

Drinking water resources over SACROC oilfield, west Texas: good news for CCS

**Rebecca C. Smyth, Katherine D. Romanak,
Susan D. Hovorka, and Changbing Yang**

**Gulf Coast Carbon Center (GCCC), Bureau of Economic Geology (BEG),
Jackson School of Geosciences, The University of Texas at Austin**

**Funded by the U.S. Department of Energy National Energy
Technology Lab (DOE/NETL) Southwest Regional Carbon
Sequestration Partnership (SWP) program**

Industrial partner: Kinder Morgan LLC

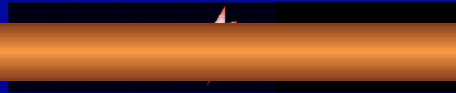
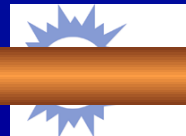
**Technical support: Kinder Morgan, Los Alamos National Laboratory
(LANL), and Schlumberger Carbon Services**

Additional support: GCCC at BEG

100 Years of Scientific Impact



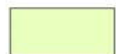

1909-2009



CO2 Sources

-  Natural
-  Mixed

CO2 EOR fields

-  CO2 Candidate
-  CO2 Projects

 Kinder Morgan CO2 Pipeline

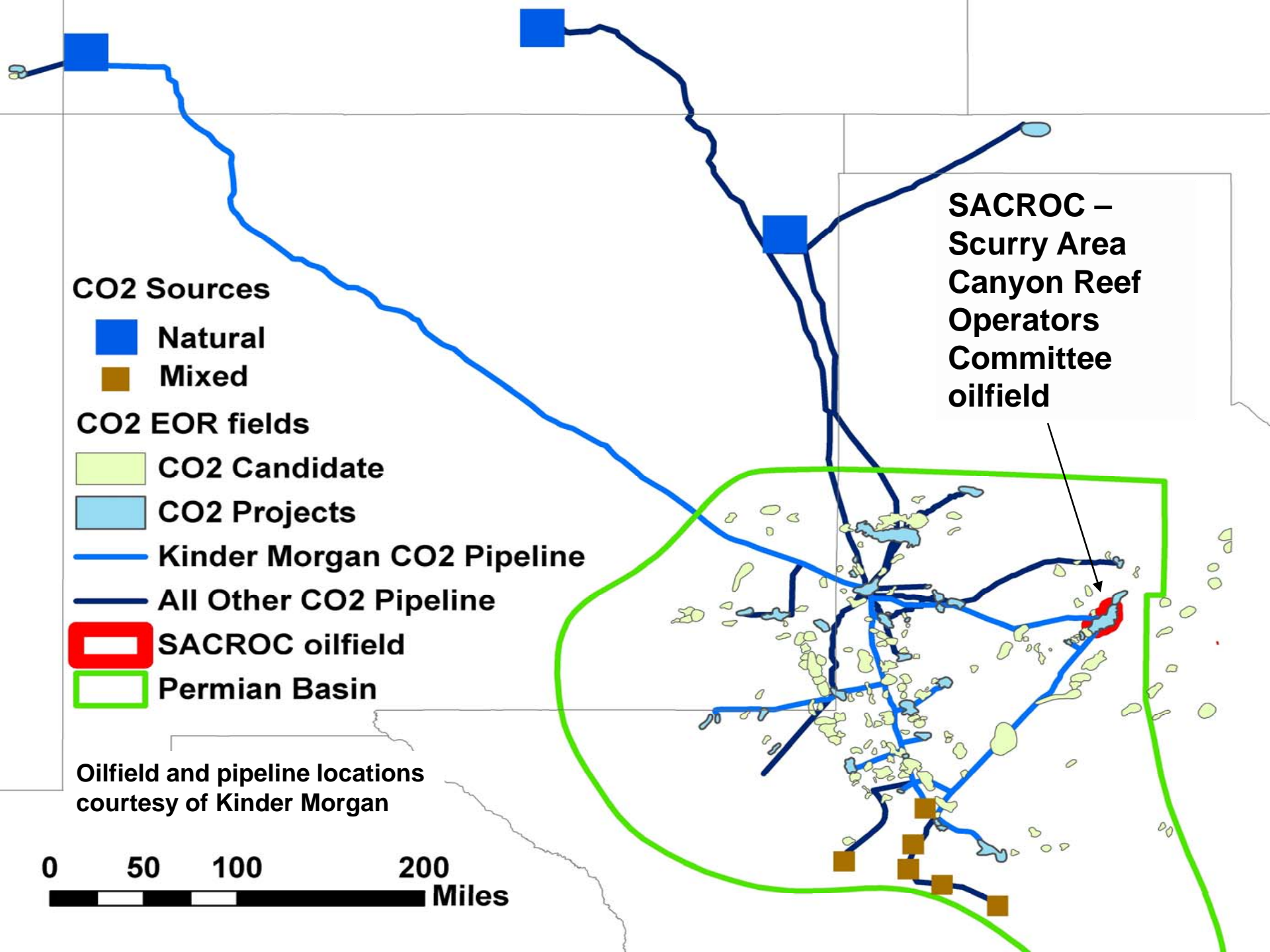
 All Other CO2 Pipeline

 SACROC oilfield

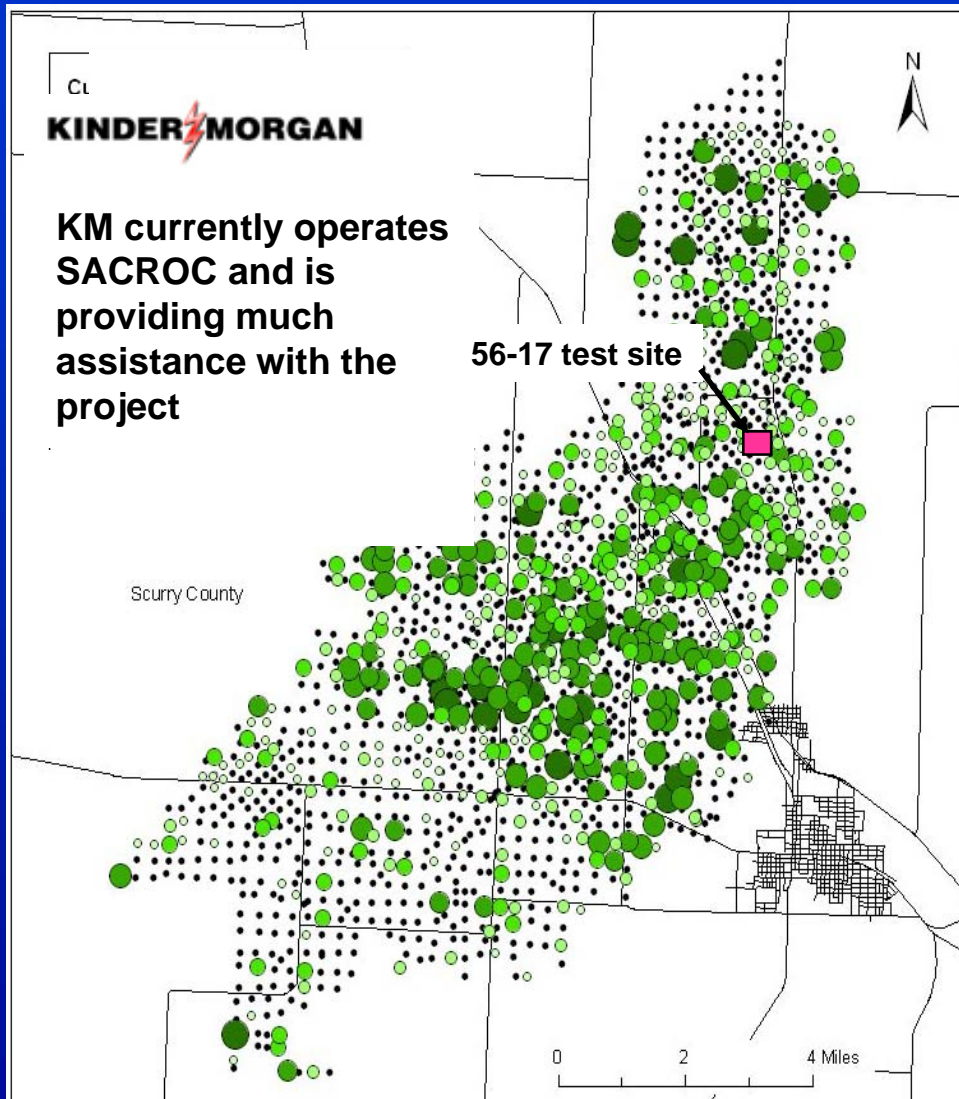
 Permian Basin

Oilfield and pipeline locations
courtesy of Kinder Morgan

**SACROC –
Scurry Area
Canyon Reef
Operators
Committee
oilfield**



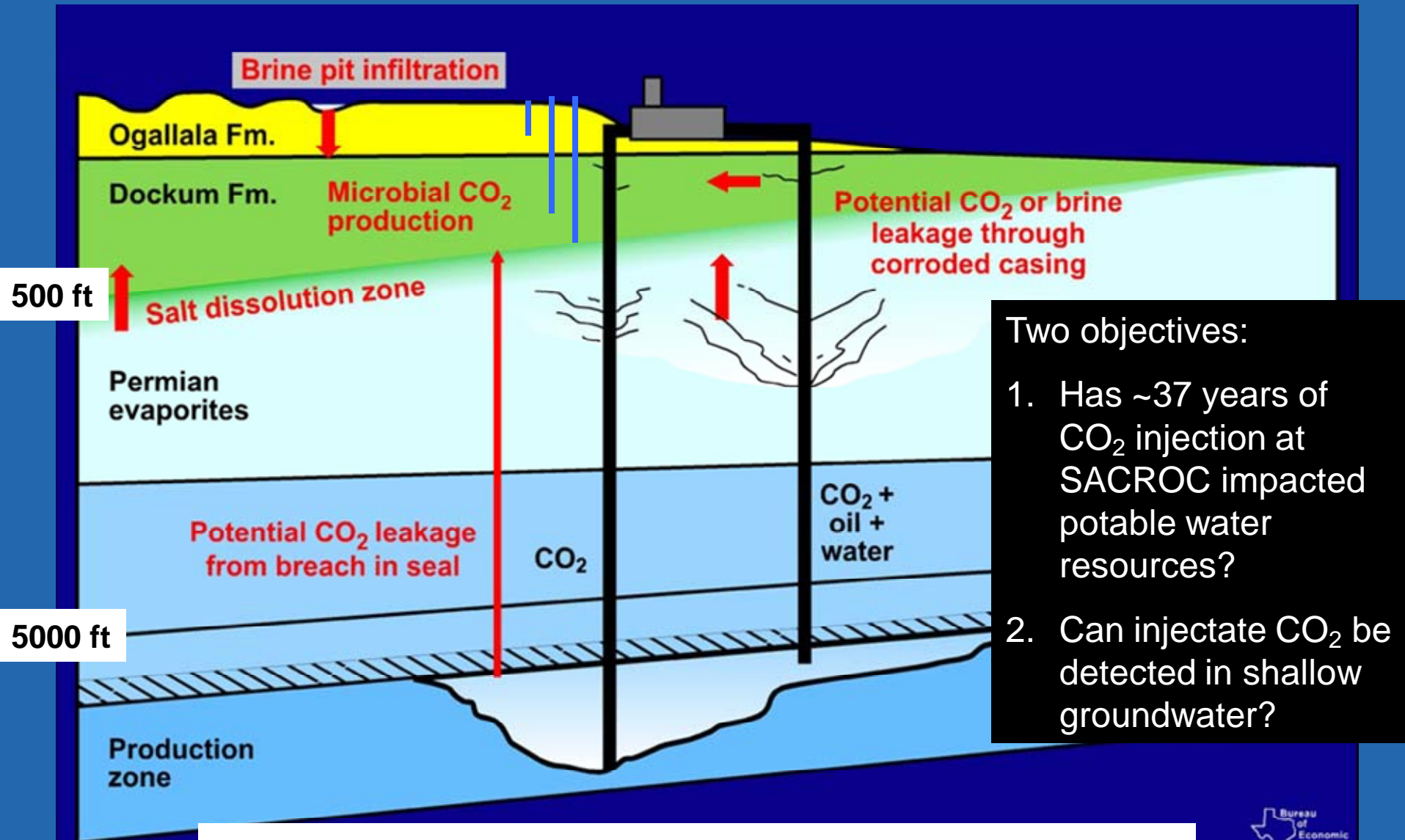
SACROC Previous CO₂ Injection



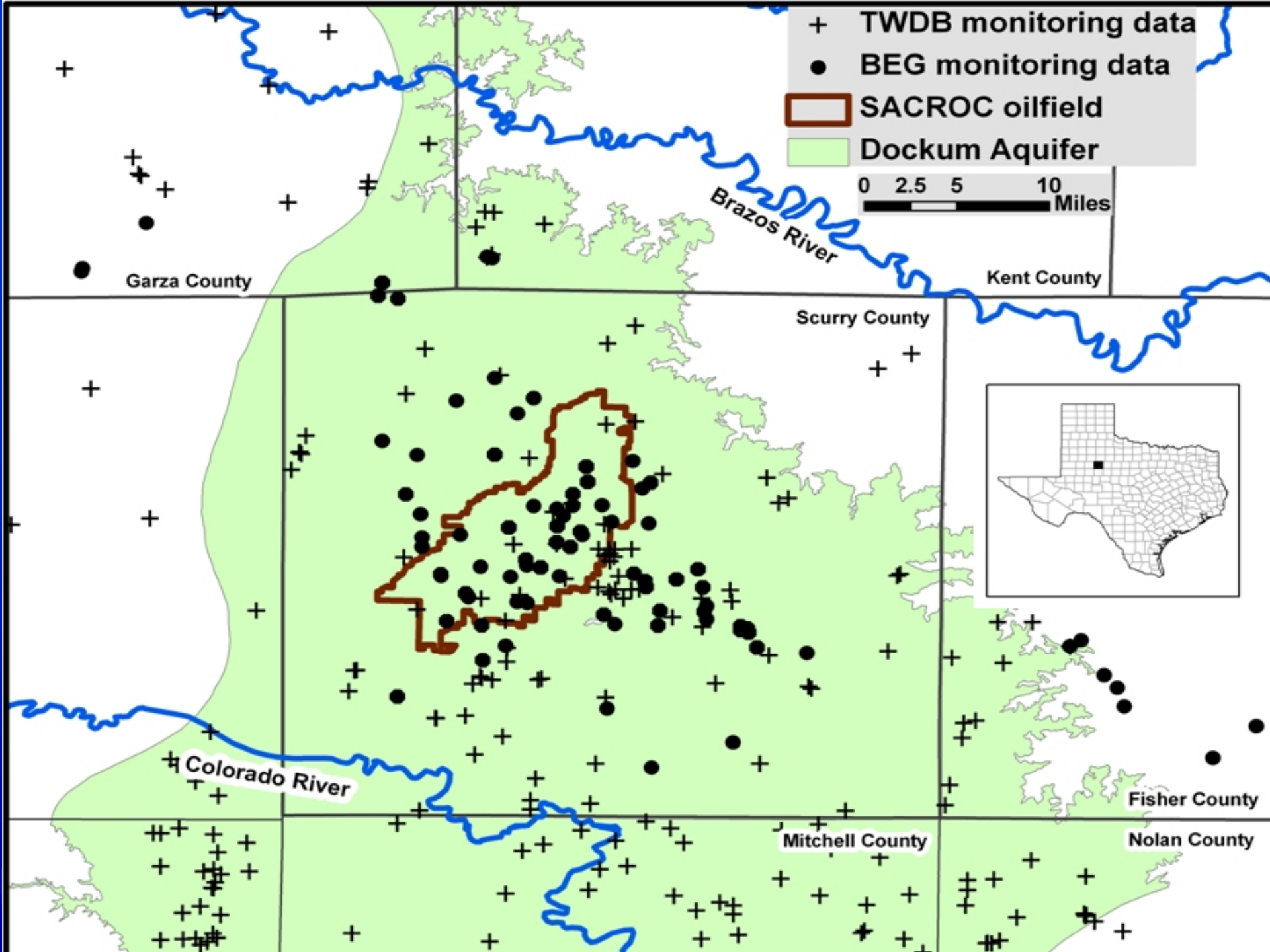
- 3.3 trillion standard cubic feet (TCF) or ~175 million metric tons (Mmt) CO₂ injected for enhanced oil recovery (EOR) since 1972 by multiple field operators (BEG, 1984; KM, 2009)
- 1.7 TCF (78 MMt) CO₂ recovered as of October 2009 (KM, 2009)
- Southwest Partnership (SWP) researchers are among first to test if this CO₂ is trapped in reservoir zones or if it has leaked into overlying strata



Groundwater Conceptual Model



Groundwater system is complex and dynamic!



