly over or drive across...as quickly as possible.



**Fig. 1.** Population density, July 2007 (US Census Bureau, 2007).  
The box indicates the general area of the US Great Plains.

Following the environmental and social disaster of the Dust Bowl in the 1930s, when drought and winds following on the heels of excessive land clearing caused extensive erosion and loss of income in a large part of the Great Plains, the federal government established the Soil Conservation Service (now the Natural Resources Conservation Service) and instituted an acquisition program for highly erodible land. In response to another major drought in the 1950s, Congress created the

Soil Bank, a temporary retirement program for farmland. At one point, about 5.7 million ha were set aside in the Great Plains (Laycock, 1988), but the program was ended due to costs (Bedenbaugh, 1988). With the 1985 Farm Bill (Food Security Act of 1985), Congress created another environmentally (and production) oriented means to temporarily retire land, the Conservation Reserve Program (CRP). The program provides payments to farmers who enroll eligible cropland with highly erodible soils. The CRP's key goals originally were soil conservation and reduced overproduction in the agricultural sector. Since 1985, protection of wildlife habitat also has been recognized as an important benefit and purpose of such resource protection, and there has been growing interest in the program's carbon sequestration potential. Some farmers have enrolled in the CRP in order to obtain more reliable income. There are concerns, however, that with upcoming contract expirations much of the land currently enrolled will be converted back to crop production, largely due to high commodity prices. With good crops and high prices, the average net farm income in Kansas in 2007 was \$115,035, as compared with \$46,593 in 2006, according to the Kansas Farm Management Association (*Topeka Capital-Journal*, 2008). Incomes were highest for irrigated crop operations, with an average of \$280,585; ranches did less well, with cattle ranching operations averaging a net income of \$23,633.

## **Livestock and Crops**

Large cattle operations, first free range and then ranch-based, were introduced after bison were cleared from the Great Plains through excessive sport and market hunting and the desire to remove the traditional livelihood of native peoples. Even in 1923, Kincer noted that the "drier portions of the region, considered from a climatic standpoint, are pre-eminently grazing areas, and must so remain until moisture is artificially supplied by irrigation" (80). Ranching activities, and dryland (unirrigated) agriculture based generally on winter wheat, continue to be the key agricultural activities where supplemental water is unavailable. Since about World War II, concentrated livestock raising in feedlots or feedyards has been established in a number of areas of the Great Plains, beginning in southwestern Kansas and northeastern Colorado. A vertically integrated agricultural economy serving national and international markets typifies parts of the region, although other areas have been described as a "buffalo commons." Where there is sufficient space, water for animals and for growing feed, and connections to rail and highway transportation, beef cattle feedlots have reached capacities in excess of 100,000 head. High-capacity packing plants are often found nearby.

Since the 1990s, some parts of the Plains states have seen growth in other types of concentrated animal feeding operations (CAFOs), with the appearance of large hog operations, especially with the establishment of a packing plant in the panhandle of Oklahoma (Hart and Mayda, 1997), and movement of dairy operations into southwestern Kansas, joining the beef CAFOs long established there. Milk cow numbers have increased, especially in eastern New Mexico and southwestern Kansas, but also in parts of the Texas and Oklahoma panhandles and southern Nebraska. These operations do not have the capacity of the beef CAFOs, but they add to the mix of agricultural activities and have been seen by some as opportunities for economic diversification. Large dairy operations are affected by both push and pull factors, with competition for land pushing the activity out of parts of California, for example. Stringent environmental controls provide a push from some parts of the country, and places with more accommodating controls contribute a pull in response. The Great Plains region also offers plenty of space and reduced likelihood of conflicts with neighbouring landowners.

