From the Great American Desert to the Great American Breadbasket: Managing Groundwater in the High Plains Aquifer

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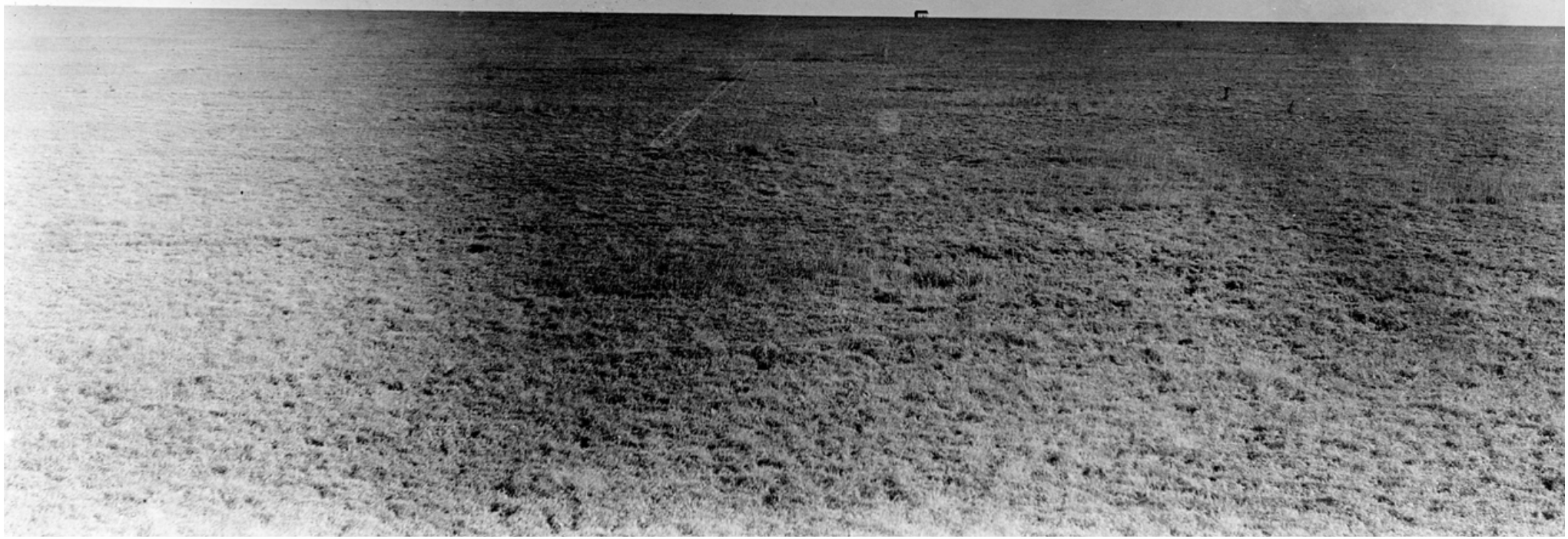
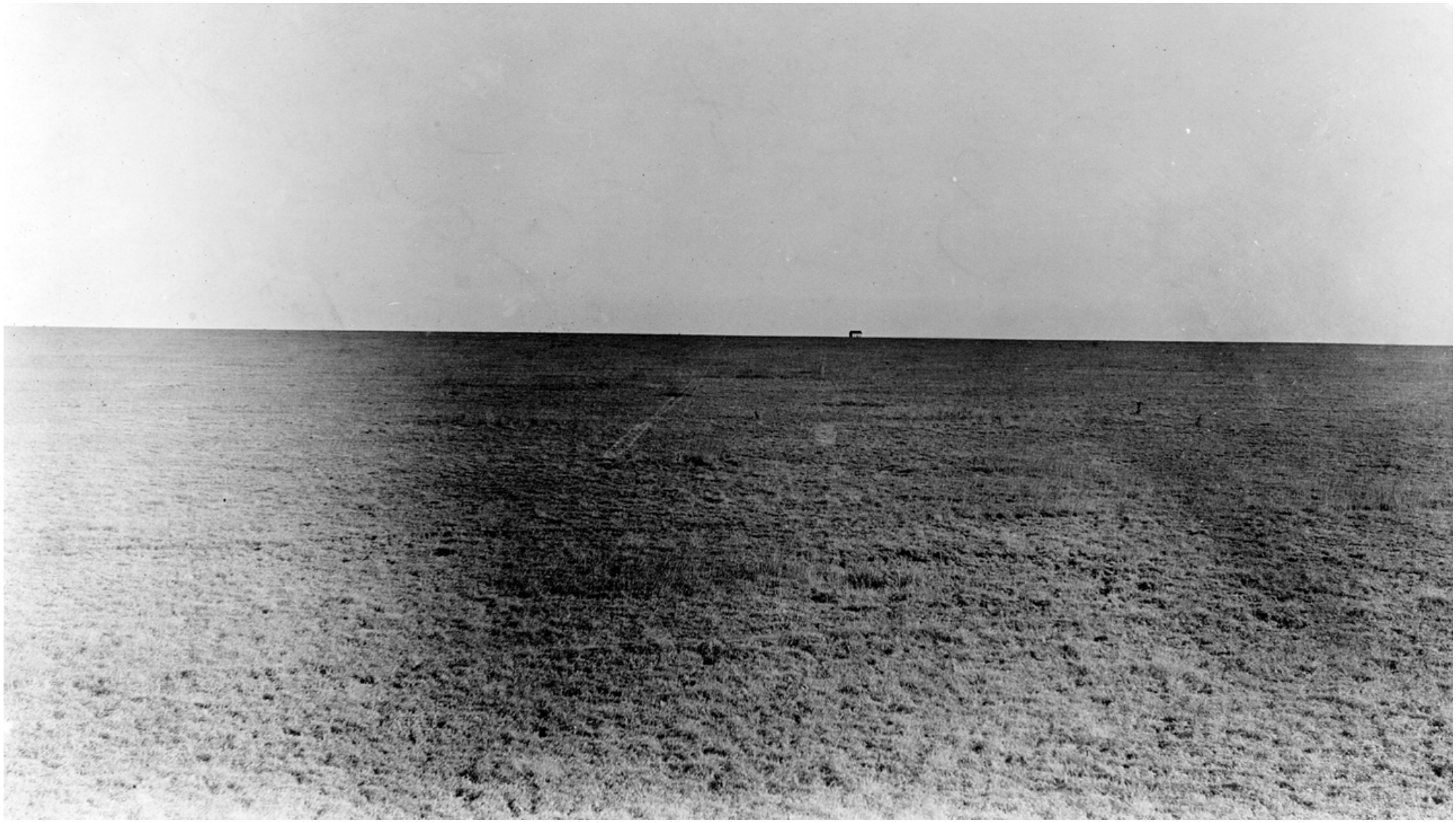
presented at