BEG Groundwater Study over SACROC



SACROC AREA WATER QUALITY

36 wells completed across both Ogallala and Dockum Santa Rosa water-bearing units; 17 wells inside and 19 wells outside SACROC; filtered cations; unfiltered anions; highest concentration measured in each well

Analyte	Drinking Water Standard (mg/L)	# Wells	BEG Wells Exceeding EPA Standards	# Wells	BEG Wells Exceeding EPA Standards - Inside SACROC	# Wells	BEG Wells Exceeding EPA Standards - Outside SACROC
---------	--------------------------------	---------	-----------------------------------	---------	---	---------	--

EPA Primary - Maximum Contaminant Level

Arsenic (As)	0.01	6	16.7%	1	2.8%	5	13.9%
Fluoride (F ⁻)	4.0	2	5.6%	0	0.0%	2	5.6%
Nitrate (NO ₃ -N)	10	5	13.9%	3	8.3%	2	5.6%
Selenium (Se)	0.05	2	5.6%	0	0.0%	2	5.6%
Ag, Ba, Be, Cd, Cr, Cu, Pb, Sb, Th, U	variable	0	0.0%	0	0.0%	0	0.0%
	variable	0	0.0%	0	0.0%	0	0.0%

EPA Secondary Drinking Water Standard

Aluminum (Al)	0.05	11	30.6%	5	13.9%	6	16.7%
Chloride (Cl ⁻)	250	10	27.8%	6	16.7%	4	11.1%
Fluoride (F ⁻)	2.0	16	44.4%	6	16.7%	10	27.8%
Manganese (Mn)	0.05	6	16.7%	3	8.3%	3	8.3%
Sulfate (SO ₄ ²⁻)	250	6	16.7%	1	2.8%	5	13.9%
Total Dissolved Solids (TDS)	1000	15	41.7%	7	19.4%	8	22.2%
Fe, Hg, Zn	variable	0	0.0%	0	0.0%	0	0.0%

WHO Drinking Water Standard

Boron (B)		8	22.2%	3	8.3%	5	13.9%
-----------	--	---	-------	---	------	---	-------

Only two analytes with concentrations higher inside SACROC

QUESTIONS?



