

Challenges to Groundwater Management

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Understanding Groundwater

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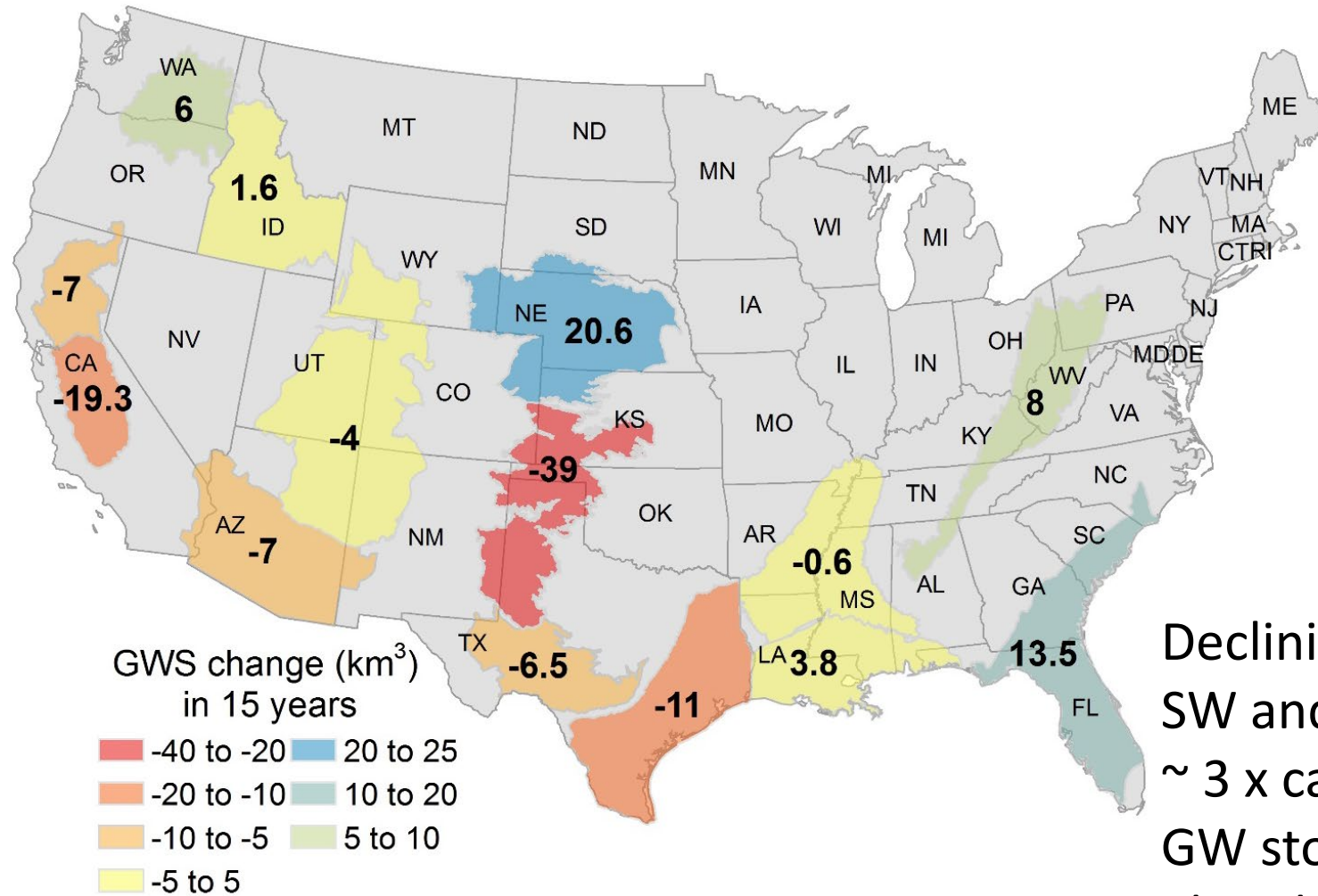
The University of Texas at Austin
Jackson School of Geosciences

Challenges to Groundwater Management in the US

1. What are the dominant controls on groundwater **quantity**?
2. What are the dominant controls on groundwater **quality**?
3. What is the **path forward**?