The Ogallala Aquifer Summit; April 9, 2018; Garden City, Kansas

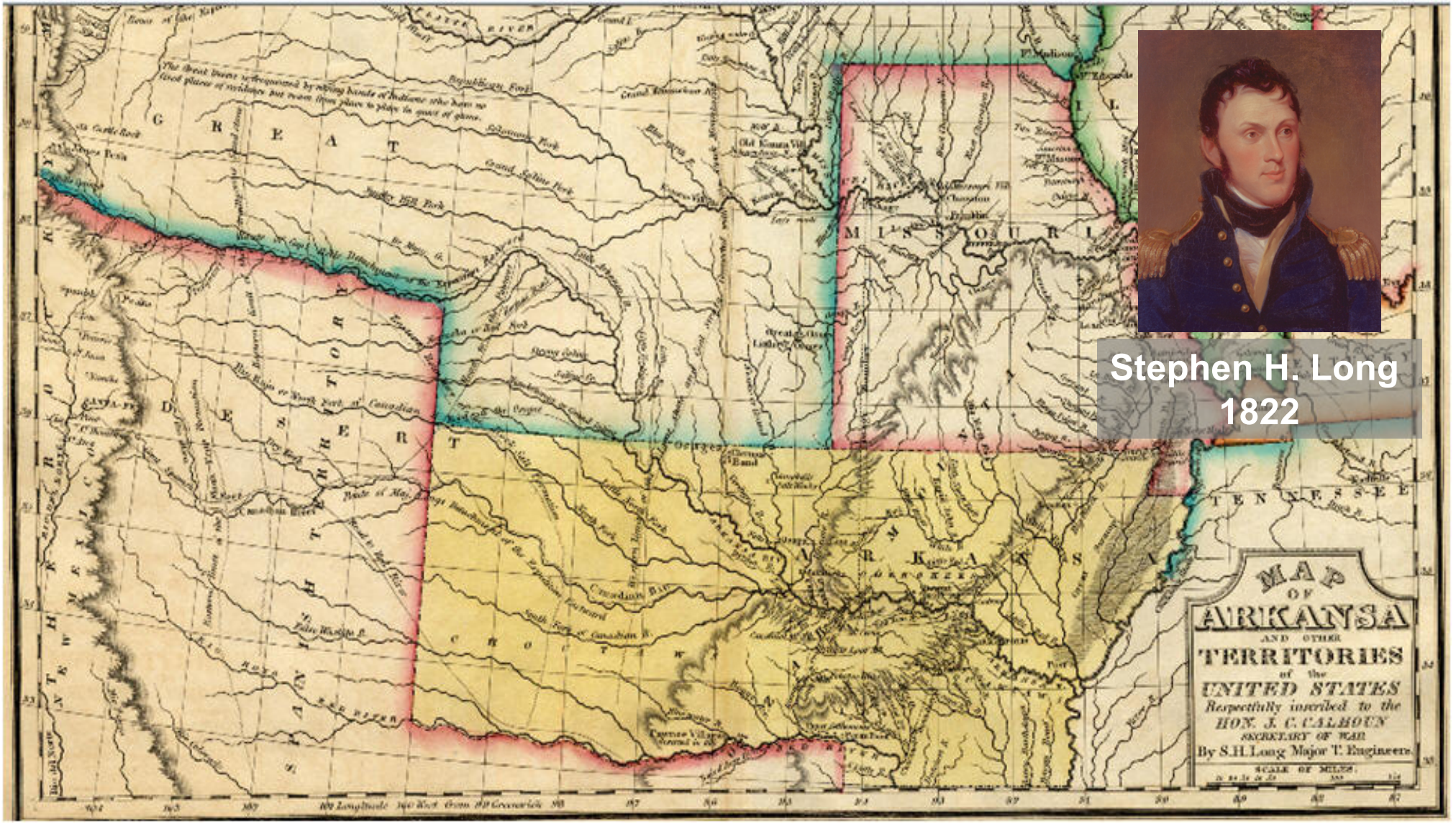




Francisco Vázquez de Coronado, circa 1541

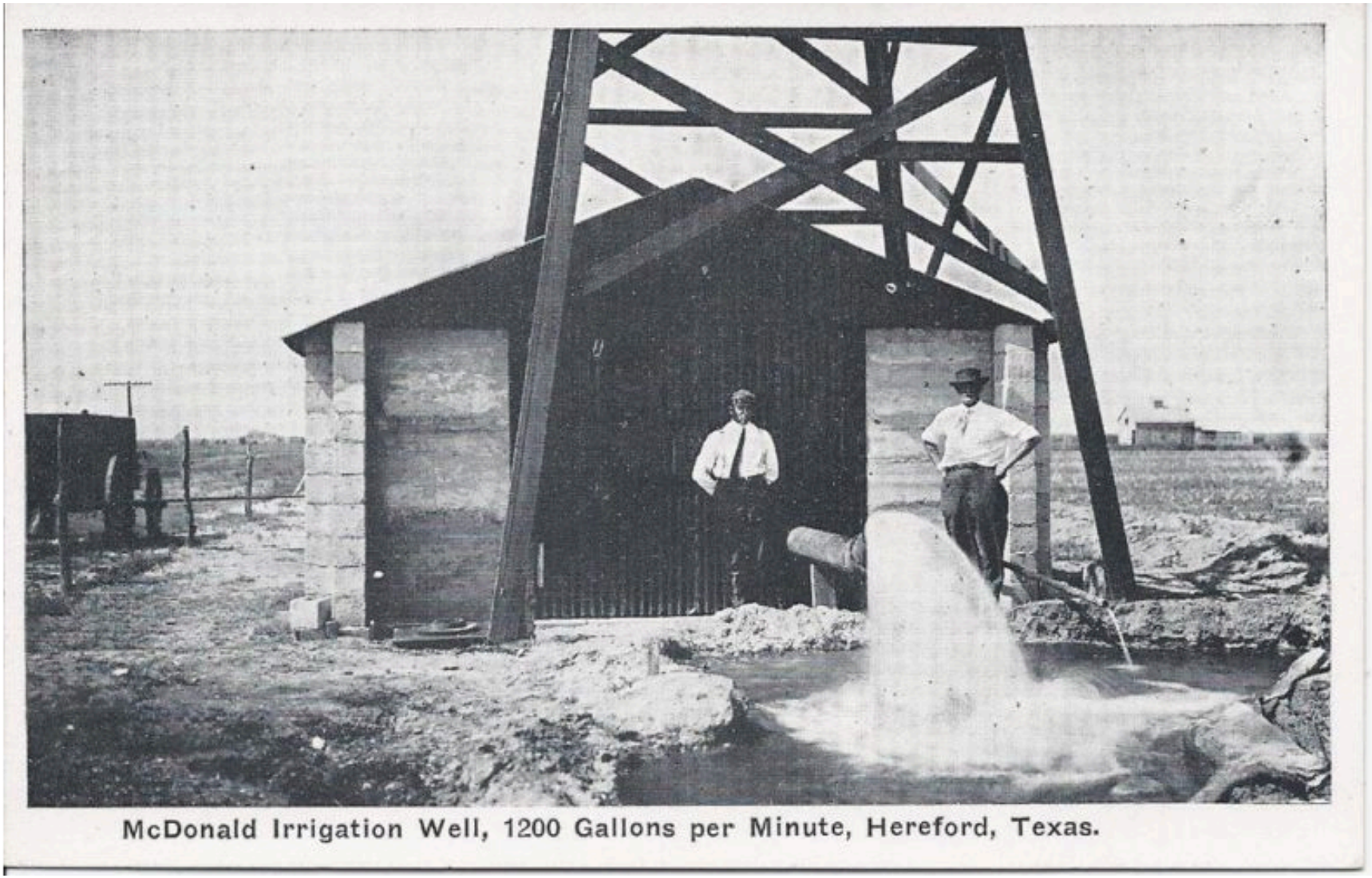
Zebulan Pike 1806

Haskell County, Kansas 1897

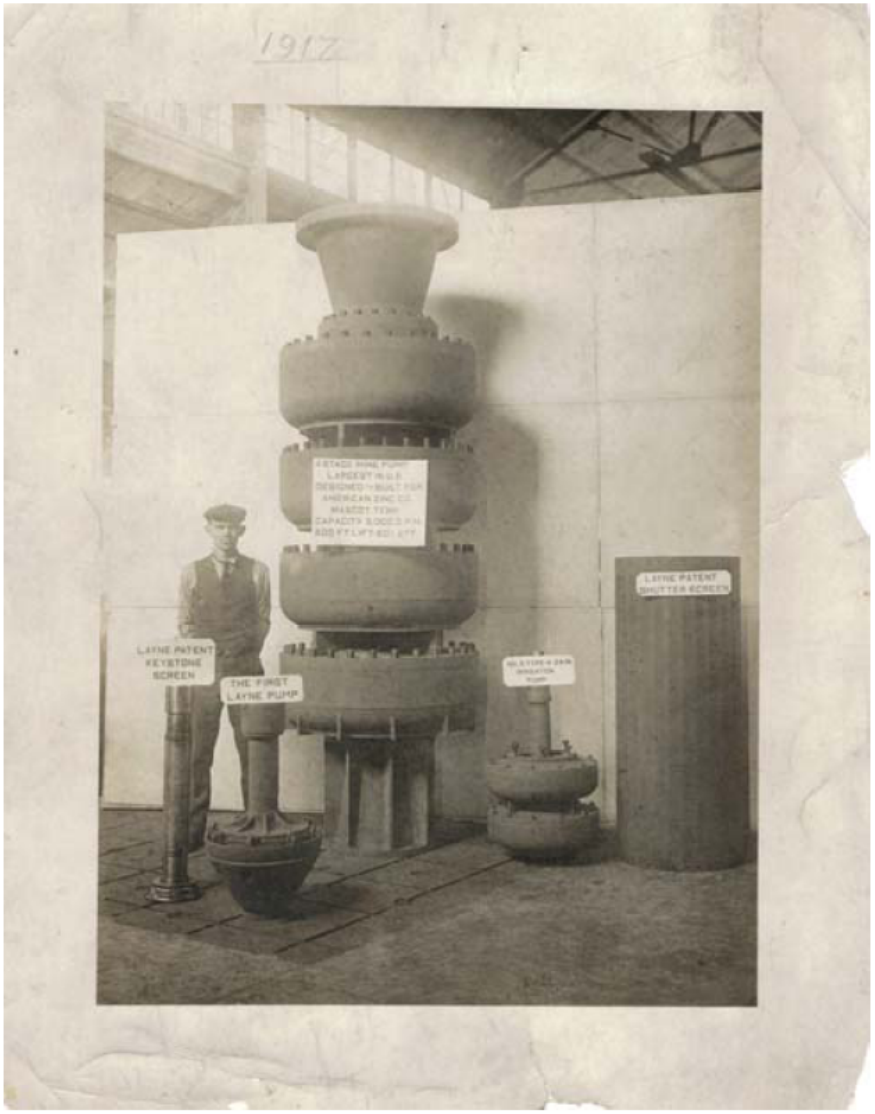

MAP
OF
ARKANSA
AND OTHER
TERRITORIES
of the
UNITED STATES