Extra Slides

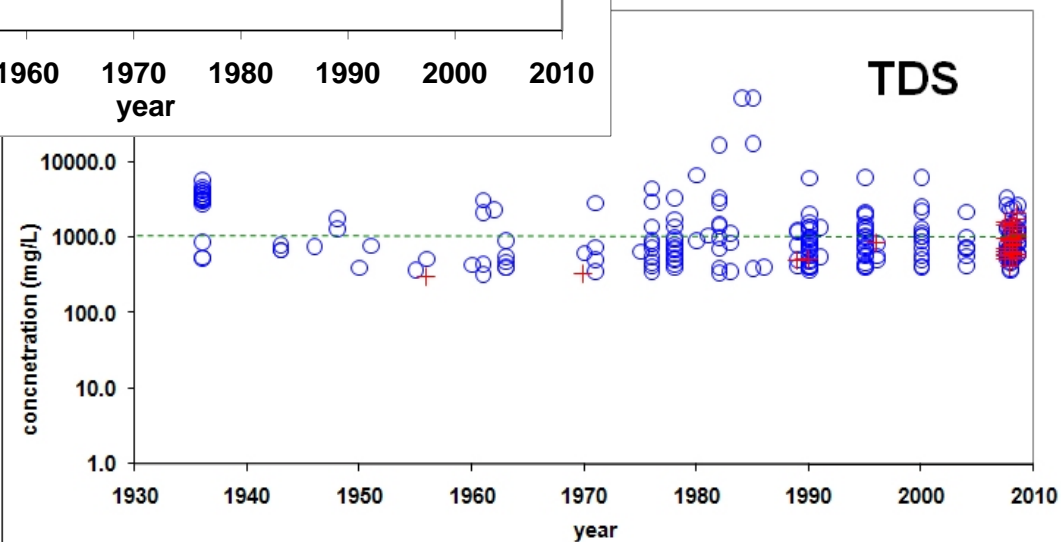
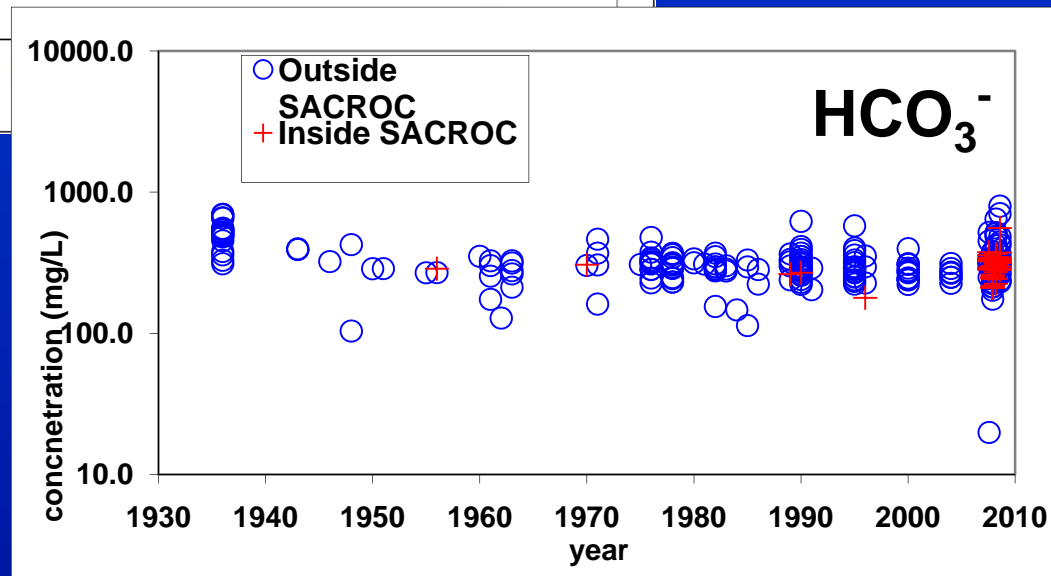
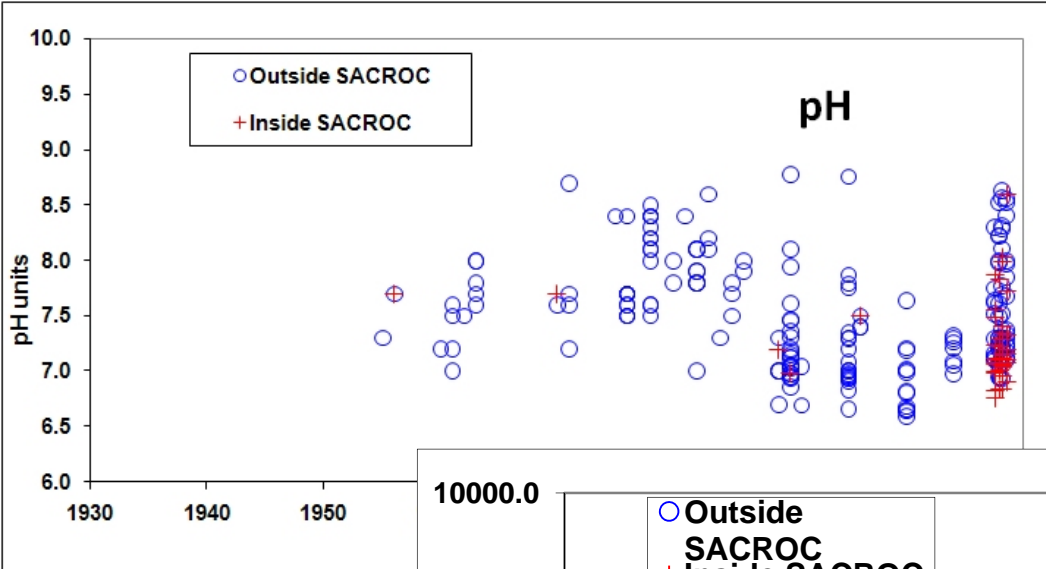
100 Years of Scientific Impact



