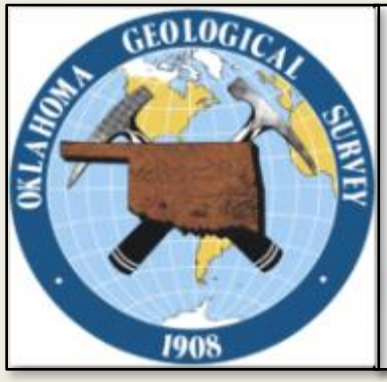


Kyle E. Murray, PhD, Hydrogeologist

Presents:

Geoscientific perspective on produced water and saltwater disposal practices

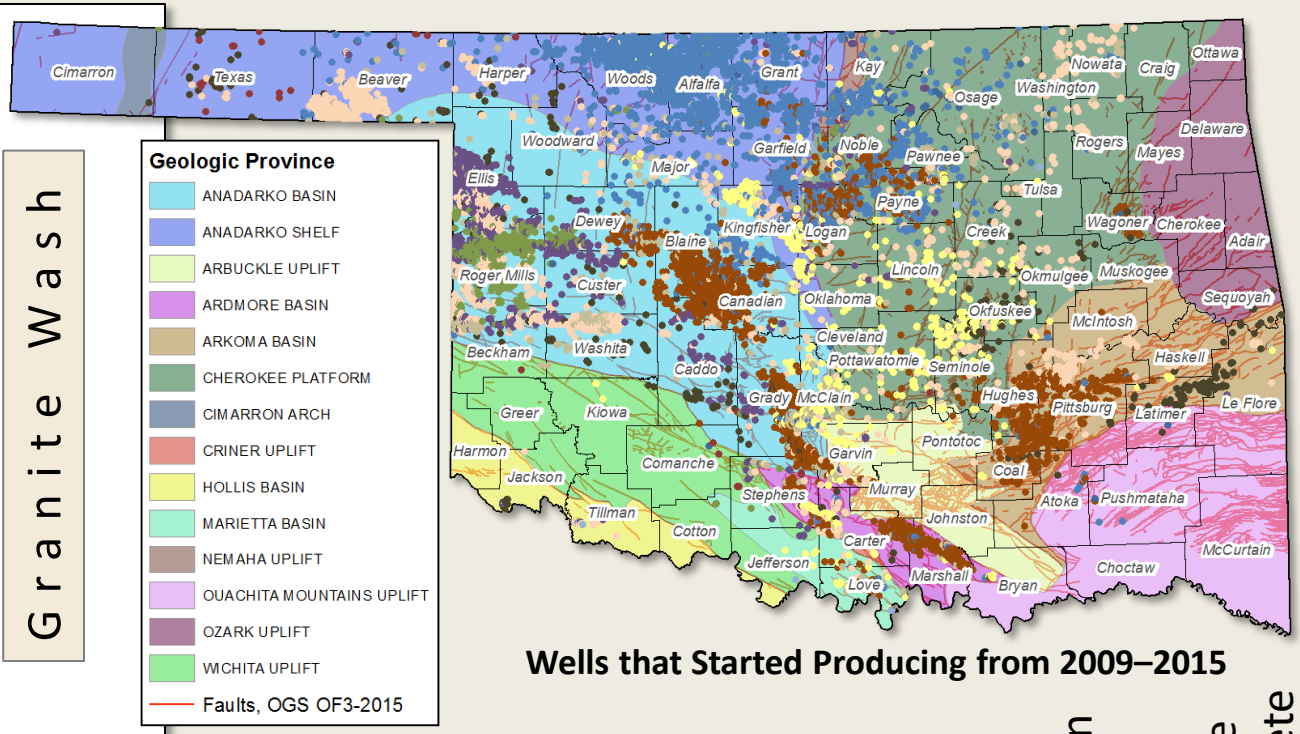
Critical Issues Webinar: Making Produced Water More Productive
In partnership with: American Geosciences Institute (AGI)