Respectfully inscribed to the
HON. J. C. CALHOUN
SECRETARY OF WAR
By S.H. Long Major T. Engineers
SCALE OF MILES
GREAT
DESERT
MISSOURI
ARKANSAS
TENNESSEE
Stephen H. Long
1822

Randolph Barnes Marcy circa **1849**


THE LEADER



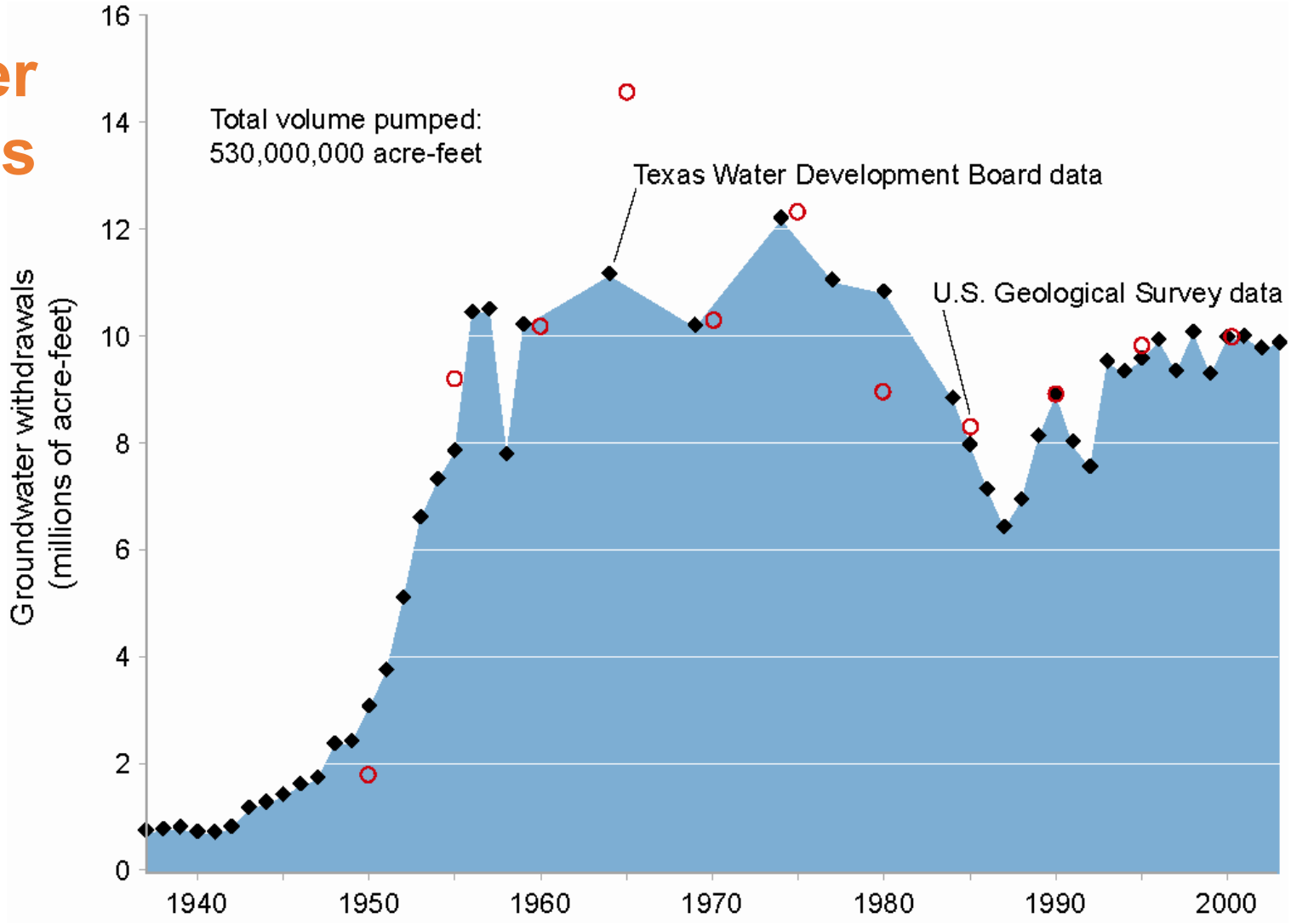
McDonald Irrigation Well, 1200 Gallons per Minute, Hereford, Texas.

