REGULATING THE OGALLALA: PARADOX AND AMBIGUITY IN WESTERN KANSAS

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ABSTRACT

Purpose – *To illuminate the underlying logic of western Kansas farmers' decisions to irrigate at unsustainable rates and the state's regulatory policies and practices that enable depletion of the Ogallala aquifer.*

Methodology/approach – *Ethnographic interviewing of 39 western Kansas farmers, state water management personnel, and archival research.*

Findings – *Farmers occupy an ambiguous position as petty capitalists who focus attention on their own farms with seasonal planning horizons, and they hold a view of "good stewardship" that melds economic and noneconomic considerations, and that provides a rationale for unsustainable irrigation practices. The state resolves the contradiction between the finite groundwater resource and ideological commitments to economic growth by devolving responsibility for water management to groundwater users.*

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Research limitations/implications – *While the small sample size is likely to be representative of the larger pool of irrigators, further research with other farmers representative of the region will be necessary to verify findings.*

Social implications – *Depletion of the Ogallala aquifer contributes to farm consolidation and community decline, and the ecological costs will leave future farmers and remaining communities without the benefits of groundwater. Western Kansas will likely have to revert to a system of dryland farming.*

Keywords: Regulation; Ogallala Aquifer; irrigation; agriculture; groundwater

INTRODUCTION

Western Kansas receives on average a meager 17 inches of precipitation per year to cool and moisten its dry soils. Despite the semi-arid climate, the region is a highly productive agricultural area, thanks to irrigation from the Ogallala Aquifer. Irrigated agriculture and its related industries are a major component of the national food system and local economies. Kansas ranks first in the nation for irrigated wheat and third for corn, much of the latter of which is used for ethanol production and cattle feed (Kansas Department of Agriculture, 2014). Corn consumes most of the groundwater pumped from the Ogallala, so it plays a key role in aquifer depletion, a serious problem that exists despite state regulation that limits farmers' withdrawals.

The state of Kansas stepped in to regulate pumping in 1945. It did so to reduce social conflicts over water, and to protect public and private interests dependent on groundwater from individuals' pursuit of profit (Peck, 1995, p. 740). The questions we ask in this chapter are these: if state intervention to regulate irrigation is a response to market forces destructive of society and nature, why does intervention fail to prevent aquifer depletion? Why do farmers knowingly drawdown the aquifer whose availability will be no less crucial to future production and farm viability? How are we to understand the relationship between economy and society in the 21st-century advanced-capitalist Kansas, and the limits of governance to defend market societies and ecosystems from the pernicious effects of self-interested decision-making? To answer these questions, we review the history of groundwater regulation in Kansas and consider how policies relate to the state's regulatory practices. We then develop a case study of western Kansas farmers' decisions to plant corn, the crop to which both the largest number of acres and the most groundwater are devoted.

By setting farmers' production practices in the context of state regulatory practices, we show the convergence that assures aquifer depletion and associated environmental and social harms. Then, drawing from farmers' views of proper farming, we show how they make sense of decisions to irrigate unsustainably and deplete the aquifer. We find that farmers' social obligations and awareness of limited groundwater contradict, but are overcome by short-run economic imperatives to stay in business. These conditions produce farmers' ambiguous status as petty capitalists and create ambivalence about decisions that may compromise the future of their farms, but that ambivalence, expressed in particular notions of stewardship, is insufficient to overcome the economic influences on their irrigation decisions. In the face of aquifer depletion, the regulatory state provides some farmers a ready scapegoat, and technological fundamentalism the promise of a solution. We further argue that the state, too, holds an ambiguous position between its obligations to society and ideological commitments to economic growth as the latter yield benefits in power and wealth to political and economic elites. Regulatory policies authorize defense of the interests of society and environment, but regulatory practices reveal there are no effective advocates for the preservation of the Ogallala. Indeed, the loudest voices are those of the beneficiaries and proponents of a laissez faire approach. The resulting deadlock between local claims on groundwater, and the state's reluctant and minimal regulation, advances aquifer depletion for which some western Kansas farmers plan, and to which others have already had to adjust.

METHODS

We based this chapter on research performed as part of the Kansas National Science Foundation's Experimental Program to Stimulate Competitive Research (NSF EPSCoR). We are part of a team whose purpose is to study farmers' decision-making under conditions of climate change and expansion of the biofuel industry in the state of Kansas. An interdisciplinary team of seven researchers (including the authors) from the University of Kansas and Kansas State University interviewed 151 farmers who were selected to match the characteristics of some 2,000 farmers surveyed across the state in 2011. Following a semi-structured interview protocol, the interviews lasted from 45 minutes to 6 hours, with an average estimated time of 2.5 hours. Of the 151 interviews, 149 were recorded, transcribed, and coded using NVivo software. Of these farmers, 39 live in western Kansas, the area west of the 100th meridian.

Our western Kansas sample is made up of farmers who live in the most arid part of the state where they, unlike their counterparts to the east, experience an arid climate and groundwater depletion first hand. Although individual farmers vary in financial and farm profiles, indicated below, agriculture in this region is remarkably homogeneous in crop choices and production practices, making the sample of 39, despite its limited size, a good representation of the larger group.

The vast majority of the farmers in our sample were white males, consistent with the general profile of Kansas farmers. Their educational attainment ranged from completion of the eighth grade to some Ph.D. coursework. The average age of the farmers in our sample was 60 years, ranging from 22 to 85, and they averaged 35 years of farming experience, ranging from 2 to 64 years. The average age of Kansas farmers is 58 (Kansas Department of Agriculture, 2015). As a group, western Kansas farmers have the same amount of farming experience, but are about two years older on average than their central and eastern Kansas counterparts. Western Kansas farmers most commonly grow corn, grain sorghum, soybeans, wheat, and alfalfa and have an average farm size of 2,232 acres, triple the state mean. The farmers in our western Kansas sample were all men, although it should be noted that women play important roles on farms, in, for example, occasionally carrying out field operations as well as budget management and record-keeping.

THE OGALLALA: ECONOMIC, ENVIRONMENTAL, AND SOCIAL SIGNIFICANCE

The Ogallala Aquifer is an underground deposit of water-saturated soils and rocks underlying 174,000 square miles of eight states – Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. It was created by alluvial deposits from the Rocky Mountains millions of years ago and was known as early as 1854 (Kromm & White, 1992, p. xiii). Yet before World War II, agriculture in Kansas, particularly the western portion, was precarious. Droughts in the 1860s (Prentis & Race, 1909, p. 130) and 1880s (Miner, 2002, p. 148, 171) severely damaged the agricultural economy of the state. In the 1910s and early 1920s, Kansas weather moderated and agricultural endeavors met with more success. By the turn of the century, Kansas was a leader in the production of corn and wheat (Miner, 2002, p. 140; Prentis & Race, 1909, pp. 235–236). Unfortunately, this bonanza was short-lived and the dual disasters of the Dust Bowl and the Great Depression crushed Kansas agriculture under their heels. The hardest hit area of Kansas was the western part of the state, particularly the southwest corner (Worster, 1979, p. 36). Kansas lost about 80,000 people to outmigration during this time and once prosperous communities became shells of their former selves (Bader, 1988, p. 72).

