



Valuing Groundwater Across Irrigation and Livestock Systems

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This work was supported by the Foundation for Food and Agriculture Research (FFAR) Seeding Solutions Program, grant ID 23-000780. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of FFAR.

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Main Takeaways

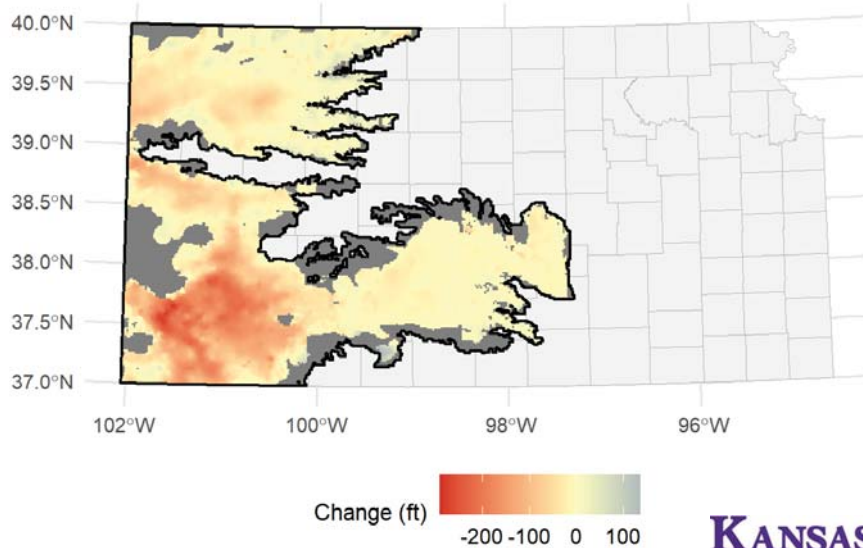
- Value of groundwater is increasing over time
- There is a significant premium for land with groundwater access
 - While irrigation rights confer larger premium in absolute terms, livestock rights provide a greater percentage change on average.
- Local hydrology also plays a significant role
 - Premium for irrigation rights grows as saturated thickness increases
 - Premium for livestock water rights greatest at extremes of saturated thickness

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Background

Change in Saturated Thickness
Pre-Development to 2023–2025 Average



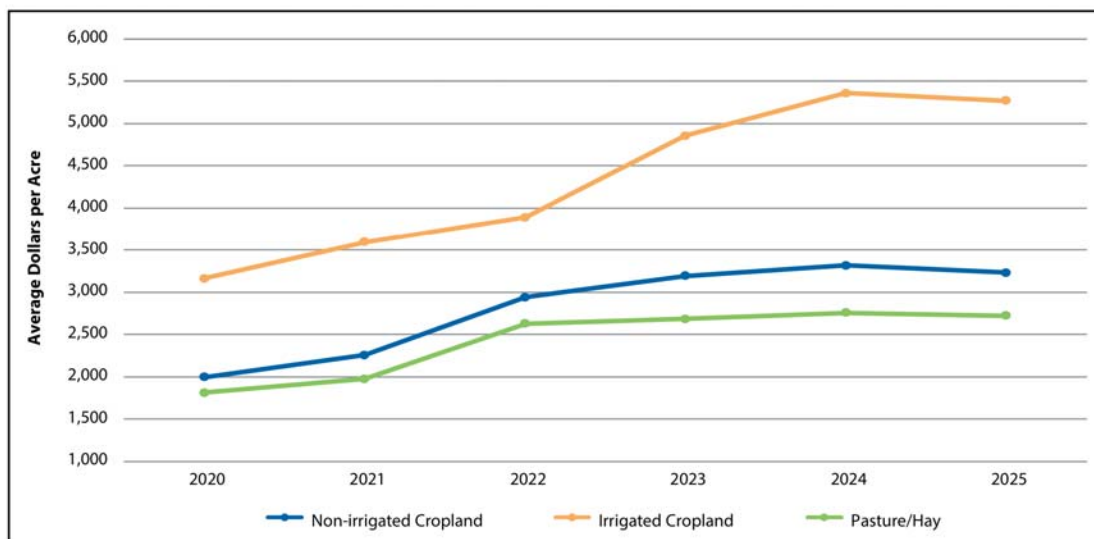
- Groundwater is the primary source of water in Western Kansas
- Water rights in Kansas differentiate between uses
 - Transferring between uses is possible but costly