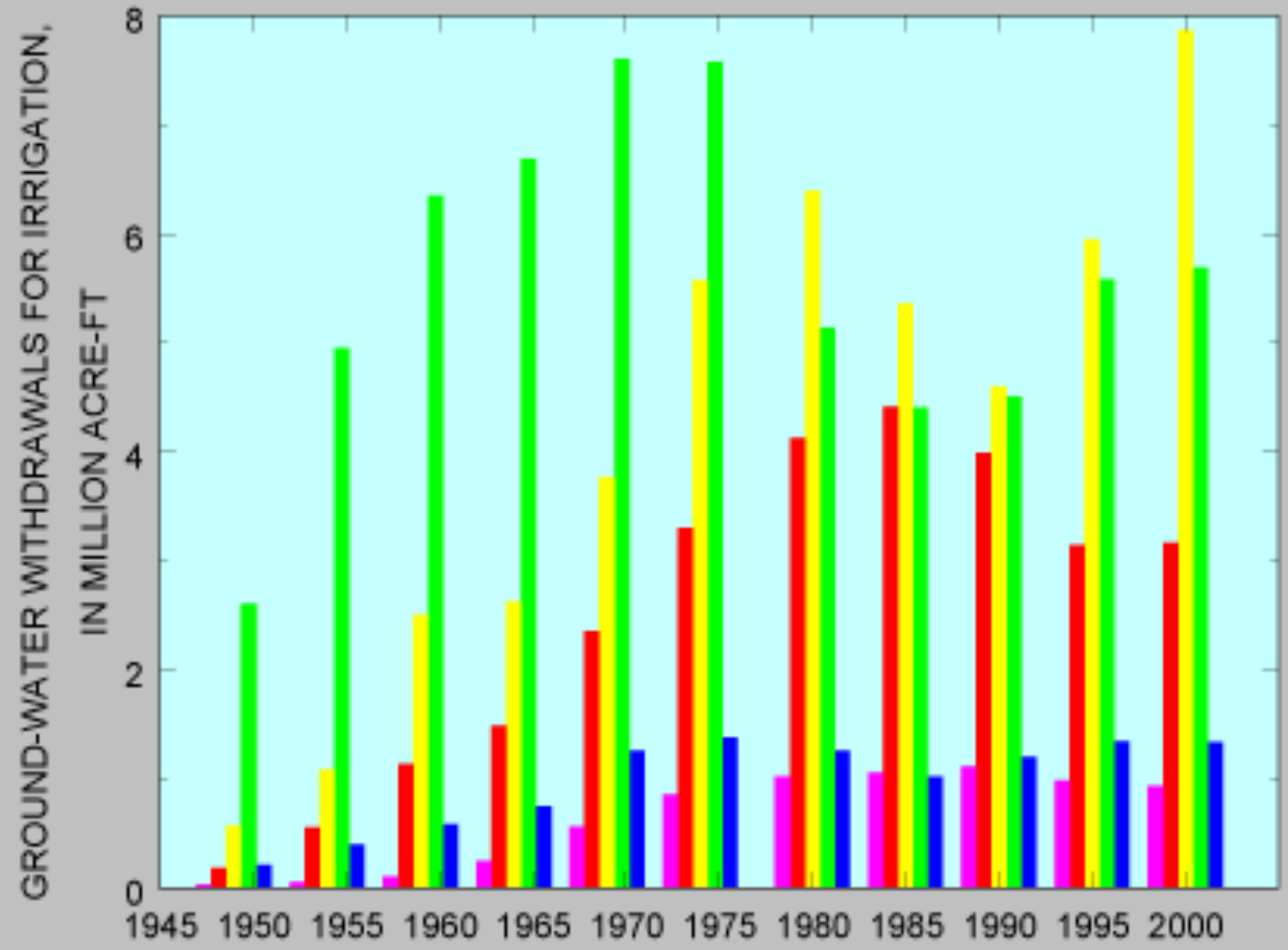


Mahlon E. Layne
1902


LAYNE

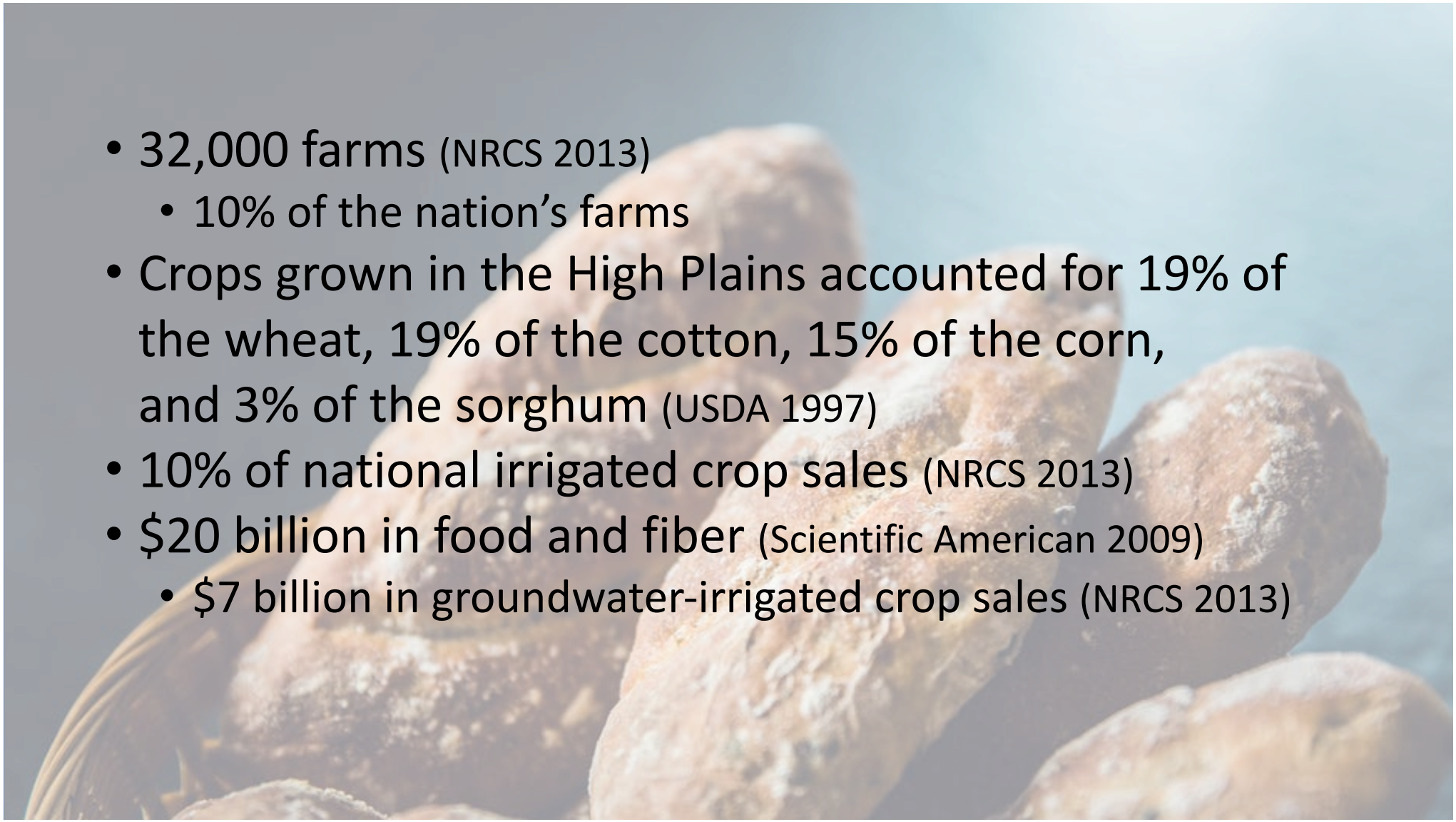
Groundwater use in Texas



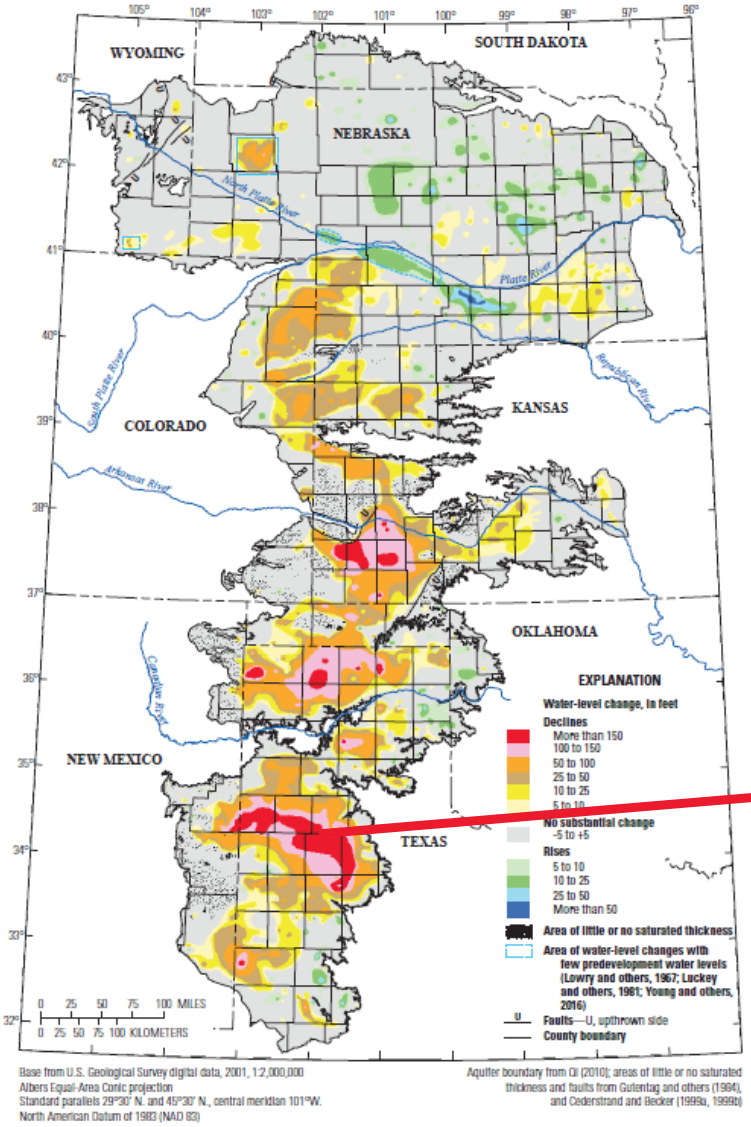


Increased from 4 mAF in 1949 to 19 mAF in 1974 for the High Plains Aquifer in total

from USGS



- 32,000 farms (NRCS 2013)
  - 10% of the nation's farms
- Crops grown in the High Plains accounted for 19% of the wheat, 19% of the cotton, 15% of the corn, and 3% of the sorghum (USDA 1997)
- 10% of national irrigated crop sales (NRCS 2013)
- $20 billion in food and fiber (Scientific American 2009)
  - $7 billion in groundwater-irrigated crop sales (NRCS 2013)