From Norman, OK
December 11, 2015

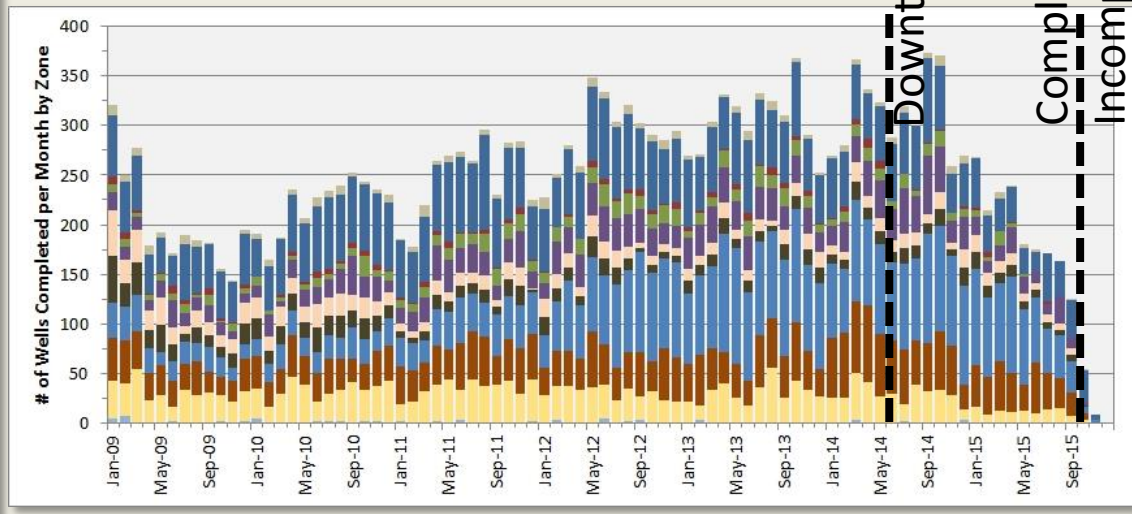
Zone	Group	Formation
Multiple-Undiff		
Other or Unspec.		
Permian		Garber
	Chase	Brown Dolomite
	Council Grove	Pontotoc
	Admire	Belveal
Virgilian	Wabaunsee	Cisco Lime
	Shawnee	Pawhuska
		Endicott
	Douglas	Tonkawa
Missourian	Hoxbar	Lansing
		Cottage Grove
		Kansas City
		Hogshooter
		Layton
		Cleveland
Desmoinesian	Marmaton - Deese	Oswego
	Cabaniss - Deese	Skinner
	Krebs - Deese	Red Fork
		Burbank
		Bartlesville
		Hartshorne
Atokan-Morrowan	Atoka	Gilcrease
		Dutcher
	Morrow	Cromwell
	Springer	Wamsley
Mississippian	Chester	Manning
		Caney
	Meramec	Miss Lime
		Miss Chat
		St. Louis
		Mayes
	Osage	Sycamore
	Kinderhook	Kinderhook
Woodford	Upper Devonian	Woodford
Dev to Mid Ord	Middle Devonian	Misener
	Hunton	Frisco
		Bois d'Arc
		Henryhouse
		Chimneyhill
	Cincinnatian	Sylvan
		Viola
	Simpson	Bromide
		Wilcox
		McLish
		Oil Creek
Arbuckle	Arbuckle Group	West Spring Creek
		Kindblade
		Cool Creek
		McKenzie Hill
		Butterly dolomite
		Signal mountain
		Royer dolomite
		Fort sill limestone
Basement & Crystalline Rock	Cambrian	Reagan
	Pre-Cambrian	Granite

Granite Wash

Key to Symbols
Sandstone
Carbonate
Shale
Coal
Granite



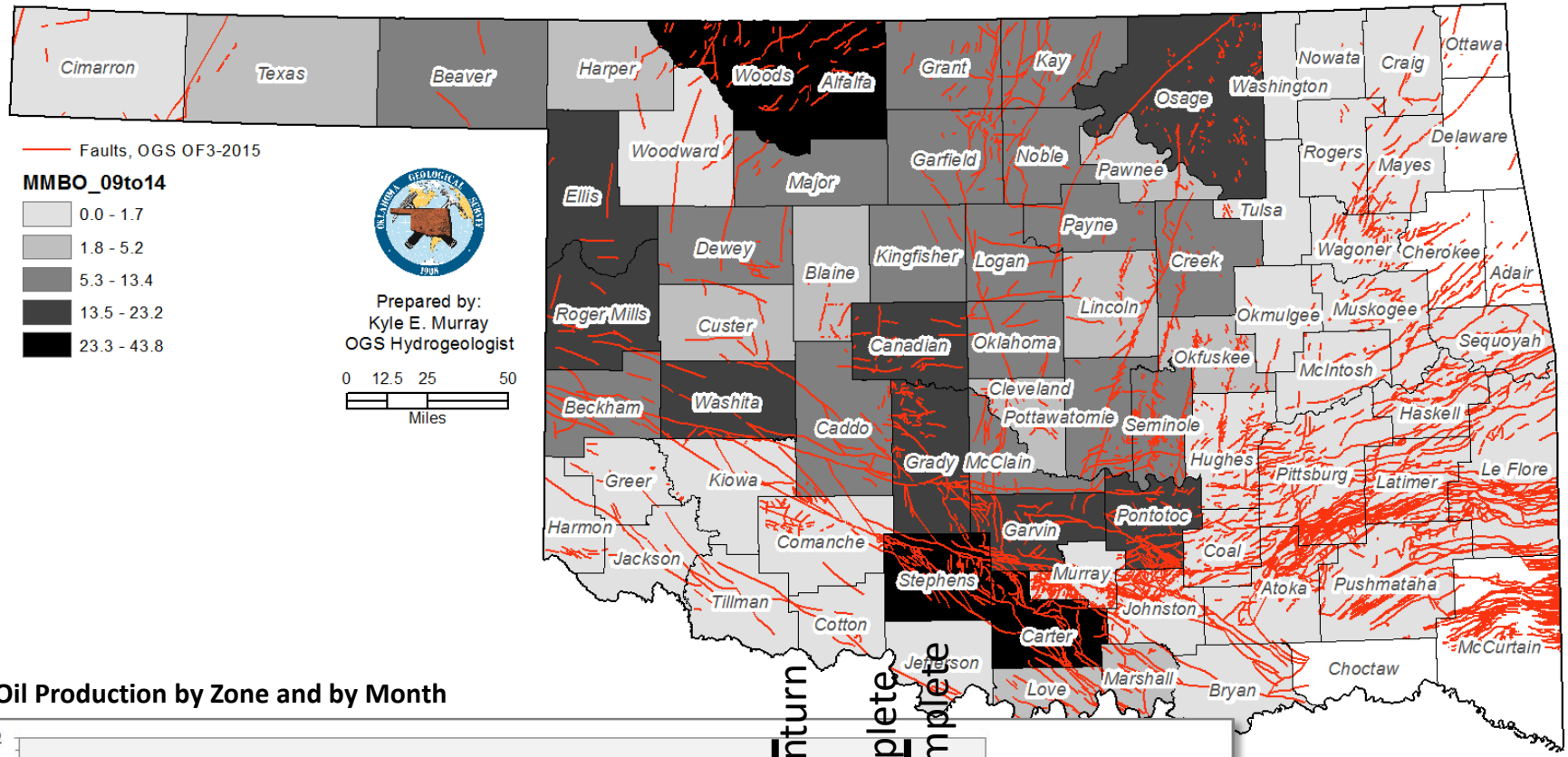
Wells that Started Producing from 2009–2015