The few streams and rivers in western Kansas contained too little water for widespread irrigation, and early hand-dug wells and windmill pumps produced so little water that the USGS originally believed irrigation held little promise for the region (Johnson, 1901). The fortunes of western Kansas would change after World War II, however, with improvements in engine, pump, and drilling technology that allowed farmers to access the Ogallala Aquifer for extensive crop irrigation (Hornbeck & Keskin, 2014; Opie, 1993, pp. 133–134). The land began to blossom with people, livestock, and crops, and the success of these early irrigators attracted more people to the region where Ogallala water flowed freely. Some people believed the supply was inexhaustible (Green, 1973).

It was not long, however, before the promise of unlimited water faded. The aquifer recharges very slowly – less than one inch per year on average due to high evapotranspiration, low infiltration rates of surface water, and because rainfall is mostly captured by crops – and withdrawal rates quickly exceeded recharge rates (Buchanan, Buddemeier, & Wilson, 2009; Hornbeck & Keskin, 2014). The U.S. Geological Survey estimates that farmers quintupled withdrawals between 1949 and 1974 (Hornbeck & Keskin, 2014, p. 193). The aquifer is depleted by 30%, with another 39% projected loss over the next 50 years at current rates of extraction (Steward et al., 2013). Today, 90% of the water from the Ogallala goes to irrigation agriculture with the balance used by industry, municipalities, and households (White, 1994, p. 31).

Rural society is affected by irrigation and aquifer depletion. While the earliest applications of groundwater were used to intensify production on existing acreage, the success of irrigation encouraged farmers to increase the size of their holdings (Hornbeck & Keskin, 2014). Land concentration, requiring that some farms fail and acquisition of large-scale, labor-saving equipment, contributes to population decline in western Kansas. Contributors to rural structural change are many and complex, and community decline has its own consequences (Gibson and Gray, forthcoming).

Among the causes of both farm consolidation and community decline are rising costs of production, farmers' declining share of consumer food purchases (Canning, 2011, p. 10), farm debt, and a history of policy incentives that reward economies of scale. As fewer farmers and their families remain in the countryside, schools, post offices, banks, and other businesses close their doors, and families move away, unable to find work or educate their children.

The Ogallala Aquifer also contributes to streamflow and is the main source for household drinking water (Evans, 2008). Especially in drought years, groundwater is an important source of water to the Cimarron, Upper Kansas, and Smoky Hill-Saline basins that have seen historically low flows in recent years (Kansas Water Office, 2009b, p. 6). Flow rates relate not only to aquifer contributions but also to runoff, a major source of contamination of surface water by pesticides and other toxins. Exhaustion and contamination of fresh water resources makes groundwater even more important for future generations.

Irrigation can also reduce soil fertility through salinization when source water is salty, and floodwater irrigation, still practiced by a few farmers, can cause erosion. While reductions in soil fertility can usually be addressed with fertilizers and other amendments, no substitutes exist for soil that is washed away, and nothing can replace water in the production of crops and livestock. Whether or not water withdrawals are reduced to sustainable levels, farmers in many areas face the prospect of returning to dryland farming. They will do so at current depletion rates when pumping becomes increasingly expensive as water levels drop; at sustainable rates, pumping will have been reduced by 80%, and crop production would suffer accordingly (Steward et al., 2013, p. E3480).

Precipitation in western Kansas is sufficient to grow only grain sorghum and wheat profitably without irrigation, but dryland yields are lower, has wider variability than irrigated crops, and crop failures are more common (Rogers, Alam, & Shaw, 2008). A dryland farmer near Ulysses, Kansas harvested only five bushels of wheat per acre in the several drought years before and during our study. This was well below the average unirrigated yield of about 30 bushels per acre in this farmer's county (United States Department of Agriculture, 2012). Although this farmer had crop insurance, several successive years of failure will still lead to the farm's demise. As the farmer worried in 2014, "Eventually, I am going to have to cut a crop, or else."

Although western Kansas has a history of growing dryland corn, dryland yields do not offer a sufficient return in the modern economic environment. In the drought of 2012, irrigated corn in the region yielded over 175 bushels per acre, while dryland corn yielded about 10% of that harvest (United States Department of Agriculture, 2012). Even in normal years, typical dryland yields for corn are about half of those of irrigated crops (United States Department of Agriculture, 2011).

THE CORN ECONOMY

> The gas industry comes out here and mines gas, and they produce it as fast as they can. They try to suck it out and do everything they can to get the most economic yield out of it. And for us as farmers to think we're any different, we're not. I mean, we do the most economical thing. If I've got enough water to grow corn, that's what I'm going to do because it's the most economical crop. I see some real value. There's some money going around now.

Although western Kansas farmers irrigate other crops, the lion's share of groundwater is devoted to corn, and this southwest farmers' view is not uncommon. Where outside observers may see a dry well as a tragedy to be avoided, he equates a dry well with a played-out oil deposit, an acceptable consequence of pursuing the greatest economic return.

In 2012, western Kansas farmers used over three times more water for corn than they did for alfalfa, sorghum, soybeans, and wheat combined (Kansas Department of Agriculture, 2012). This difference is a function in part of the greater number of acres planted to corn – almost three times the other irrigated crops combined – but it is also due to corn's high water demands which can be double those of grain sorghum and wheat. There are several important reasons for this pattern. Irrigated corn has the highest potential yield per acre of the major grain crops grown in Kansas (Perry, 2006). In addition, genetic engineers have made corn varieties that are resistant to weed killers and which produce their own insecticides.[1] These changes have made corn one of the most successful crops. The second important reason for emphasis on irrigated corn production is the price. The demand for corn in the cattle feedlots of the region has kept the price high relative to other crops (Steward et al., 2013, p. E3478), and the growing ethanol industry has also begun to boost demand for corn as a readily available energy feedstock. Beginning in 2005, several pieces of energy legislation mandated the increased use of renewable fuels (Langpap & Wu, 2011). While other factors were involved, the demand for corn after the ethanol mandate increased the price four-fold (Wang, Fan, Liu, & Dharmasena, 2016), from a little over $2 per bushel in 2005 to almost

$8 at various points in subsequent years (FarmDoc, 2016). Commodity prices can be volatile, and in early 2016, corn had fallen to below $4 per bushel, a level at which farmers begin to worry about their ability to pay the costs of business. When corn prices are high, however, farmers take advantage of opportunities to expand production. One corn farmer, who pays the costs of land rental as well as pumping costs, summed it up:

> Now it's profitable to farm irrigated rented ground because the prices have changed and the varieties are better. You can raise 250-bushel irrigated corn pretty regularly now where 20 years ago that was very unusual to raise that good of corn.