Shifts in scale of production have been widely noted for the last half century, but other changes are also notable. In the High Plains, many adjustments have been made based on the availability of water, and can be seen in geographic shifts responding to drought, changing groundwater access, and government programs that may be used to augment income (such as the Conservation Reserve Program). Drought has been a periodic hazard for agricultural producers in the region (e.g., Rosenberg, 1986). There is considerable spatial variability in water resources, and areas that have had access to groundwater resources like the Ogallala-High Plains aquifer system are now seeing reduced water availability due to several decades of withdrawals greatly exceeding recharge rates, and due to high energy prices.<sup>3</sup> Crops and land cover have shifted in response to changes in water availability and enrollment in agricultural programs; CRP enrollment has offered some farmers an opportunity to stabilize income and has created situations where agricultural land use has changed as a result of federal policy and program availability. Researchers and policymakers must recognize and understand these changes and their implications for the vulnerability, resilience, and adaptive capacity of agricultural enterprises and rural communities in the face of environmental variability, including the potential effects of global climate change.

### **Evolution of the “Buffalo Commons”**

In 1987, Deborah and Frank Popper suggested that population decline in the Great Plains would lead to the creation of a vast re-naturalized area they referred to as the Buffalo Commons. They saw a bleak future for virtually all Plains communities:

It is hard to predict the future course of the Plains ordeal. The most likely possibility is a continuation of the gradual impoverishment and depopulation that in many places go back to the 1920s. A few of the more urban areas may pull out of their decline, especially if an energy boom returns. And a few cities—Lubbock and Cheyenne, for example—may hold steady as self-contained service providers. But the small towns in the surrounding countryside will empty, wither, and die. The rural Plains will be virtually deserted. (16)

This led to strong negative reactions from Great Plains residents (to put it mildly), who disparaged the Poppers for their lack of understanding of the region and its people. Indeed, the Poppers’ initial interpretation that land depopulation created unused land was wrong in some ways: although few people occupy large parts of the region, lack of occupancy does not mean lack of use. On the other hand, although the federal reacquisition and management of the area that the Poppers originally envisioned has not occurred, parts of the region have indeed reverted to buffalo (*Bison bison*) grazing.

By 1999, the Poppers noted that there were changes consistent with a Buffalo Commons “metaphor” for change in parts of the Great Plains. These included adoption of bison as livestock by ranchers, growth in membership in the National Bison Association, creation of the North American Bison Cooperative (for meat processing), and creation of the InterTribal Bison Cooperative to promote bison raising and the place of bison in Native American culture. Over the last 20 years, bison—and other native wildlife—also have received growing attention as a tourism resource (Popper and Popper, 2006; Kurlantzik, 2008). This holds promise as a contributing

economic activity for portions of the Great Plains, though it should be remembered that tourism can be highly sensitive to broader economic conditions. Beyond tourism benefits, the appeal of bison meat as a healthy alternative to beef and the desirability of an animal that is well adapted to regional environmental conditions also constitute reasons for shifts and hope for a reliable income source. According to a National Bison Association press release in 2007, bison meat sales saw double-digit increases in each of the previous three years, and expectations are for continued increases in production and sales. The release cited several reasons for expansion:

People have discovered that bison is a great tasting, healthy meat that is sustainably produced by North American ranchers...At the same time, our marketers have done a great job in developing a national distribution system that is bringing bison to foodservice and retail outlets across the country. And, smaller rancher-marketers have continued to develop a strong customer base among people looking for locally-raised food.

## **Energy**

Energy has played an important role in the economic and social development of the Great Plains. In the early days of settlement, energy development was beside the point: most power was provided by horses, mules, and oxen (based on locally grown feed) to work the fields and provide transportation, and by wind to pump water. However, as the nation industrialized and discovered the wonders of fossil fuels, first the petroleum of Texas was tapped, and then oil field development spread to states like Oklahoma and Kansas. Natural gas fields were developed later on. In many cases, derelict well pumps may be seen where the remaining oil is no longer of sufficient quantity to withdraw. In other areas, such as the Hugoton Field region running from the Texas panhandle into southwestern Kansas, natural gas resources have been depleted to the point where options like infilling (increasing well density) or forcing remaining gas toward the surface by adding other fluids are being employed.

