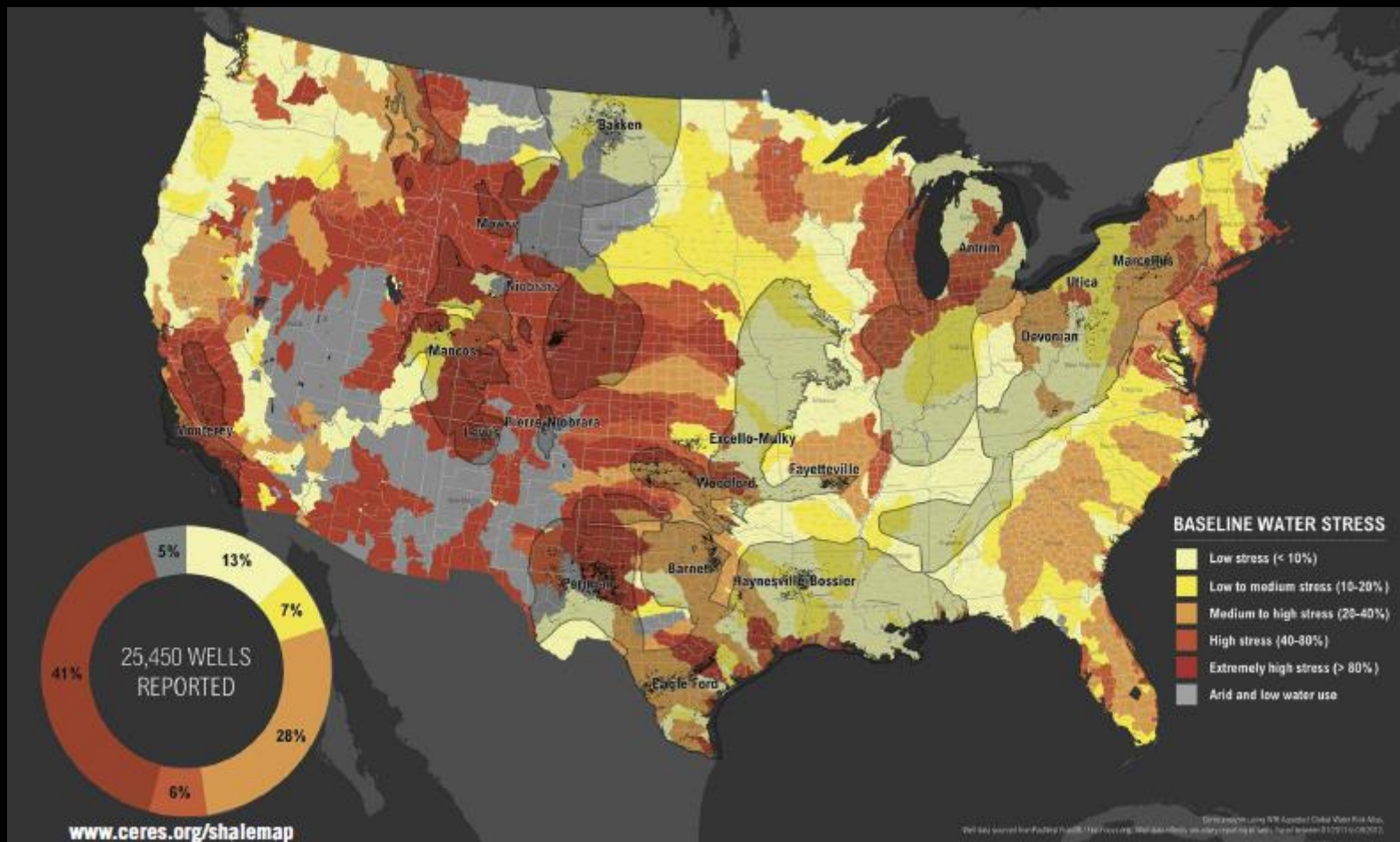


The Water Footprint of Oil and Gas Production using Hydraulic Fracturing in Unconventional Reservoirs in the U.S.

