The economic importance of Western aquifers

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How do we value groundwater in economic or social terms?

- The jobs supported by water? Contribution to the local or national economy?
- The value of water as a lifeline?
- What it would cost to replace groundwater with water from other sources?
- Cultural or existence values, or the value of a way of life?

Two quick – and equally valid – answers frame the issue

What is the value of water?

Republican River Basin example, 2005-2006

	Estimated value (78,960 acre feet)
Kansas, total	$72 million
Kansas, average	$900/acre foot
Nebraska, total	$10,000
Nebraska, average	$0.13/acre foot

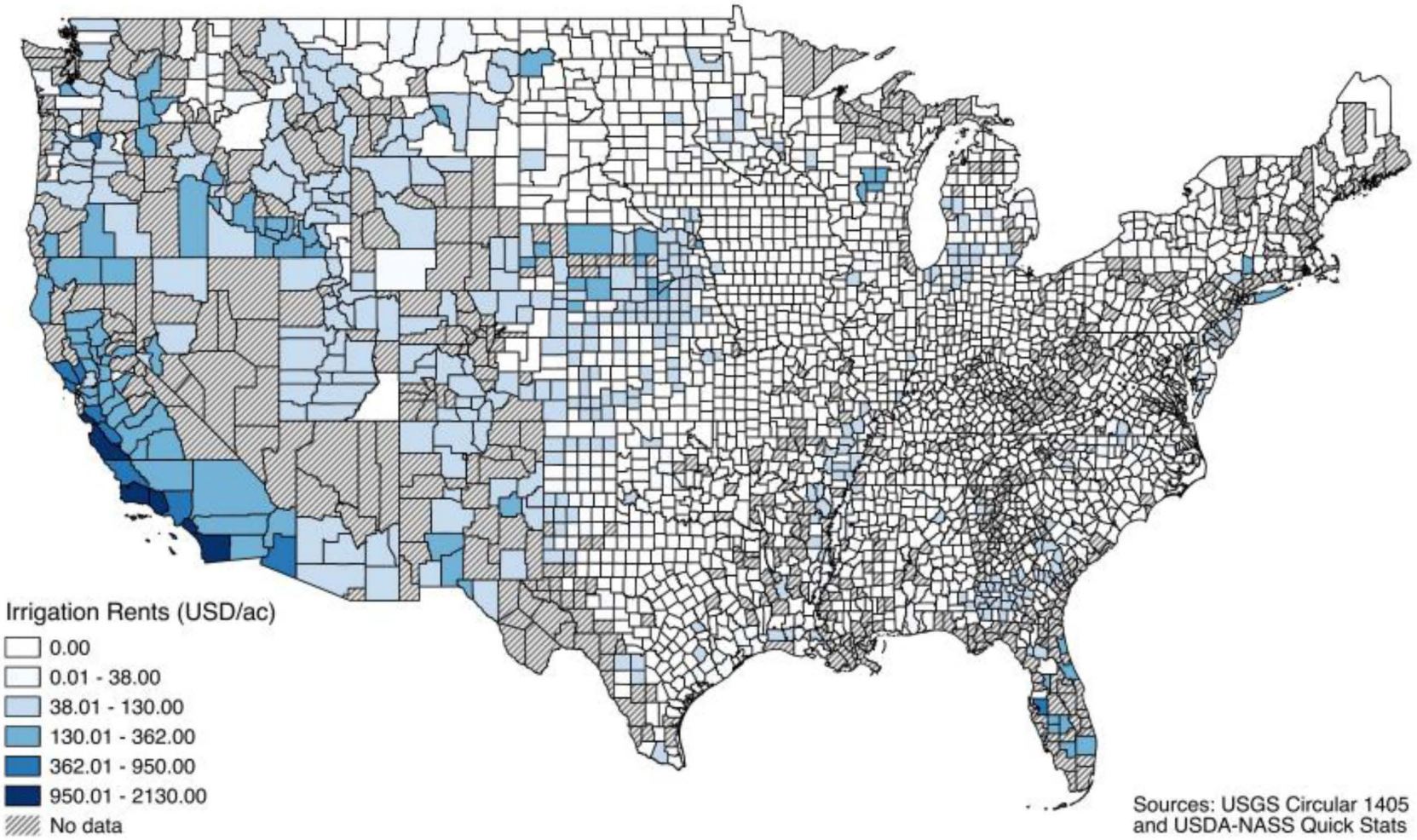
Groundwater plays a critical role in

- Mitigating drought and climate change risk
- Maintaining agricultural productivity, food security, and rural economies
- Sustaining freshwater ecosystem services

What is the buffer value of groundwater?