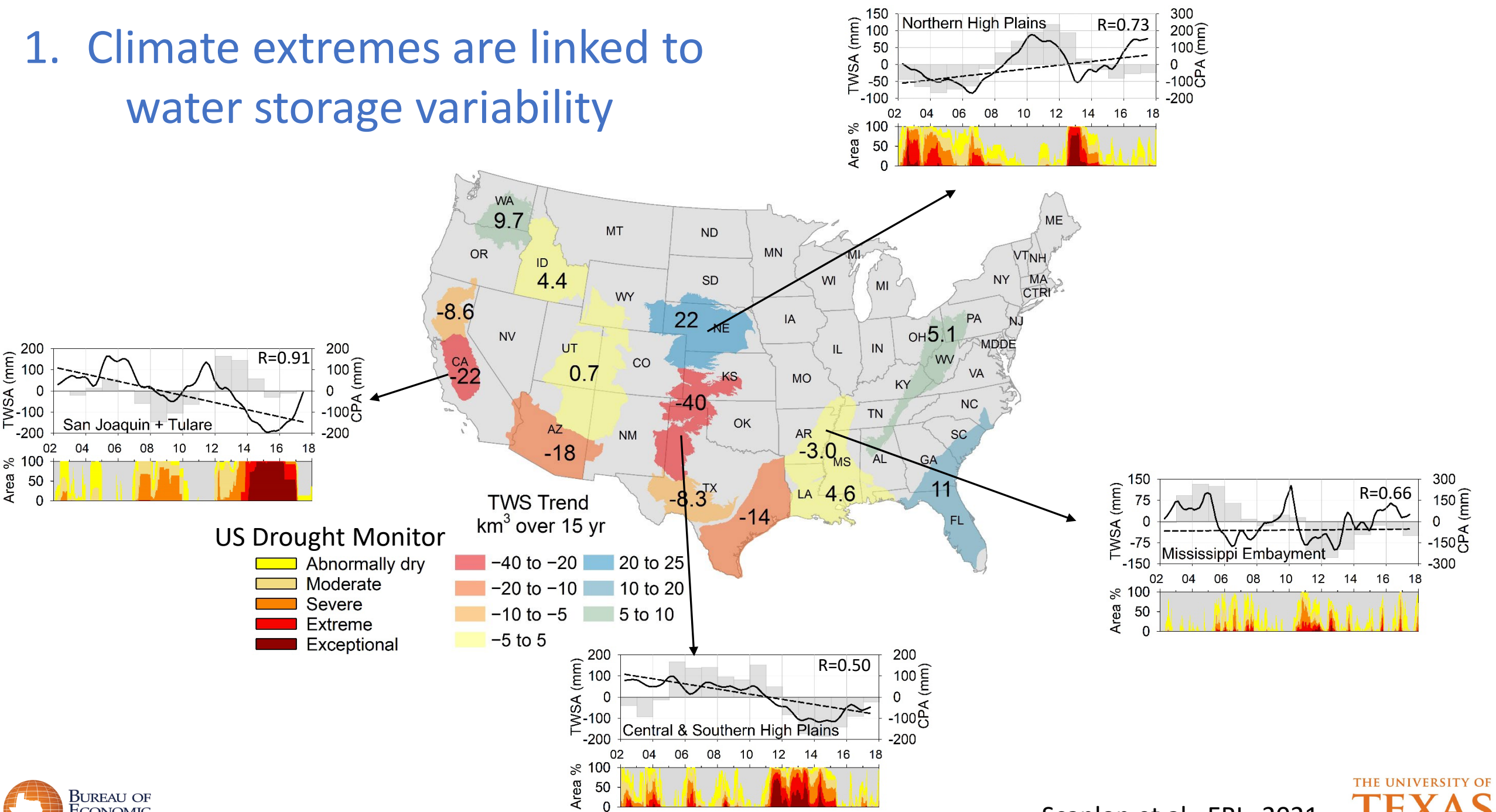


1. Groundwater Storage Change from GRACE (2002 – 2017)

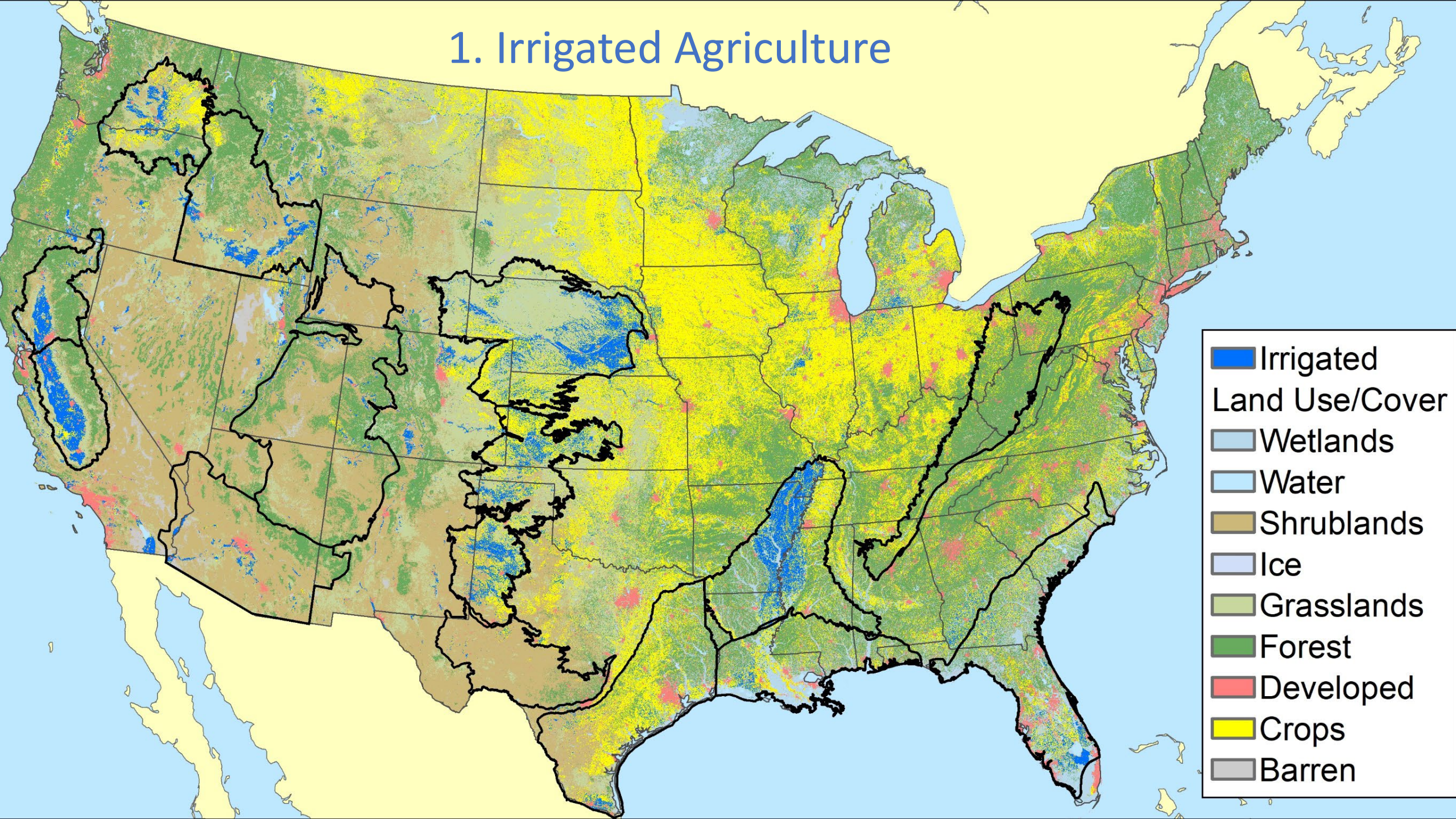


Declining GW storage SW and SC US, ~90 km³
 ~ 3 x capacity of Lake Mead
 GW storage stable or rising elsewhere