The advantageous characteristics of corn for western Kansas farmers make it almost blasphemous to speak against it. Farmers' statements may begin, "I'll probably get in trouble for saying this," or "I shouldn't be saying this, but …." Corn farmers understand the cost to the aquifer, but they politely ignore or disagree with detractors. However, the decision to grow irrigated corn for the highest yields is not always automatic, even considering the advantages. The characteristics of farmers' wells play a role in the decision-making process.

Although the state limits the amount of water a farmer may withdraw in a year (a typical limit is 2-acre-feet, or 651,702 gallons per acre), fewer and fewer wells can produce this quantity during the growing season. A well that produces 400 gallons per minute[2] to irrigate a 125-acre crop circle would need 141 days to pump the total allotment. Farmers who run wells that produce less than a corn crop needs may decide to switch crops:

> Some of the lower quality wells, maybe grains or milo[3], is a better alternative than corn. Wheat is a better alternative for very low volume wells. You can get some good out of that. So I guess you manage the quantity by crop selection and by yield goals.

When this farmer mentioned well quality, he was not talking about the characteristics of the water itself, but the productivity of the well. And to demonstrate that the decision to grow irrigated corn is complicated by multiple factors such as the price of inputs, pump engine fuel, and the anticipated price of the crop, he added:

> I mean, you may have to decide that, yes, I can pump enough water to get 200, 220 bushels of corn, but the economics and the water use works out better if I decide that 160 or 180 bushel of corn is where I should be in planting population[4] and fertilizer according to that kind of a goal.

A consequence for farmers who choose to plant water-intensive corn is increased vulnerability to drought, a problem increasingly common to the region with the effects of climate change (Hornbeck & Keskin, 2014). This was evident during our interviews in the intense drought years of 2011 and 2012, when even irrigated corn failed.

These droughts reflect the hotter and drier weather predicted by climate change, and they place an even greater burden on the aquifer (Shafer et al., 2014).[5]

The farmers we interviewed are aware that the Ogallala Aquifer is declining and that their decision to grow irrigated corn reduces its useful life. Many also recognize that the end of corn production will necessitate a tremendous and painful restructuring of the western Kansas economy:

> The Ogallala is being depleted at such a tremendous rate that irrigation's going to be a thing of the past, and if irrigation goes, the plentiful grain supply's going to go out here for particularly feed grain, and when that goes the feed yards go, and when the feed yards go, the packing plants will go, and when the packing plants go, most of the immigrants are all going to be gone. It's going to be a snowball effect.

Groundwater is the bedrock on which much of western Kansas economy and society are built. Yet recognition of the shared social and structural impacts of aquifer depletion sits in stark contrast to the way farmers relate to the Ogallala. Individual farmers own water rights, wells, pump engines, and a private network of pipes and sprinklers to deliver water to their fields. There is no common infrastructure nor collective ownership nor shared decision-making as in other cases investigated by anthropologists (Barnes, 2014; Geertz, 1972; Lansing, 1991; Rodríguez, 2006). Unlike water flowing through communally owned irrigation canals or pipelines, Kansas groundwater is largely invisible and unevenly distributed, and, as we discuss later, access to it is held as a private property right. Geertz observed (1972) that irrigation systems reflect the cultures from which they arise. The irrigation systems in western Kansas follow this rule: they are individually and privately owned, consistent with a culture built around private property rights, but because groundwater is held in trust by the state of Kansas, irrigation is also subject to state regulation.

THE STATE STEPS IN

The state of Kansas has created a large and complex bureaucracy to implement and uphold the laws that define surface and groundwater management. Yet, regulatory rules and practices can best be described as minimal and reluctant. Both past and present regulations concentrate on managing conflicts between current users of Ogallala water, setting aside concerns for its availability to future users.

Regulatory Infrastructure

Before the Water Appropriation Act of 1945 first gave the state of Kansas authority to regulate groundwater, the state followed the "absolute ownership" doctrine passed in the 1800s. This doctrine allowed farmers to pump water from their own land and use it as they saw fit, without regard to neighbors' water needs. Rights were neither quantified nor recorded, and conflicts were settled in courts that upheld the common law view that "underground waters are part of the real property in which they are situated" (cited in Peck, 1995, p. 739). Following a court ruling that the state's chief engineer had no authority to allocate water, then Governor Schoeppel commissioned a study of water laws in Kansas and other states. The report noted that water uses since statehood had shifted from navigation and waterpower (which required uninterrupted streamflow), to irrigation, municipal, and industrial uses. And it pointed to other states that had already come to rely on administrative agencies to oversee water uses under rules of prior appropriation. These rules hold that the first farmer to acquire a water right, a "senior" right, has priority over neighbors with "junior" rights, those whose rights were acquired later. In short, junior water rights holders may not reduce the availability of water to those with senior water rights (Peck, 1995, p. 740). The report concluded with legislative recommendations that became the Water Appropriation Act of 1945 (Peck, Rolfs, Ramsey, & Pitts, 1988).

The purpose of the Water Appropriation Act is to "conserve, protect, control and regulate the use, development, diversion and appropriation of water for beneficial and public purposes, and to prevent waste and unreasonable use of water" (HB 322, Kansas Legislature).[6] With subsequent amendments, the act created the state's complex institutional framework for regulating groundwater. Ultimate authority rests with the governor and state legislature to make water laws, and with the state's chief engineer to oversee water rights. The Kansas Water Office (KWO), created in 1981 as the state's policy development and planning agency, provides research and staff support to the governor and legislature regarding water resources. It develops and implements the Kansas Water Plan "to coordinate the management, conservation, and development of the state's water resources" (Kansas Water Office, 2009a, p. 2).

Groundwater management flowed exclusively from the top until 1972 when the state legislature passed the Groundwater Management District Act. This law created local boards of directors made up of water rights holders from each of the counties encompassed by the five groundwater management districts (Fig. 1). Groundwater management districts (GMDs) provide water-use administration, management plans, and information to identify research and regulatory needs within their boundaries (Kansas Geological Survey, 2013). They may exercise eminent domain, require metering, and levy water-user charges. However, they should not be understood as conservation bodies. Their role is to manage the use of the aquifer based on the wishes of their constituents and in accordance with state regulations.