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Land Values in Kansas

Trends in Average Land Value – By Type

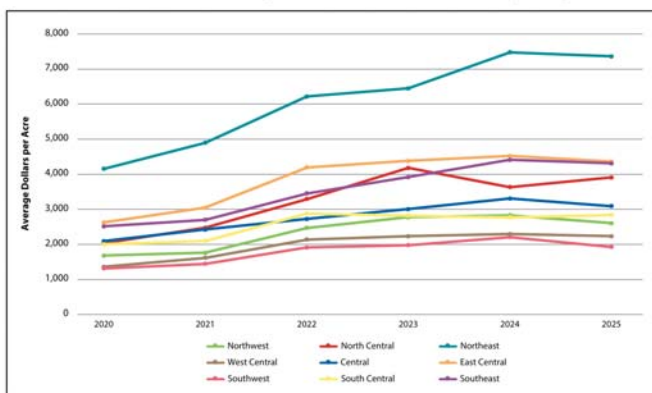


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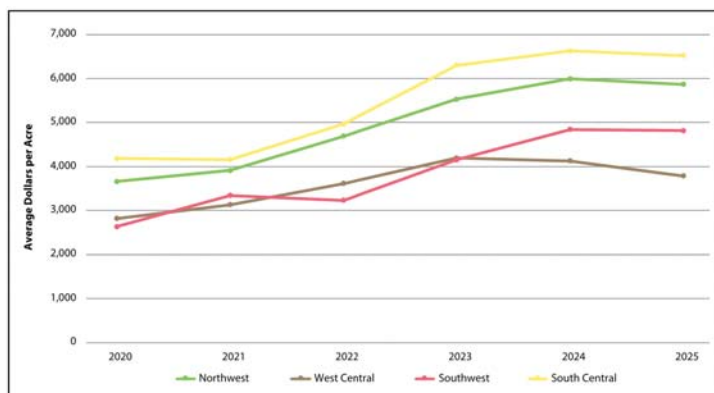
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Land Values in Kansas

Trends in Non-irrigated Land Value – By Region



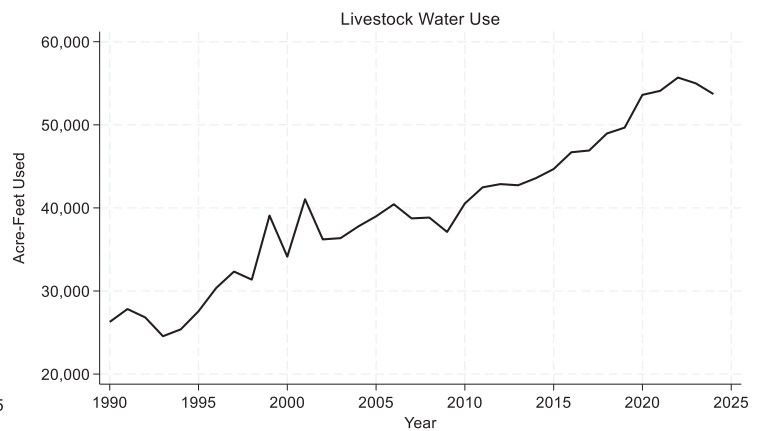
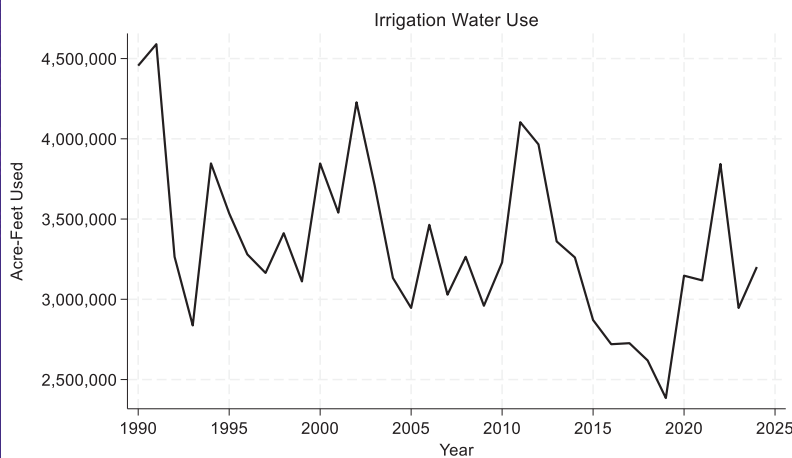
Trends in Irrigated Land Value – By Region