	Irrigated yield/ Dryland yield
Wet year (2014)	
Lancaster County	1.25
Chase County	2.57
Dry year (2012)	
Lancaster County	2.49
Chase County	11.65

County-Level Irrigation Rents



Sources: USGS Circular 1405
and USDA-NASS Quick Stats

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Estimating the value of groundwater

In common with surface water, the value of groundwater varies across space and time with

- Input and output prices
- Local biophysical conditions (e.g. weather, soil type)
- Technology and management choices
- Policies, including regulatory risk

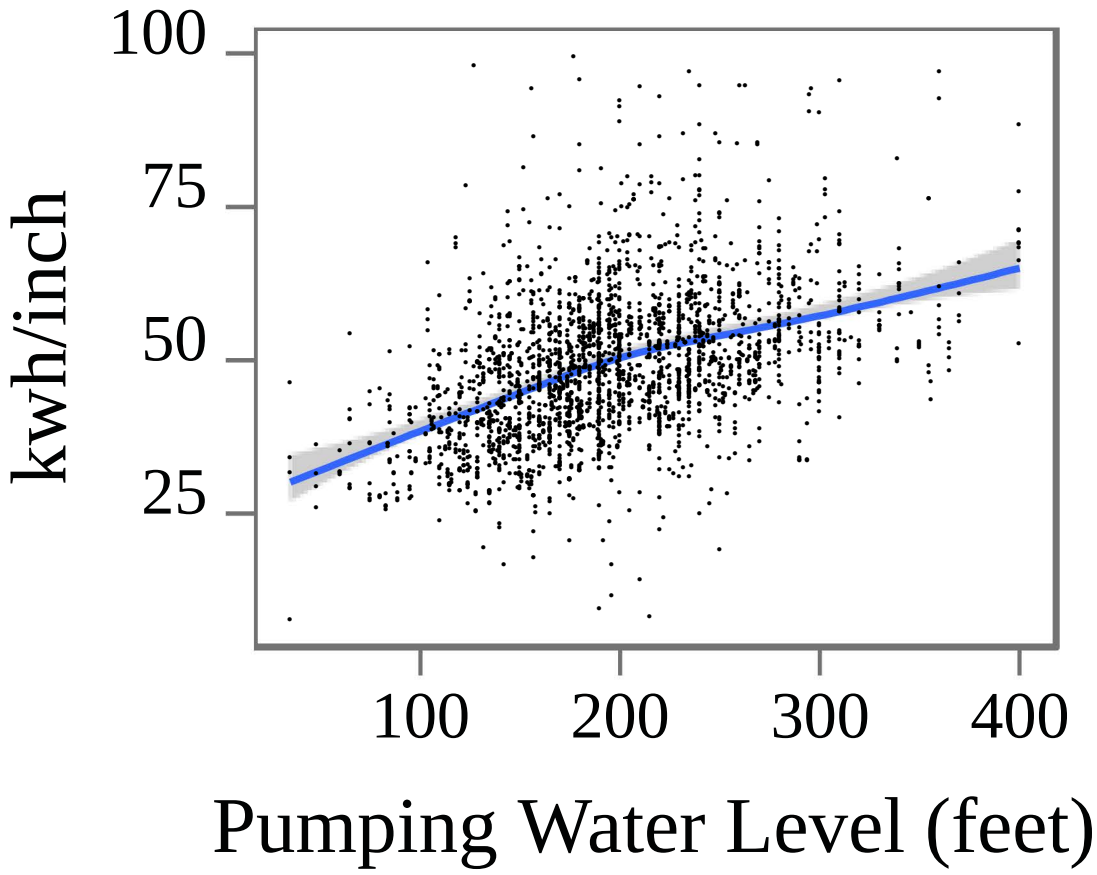
Distinctly for groundwater

- Production infrastructure is privately held
- Provision costs are idiosyncratic
- Aquifer conditions introduce risk via well yield

Property rights and groundwater management

- We don't know enough about why or how much water is actually being used
- It's much more difficult to monitor and restrict water use than we acknowledge
  - People respond to incentives and if there's money to be made, some people will cheat
  - There's a big difference between how regulations are written and how they're implemented