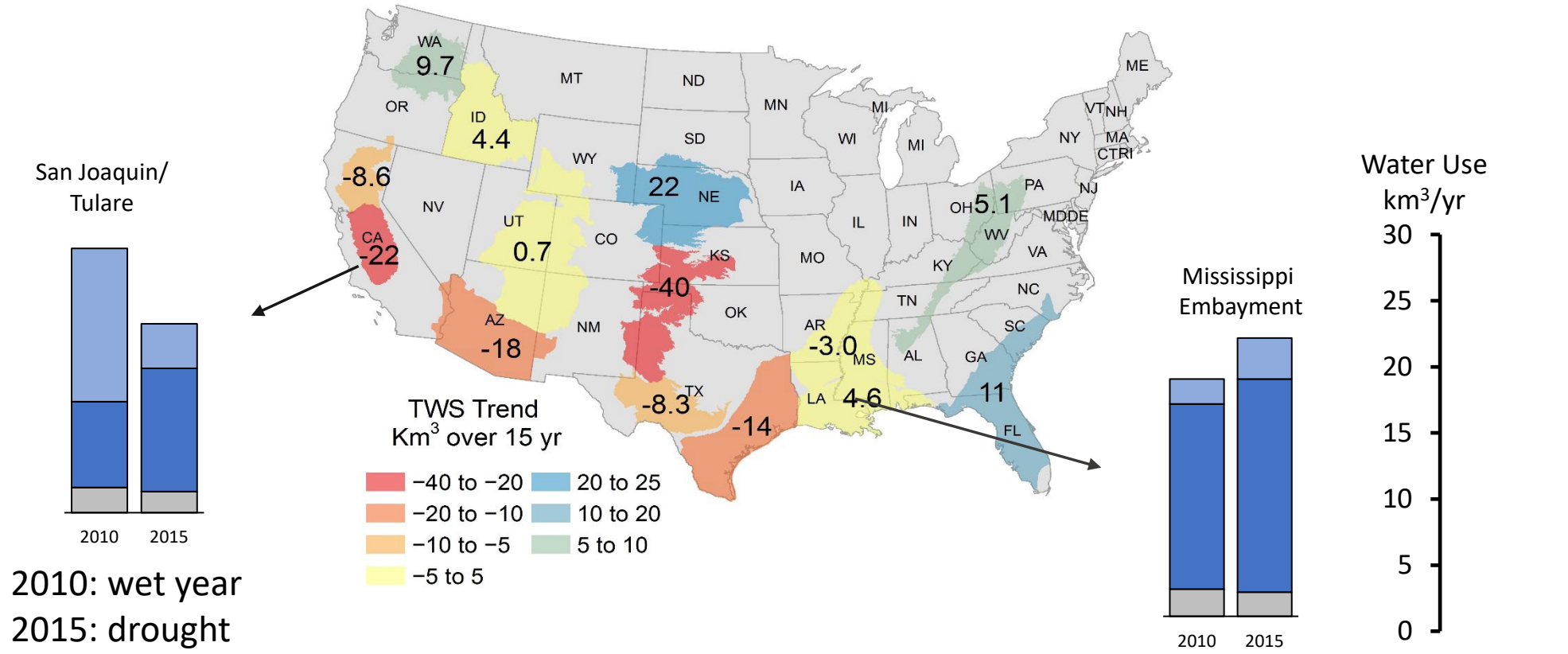
1. Climate extremes are linked to water storage variability