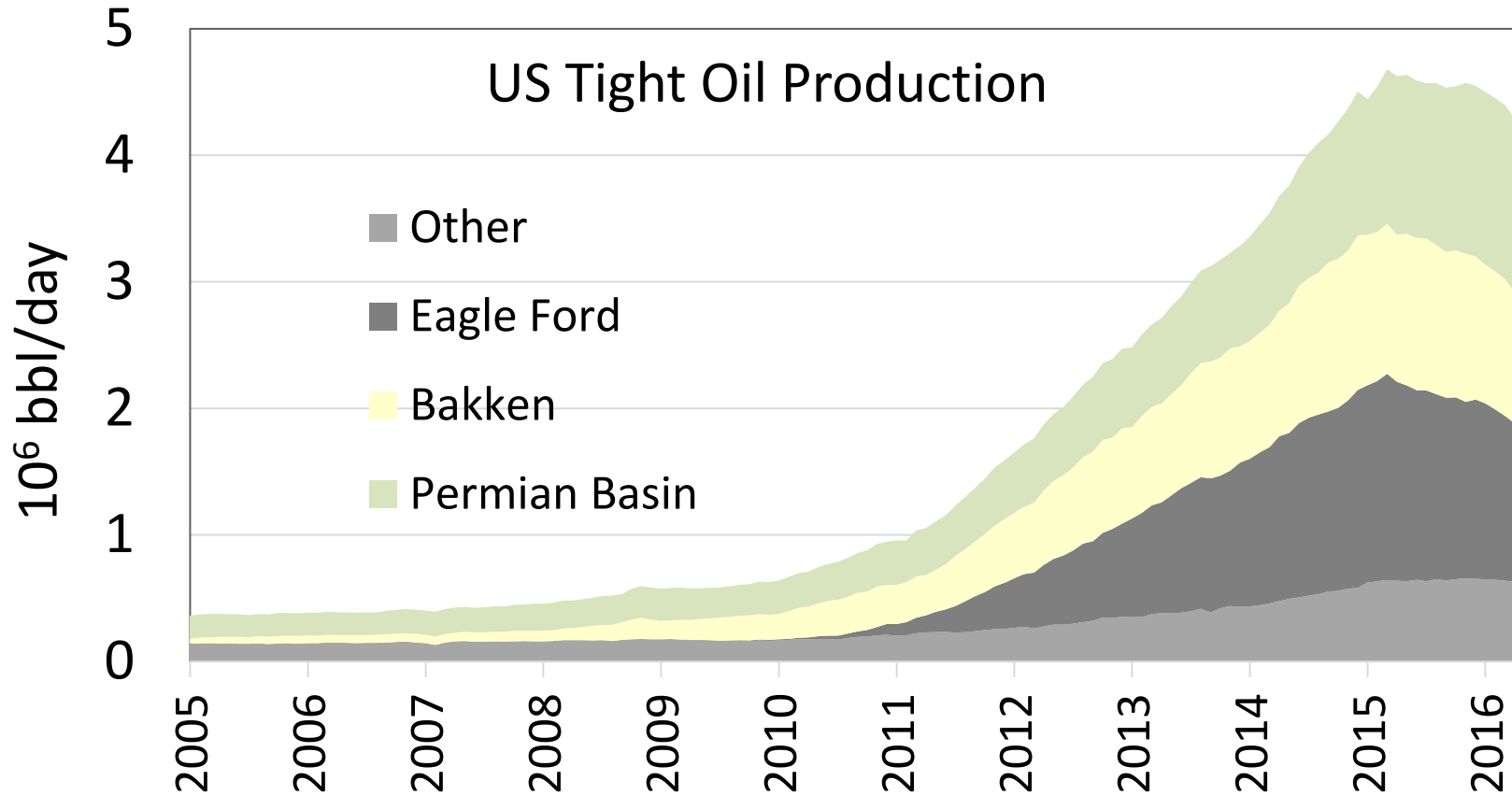
Scanlon, Bridget R. and Robert C. Reedy
Bureau of Economic Geology, Jackson School
of Geosciences, Univ. of Texas at Austin,
Austin, Texas, USA

Water scarcity is a concern in the western U.S.