Related Literature

- Irrigated land within the High Plains region of Kansas is valued 53% higher than non-irrigated land (Sampson et al., 2019)
- 71% land value premium associated with groundwater access (Edwards et al., 2025)
- Prior evidence suggests significant difference in value of water between uses
 - In California surface water markets, there is a willingness-to-pay gap of \$2500/acre-foot (Ferguson, 2025)

Livestock and Irrigation Water Use



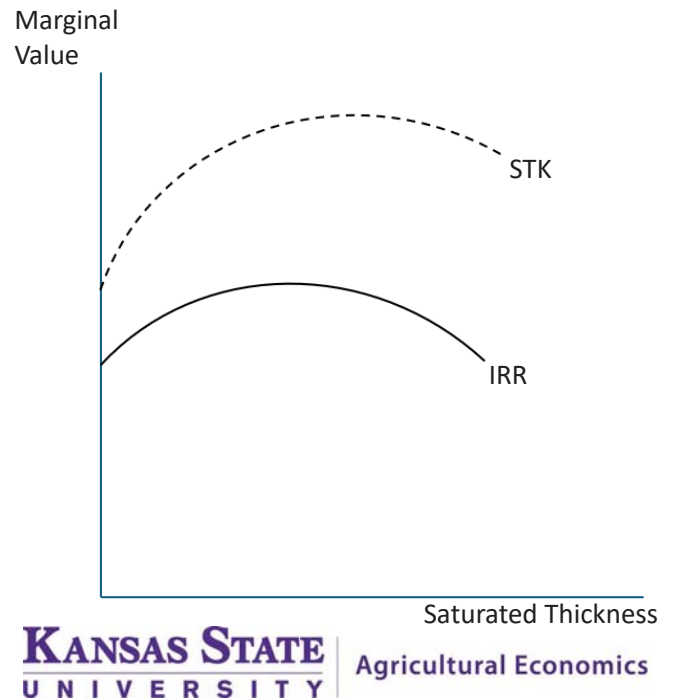
Hedonic Price Model

- Hedonic prices are the implicit prices of attributes that are observed from differentiated products (Rosen, 1974)
- Isolates the implicit value of attributes that are not sold separately by holding other factors constant

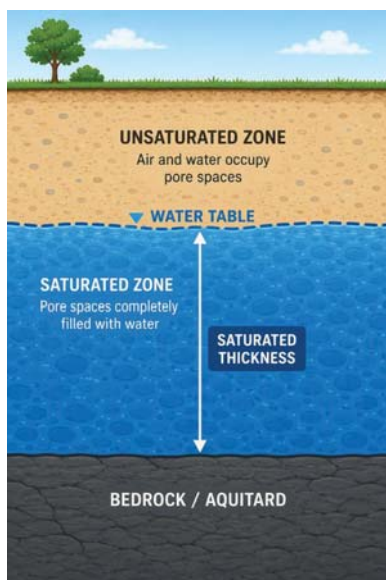


Hypotheses

- Marginal value is greater for livestock parcels
- Increase in marginal value is greatest at lower levels of saturated thickness