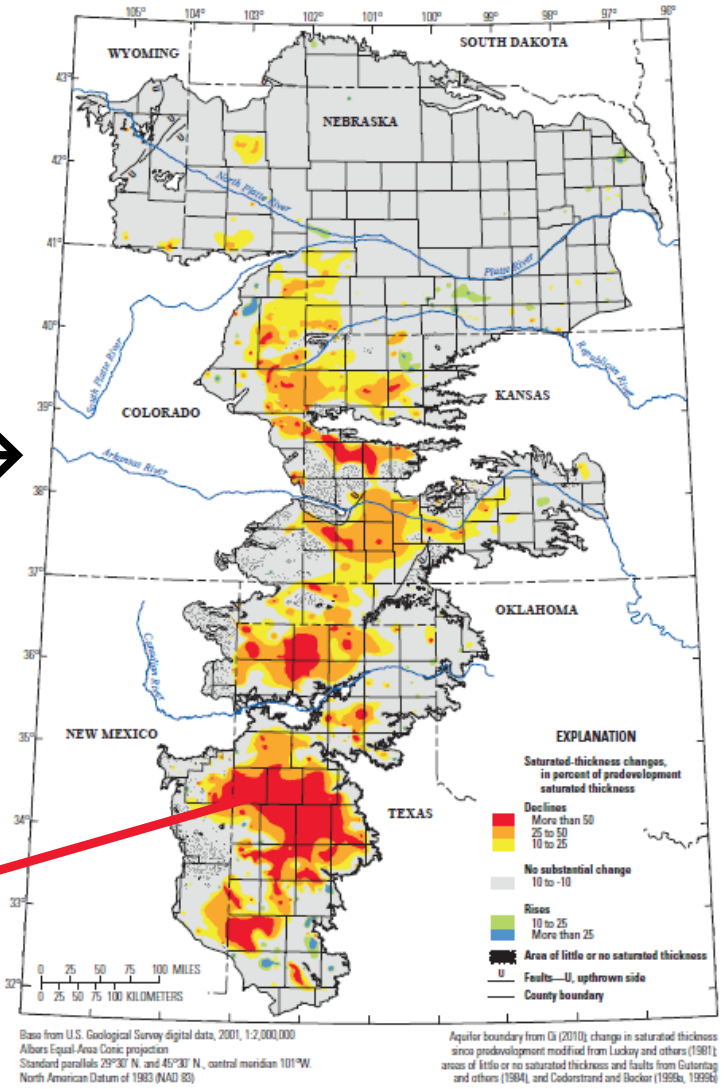


← total decline

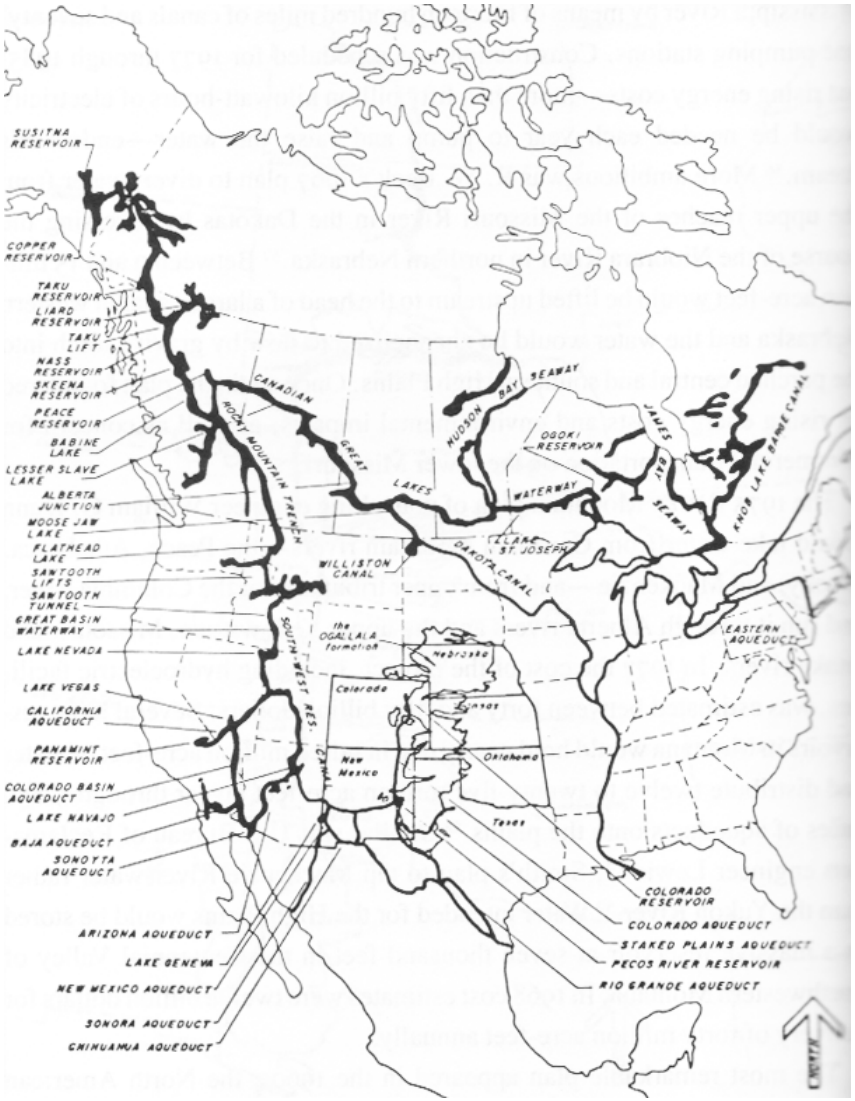
% reduction in sat thick →

>150 feet

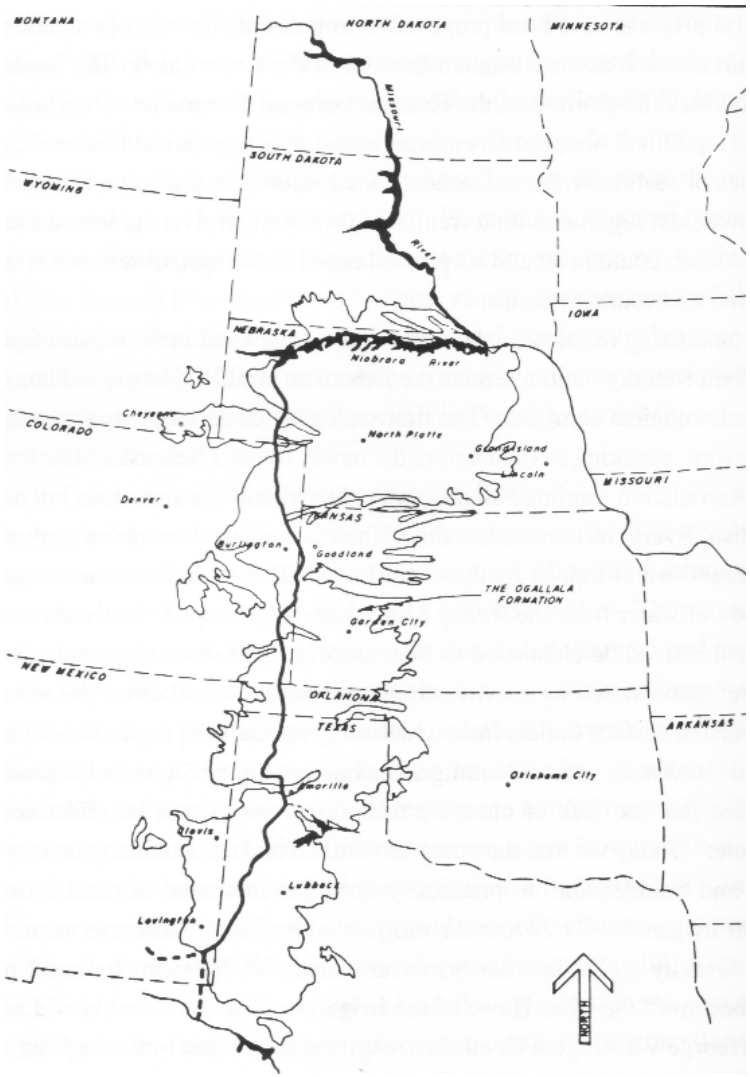
>50%



images from USGS (2015)

