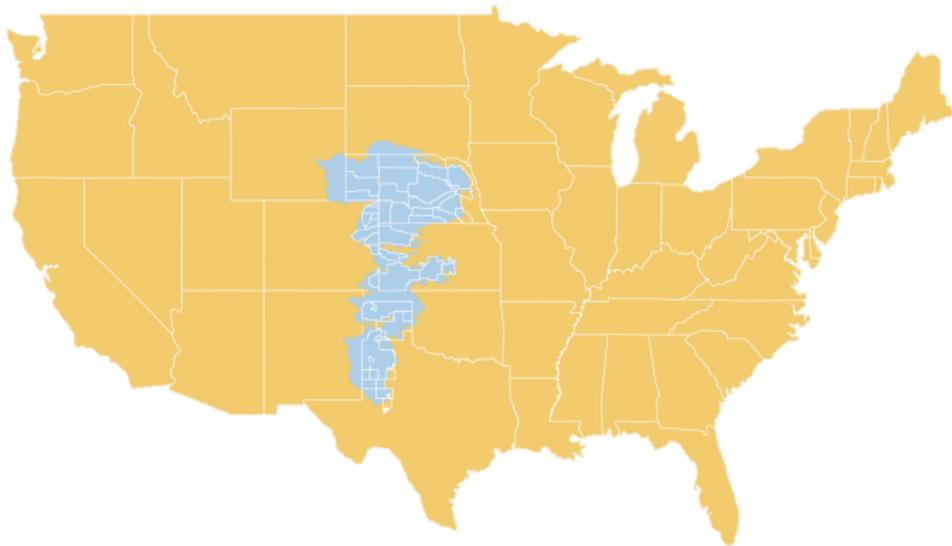


Innovations in High Plains Water Management Institutions

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Groundwater plays a critical role in



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

U.S. agricultural groundwater policy and law

- Federal level
- State level
- Local level (county, basin)
- Hyper-local level (sub-basin)

1. Metering



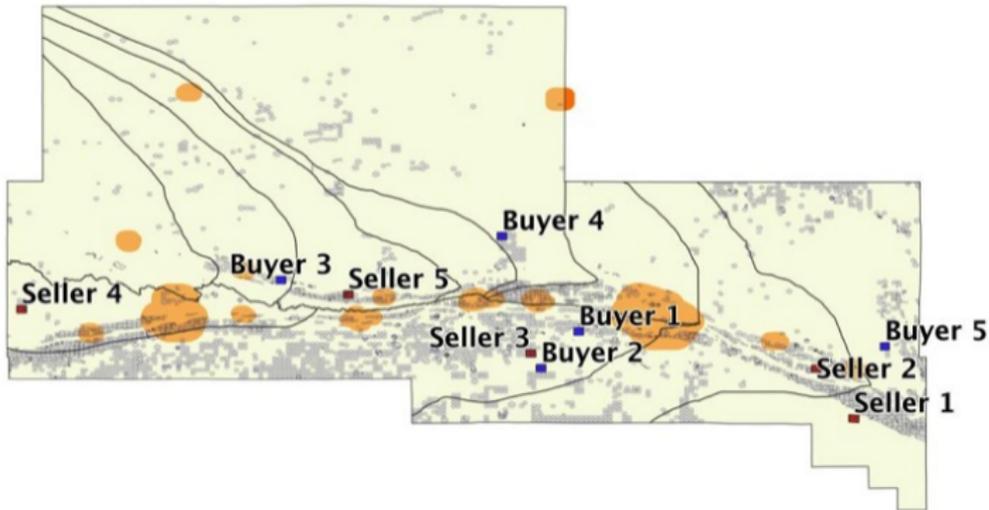
State of agricultural groundwater metering

- The Upper Republican NRD in Nebraska started metering in 1978 and was fully metered by 1982
- Meters are also found elsewhere in the HPA region
 - Nebraska
 - Kansas
 - Texas

State of agricultural groundwater metering

- There are more meters currently in the HPA region than in any other aquifer in the world
- Meters can be controversial
- Monitoring of pumping restrictions is possible without meters through certification of irrigated acreage

2. Groundwater tradable permit systems



Design of groundwater trading systems

- **Consideration of spatial externalities**

- Often a primary driver of regulation
- Lead to complex rules and regulations e.g. zoning, offsets

- **Conveyance issues**

Unlike surface water markets, conveyance is not an issue

- **Consumptive water use**

- Existing markets transfer either applied water or irrigated acreage
- Reasons are likely pragmatic

- **Other considerations**

- Paper water, carryover provisions. . .
- There is enormous institutional variation and complexity