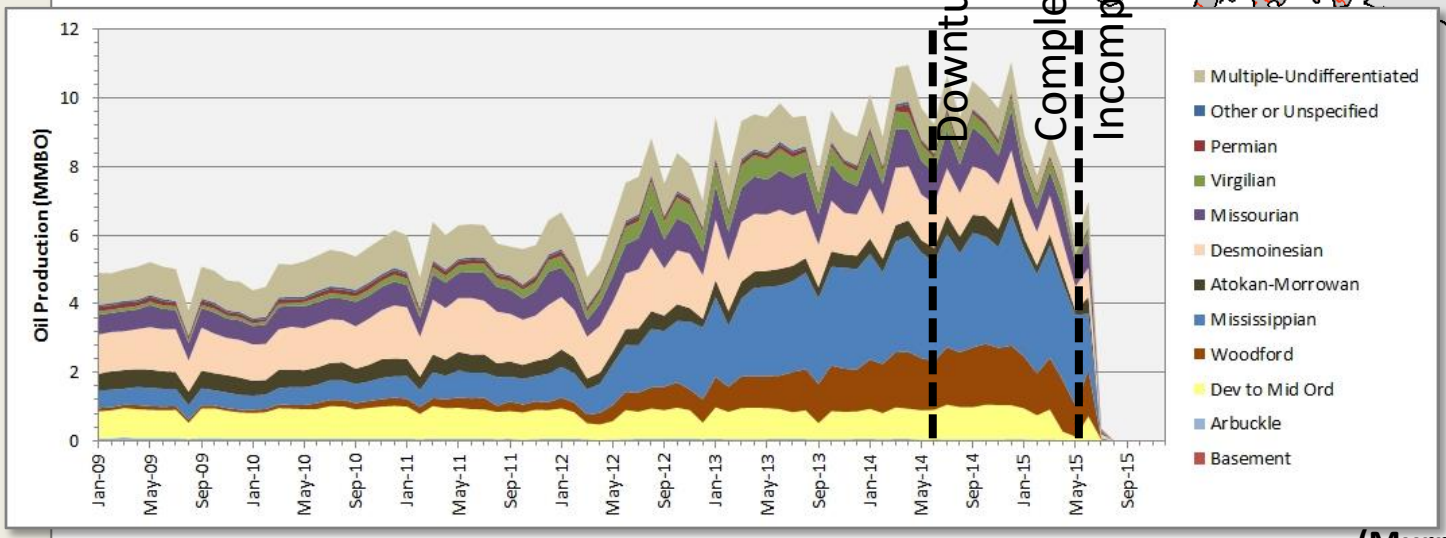
Completions by Zone and by Month, 2009–2015

(Murray, 2015 – in preparation)