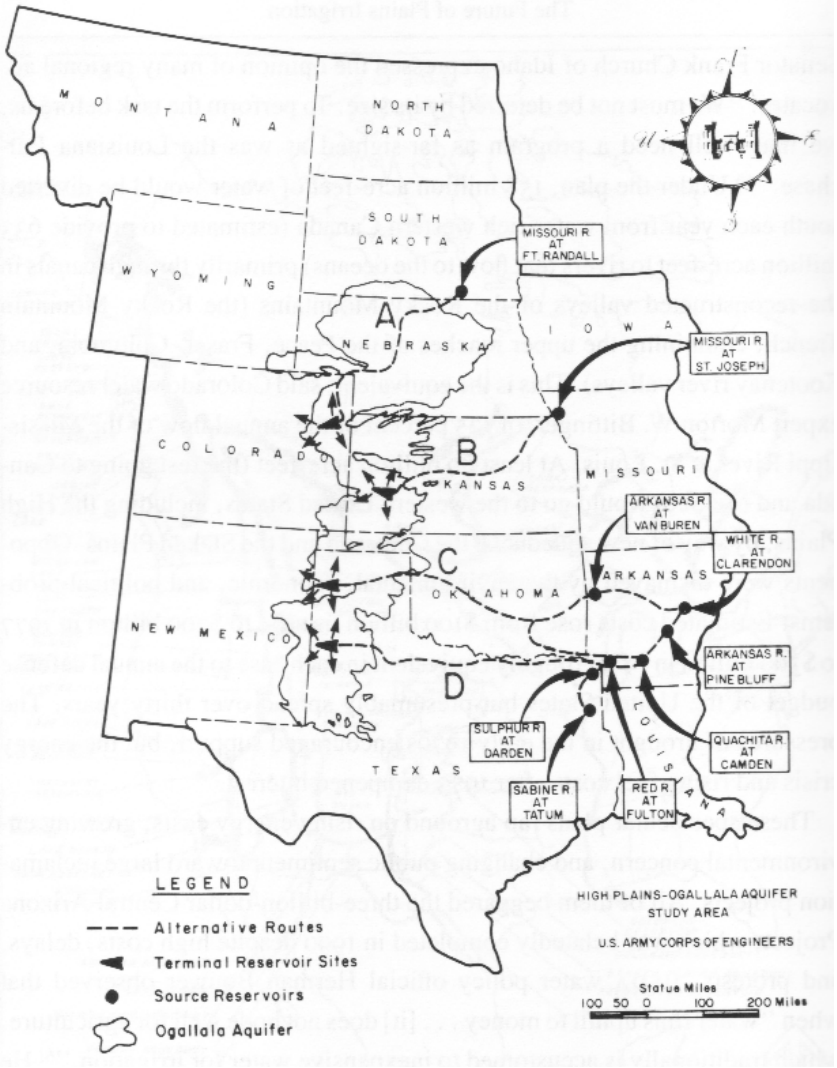


North American Water and Power Alliance 1965



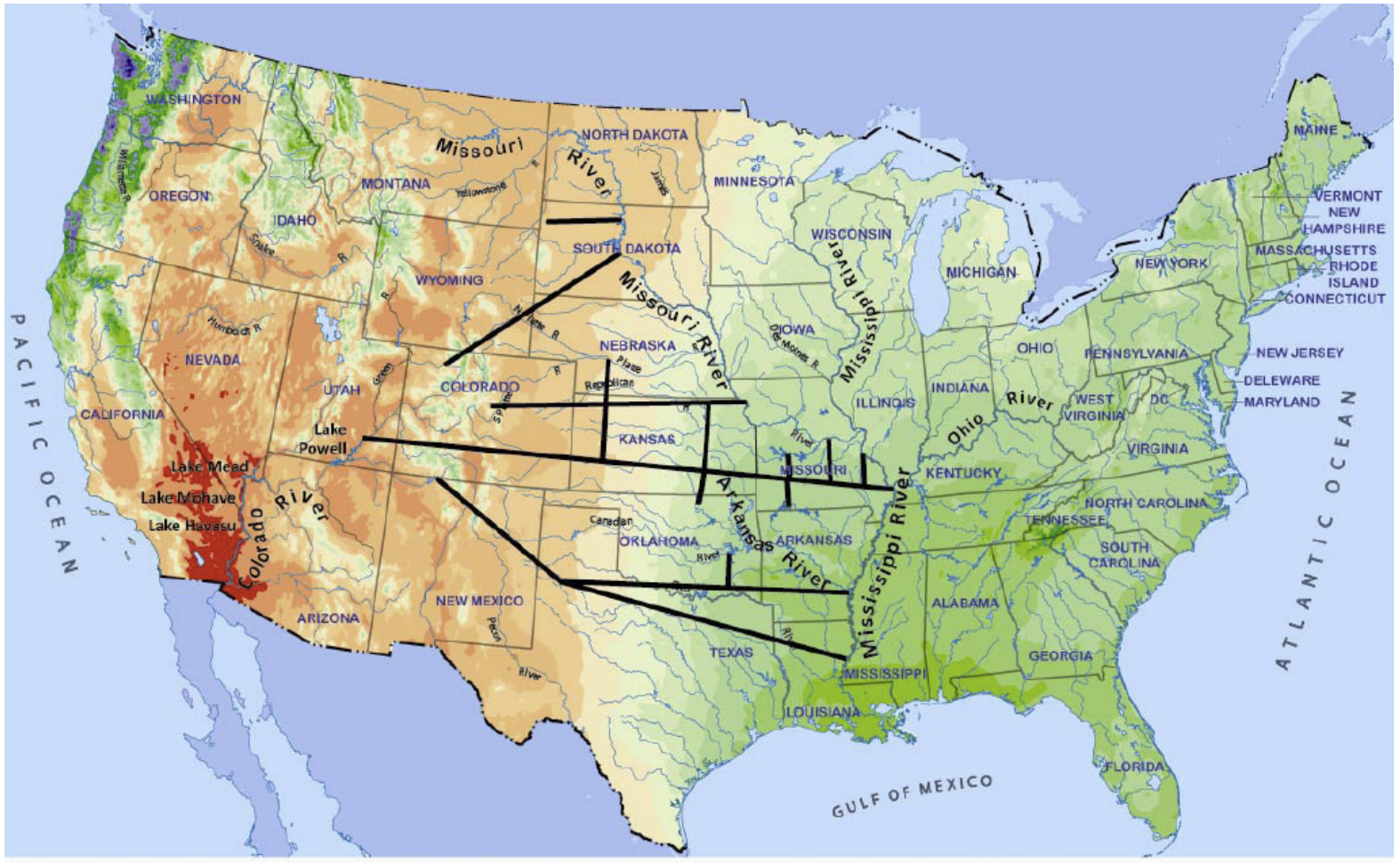
R.W. Beck & Associates 1967

Texas Water Development Board 1968



U.S. Army Corps of Engineers 1982

Lawrence Livermore National Laboratories 2009



Colorado

- State owns groundwater
  - Pre-1957: Unregulated
  - 1957-1965: Managed under maximum use
  - Post-1965: Integration with modified prior appropriation
  - 2002: Settlement on Republican River Compact lawsuit
- Colorado Ground Water Commission
  - Two Designated Ground Water Basins over High Plains Aquifer
- Nine Ground Water Management Districts
- Farmers formed the Water Preservation Partnership
- Limited Research Irrigation Farm (USDA)
- It’s illegal to throw a snowball at someone in Aspen

Kansas

- State owns groundwater
  - Kansas Water Appropriation Act
    - Prior appropriation
- Management
  - Permits through Kansas Department of Agriculture
    - Most of the High Plains Aquifer is fully permitted
  - Groundwater Management District
    - Local Enhanced Management Areas
  - Water Conservation Areas
  - Water Transition Assistance Program
- Water Technology Farms
- “World’s largest” hand dug well in Greensburg

Nebraska

- State owns groundwater
  - Groundwater Management and Protection Act
  - Modified correlative rights
- Management
  - Natural Resource Districts (23 of ‘em)
    - Groundwater management plans
    - Integrated management plans
    - Basin-wide plans
  - Water Resources Cash Fund/Water Sustainability Fund
- Testing Ag Performance Solutions
- Increasing nitrates
- Edwin E. Perkins of Hastings invented Kool-Aid in 1927

New Mexico

- State owns groundwater
  - Prior appropriation
- Management
  - Office of the State Engineer
    - Groundwater rules
  - Underground Water Basins (7 of ‘em)
    - Basin guidelines
  - Critical Management Areas
- Ute pipeline
- Has more cows than people

Oklahoma

- State owns groundwater
  - Pre-1967: As permitted
  - Post-1967: Correlative rights
- Management
  - Oklahoma Water Resources Board
  - Oklahoma Panhandle Agriculture and Irrigation Association
  - County Conservation Districts
  - Panhandle Regional Water Plan
- Oklahoma Panhandle Agriculture and Irrigation Association
- Oklahoma has more man-made lakes than any other state

South Dakota

- State owns groundwater
  - Prior appropriation
- Management
  - Rosebud Sioux Tribal Water Resources Office
    - Tribal Water Conservation Code
  - Water Management Board
    - Administered by Department of Environment and Natural Resources
  - Strict, no-depletion policy
    - “Annual withdrawal of groundwater not to exceed recharge…” SDCL 46-6-3.1
- South Dakota has more miles of shoreline than Florida

Texas

- Groundwater owned by the landowner
  - Varied management schemes built on a Rule of Capture foundation
  - Correlative rights most common in High Plains Aquifer
- Management
  - Groundwater Conservation Districts
    - Issue permits
    - Groundwater Management Areas
    - Desired Future Conditions/Modeled Available Groundwater
      - Planned depletion for much (if not all) of the High Plains
    - Groundwater Management Plans
- Alliance for Water Efficiency
- It's illegal to expose oneself or swear in front of a corpse