1909-2009

Bureau of Economic Geology

Temporal Trends of all TWDB & BEG Data

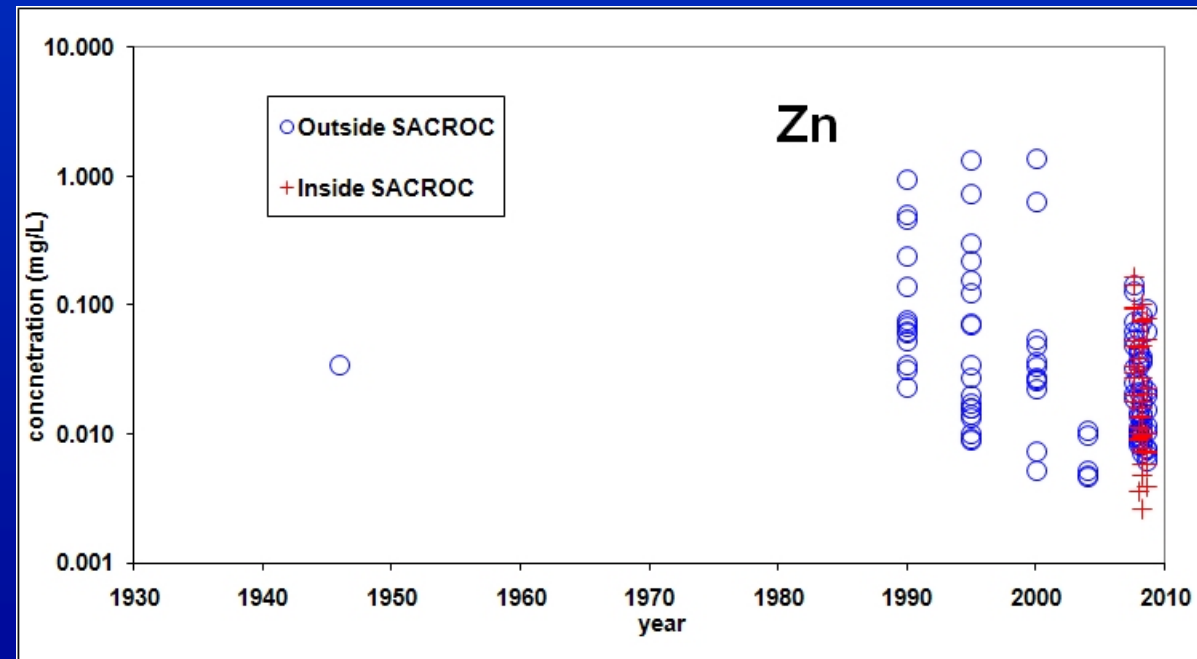
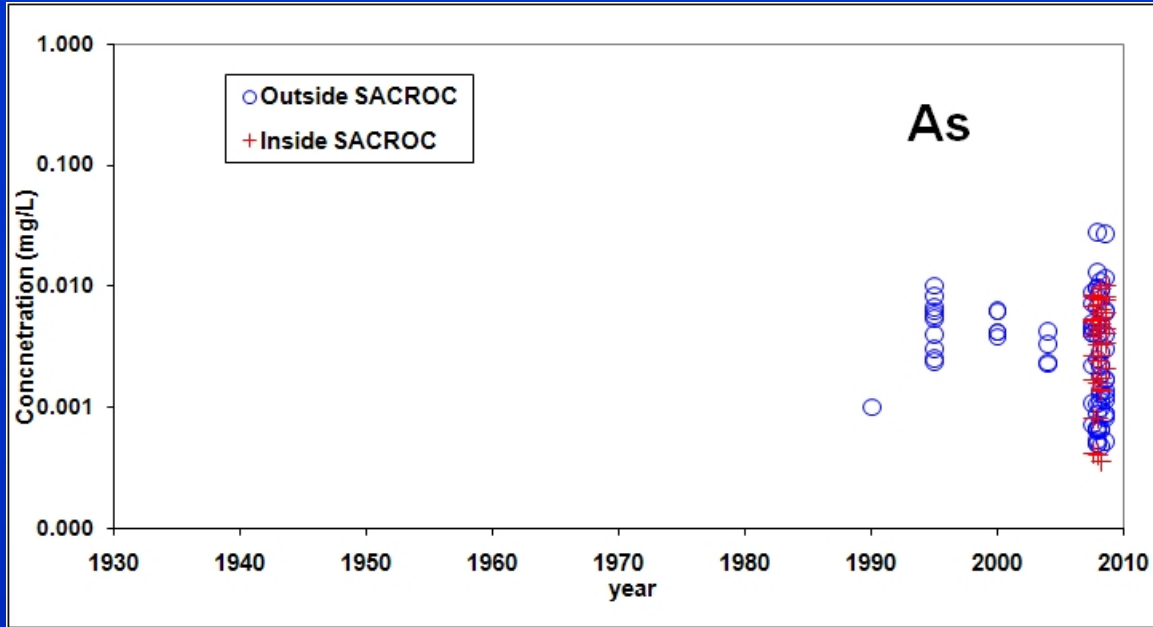


100 Years of Scientific Impact



1909-2009 Slide courtesy of R. C. Smyth

Temporal Trends of all TWDB & BEG Data



100 Years of Scientific Impact



1909-2009

Bureau of Economic Geology