Saturated Thickness



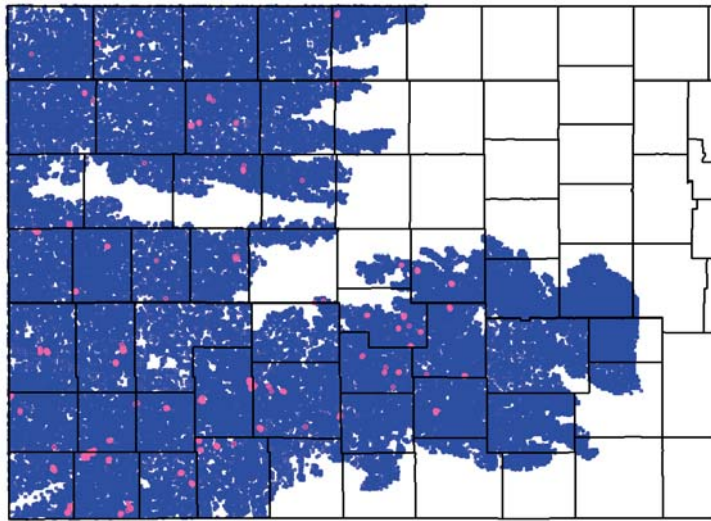
AI Generated Image

- Saturated thickness is the vertical distance between the water table and the base of the aquifer
- Represents the thickness of the aquifer that is fully saturated and available to store and transmit groundwater

$$\text{Saturated Thickness} = \text{Water Table} - \text{Bedrock}$$

Land sales by use code

Data



Water Right Code

● IRR ● STK

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- Ag land sales data from 1985-2024
- Water right data from WIMAS
- Town and population data
- Temperature, precipitation and soils
- Saturated Thickness from KGS

Summary Stats

	n	mean	sd	min	max
Real Price/Acre		11,416.91	23954.85	5.010197	257652.5
Saturated Thickness (100s of Feet)		1.241617	.9163462	0	5.725888
Real Total Improvement		24,788.6	62891.66	0	417948
Authorized Quantity		107.9186	122.0446	0	704
Total Acres		151.9031	123.4621	.05	850.1
Percent Crop		70.32344	40.14102	0	2786.889
Observations	165,359				

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Econometric Model

$$y_{it} = \beta_0 + \beta_1 \varphi_{it} + \beta_2 \varphi_{it}^2 + \beta_{wr} w_i + \beta_w w_i (\varphi_{it} + \varphi_{it}^2) + \beta_3 z_{it} + \beta_4 x_i + \beta_5 h_{it} + \varepsilon_{it}$$

- y_{it} = sale price of the parcel
- $\varphi_{it}, \varphi_{it}^2$ = saturated thickness, saturated thickness squared
- z_{it} = temperature and precipitation
- x_i = water right characteristics, aquifer characteristics, county, distance to the nearest town of population over 1k, 10k, and 40k, soil characteristics
- h_{it} = total improvements
- w_i = any water right
- ε_{it} = error term

Results

Irrigation

- Another 100 ft of saturated thickness increases price of irrigated parcels by 12.25%
- Average increased price of \$1,556.37/acre