Wyoming

- State owns groundwater
  - Prior appropriation
  - No exemptions allowed since 1969
- Management
  - State Engineer's Office
  - Control Areas set by the Engineer's office
    - 3 of 'em, all over the High Plains Aquifer
    - One requires adjudication and metering and no permits for >5 acre-feet per acre
  - Underground Water Districts set by the Engineer's Office
- Laramie County Conservation District converting irrigated land to dry land with the Agricultural Water Enhancement Program
- There are only two escalators in the entire state

opportunities

many states/similar challenges

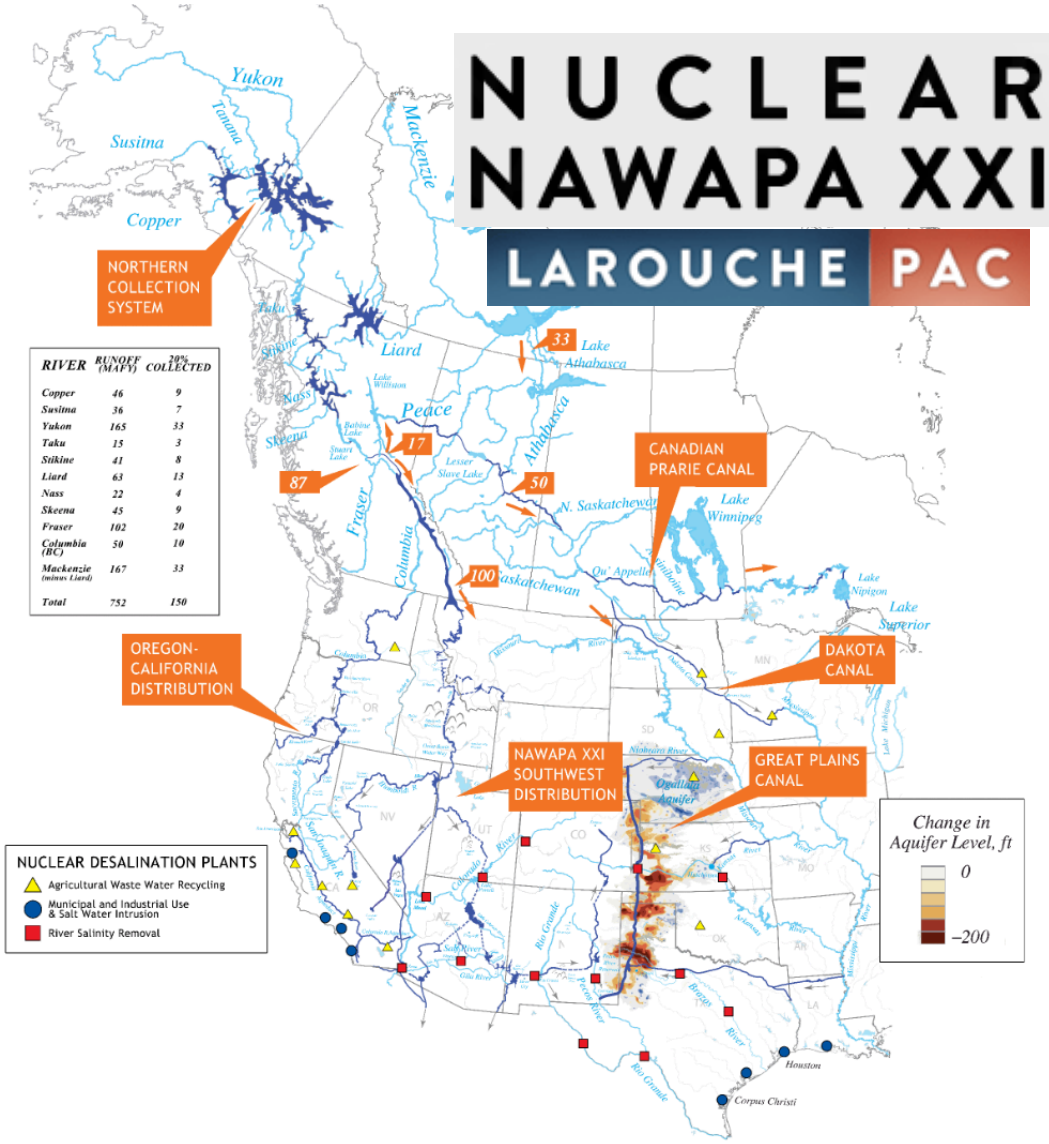
- Depletion
- Transition to dryland
- Data and science
- Conserving water
- Employing new technologies
- Governance
- Federal funding/support

states working together

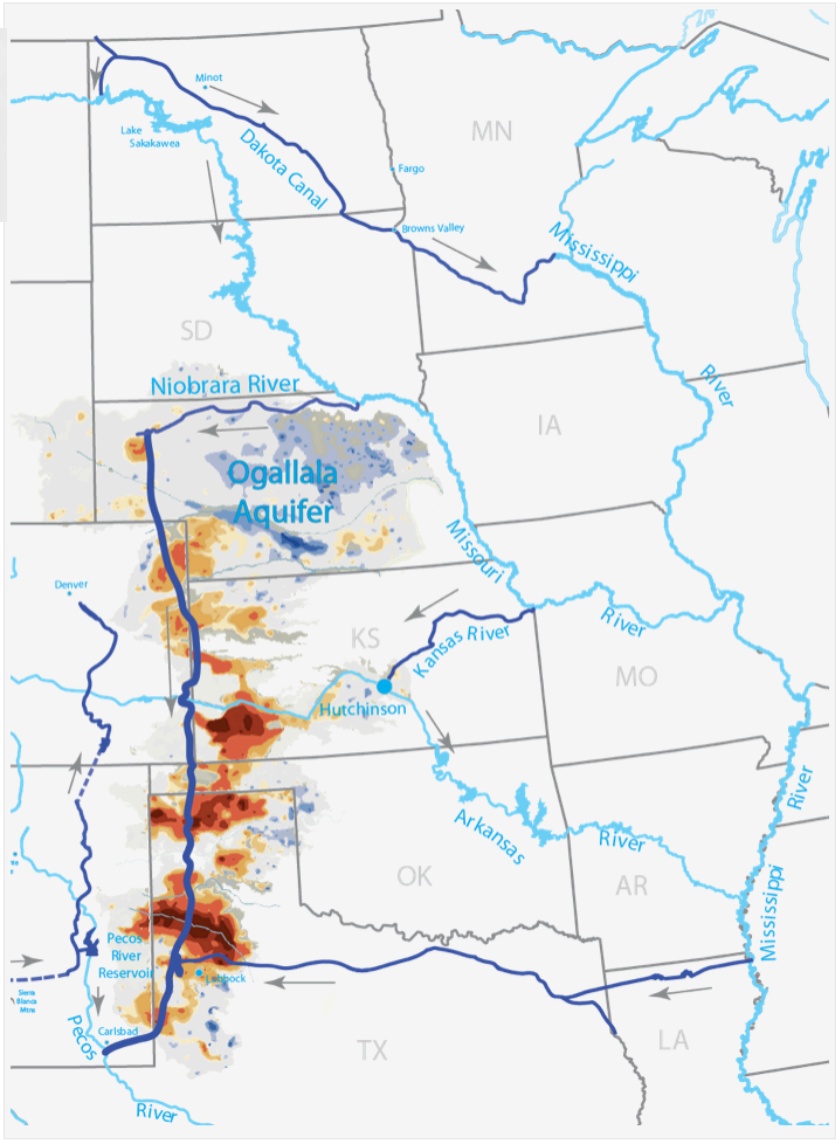
- Western States Water Council
- ~~High Plains Aquifer Coalition~~
- Groundwater Management Districts Association
- via U.S. Geological Survey
- via U.S. Department of Agriculture
  - The Ogallala Water Coordinated Agriculture Project

NUCLEAR NAWAPA XXI

LAROUCHE PAC



RIVER	RUNOFF (MAFY)	20% COLLECTED
Copper	46	9
Susitna	36	7
Yukon	165	33
Taku	15	3
Stikine	41	8
Liard	63	13
Nass	22	4
Skeena	45	9
Fraser	102	20
Columbia (BC)	50	10
Mackenzie (minus Liard)	167	33
Total	752	150



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