The chief engineer, whose position is situated within the Department of Agriculture, Division of Water Resources (DWR), is authorized to oversee the GMDs. He approves or denies applications for water appropriation, determines the amount of water appropriation allowable consistent with public interest, authorizes construction of diversion works, confirms that permits are perfected in accordance with use permits, requires measuring devices to record withdrawals, and receives annual reports of water use by all permit holders. The chief engineer may also require conservation plans

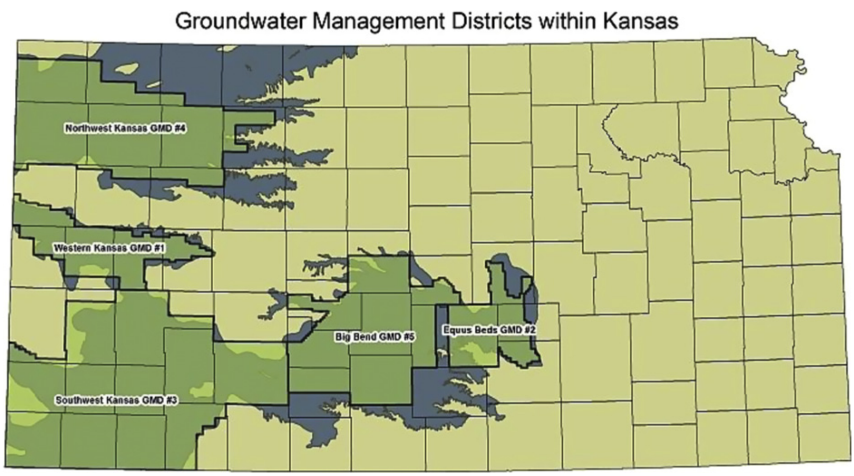

Fig. 1. The Extent of the Ogallala Aquifer Is the Shaded Area Outside of the GMD Boundaries. *Source*: Kansas Geological Survey, High Plains Aquifer Atlas (2016).

and practices that assure public benefit and promote public interest, terminate water rights under specified conditions, and exact civil penalties for violations of Kansas water law.

REGULATORY PRACTICE

Farmers may buy, sell, or otherwise transfer water rights that are acquired by application to the chief engineer. A water right is a "real property" right (Peck et al., 1988, p. 22), though the water itself belongs to the state to be allocated for the benefit of Kansas residents (Kansas Water Office, 2009b, p. 1). Water rights appropriate a maximum annual quantity of water that can be pumped at a maximum flow rate, to be used for purposes authorized by the chief engineer in an authorized location and from an authorized point or points of diversion (Peck et al., 1988, p. 22). A permit may be granted for withdrawal "for beneficial use of that water, without waste, if that use does not cause impairment of an existing, more senior water right and does not unreasonably affect the public interest" (Kansas Water Office, 2009b, p. 1).

Ogallala management, indeed all surface and groundwater management for the state, must serve the public interest, defined as water use that produces "the highest public benefit and maximum economical development" (K.S.A. 82a-711). But in 2004, "sustainable yield management" became part of the Kansas Water Plan with the goal to set development and use criteria within defined hydrologic systems to ensure long-term stability. These contradictory goals were resolved for the Ogallala by excluding it from the set of hydrologic systems to which sustainable yield management applies. Instead, the state hopes to "reduce water level decline rates" in the aquifer (*ibid.*). The plan defines a vision for the Ogallala: to have "sufficient water resources in western Kansas to support healthy, economically strong communities and rural lifestyles, today and for future generations" (*ibid.*). The stated goal is to "conserve and extend the life of the Ogallala," an extraordinary challenge in light of the aquifer's exclusion from sustainable yield management and the plan's acknowledgment that in most locations, annual withdrawals far exceed recharge (*ibid.*).

Because the governor and large majority of state legislators in Kansas support putatively free and unregulated markets, and western Kansas agriculture contributes significantly to the state's GDP, the state prefers voluntary approaches to conservation wherever possible (Kansas Water Office, 2009b, pp. 2–3). One initiative advanced by the KWO is voluntary reductions in water use within what is termed a local enhanced management area, or LEMA. A LEMA is a geographic area in which the water users vote, with approval by the chief engineer, to restrict their water use by a certain amount. To date, farmers in only a small section of Sheridan County, located in the northwestern part of the state, have approved a LEMA. The LEMA encompasses less than 99 square miles and contains 185 irrigation wells and 10 non-irrigation wells out of 950 total irrigation wells in the county (Kansas Geological Survey, 2016; Sheridan 6 Advisory Committee, 2014). LEMA members agreed to five years of restricted water use, a period that will end in 2017. It remains to be seen whether or not members will agree to its renewal.

An effort to create a GMD-wide LEMA in the central part of western Kansas failed when the vote did not win the required two-thirds supermajority (Bickel, 2014). In the neighboring GMD to the south, farmers as well as the board president of the GMD said the idea is a "non-starter." One of the objections to the proposed LEMA is its relatively small geographic area, leading farmers to worry that their sacrifice will benefit non-participating neighbors more than themselves. The LEMA has little chance of passing until other options or alternative supplies are exhausted.

One such alternative was the trans-Kansas aqueduct, an expensive, ambitious project revived from a shelved 1982 proposal (Helmke, 2014). The project would take water from the Missouri River in the northeast corner of Kansas and deliver it some 360 miles to irrigators in the southwest corner. Despite opposition by at least one of the state's four federally recognized American Indian tribes, and Missouri Governor Jay Nixon's admonition that Kansas should "back off," the project was studied by the KWO and U.S. Army Corps of Engineers, and it was included in Governor Sam Brownback's 50-year water plan (Kansas Water Office, 2015, p. 43). However, the $18 billion cost of the project, the anticipated political battles with neighboring states, and the eminent domain issues inside of Kanas proved to be too much to overcome (Unruh, 2015). The project has been shelved once more.

Neither such pipe dreams nor unpopular LEMAs are likely to affect the future of the Ogallala. This is so because GMDs were created to prevent "*economic* deterioration" and because water rights holders, either directly or through their elected representatives on the GMD, have the right "to determine their destiny with respect to the use of the groundwater;"[7] although local authority comes with oversight of the state's chief engineer (Kansas Water Office, 2009b, p. 2).

Legally mandated, across-the-board cuts in withdrawals, however, could make a significant difference. Steward et al. modeled the life of the Ogallala using different withdrawal scenarios. They found that "[w]ater use reductions of 20% today would cut agricultural production to the levels of 15−20 y[ears] ago, the time of peak agricultural production would extend to the 2070s, and production beyond 2070 would significantly exceed that projected without reduced pumping. Scenarios evaluate incremental reductions of current pumping by 20−80%, the latter rate approaching natural recharge" (Steward et al., 2013, p. E3477).