Oil Production by County 2009–2014 and by Zone 2009–2015

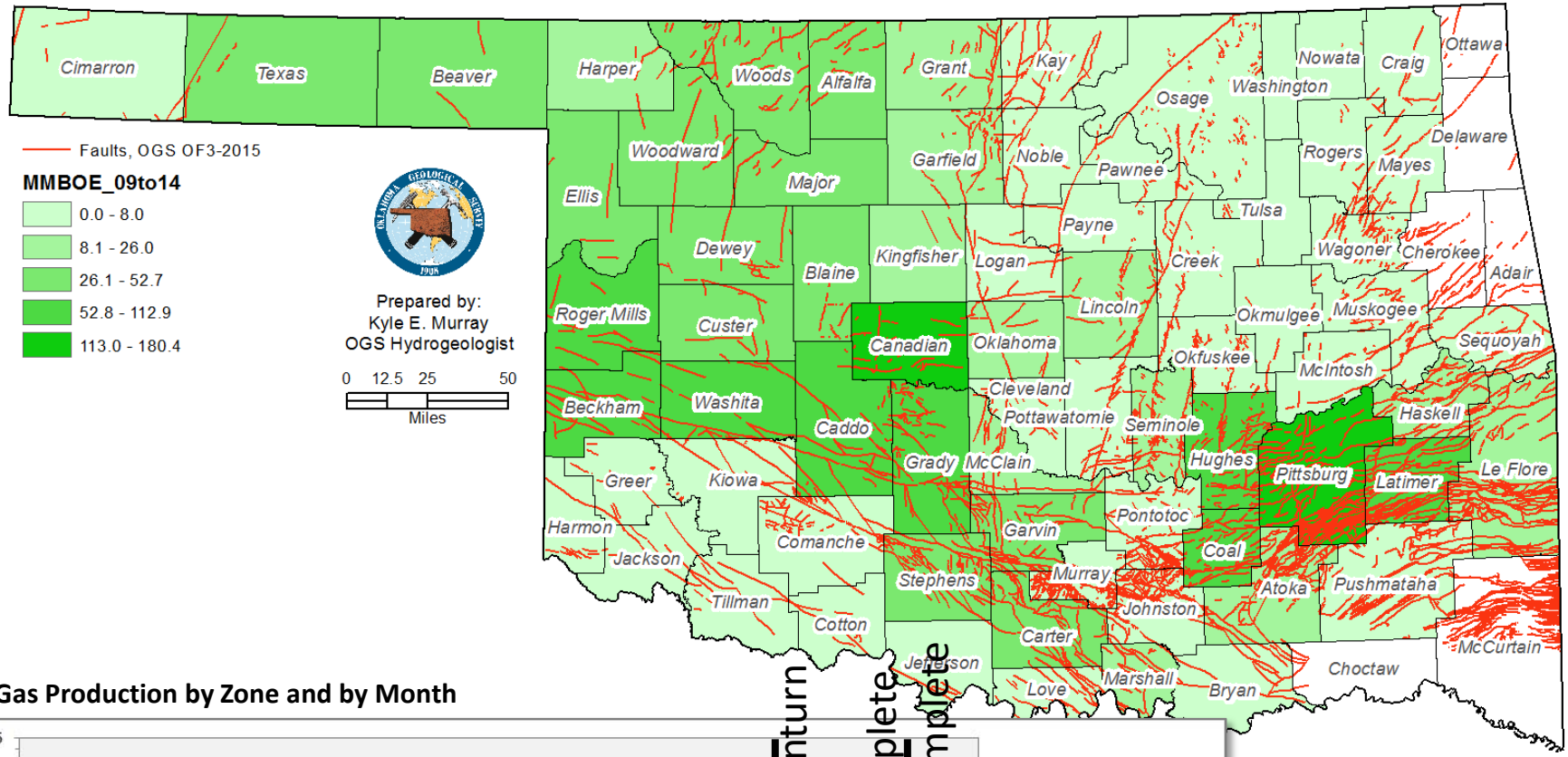


Oil Production by Zone and by Month

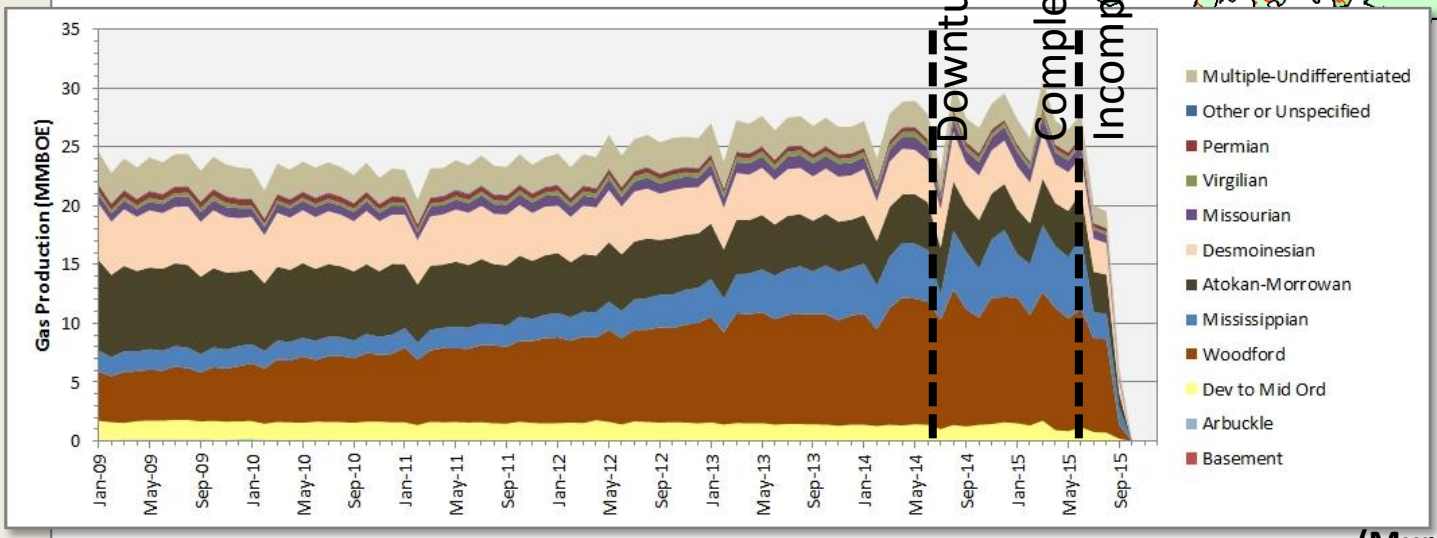


(Murray, 2015 – in preparation)