Wind power has long been used at the farm scale for bringing water up from below, but only since the latter 1990s and early 2000s have large windfarms feeding into the national grid been developed in the Great Plains. Kansas has three wind energy projects of 100 MW capacity or more, all brought online since 2000, and another is planned for 2008 (American Wind Energy Association, 2008). Other Plains states have a variety of small to large wind facilities, with most dating after 1998. These can be meaningful in their energy provision to communities and in their economic benefits to farmers, who can receive about US\$2,000 per year for each wind tower.

A number of ethanol production plants have been built throughout the Great Plains. The same is true for much of the country, with corn serving as the feedstock of choice at the present time. The United States had record corn production in 2007, and 2008 saw the second highest corn acreage planted since 1946, with 87.3 million acres (down 7% from 2007) (National Agricultural Statistics Service, 2008). Feed grain prices are expected to remain high, which will continue to trouble livestock producers. Rising corn prices, driven by the ethanol boom from an average of US\$2.00 per bushel in January 2006 to US\$4.28 in January 2008 (Beaubien, 2008), also have had a negative effect on other crop production and on subsectors of agriculture.

Rising fuel prices—for gasoline and, especially, diesel—have created further problems for farmers and ranchers. Most farm equipment and trucks run on these fuels, so higher prices increase the cost of bringing in agricultural supplies and shipping out agricultural goods, as well as increasing farm household costs. Agrochemical costs also rise with petrochemical costs. In

addition, pumping groundwater requires energy use (very often fossil-fuel based), and more energy is required to lift water from increasing depths as groundwater resources are depleted.

### **The Southwestern Kansas High Plains**

The southwestern corner of Kansas is in the High Plains portion of the Great Plains region and has many of the more general regional characteristics described above. Because of its Dust Bowl location, repeated droughts, and changes made possible by use of the Ogallala-High Plains aquifer system, this area has long received particular attention from historians, sociologists, geographers, and others.

The Kansas High Plains and contiguous Oklahoma and Texas panhandle areas were in the core of the 1930s Dust Bowl region. The (highly variable) precipitation generally averages under 20 inches of rainfall annually. Additional major droughts occurred in the 1890s and the 1950s, with less extreme periods of drought at other times. In spite of the relatively difficult environment, this region has been thriving in recent years, unlike many other parts of the Great Plains. As noted by Powell (1879),

There are two considerations that make irrigation attractive to the agriculturist. Crops thus cultivated are not subject to the vicissitudes of rainfall; the farmer fears no droughts; his labors are seldom interrupted and his crops rarely injured by storms. This immunity from drought and storm renders agricultural operations much more certain than in regions of greater humidity. (11)

Early settlers and inhabitants up to the 1950s had to rely on the relatively rare surface water and on the storage and diversion structures that were built in conjunction with the major streams (Sherow, 1990), but eventually means were developed to tap into a vast underground water system (Kromm and White, 1992). Starting in the 1950s, but particularly from the 1960s through the 1980s, the use of water from the Ogallala-High Plains aquifers underwent tremendous expansion, and groundwater came to support a large area of irrigated agriculture (Fig. 2). This decreased the impact of drought on farming: there has been a reduced relationship between cropland harvested and drought with the expansion of irrigation. The southwestern corner of the state is dominated by agricultural land use, with 93% in rangeland or crop production (Harrington *et al.*, 2009). A cattle culture and an agriculture support base has, in turn, supported expansion of beef cattle feeding operations, large packing plants, and associated support activities—from irrigation equipment supply sales to manufacturing of boxes for the shipment of beef. Reliance on agriculture, particularly groundwater-supported agriculture, is high.