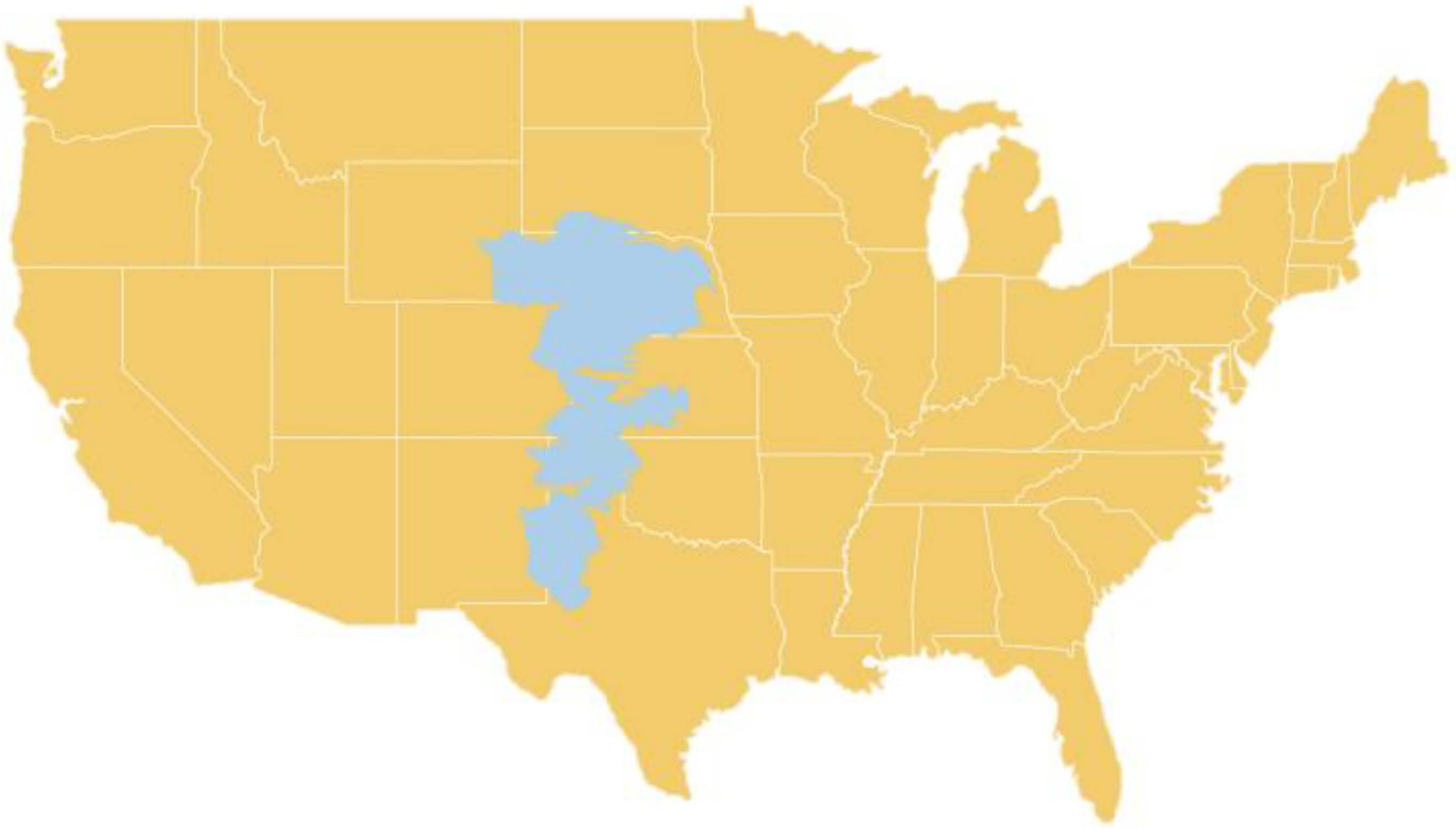
The provision cost of groundwater



Agricultural production risks and well yield

- Groundwater is used to meet crop ET needs
- Well yield limits instantaneous application rates
- High-yield wells can meet crop water needs *always*
- Low-yield wells can meet crop water needs *sometimes*
- The relationship between incremental well yield and value is nonlinear and nonmonotonic

A Tale of Three Aquifers



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A Tale of Three Aquifers

Northern High Plains (NE)

- High recharge, stable well yields
- Marginal value low, total value medium-high

Central High Plains (KS)

- Low-medium recharge, declining well yields
- Marginal value high, total value low-medium

Southern High Plains (TX)

- Low recharge, declining well yields
- Marginal value medium-high, total value low-medium

Conclusion

- The value of groundwater varies across space and time due to varying biophysical and socioeconomic factors
- Well yield is useful in thinking about how aquifer conditions influence water risk
- The difficulty of monitoring and enforcement of groundwater restrictions is underappreciated

Thank you!

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