Gas Production by County 2009–2014 and by Zone 2009–2015

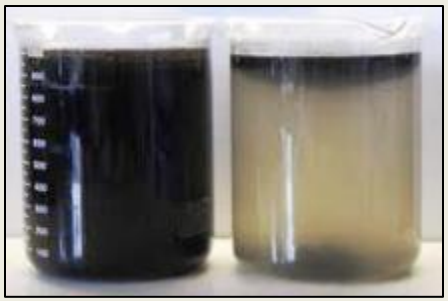


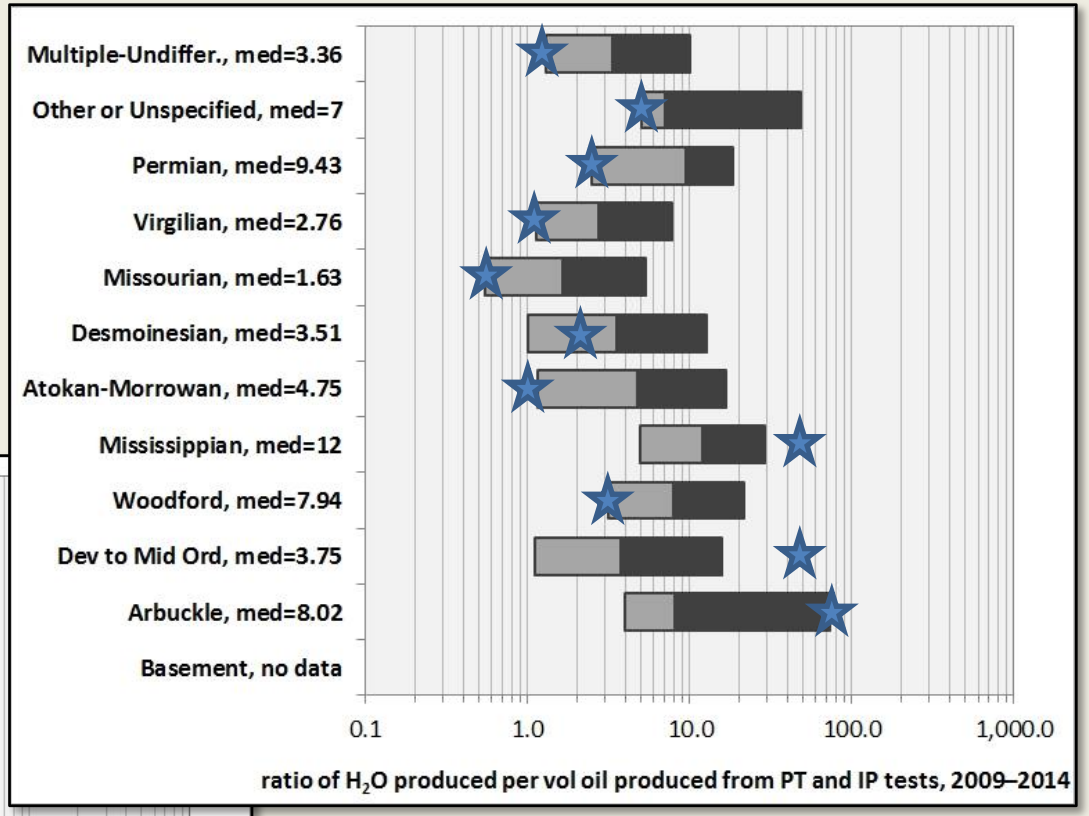
Gas Production by Zone and by Month

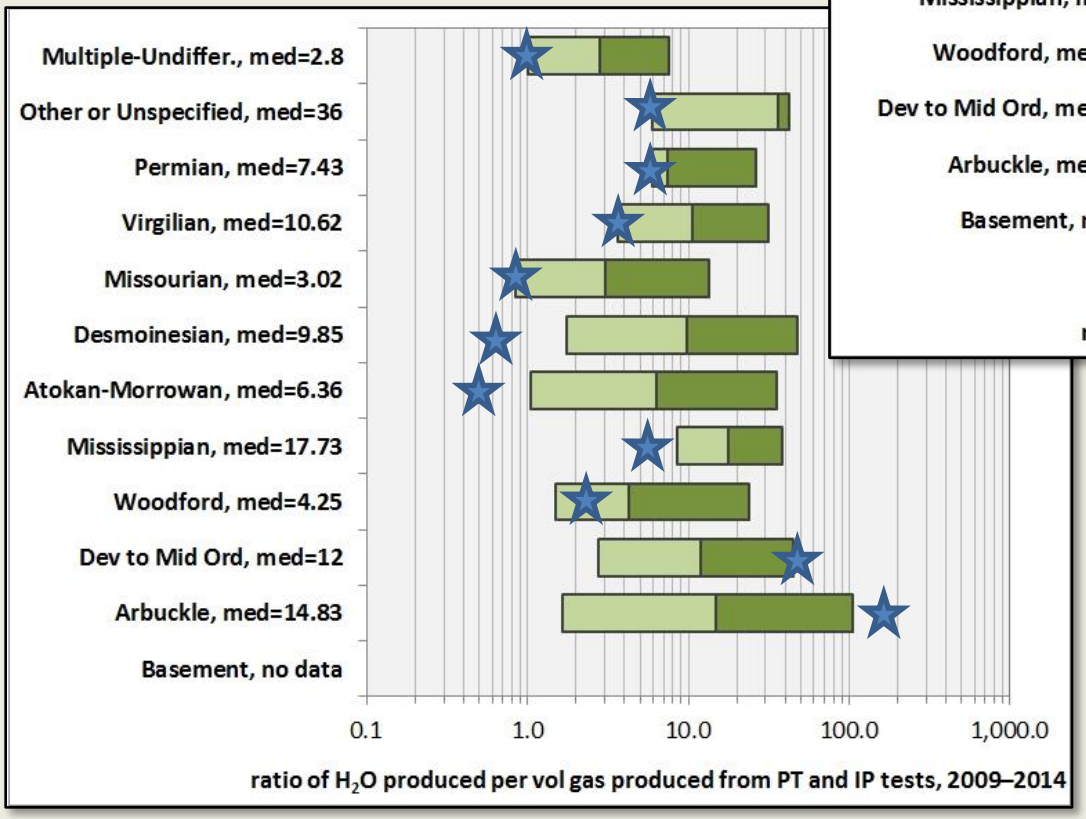


(Murray, 2015 – in preparation)