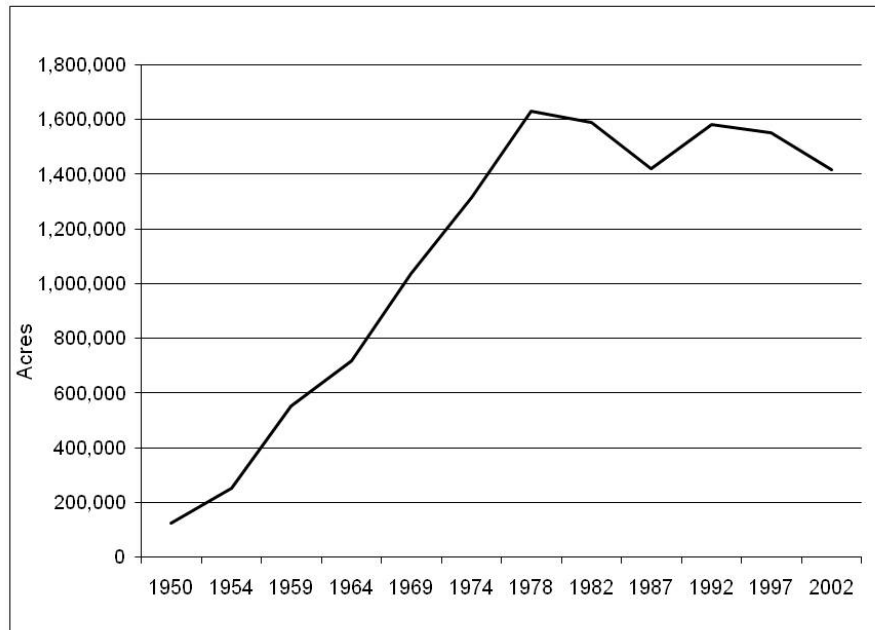


Fig. 2. Increase in irrigated land area, southwestern Kansas (19-county area) (US Census of Agriculture, various years; the irregular intervals are due to irregular census dates in earlier years).<sup>4</sup>

In western Kansas, many adjustments are driven by the availability of water, with agricultural shifts in response to drought, changing groundwater access, and government programs that may be used to augment income. For the western third of the state, where there is very little surface water, there has been great variability in access to water resources, particularly the Ogallala-High Plains aquifer system. Although irrigation has helped mitigate agricultural sensitivity to climate variability (Bloomquist, *et al.*, 2002, following on Bell, 1942), it may actually increase vulnerability in the long term (Dregne, 1980). As the groundwater resource upon which the region has become reliant is depleted, agriculture will be forced to change again in response to this stress (Harrington, 2005). In some parts of western Kansas, the loss of access to sufficient groundwater means irrigation is no longer economically viable. Previously irrigated fields have reverted to dryland agricultural use (Kettle *et al.*, 2007). For the 14 southwesternmost counties in the state, Leatherman *et al.* (2004) estimated that, should cropping shift to dryland (non-irrigated) only, there would be a total income loss of \$89 million (in 2003 dollars), with 2,178 jobs lost. This is in spite of increased production values for the dryland crops of sorghum, hay and pasture, and sunflowers. It should be noted, however, that much of the area is not now irrigated: range makes up 64.5% of all agricultural land for the 19-county region (60.4% of the total land area), and only 42% of cropland is irrigated (Harrington *et al.*, 2009).

Two wind farms, Spearville Wind Energy Facility (100.5 MW capacity) and Gray County Wind Farm (112.2 MW), are now located in southwestern Kansas. There are also ethanol production plants in western Kansas, and a large coal-fired power plant in the region. Although the power plant sits atop the Hugoton natural gas field, it relies on coal imported from Wyoming (Harrington and Kaktins, 1998).<sup>5</sup> Energy-related activities are important, but not key, to the economics of the area. With continued attention to renewable energy, the importance of these activities may increase; commercial wind power generation contributes to farm income and is thus linked to the already dominant agriculture of the region.



White (1994) noted that a few communities in western Kansas, particularly Garden City, Liberal, and Dodge City, were “gainers” in terms of population; these are the key trade centers in the area and have good access to groundwater resources. Gains have largely been linked to the immigration of Hispanics to work in packing plants, and an influx of Southeast Asian refugees in the 1970s/early 1980s (Broadway, 1994). Much of the rest of western Kansas has seen (and is seeing) population loss, with younger residents leaving and many of the older residents aging in place. Even Garden City, the largest community in southwestern Kansas, has experienced recent declines, from an estimated 1 July population of 28,547 in 2000 to 26,629 in 2007 (US Census Bureau, 2008a). Much of this loss can be attributed to the closing of a large beef packing plant following a fire in 2003.