1. Irrigated Agriculture



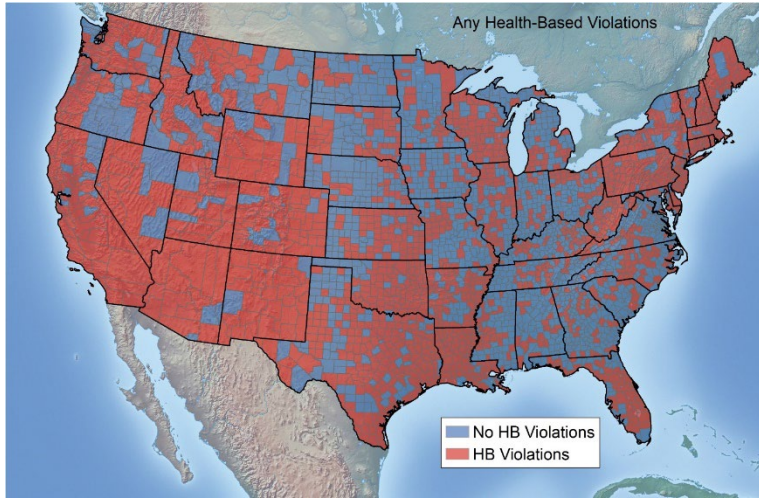
1. Irrigation Impact on Water Storage



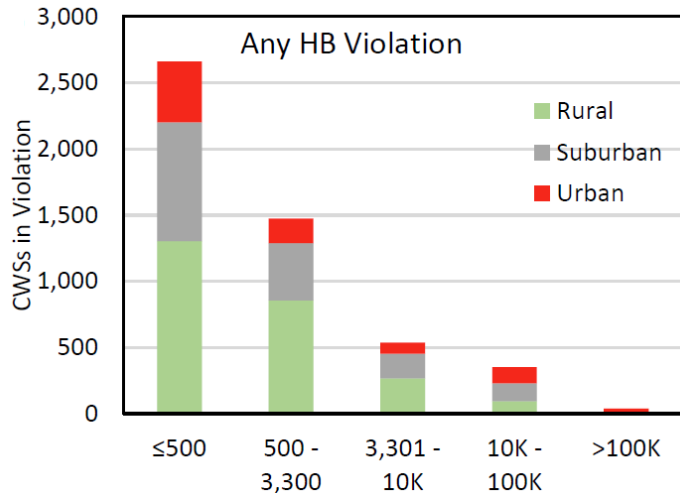
2010: wet year
2015: drought

Irrigation amplifies drought impacts in the SW but dampens impacts of drought in NW (irrigation source is important)
Groundwater pumpage for irrigation in humid regions can capture surface water

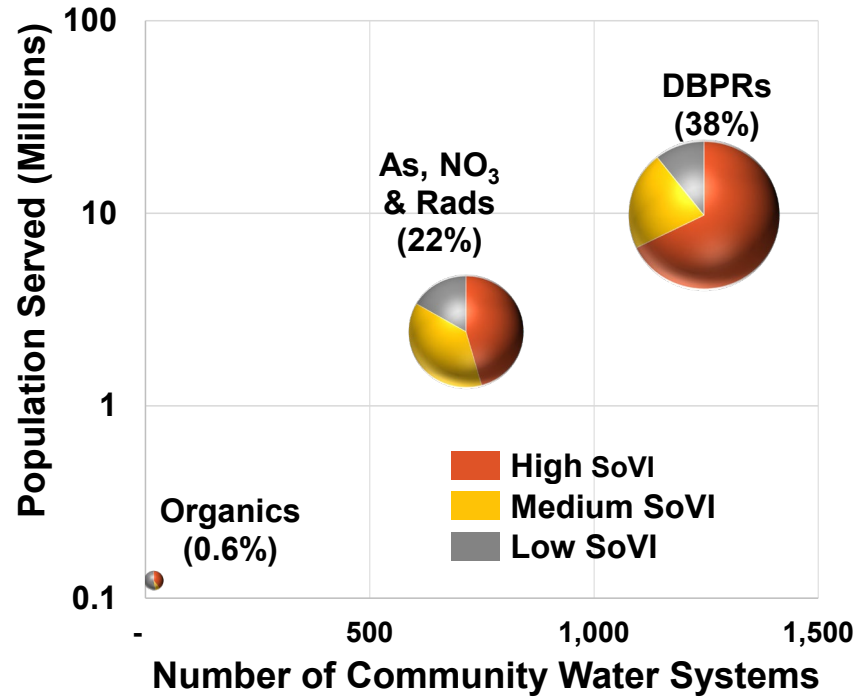
2. Water Quality: Community Water Systems (2018 – 2020)