"Calibrated" ratios used to calculate produced H_2O from 2009–2015

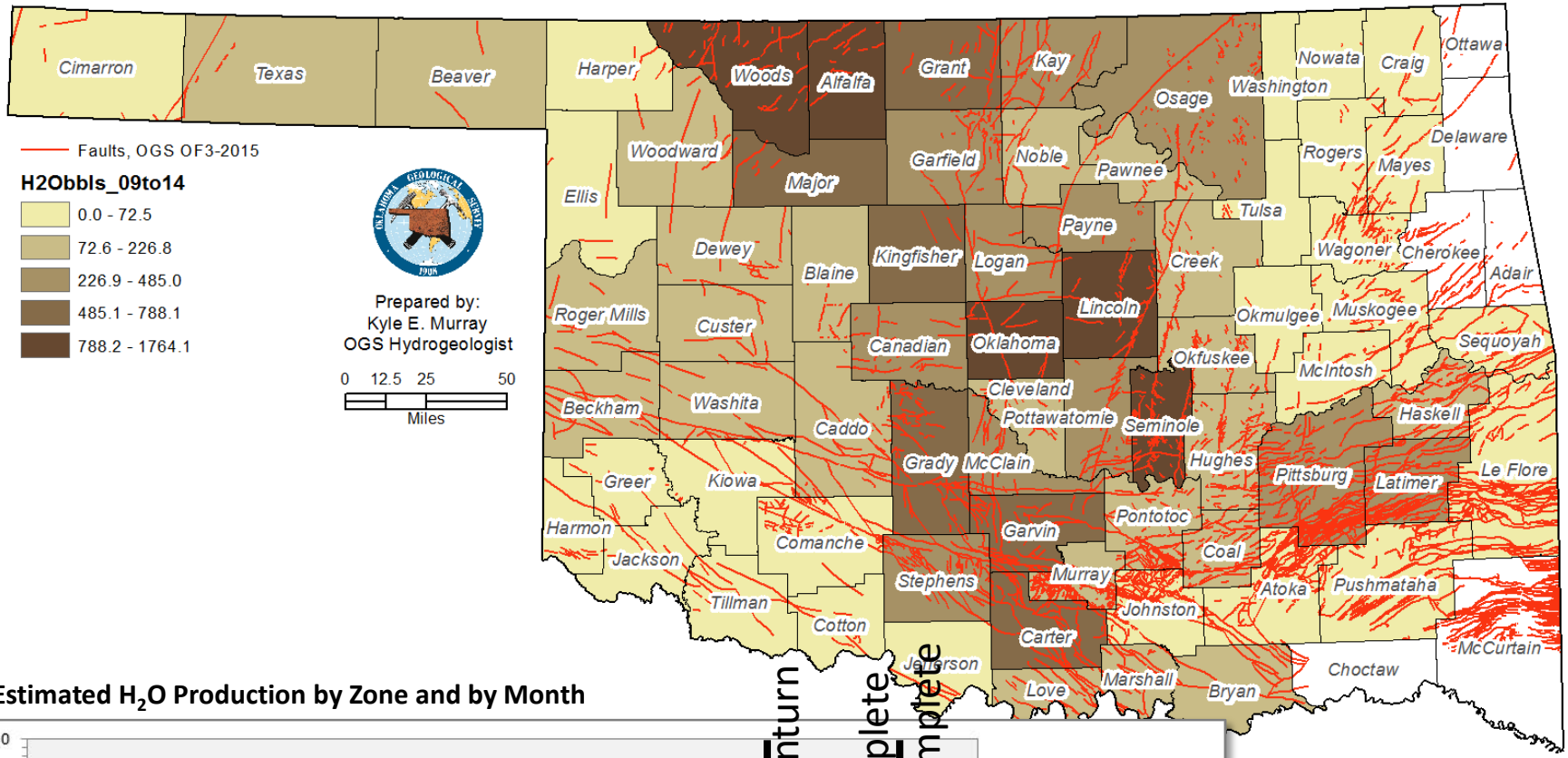




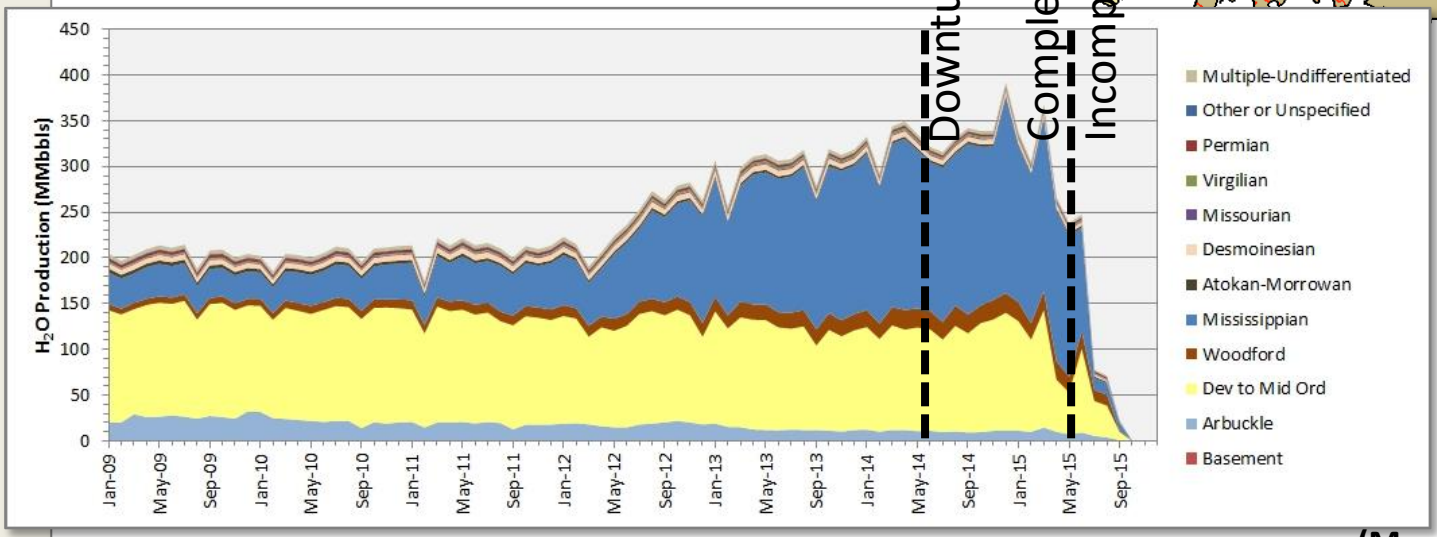


(Murray, 2015 – in preparation)