One legal mechanism exists that could make sustainable extraction a reality. In 1978, the Kansas legislature authorized the chief engineer, after a public hearing, to designate Intensive Groundwater Control Areas (IGUCAs) wherein additional regulation may be applied. GMDs may also petition the chief engineer for this designation. Criteria include "that groundwater levels are declining excessively, the rate of groundwater withdrawal exceeds the rate of recharge, unreasonable deterioration of groundwater quality has occurred or may occur, or other conditions exist warranting additional regulation to protect public interest" (Kansas Water Office, 2009b, p. 14). The chief engineer has designated only two IGUCAs in the Ogallala region, both authorized in 1984. The Arkansas IGUCA was authorized after a 1983 hydrologic study "indicated excessive declines in groundwater levels, [and] groundwater withdrawal rates equal to or in excess of the rate of recharge." The Upper Smoky Hill IGUCA was authorized because of "[d]eclining inflow of water into Cedar Bluff Reservoir [that] contributed to declining water levels and water flow below the reservoir" (Kansas Department of Agriculture, 2009).

Without the political will to authorize widespread IGUCA designations, or certainty that their widespread use would survive legal challenges (Peck, 2014), management of the Kansas Ogallala is subject to a recent court case. The decision in *Clawson v. State of Kansas Department of Water Resources* hamstrings the Department of Agriculture's ability to reduce a water right once the chief engineer has granted it. In the *Clawson* case, the chief engineer issued a water right, but with the provision that he could reduce the allocated amount at a later time. The court ruled that the chief engineer does not have the authority to modify a permit once it is issued, thereby undercutting the possibility of administratively mandating reductions of water rights. Likely, new legal powers will need to be enacted to mandate reductions.

Until *Clawson*, the state showed little interest in such reductions. Kansas, like many other "prior appropriation" states in the West, had a "use-it-or-lose-it" provision built into the water law to prevent speculation on water rights and to ensure that the water was put to beneficial use. After five years of non-use, a right holder risked losing the right or having it reduced. Farmers understood this provision to mean that they needed to pump their full rights, or as much as their wells were able to pump, to avoid losing their allotments. In some cases, farmers pumped more water than their crops needed (Bickel, 2014).

A typical water allotment is about two-acre-feet, or more than 650,000 gallons per acre. In most years, this amount is sufficient to grow a crop for those with adequate well capacity. In the drought and heat-stricken years of 2010 and 2011, when nighttime temperatures in parts of Kansas remained for weeks above 90 and occasionally 100 degrees Fahrenheit, even two-acre-feet was not enough water to bring a crop to maturity. Farmers were then faced with a grim choice – let their crops wither in the fields and waste the water and other resources already invested, or pay a fine for over-pumping their allotments. As one farm explained: "Well, the problem is, once you're locked into that corn, you can't be conservative about [water application]. Either you're going to grow a corn crop or you're not." In response to this conundrum, in which an abandoned crop would mean a total waste of water, the chief engineer responded by authorizing a one-time drought term permit to let producers in this predicament borrow from the next year's allocation to finish the crop (High Plains Journal, 2011).

The state has found other ways to keep water flowing when farmers say they need it. In 2012, the state refined its multi-year "flex account" provision so that a 10% reduction in water allocation was not required to qualify for participation. Flex accounts allow farmers to use five years of water allotments, based on either a formula for crop needs for their area or average past use, whenever they need it most (Kansas Department of Agriculture, Division of Water Resources, 2012). As the drought continued, Kansas also removed the "use-it-or-lose-it" provision to encourage farmers to conserve rather than mine water (Griekspoor, 2012). Now farmers may stop using poor wells until crop and energy prices converge with extraction and distribution technologies to make these poor wells viable again. This policy change removes the certainty of long-term water savings through well attrition.

In 2014, Governor Sam Brownback called for a 50-year vision for the water supply of Kansas, which includes both groundwater and surface water resources. The state released the resulting document, to which hydrologists, geologists, and other water specialists contributed, in January of 2015 (Kansas Water Office, 2015). The document both recognizes the threat from over-pumping the Ogallala, and through inaction, it assures the status quo of its depletion. Governor Brownback, in the opening pages, articulates the state's position: "Water and the Kansas economy are directly linked. Water is a finite resource and without further planning and action we will no longer be able to meet our state's current needs, let alone growth" (Kansas Water Office, 2015, p. 4). Yet, the 50-year vision treats environmental concerns as abstractions that can be useful in securing federal money, or in crafting a conservation message with appeal to a wider audience, but it offers no action plan. Instead, the state's commitment to economic growth takes priority over environmental concerns.

Given the priority of economic growth over all else, it is not surprising that the state finds itself in a bind regarding the future of the Ogallala. Unless the state is willing to designate many more IGUCAs, it can neither reduce an existing water right nor retire it for non-use. As the governor's 50-year water plan demonstrates, the lack of political will to use the one legal tool available, or to legislate new ones, leaves the state with voluntary reductions on aquifer withdrawals, a solution most farmers have already rejected.

VIEWS FROM THE FARM

> I'm glad I'm old so I won't have to fight that fight. … I've irrigated, pumped a lot of water. But you drive around and see all the wells that have been abandoned now. Maybe it'll just, the water will go away and all the issues will go away because there's no water to discuss. Might be what happens, I don't know. I know when you start threatening someone's appropriated water amount, if you want to get a fight started, that's what you say, that you're going to take 25% of that away. … But just say, ok, go ahead and pump it. It'll be gone and we don't have to talk about it.

Irrigators know they are depleting the Ogallala, but like most Kansas farmers in our study, they strongly oppose state regulation as a matter of principle, equating it with the loss of freedom. Yet our interviews revealed a diversity of views when it comes to west Kansas groundwater. Some seem to accept regulation as necessity, even blaming the government for not doing more to restrict access:

> They found out that the control of the water quantity takes regulation. There's things that [are] basically uncontrollable because of real short-sightedness on the part of the governments, which could've created some projects that would've kept it as a renewable resource. But plentiful water's pretty much mined out.

Others want the government to trust farmers because no one has deeper and more personal investments in the aquifer, nor more to lose if they make poor decisions about how much water to apply.

> If you're a farmer that irrigates, that's your livelihood! You know, it's just like if you don't take care of the water, that'd be like not taking care of your kids. I mean that's your livelihood there, so farmers are going to take care of the water quantity and quality both!

At the same time, the fact that the aquifer is held as a state trust – the state creates rules of access and use – means farmers do not have to feel responsible for the consequences of their irrigation decisions.

> Interviewer: If you were to give advice to a new farmer, how would you suggest they manage water quantity?
>
> Farmer: Well, I tell you what, it's all pretty much managed for you. You don't have to do much there about it. State of Kansas tells you how much, what's the maximum amount of water you can pump, if you have irrigation rights. … I mean, it's pretty much managed by the state and federal agencies.

Willingness to rely on state water management may also flow from the fact that the state has yet to deny irrigators the water they need to grow water-intensive crops like corn, leaving farmers to make adjustments as well conditions dictate.