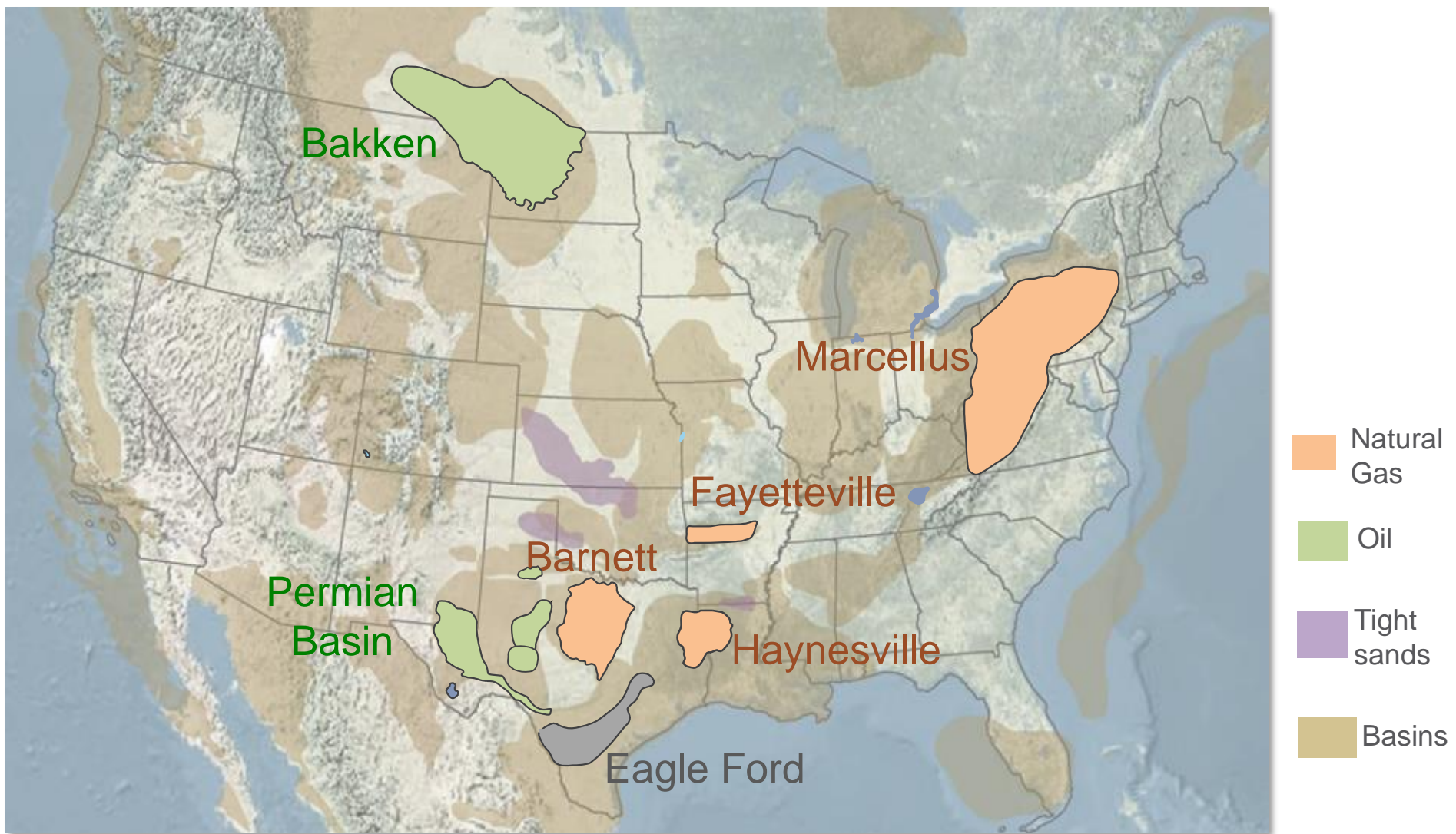
Freyman et al., CERES, 2013

U.S. Oil Production

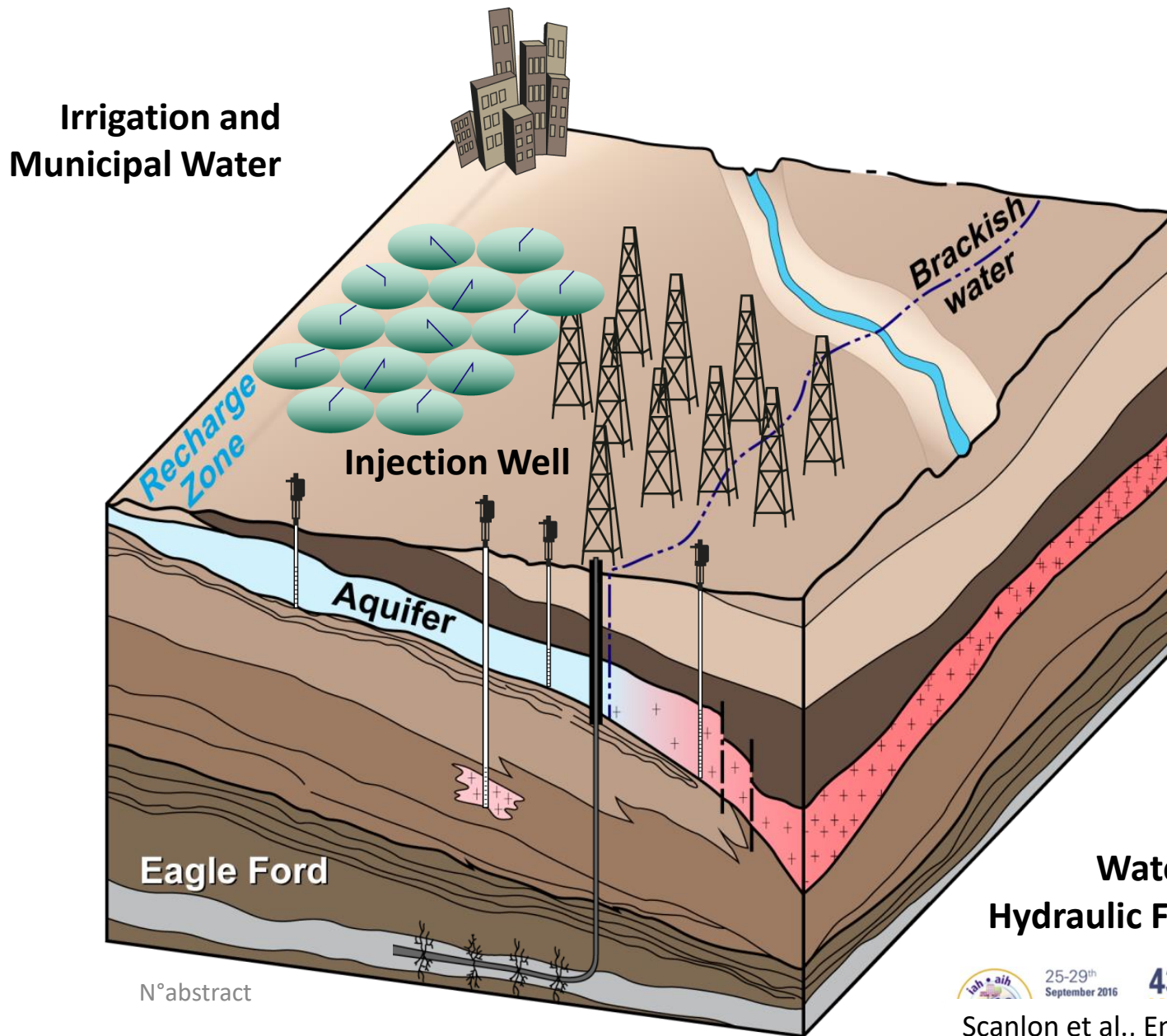


Shale reservoirs account for ~ half of U.S. oil and gas production.

Major Shale Plays in the U.S.