Livestock

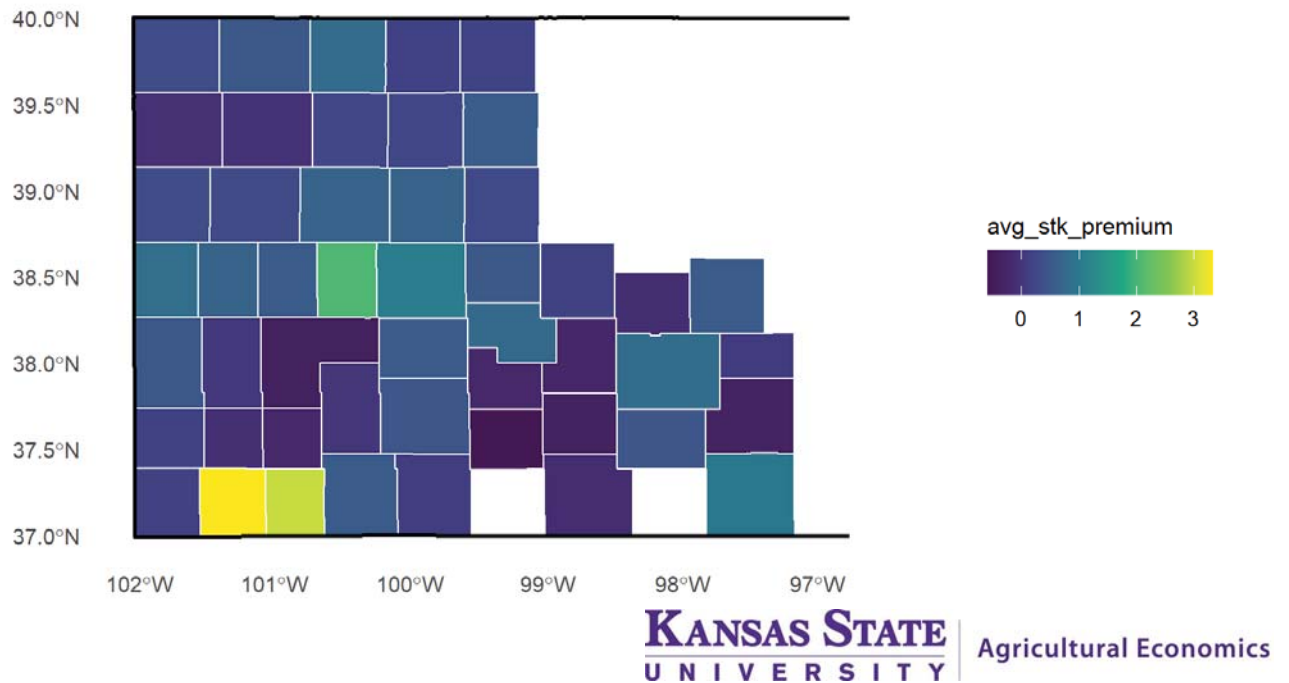
- Another 100 ft of saturated thickness increases price of livestock parcels by 13.3%
- Average increase of \$845/acre

- There is a greater marginal affect for livestock water rights
- The greater price per acre comes from the higher average cost per acre for irrigation land



Spatial Variation

County Average Stockwater Premium



Main Takeaways

- Know your water right and know your local aquifer
 - Value of additional authorized acre/feet, value of additional saturated thickness
- Consider local demand for water independent of current use
- Plan ahead to anticipate policies that affect land portfolio

Know Your Water Right and Local Aquifer

WIMAS

- Information regarding water right



KGS

- Information regarding aquifer characteristics



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Local Demand for Water

New dairy opens in western Kansas, boosts local economy

by: [Carina Branson](#)
Posted: Jun 2, 2026 / 07:04 PM CDT
Updated: Jun 3, 2026 / 07:06 AM CDT

ILS to build new facility in Pawnee County

Feedyard will be built from ground up

An AI data center project for western Kansas might use less water than irrigation farming

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Policies That Affect Land Portfolio – HB 2279

Withdrawal Reductions

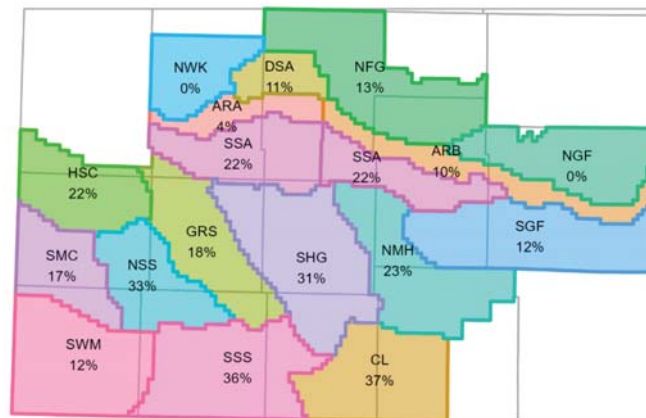


Figure 1. Percent reduction in groundwater withdrawals relative to a ten-year average (1994-2023) estimated to keep the aquifer level stable in each I-CARE region. The percent reductions are estimated using the Q-Stable methodology.