> So now I'm in a situation where I've got $200 an acre invested in ground, and the seed, fertilizer, chemical, and I'm having to abandon it because I can't run a sprinkler on everything and keep everything wet.
>
> We had what you call test holes drilled. First of all, we only did it on ground that we owned, not rented. And the second thing was we tested [to] see if there was any water there. Well, we were very fortunate because all of our ground, it was an abundance of water. Some of it was not real close to the pivot but almost all of it was. And so we just went and drilled a well and put it in, and every time they drilled a well they said, "Well, you'll never need more water than what you've got right here. You'll never run out of water." Well, we've run out of water. So never is about 35 years.

In some areas then, farmers have returned to dryland production. In others, irrigation proceeds apace and usually, but not always, within the bounds of state regulation. Despite the willingness of the state to work with farmers to adapt to the increased need for water in drought years, the *Garden City Telegram* reported that 114 farmers exceeded their allotments for the first time in 2013. Another 70 received second warnings, and a few, after the third warning, were fined $1,000. Penalties for over-pumping have become more severe over time, but are still not much of a deterrent.

In reality, only farmers with sufficient water make decisions about how much to apply; those with too little pressure may turn on their sprinklers and let them run because they cannot reach, let alone exceed their allocations. They can only hope to apply enough water for the crop they planted.

> Well, we'll keep the irrigation going, and we just set it out, you know. You do the best you can. Once they're planted and going, there's not much you can do, you know. You just hope for rain or, you know, you just keep the irrigation going. … When we start irrigating corn and we don't shut our wells off, we'll run 24/7 for two and a half months. We shut off to change old irrigation motors, unless we get a big rain. You know, an inch and a half, two inch or something that's a good slow rain that soaks in. And you just don't shut down because you don't get caught back up, you know.

The problem, as some farmers see it, is not the amount of water individuals apply, but rather that too many people have access to water. In 2005, the Garetson brothers of Haskell County filed suit against a neighbor, claiming that his wells, located along the border of the Garetson farm and junior to the Garetsons' senior water rights, harmed the Garetsons' wells, forcing them to drill more deeply. Community pressure brought to bear on the Garetsons, whose legal action was regarded as unneighborly, led them to drop the suit. They refiled it in 2012 and recently won an injunction against the owner's use of his junior rights (Bickel, 2016).

The Garetsons' response to competition for scarce water is not typical, although their success concerns those who fear a rush on the courts by holders of senior water rights. In our sample, farmers did not blame each other, nor argue others should lose their water rights. Rather, when it comes to the Ogallala, farmers, like the state, want to let market and environmental consequences act as arbiters.

> We're not going to pump it dry. Anybody who says we're going to pump it dry is wrong, in my observation. As the water declines, people quit pumping because it gets economically unfeasible to do. So people think we're pumping this aquifer dry willy-nilly. That's not what we're doing. We're trying to take care of it. … I hear too much come from central and eastern Kansas that 'you guys are wasting water out there.' That's a bunch of BS in my observation. We're doing it to keep economically viable. We're darn good stewards of the water and stewards of the land. Not just me, but I mean everybody out here.

Across-the-board mandatory reductions today could make possible a future farmers want for the next generation. Paradoxically, saving water for tomorrow would reduce yields and lead some farms into bankruptcy today. Regardless of the desire and dread inherent in mandatory reductions, farmers doubt the state's will to take such politically unpalatable steps.

> First of all, they issued twice as many permits as they knew was sustainable. But they did that because they were selling permits and everything was going great guns out here, expansion, expansion, uncontrollable expansion. Now when it comes time to meet the responsibility of it, it's best that they totally shirk that responsibility of saying, "Okay, well we've got, we allocated too much usage, so we're going to have to cut it back by 20 or 30%." They're not going to do that. They're going to wait until people like myself have wells that you can't pump water out of anymore and, hey, no problem!

DISCUSSION: PARADOX AND AMBIGUITY

Faced with needing groundwater to survive into a future without it, how do western Kansas farmers resolve this paradox? How have they determined that what they are doing is the right thing to do? To answer these questions, we turn to Polanyi's notion of embeddedness[8] to explain and illuminate farmers' views of "good stewardship." For Polanyi (1944, p. 57), social relationships in market society are configured within the sphere of the capitalist market. That sphere for farmers is significantly defined by industrial agriculture, wherein production technologies converge with economy and market ideology, and which uniquely shapes farmers' values, goals, and relationships with nature and society. We find that these relationships are ambiguous and reflect farmers' status as petty capitalists who must somehow reconcile the contradiction between faith in infinite economic growth and finite resources by which to grow. Under these conditions, farmers' interpretations and enactment of good stewardship lead them to prioritize short-run economic imperatives over the future of the aquifer.

Following Smart and Smart (2005), "Petty capitalists regularly operate in the ambiguous boundaries between capital and labor, cooperation and exploitation, family and economy, tradition and modernity, friends and competitors." These characteristics well describe the farmers we interviewed. They place a high value on their autonomy as owners of their operations, but they are "owner-operators" whose labor must be applied to the endeavor. They feel strong moral obligations to generate sufficient income to care for their families and communities, to behave in a neighborly way, and to leave the land at least as good, if not better than they found it, so they can deliver it into the hands of the next generation of farmers. They watch their neighbors to see what and how they are doing, and they measure their own success in a friendly competition that becomes serious, even threatening, in the world of volatile transnational commodity markets and global financial institutions. Farmers know that production and income underwrite the noneconomic aspects of farming that they value highly and enjoy. To survive in this local-global, cooperative-competitive environment, farmers subscribe to a shared understanding and set of practices that define "good stewardship."

Stewardship for the farmers we interviewed means many things: minimizing erosion, neighborliness, conserving moisture and organic material in the soil, timeliness in getting work done, keeping debt to a minimum, staying up-to-date on best practices, and keeping up with technological advances. These priorities illustrate the mix of economic, social, ecological, and technological concerns that farmers in our study frequently identified. As the four farmers later illustrate, farmers do not readily separate these concerns but rather see them working together.

> Interviewer: What does it mean to be a good farmer?
>
> Farmer A: Oh I think stewardship. Stewardship to the land, stewardship of dollars. I guess stewardship is the word I'm looking at. But that's what I believe in. I think you need to make every dollar pay. And every bushel you can get off a piece of ground.
>
> Farmer B: A good farmer would be one that produces good crops and takes good care of his land, and is able to help other people when they get in trouble, and to be trusted by your neighbors and fellow farmers.
>
> Farmer C: Well, first thing that comes to my mind is profitability, sustainability. I guess when I look at the area, and if I consider a person a good farmer, if they're still farming today, they must be a pretty good farmer because they've come through a lot of bad times. So I guess they've had to remain profitable. Their farming practices and everything, they've been sustainable.
>
> Farmer D: I mean … organic matter is money. Price is fertilizer … it's just money.