Schematic of Eagle Ford Shale Play



N°abstract

**Water Supply
Hydraulic Fracturing**



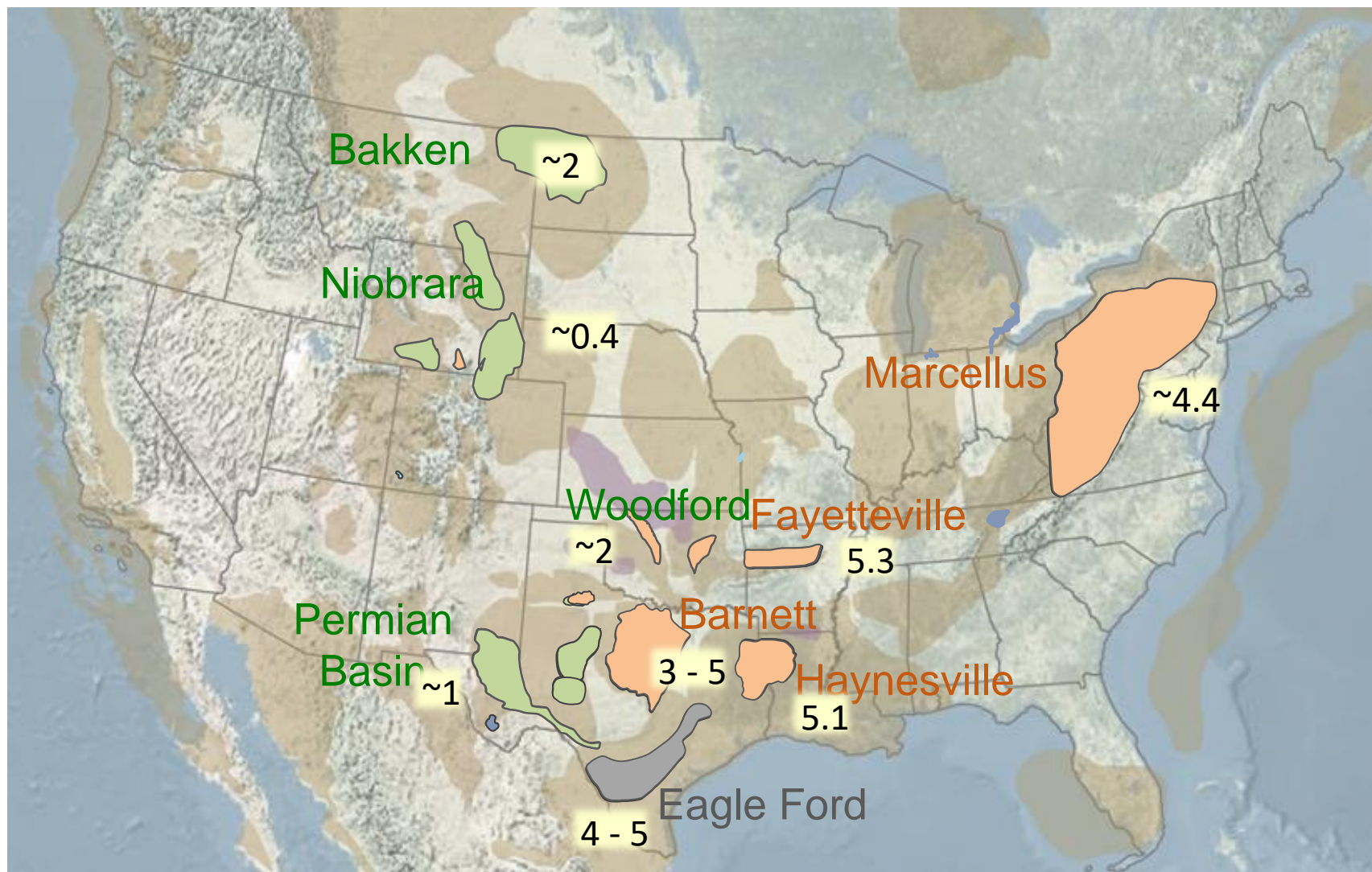
25-29th
September 2016

43rd



Scanlon et al., Env. Res. Lett. 2014

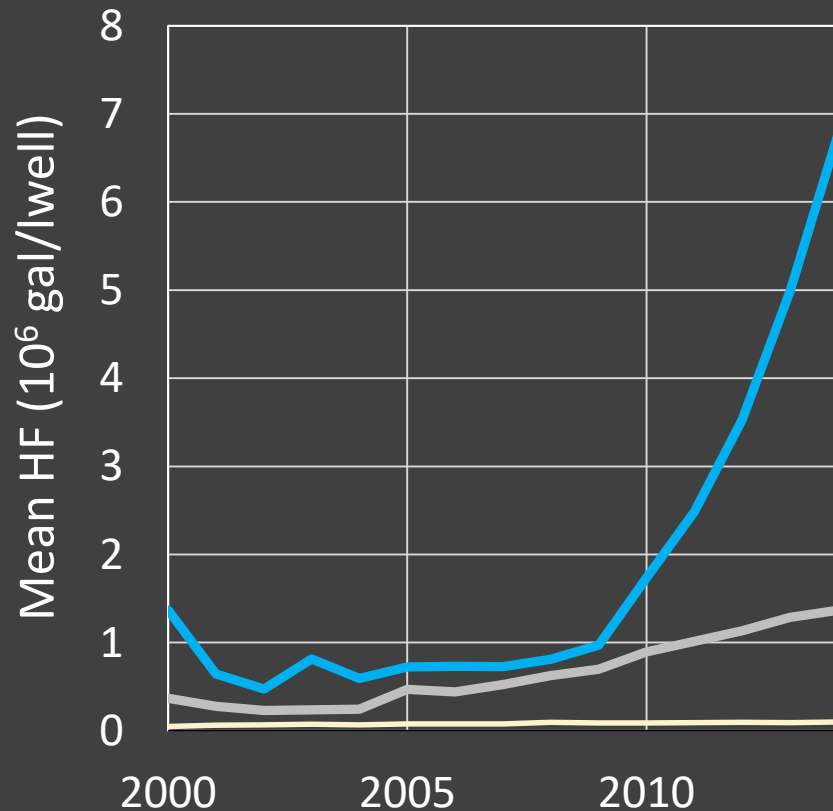
Water Use for Hydraulic Fracturing (million gallons/well)



Freyman et al., 2013; Nicot et al., 2014; Scanlon et al., 2014; Kondash & Vengosh, 2015

Water use for hydraulic fracturing has been increasing with time

Permian Basin



Controls on Water Use:

Vertical vs. lateral wells

Length of laterals

Frac fluid types (slickwater vs. gels)