Produced H_2O by County 2009–2014, and by Zone 2009–2015

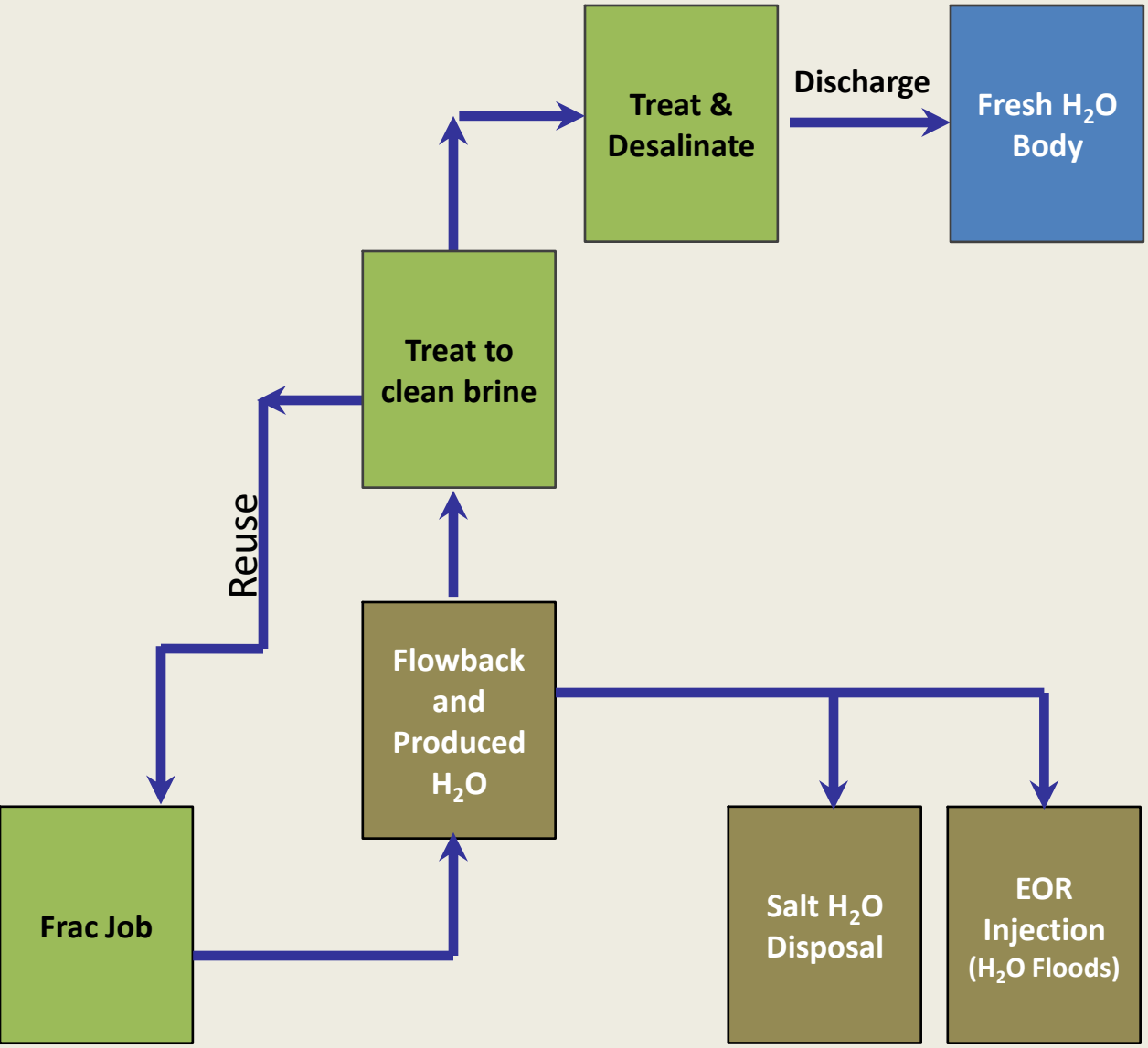


Estimated H_2O Production by Zone and by Month



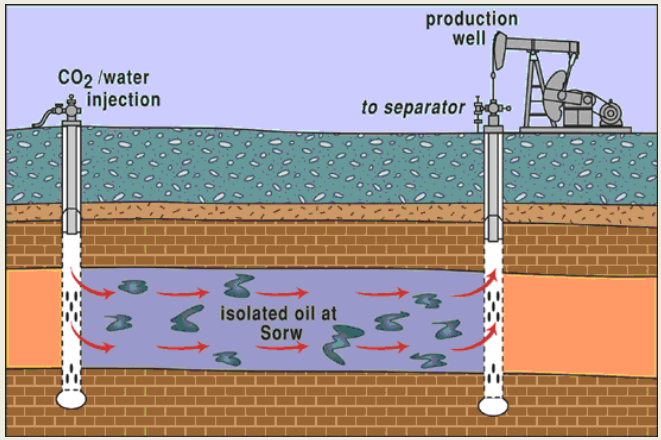
(Murray, 2015 – in preparation)

What do we do with the co-produced saltwater?