The area’s current dependence on natural resources and agricultural production contributes to its potential economic vulnerability (Harrington, 2005). Irrigation use of the Ogallala-High Plains aquifer system is not sustainable; its management has been based on the concept of “managed depletion,” with the idea of extending the useful life of the resource, but not making it sustainable long into the future. Moves to prolong the use of the aquifer have been based on increasingly efficient irrigation technologies and crop changes. Residents of the region retain a sense of adaptability and resiliency to changing conditions. However, although farmers in southwestern Kansas and other parts of the Great Plains have been able to adapt to a highly variable climate system and overcome drought and other climatic hazards (Harrington *et al.*, 2009), uncertainties associated with climate change are on the horizon.

### **Disaster as Opportunity: Greensburg, Kansas**

Just one county to the east of the southwestern Kansas High Plains area described above, a small town has become a focal point for place development. Greensburg, the county seat of Kiowa County, is a typical Great Plains community. The Greensburg population is mostly white (97% white; less than 2% Hispanic) and declining (from 1,574 in 2000 to an estimated 1,452 in 2004). Estimates show a loss in county population, as well: from 3,255 in 2000 to 2,953 in 2007 (US Bureau of the Census, 2007).

In May 2007, Greensburg was hit by an EF-5 tornado (the most intense—and destructive—category). The tornado killed 11 people and destroyed virtually the entire town. The irony is that the disaster, while a tragedy, also brought the community tremendous attention—including multiple news stories and a 13-episode series on Discovery Communications’ Planet Green television network—and donations ranging in size from US\$5 (through the One Million \$5 Donations campaign) to much larger gifts and other support. The almost complete demolition of Greensburg also created an opportunity for “green” redevelopment. In the wake of the disaster, Governor Kathleen Sebelius declared, “We have the opportunity of having the greenest town in rural America” (Rothschild, 2007). Greensburg plans to build all city structures to the US Green Building Council Leadership in Energy and Environmental Design (LEED) Platinum standards (City of Greensburg, 2007). A nonprofit organization, Greensburg GreenTown, has been “established to provide the residents of Greensburg, Kansas with the resources, information and support they need to rebuild Greensburg as a model green community” (Greensburg GreenTown, 2008). A variety of businesses and organizations, from the GM dealership to the Baptist Church, are planning “green” buildings at some level. The city’s long-term recovery plan highlights “sustainable (green) development,” focusing on building programs and energy alternatives. It

appears that some residents who might otherwise have moved away have been energized to remain in Greensburg. President George W. Bush attended the May 2008 high school graduation in recognition of the disaster and recovery process.

Thousands of similar small communities have not received such attention (and do not have a “clean slate” on which to build more sustainable conditions), but could benefit greatly from assistance with transitioning to economic, social, and environmental sustainability. In the Greensburg case, it will be years before we know if this type of place-based development works in the long term. In the meantime, other communities of a variety of sizes throughout the region lack the resources to address development needs and are unlikely to be focal areas for economic growth; many of these communities will likely experience continued population decline.

### **Space, Sector, Place, and Economic Development**

In 2003, Governor Sebelius convened a Rural Life Task Force to address issues affecting rural parts of Kansas (Governor’s Rural Life Task Force, 2003). The task force report identified a number of concerns regarding social and economic sustainability in Kansas. Environmental connections were not addressed as part of the committee’s concerns, although these can be critical to local well-being. Although the task force was formed in recognition of the need to address issues in rural areas, no further action appears to have been taken. In a way, Greensburg may have become the “poster child,” and certainly the focal point, for rural development in Kansas.