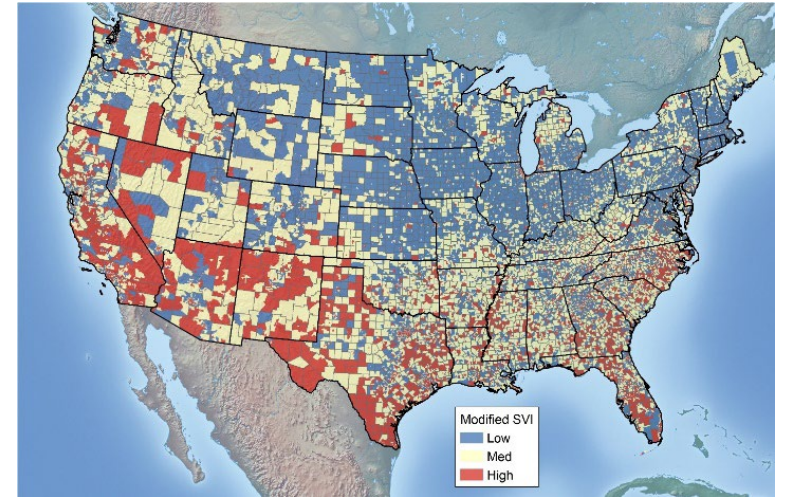
Counties with any health-based (HB) violation (2018 – 2020)
 1 in 10 people were exposed to a health-based violation