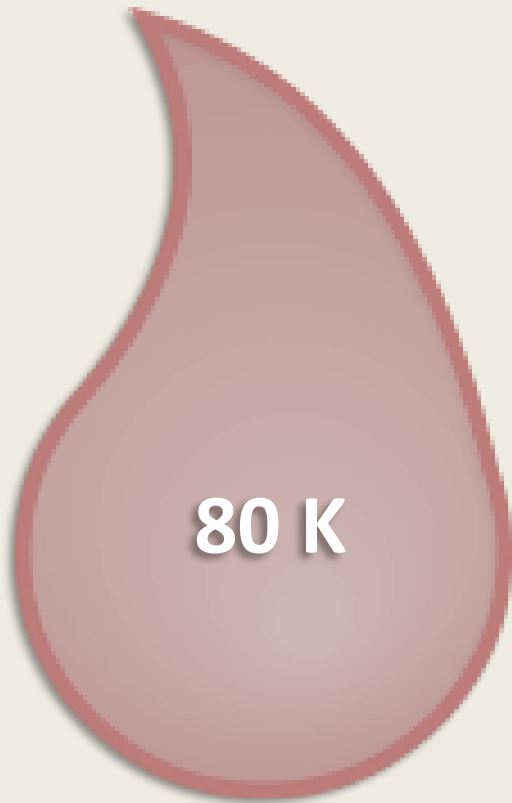
No. of frac stages

Industry adapting to water scarcity in some regions

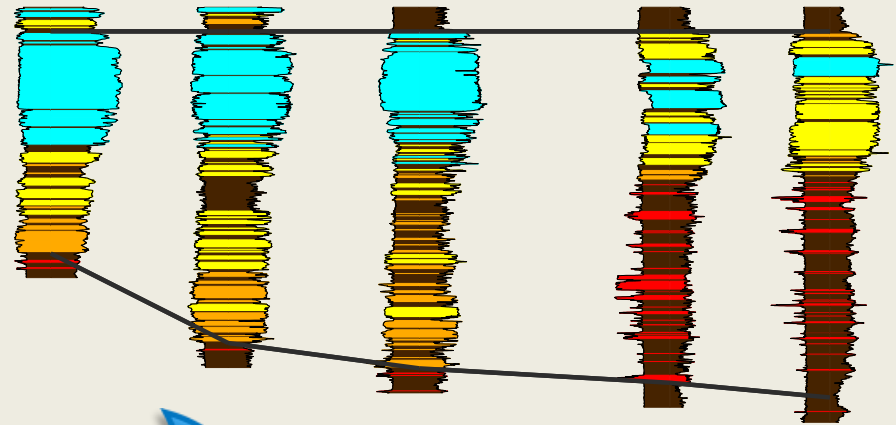
- Hydraulic fracturing no longer restricted to using freshwater
- Using brackish groundwater in Permian and Eagle Ford
- Reusing/recycling produced water

Brackish Groundwater Resources in Eagle Ford Shale Play

WATER SUPPLY relative to 20-yr HF Water DEMAND (BGAL)



*Brackish
groundwater*



*Fresh
groundwater*

0.3 K

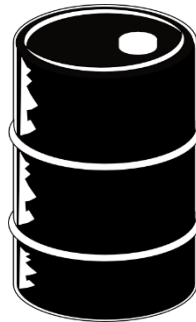


*20-yr
HF water demand*

How much water is produced with oil and gas?