Good stewardship then folds noneconomic concerns into economic ones. From our interviews, we have gleaned three keys to understanding the economic aspects of stewardship as farmers do. They must minimize waste, maximize efficiency, and subscribe to technological fundamentalism. These values reveal the influence of economic discourses that characterize the larger economic system within which Kansas farmers are embedded. This economic system not only influences farmers' values in western Kansas; it shapes the industrial agricultural network of which they are a part, and that is itself a constituent of a global economy whose elements constrain production and business decisions in fundamental ways. As we have argued elsewhere (Gray & Gibson, 2013, p. 83).

> Farmers' participation in the network increases their commitment to the ideologies, practices, and technologies of industrial agriculture. These practices compromise the

health of agro-ecosystems, and farmers must focus on short-term mitigations that support crop yields sufficient to ensure the financial survival of the farm. Farmers accomplish this goal by using technological innovations, experts to guide production decisions, and credit, all of which collectively influence the kinds of information that farmers value, the ways they farm, and what it means to be a good farmer. Farmers make adjustments to immediate conditions, adjustments made in the direction of what works in their changing environment. This environment for farmers involves soil and water, but also economic and policy arrangements – all of which reinforce the necessity of short-run success, even at the cost of longevity.

When the values of maximum efficiency and minimal waste are applied to those aspects of farming over which producers have control, and weather and markets cooperate, the farm ledger is expected to show a favorable ratio between the prices received for the harvest and costs in time, labor, and other inputs. One of the most conspicuous ways farmers pursue these economic goals is through the use of state-of-the-art technologies.

Interviewer: What significant changes, if any, have you made on your farm within the last ten years?

Farmer: Well, probably one of the big things has been this GPS, you know, and spraying and using the chemicals, the no-till type stuff … especially over the past ten years. It really started in the mid-90s, I kind of started moving more into it, but then when they came out with some economical, affordable and good systems, so the GPS and the auto-steer, … but those are some big jumps you know, and the Internet, computers, you know all of this is kind of a bigger and bigger role. The whole game.

Interviewer: What were your considerations going into making those changes?

Farmer: Well, efficiency among other things … Now I take a little nap between turns [laughs] … and thank God it's got this little thing, bleep bleep, when you get to the turn.

While farmers enjoy the prestige of owning the latest in high-tech farm equipment, they underscore the importance of competitiveness, a characteristic of stewardship that requires pursuit of the kinds of efficiencies machines make possible. Technologically advanced, large-scale equipment allows farmers to plant and harvest more acres faster, with savings in labor and time, and recent emphasis on technological precision means savings in the cost of various inputs, including water.

Farmers' adoption of high-tech solutions, such as GPS-guided equipment and digital translation of key information, has changed farmers' relationships with land and water in ways unimagined a few decades ago. New ecological relationships mean changes in the definition and practices of good stewardship. For example, the farmer who listens to commodity prices on his tractor's radio, or naps between turns, illustrates a certain detachment and inattention to the work the machine accomplishes on the landscape. His position in the field, planting density, harvest size, and soil moisture, when rendered as digital data sets, extend his capacity and capability, but also fragments a formerly unified process and contributes to fragmented nature subject to manipulation (Hanson, 2013, pp. 2–3). Soil is understood as a growing medium of measurable and remediable proportions of moisture, pH, and nutrients. Water, no longer available only from the skies, is ideologically rendered as a "resource" of the farm to be extracted, and as a "cost," like labor, to be minimized. And while flow rates and gallons applied speak to the health of an individual well, invisible in the data set is the material fact of the aquifer's existence as a finite component of a regional and global hydrological system.

Stewardship of groundwater requires attention to how much water a crop requires, the costs of pumping and other inputs, and the price farmers expect to receive for the crop. A good harvest and the ability to plant another crop, they believe, are the rewards for efficient water use. A common refrain from farmers on this topic is, "You should not punish those who have already been conserving." What they mean by "conserving" is waste reduction by, for example, installing drop nozzles on their pivots and not using more than a particular crop requires. They do not mean consumption reduction because, among inputs, water requirements are only as elastic as the scarce and unpredictable rains allow, and rights to adequate groundwater remove the uncertainty of weather. As one farmer put it, "You need what you need and you use what you need, but you shouldn't waste it."

Farmers have enjoyed bigger and bigger yields that stand as proof that science and technology can reduce the costs and uncertainties of weather and global markets, and that the proven production practices they employ really are, in their views, representative of good stewardship. They listen to the advice of extension agents, crop consultants, and other farmers, and they do what experience teaches them to do. They plan and act for the near term because farming is a seasonal business for which cash flow between harvests is the difference between supporting a family and bankruptcy. Yet, farmers are caught in their ambiguous status between short-term economic imperatives to protect the farm for future farmers, and long-run water availability to make high-yielding irrigation agriculture possible. They are caught between competition for land and water, and neighborliness that calls for cooperation; and between the drive and technological ability to expand their farms while supporting their communities and families. Like capitalists, they look for ways to maximize efficiencies, minimize costs, and protect the profit margin of their operations. But unlike capitalists, farmers cannot simply move in search of new water supplies. Aside from the scarcity of farmland, they are rooted in place by heritage and commitments to family, friends, and community.

As the technologies and scale of farming in western Kansas have changed, what farmers have to know and do, and what it means to be a good steward, have also changed. Farmers almost always operate within the law, consistent with societal expectations of how businesses should operate, and with the shared values and goals of the industrial agricultural network. As they have acquired new skills and adopted new technologies, new challenges have arisen, but they believe that science and technology will provide solutions. Just as problems of soil fertility, irrigation, and the demands of large-scale production have been solved with past innovations, so will future problems be solved. And if a technological rescue fails to materialize, farmers can revert to dryland production.

The paradox of drawing down the Ogallala to preserve a future without it is resolved not by reduced extraction, but with a kind of stewardship that farmers define in particular ways. Most important are conditions *on the farm* where farmers practice waste avoidance and efficiency, and keep current in technology and education. This operational paradigm necessitates a privileging of present on-farm and family needs over future needs for water and community. It rests on faith that technological innovations will continue to remove obstacles as they arise. It is also solved by assigning responsibility where it legally lies: with the state where, beyond the boundaries of individual farms, elected and appointed administrators consider the health of the aquifer that underlies Kansas and its contributions to the primary goal of economic growth.

THE EMBEDDED STATE

The state of Kansas, like farmers, also occupies an ambiguous position. On the one hand, the state serves the people of Kansas who legitimize its actions in the electoral process. On the other, policies are most strongly influenced by economic elites and business interests (Gilens & Page, 2014, p. 564). Out of these competing obligations, and despite the heterogeneity of state actors, elected leaders tend to serve those whose greater resources purchase influence, and who insist on the virtues of a self-regulating market.