Health-based violations mostly in **small systems** in **rural areas**



Causes of health-based violations

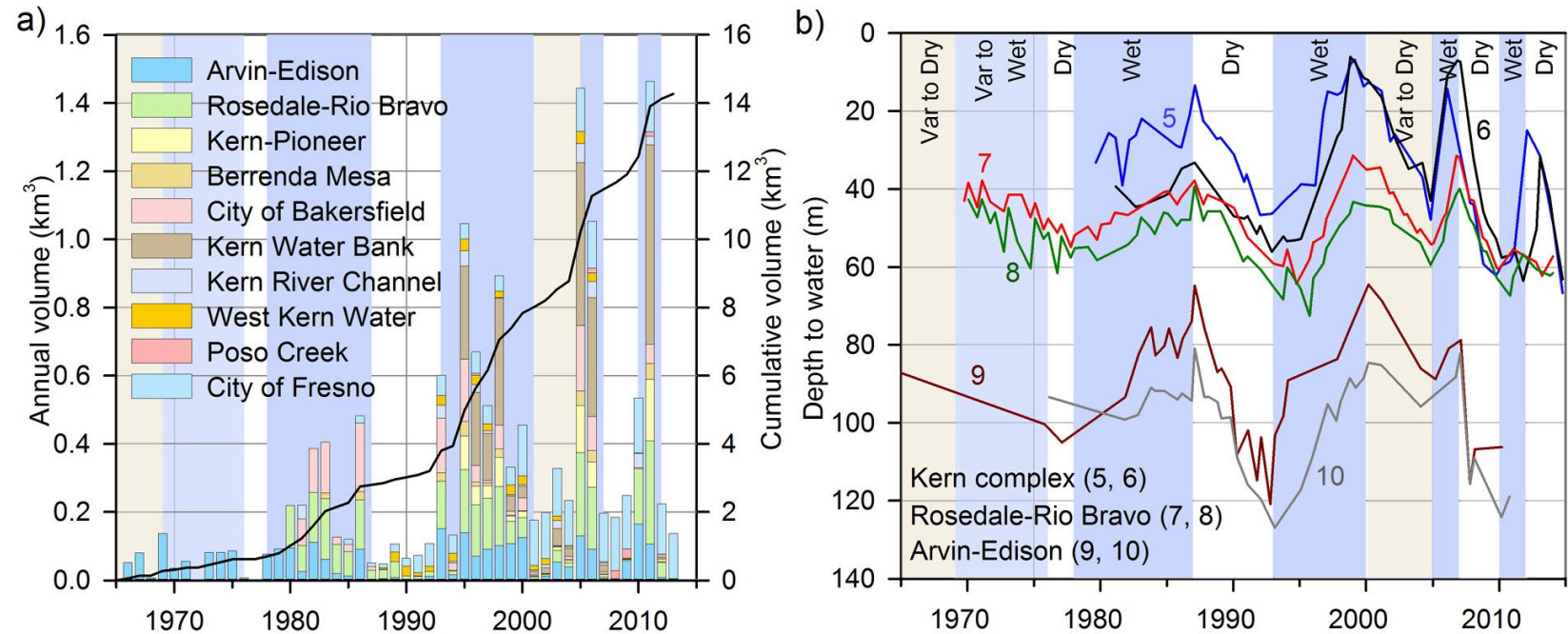


Modified Social Vulnerability Index (SVI)
 Socioeconomics, race & language, demographics & housing