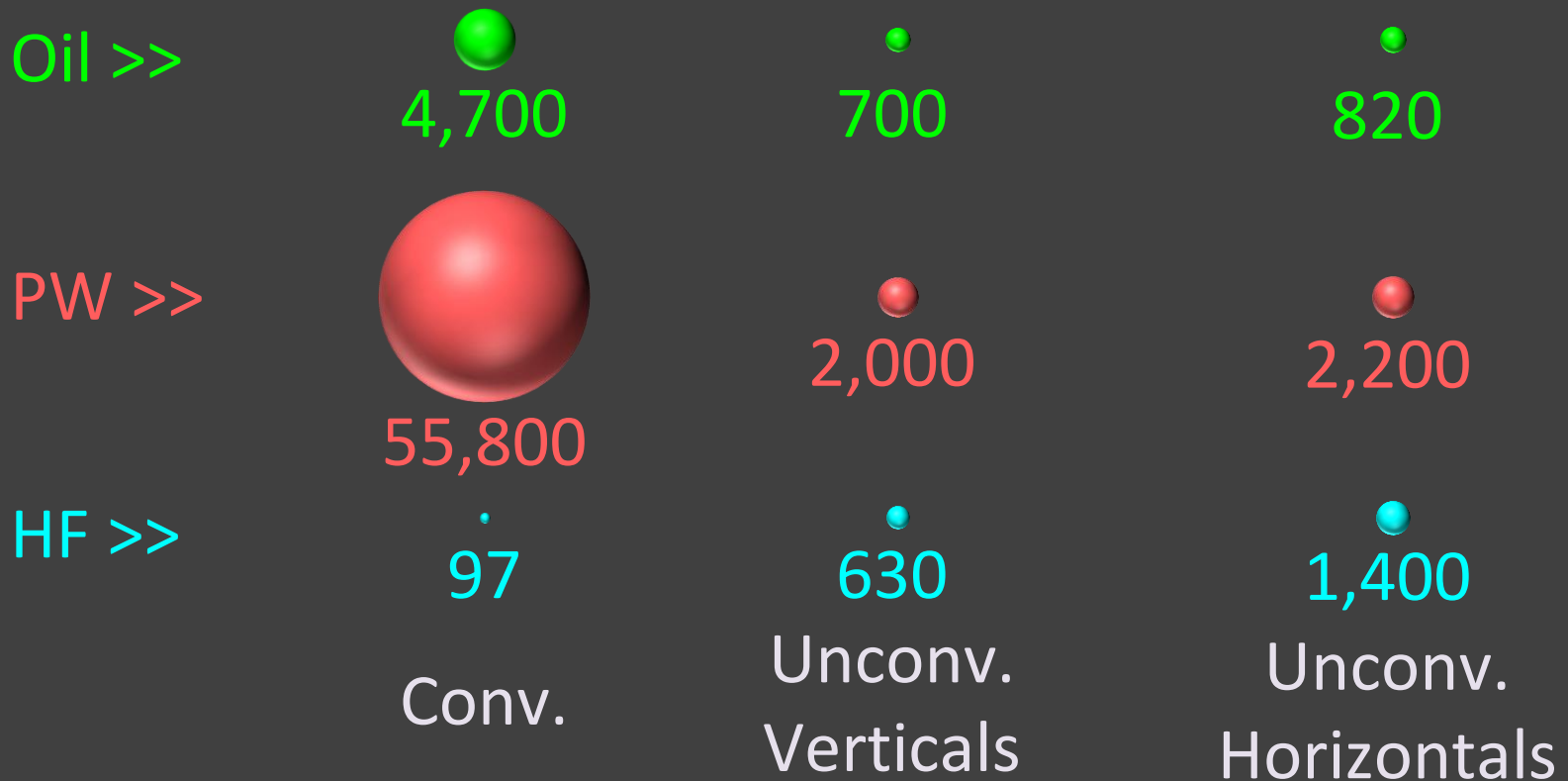


In the U.S. for each barrel of oil that is produced, an average of 9 barrels of water are produced