Polanyi regarded such situations as dangerous to society, and many scholars interpret his work to mean that the state, the advocate of market society, is embedded in the economy. Block (2003, p. 8) argues instead that Polanyi saw the impossibility of a society fully embedded in the economy, and that this "stark utopian project" of liberals would predictably be impeded by society's actions in its own defense. From this point of view, the neoliberal project, initiated some 35 years ago, can be seen as the latest effort to embed society in the capitalist economy, coopting the state's regulatory authority to advance the ends of capital rather than that of society. In Kansas, to be sure, the economy has long held the upper hand.

More than a century ago, Johnson (1901) expressed concern for the unsustainable use of the Ogallala, but it was not until 1945 that the state acted to manage groundwater exploitation. The issue the state intended to resolve with the Water Appropriation Act was one of social instability caused by competition over water (Peck, 1995, p. 740), leaving the problem of unsustainable extraction unaddressed. From the 1945 beginning of regulation in the hands of the governor, legislature, and chief engineer, amendments have gradually decentralized control, placing it in the hands of irrigators whose representatives sit on groundwater management district boards. The most potent regulatory tool available to the state remains designation of IGUCAs, a tool rarely deployed despite substantial evidence of those conditions that would allow it.

The contradiction between the state's obligations to the people of Kansas, and the subordination of their well-being to economic values that threaten their future, is resolved by water law that defines the public interest in economic terms. The contradiction between a finite resource and infinite economic growth is resolved by devolution of responsibility to groundwater users themselves. By allowing irrigation to continue apace, the state protects the Kansas agricultural economy, and the farmers and agribusiness interests that constitute it, at least for now. In southwest Kansas, where the drawdown of the aquifer in some areas was up to five feet per year in the mid-1990s, board members of GMD three have planned for depletion. Instead of working for sustainable extraction rates, they control the pace at which drawdown occurs by spacing wells and by respecting the chief engineer's prohibition on new permits (Ashley & Smith, 1999, p. 147). Such planning allows farmers to revert to dryland production as well failures dictate.

The competing impulses to regulate and to let economic factors arbitrate the distribution of water show regulation to be an effect of those political machinations that allow politicians to satisfy different constituencies, including farmers. Further, the neoliberal project includes a discourse that holds regulation, popularly understood as "restriction," as the enemy of a free society, leaving both society and nature virtually unprotected, and government and business as partners in the project to promote economic growth. So why do regulations exist at all? Even if they only reduce the rate of aquifer decline, it follows that regulators recognize the problem of depletion and feel some obligation to acknowledge it. Scientists and staff members of various boards and agencies have for decades raised the alarm about aquifer depletion and most recently worked to influence the new 50-year water plan, but their voices are inaudible under the din of market fundamentalism heralded by the state's legislature and governor. They, who share authority over surface and groundwater with groundwater management districts, espouse the neoliberal ideology that links free markets to free societies, asserting the virtues of economic growth in the endless pursuit of profit. Farmers, participants in powerful industrial agricultural networks, are compelled by circumstances and take great pride in production of enormous surpluses of grain, much of it exported, fed to livestock, and converted to ethanol. Farmers claim they are "feeding the world," and whatever problems they encounter as they pursue those best practices that define good stewardship will be solved by free markets that give rise to innovation, not by government interference.

CONCLUSION

Regulation of the Ogallala by a reluctant state, whose goal is no more than to slow depletion rates, should be seen as a nod to those who express concerns for the future of water availability, and a wink to those who believe the invisible hand of the free market should oversee aquifer withdrawals. Farmers are constituents of both these groups. Their entrepreneurial concerns for water in the present are supported by state regulatory practices, and they are left on their own, as the state's laissez faire approach predicts, to adjust to the long-term consequences of declining groundwater availability.

In the 21st-century Kansas, farmers hold an ambiguous status as petty capitalists that stems, at least in part, from the fact that they are entrepreneurial advocates for an unfettered market at the same time they are members of families and communities in whose futures they are emotionally and socially invested. Although farmers believe they must expand their operations and must use the amount of water their crops require, they express frustration that the state issued too many permits and compromised the future of western Kansas irrigation agriculture.

Kansas water laws protect the market society that impels farmers' depletion of the aquifer because laws and regulations are weak or, in the case of IGUCAs, politically impossible. As currently enacted, regulations cannot induce the kind of agro-ecological and economic transformations needed to make life on the arid plains possible in the long term. Instead, regulation allows farmers and communities to adjust to declining wells, price fluctuations, and diminishing populations within the same economic arrangements that rewarded the large-scale industrial, irrigation agriculture that will deprive future generations of the water they will need.

Regulation of the Ogallala aquifer, then, is not a force that resists assaults on the future of western Kansas agriculture, but is rather the palliative that allows those assaults to continue. Instead of the surgical procedure required for social, economic, and environmental sustainability, regulation responds with a bandage to the contradiction between political commitments to infinite economic growth and finite environmental resources. Operating within the bounds of capitalist ideology, it ultimately preserves, even deepens ecological degradation and uneven distribution of wealth, power, and opportunity. Thus, any meaningful rescue of the Ogallala is unlikely to occur, or if it does, it will come too late to make a difference to future generations in western Kansas, and that will be a very different, drier place.

NOTES

1. Soybean varieties also have resistance to weed killers, but they are not a popular crop in western Kansas because the soil is largely too acidic.
2. Many farmers consider the rate of 400 gallons per minute the minimum rate necessary to irrigate a corn crop fully.
3. Milo is another name for sorghum.
4. Planting population refers to the density of seeds planted.
5. The effects of climate change will undoubtedly exacerbate depletion of the aquifer through reduced recharge and higher demand. In this chapter, we set aside the serious issues raised by climate scientists because the use of the aquifer for irrigation will result in depletion under any climatic conditions, a fact that was recognized at the beginning of the 20th century (Johnson, 1901).
6. The concept of reasonable use has a legal history related to concepts in English common law that did not allow for the consumptive use of water. That changed when American water law in the West recognized irrigation, a consumptive use, as a reasonable use of the resource. Reasonable use came to mean the

consumptive use of water for a beneficial purpose (such as agriculture) so long as such use did not interfere with other users' rights to the water (Webb, 1931, pp. 435−436). The development of this legal standard did not foresee the depletion of the water source because it originally dealt with rivers.

7. K.S.A. 82a-1020. Legislative declaration.

8. Polanyi did not fully develop the concept of embeddedness in *The Great Transformation*, leading to various interpretations of his intent. For example, see Granovetter (1985), Barber (1995), and Krippner (2002).

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