State of agricultural groundwater trading

There are growing number of regions with emergent informal and formal groundwater markets:

- High Plains region
 - Nebraska (e.g. Republican and Platte River Basins)
 - Kansas (e.g. Sheridan-6 LEMA)
- Australia
(National Water Initiative e.g. Murray-Darling Basin)
- Other regions
(Texas, Arizona, California, New Zealand, China, South Asia)

3. Aquifer depletion regulations

2 Water-Level Changes and Change in Water in Storage in the High Plains Aquifer, Predevelopment to 2013 and 2011-13

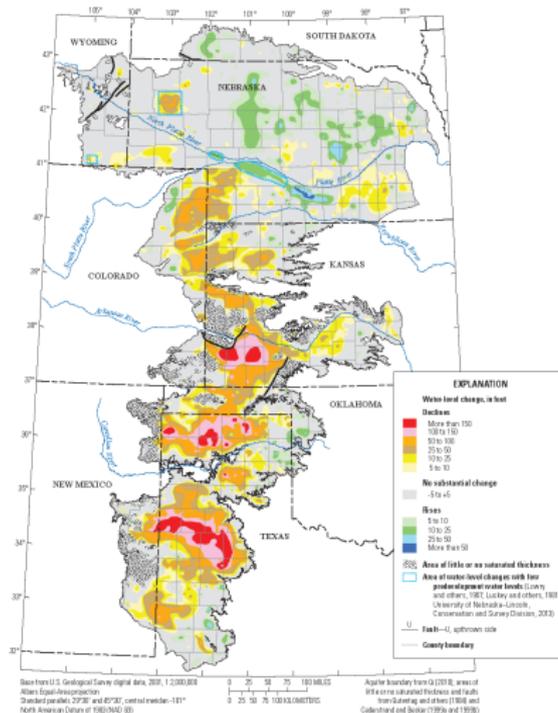


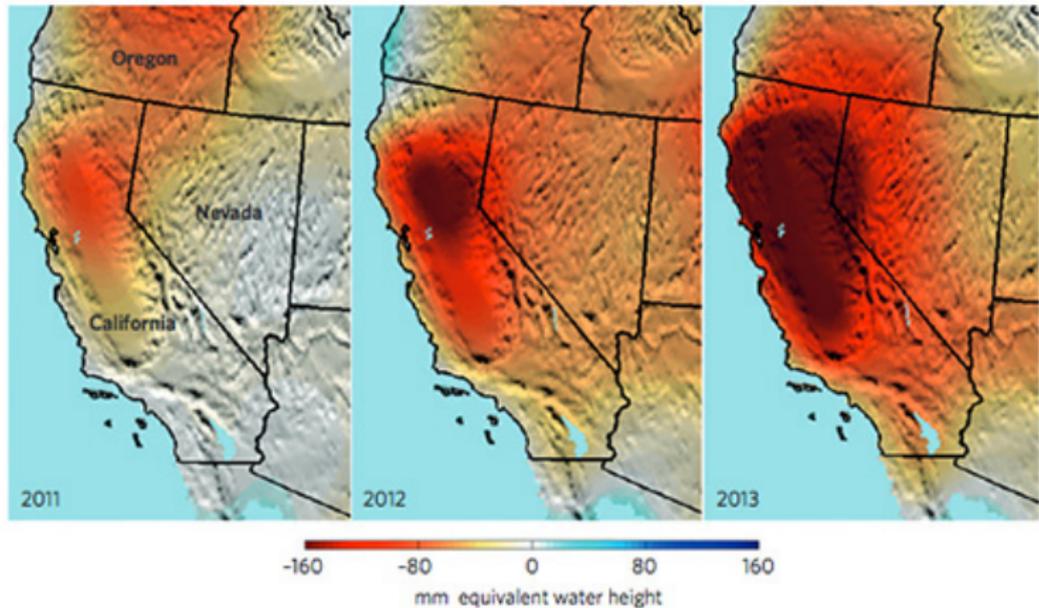
Figure 1. Water-level changes in the High Plains aquifer, predevelopment (about 1950) to 2013.

Aquifer depletion and regulation

- Aquifer depletion is a very popular theme in the news
- To date, most binding changes in groundwater policy have been driven by surface water-groundwater interaction, not aquifer depletion
- There are now a few cases where enforceable regulations are occurring due to aquifer depletion and well interference
 - Sheridan-6 LEMA (GMD #4)
 - Lower Elkhorn NRD

Innovation and failure

Central Valley Aquifer, California





Thank you!

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