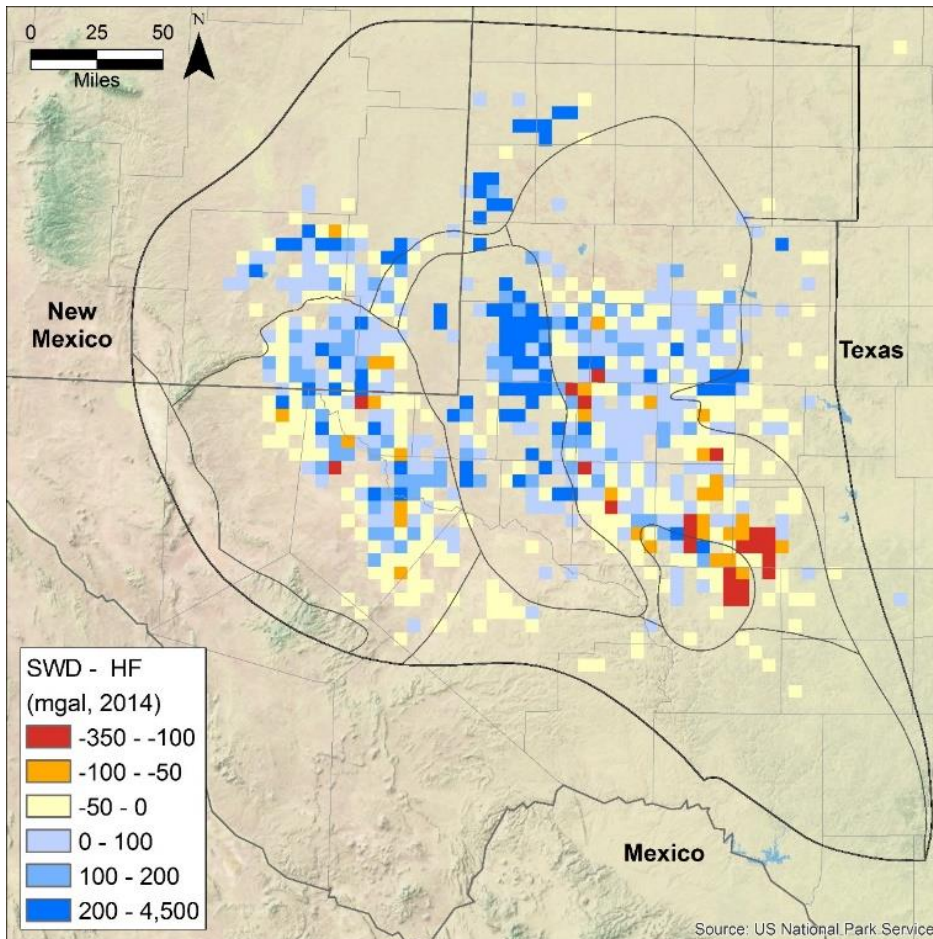


Relationship between oil and water production to hydraulic fracturing water requirements

Permian Total Production 2000-2015 (10^6 bbl)



Optimization of water use for Unconventional Energy Product



Permian Basin

Ratio of produced water disposed in subsurface relative to water demand for hydraulic fracturing at a 5 square mile grid

Blue areas: enough water from oil production to support hydraulic fracturing

Conclusions

- Water demand for hydraulic fracturing is increasing in many plays.
- Water scarcity is a concern in semiarid regions
- Companies have adapted by using brackish groundwater (Eagle Ford Play)
- Large volumes of produced water could provide source water for hydraulic fracturing (Permian Basin)
- Using produced water would reduce disposal /injection and induced seismicity risk

Sponsors:



Alfred P. Sloan
FOUNDATION



SUTUR



THE UNIVERSITY OF TEXAS AT AUSTIN

JACKSON

SCHOOL OF GEOSCIENCES

Contact: Bridget R. Scanlon
Bridget.Scanlon@beg.utexas.edu



BUREAU OF
ECONOMIC
GEOLOGY