With the exception of anomalous situations like that of Greensburg, and the few destination locales in the Plains (e.g., the scenic Black Hills/Rapid City area), it does not appear that “place” is apt to replace “sector” as the focus of economic strength in many parts of the Great Plains. Places are found within the vast space of the Plains and prairies, but are weakly differentiated and have characteristics that attract a small proportion of the general populace. There continue to be adjustments—largely reductions—in social services, school consolidations, and other changes associated with local decline. Key individuals can be important to development activities, but local leadership can be lacking in small communities, and progress can stop with the loss of a primary leader.

As illustrated elsewhere in this volume (e.g., Argent, Halseth, Markey, Vodden), development of rural places, specifically those not occupying urban fringe or near-fringe locales, is still highly contingent on natural resource use and connections to external markets. Both the space of the Great Plains and most of the places within the region remain closely linked to the agricultural sector. Demand for food will continue, and global as well as national markets create a reason for continued agricultural activity across the region. Although place matters, national policy development for the rural United States, including the Great Plains, is likely to continue to focus on general applications of policy to agricultural concerns, with other economic, social, and environmental concerns of secondary interest. With the exception of renewable energy development, there is little short-term opportunity for economic diversification or sector-independent development of place. In some parts of the Great Plains, multi-functionality of agricultural areas has been a possibility—generally in the form of farming, conservation, and recreation (Laingen, 2008)—but the entire region cannot rely on such possibilities for much economic or social betterment.

In addition to the social and economic stresses now being felt in the Great Plains, environmental stresses always loom; both may limit rural development. In addition to what Great Plains inhabitants have experienced as drought over the last century, there is evidence that prior droughts were more severe and of longer duration (Woodhouse and Overpeck, 1998; Sauchyn *et al.*, 2003). Climate change uncertainties contribute to what we *don’t* know about the stresses that

may affect Great Plains regional well-being in the future; a temperature increase is likely, as is a decrease in precipitation throughout the Plains (Intergovernmental Panel on Climate Change, 2007). Potential changes to seasonality of precipitation, greater severity and frequency of storms, potential evapotranspiration and crop stress, and variability within the larger climate pattern are possibilities.

In addressing the construction of rural place in a global economy, we need to consider the key questions for specific rural places. Beyond the economy, the key sustainability goals in rural areas and small towns need to be explored. We need to discover how local priorities are determined and how varying goals related to sense of place, economy, environment, and social connections are to be balanced against each other. How are environmental goods and services (natural capital) balanced against other interests (social, financial, human, and built capital)? How are the societal benefits and costs of rural services balanced? Local rural places often provide goods and environmental services or benefits for populations beyond their own inhabitants, but the equitability of costs and benefits may be questioned. All these themes will be vital in the global economy and the pursuit of a sustainability transition (National Research Council, Board on Sustainable Development, 1999).

## **Acknowledgment**

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## **Notes**

<sup>1</sup> In this chapter, the term “Great Plains states” encompasses North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma. The eastern portions of these states are not properly included in the Great Plains, but much of their identities are tied to the Plains. General statements about the Great Plains would apply to the eastern Rocky Mountain states (Montana, Wyoming, Colorado, and New Mexico), as well.

<sup>2</sup> See US Census Bureau (2007); the map showing population change between April 2000 and July 2007, for example, indicates population decline on a large proportion of the Great Plains. This follows the long-term trends in the region.

<sup>3</sup> As depth to groundwater increases, the energy requirement to pump it to the surface increases. Overall costs to acquire water are then exacerbated by rising energy prices, in combination with greater energy needs.

<sup>4</sup>The counties included are: Clark, Finney, Ford, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Lane, Meade, Morton, Ness, Scott, Seward, Stanton, Stevens, and Wichita.

<sup>5</sup> In 2008, a proposal to greatly expand coal-fired energy production in western Kansas became a focus of contention between supporters of coal expansion and environmental interests. Although state legislators attempted to override the Kansas Secretary of Health and the Environment, who denied a permit based on air quality and carbon dioxide (climate change) concerns (Tollefson, 2007), the Governor’s veto held.

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