Source: Cameron-Harp, 2025

Conclusion

- Different water-use rights create price wedges in land market transactions
 - There is a 12.25% marginal effect for irrigation and a 13.3% marginal effect for livestock
 - The relationship between saturated thickness and marginal effect vary significantly between uses
- Next steps
 - Who would benefit if rights were able to switch between uses
 - Examine how the value of additional groundwater or recharge capacity varies across Kansas

Thank you!

Questions?

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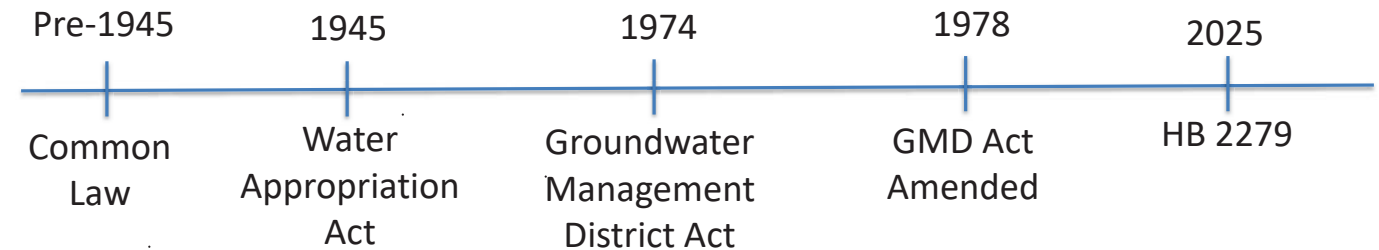
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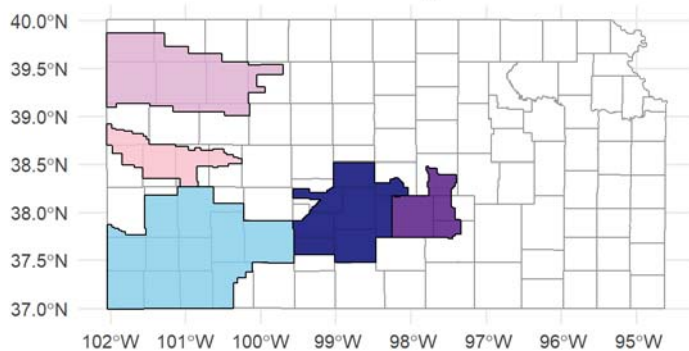
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Water Rights in Kansas



Kansas Groundwater Management Districts



GMD

1
2
3
4
5

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Data Cleaning

- Kept only open market sales
- Sales with validity codes:
 - Valid Sale
 - Involved Additional Parcels
 - Property Changed After Sale
 - Absolute Auction Sale
- Limited parcels to only those over the aquifer
- Dropped all parcels with improvements over \$500k
- Dropped saturated thickness below 0

STK and IRR Summary Stats

	Irrigation					Stockwater				
	n	mean	sd	min	max	n	mean	sd	min	max
Real Price/Acre		12773	24871.97	5.48247	257653		6671.48	10480.82	40.48357	74282.1
Saturated Thickness (100s of Feet)		1.33206	0.875883	0	5.72589		1.37337	0.780922	0.072126	4.94843
Real Total Improvement		21651.9	57758.47	0	417674		4581.7	23963.48	0	275171
Authorized Quantity		197.087	140.3545	0	704		48	65.72671	0	120
Total Acres		157.995	121.0771	0.1	850.1		166.08	104.7367	1.14	640
Percent Crop		72.7648	36.57622	0	210		73.3251	35.48464	0	100
Observations	77609					1221				