3. Path Forward: Quantity

Conjunctive management of GW and SW, Managed Aquifer Recharge

S Central Valley



Managed Aquifer Recharge: California spreading basins

Arizona: Central Arizona Project, Colorado River water

Idaho: Eastern Snake Plain Aquifer Managed Aquifer Recharge

2. Path Forward: Quantity

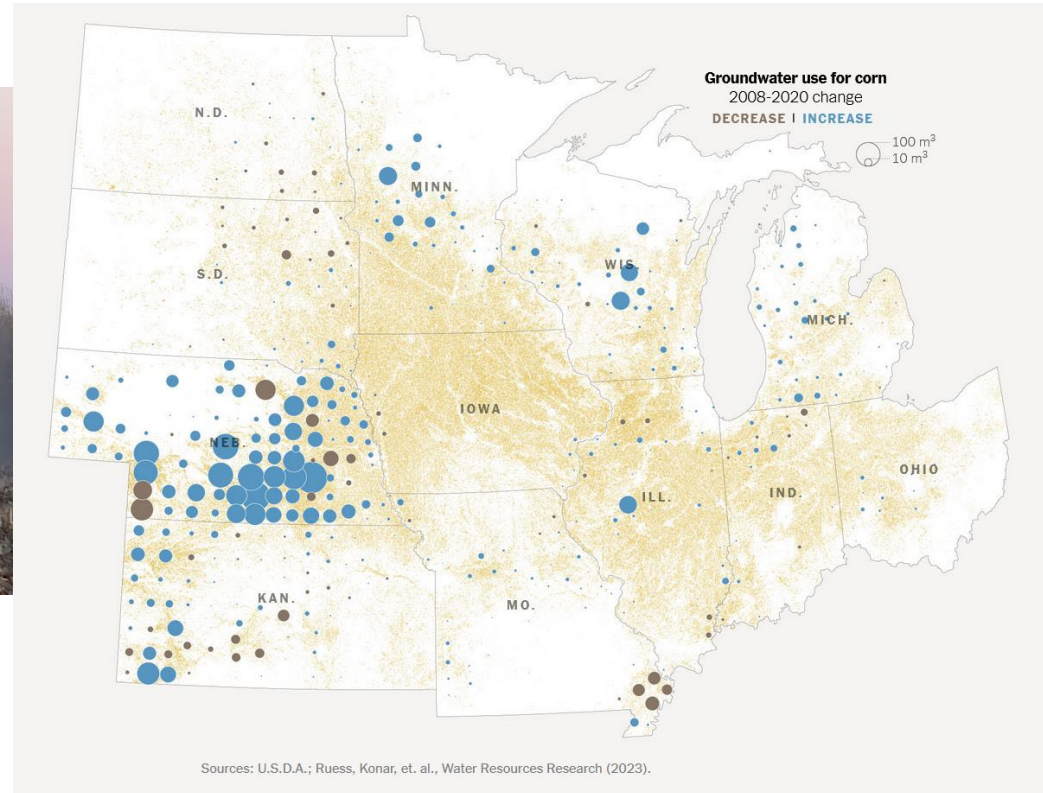
Water smart agricultural policies



The New York Times

UNCHARTED WATERS

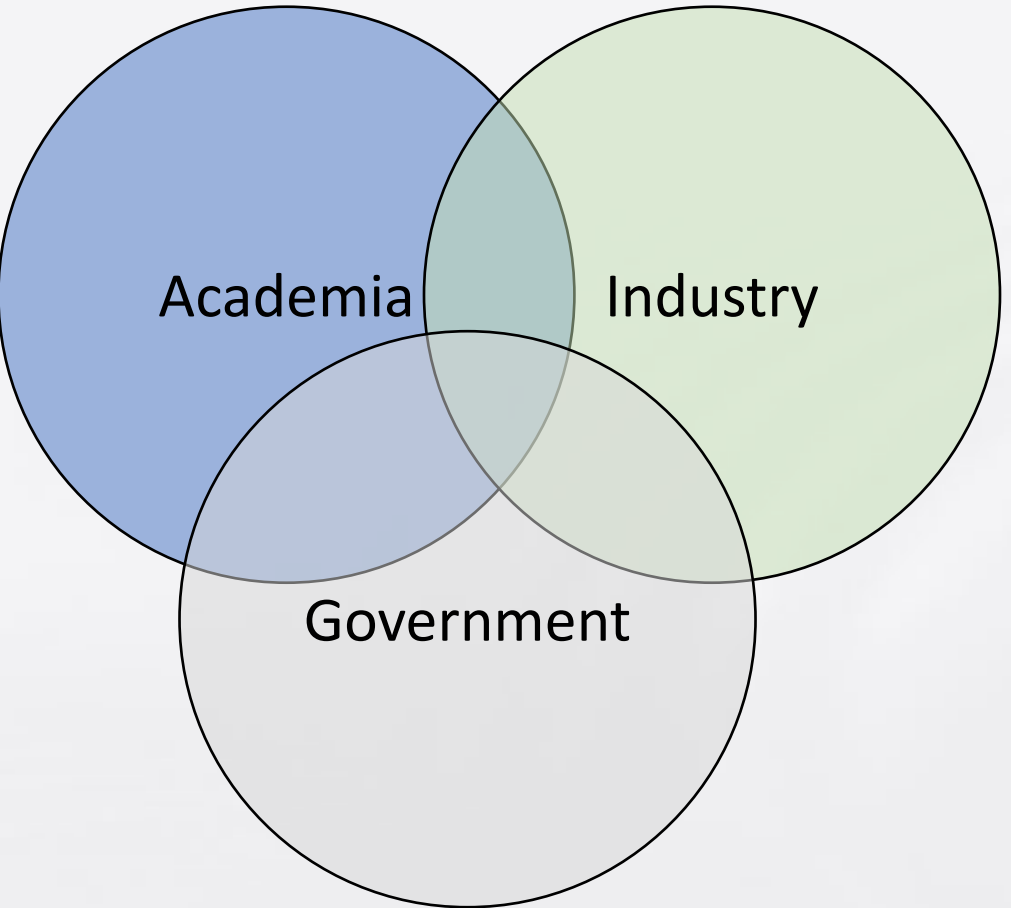
Airlines Race Toward a Future of Powering Their Jets With Corn



Path Forward: Quality

1. Stop polluting?
2. Many systems are small, rural, and sole source
- 3. Treatment and regionalization** potential solutions
- 4. Workforce development:** both regulators and system operators
 - Improves regulatory enforcement and managerial capacity

3. Path Forward



Tools
Remote sensing
Modeling
Monitoring
AI/ML

Funding Issues
Federal Funding
Inflation Reduction
Act to states
Academic research
excluded

Communication

NAE Member Led Event
Water Resources Podcast



<https://wrp.beg.utexas.edu/>

Summary

1. Dominant controls on groundwater **quantity**?

Climate and climate extremes, irrigation

2. Dominant controls on groundwater **quality**?

Geogenic and agricultural sources

3. Path Forward:

Quantity: Conjunctive management of GW and SW (Managed Aquifer Recharge)

Water-smart agriculture

Quality: treatment, regionalization, workforce development

Increase interagency collaboration (e.g., GW/SW, water and agriculture)

Improve **collaboration** between academia, industry, and government

Stable funding for programs (e.g., workforce development, research programs)