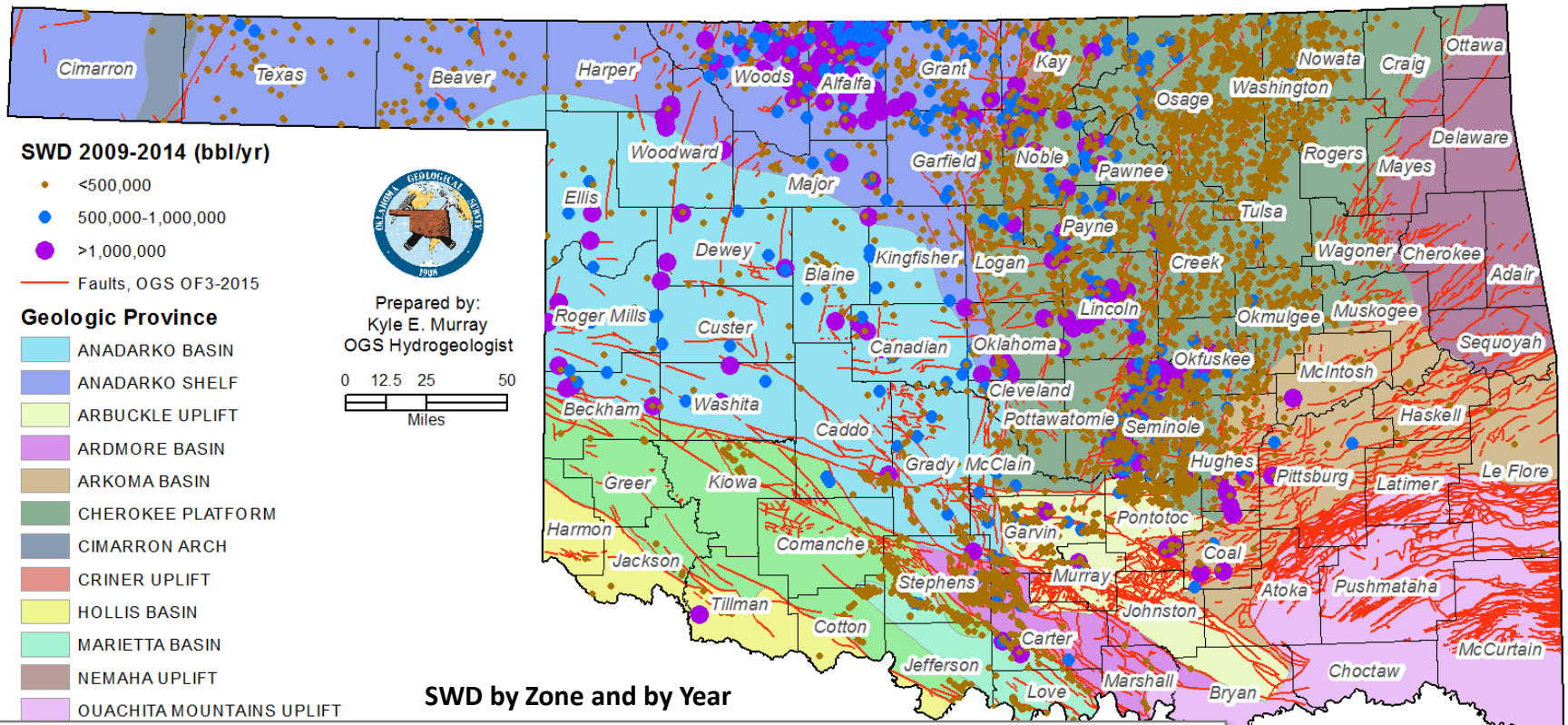


Salt H_2O Disposal

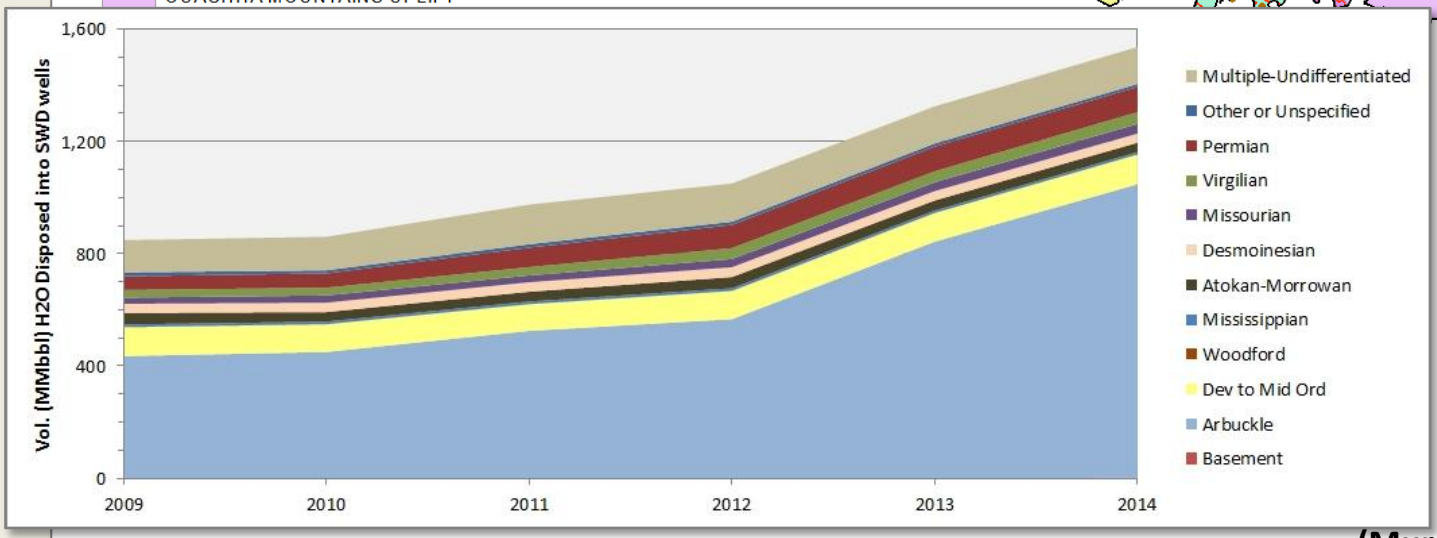
EOR Injection (H_2O Floods)



SWD in Oklahoma, 2009–2014

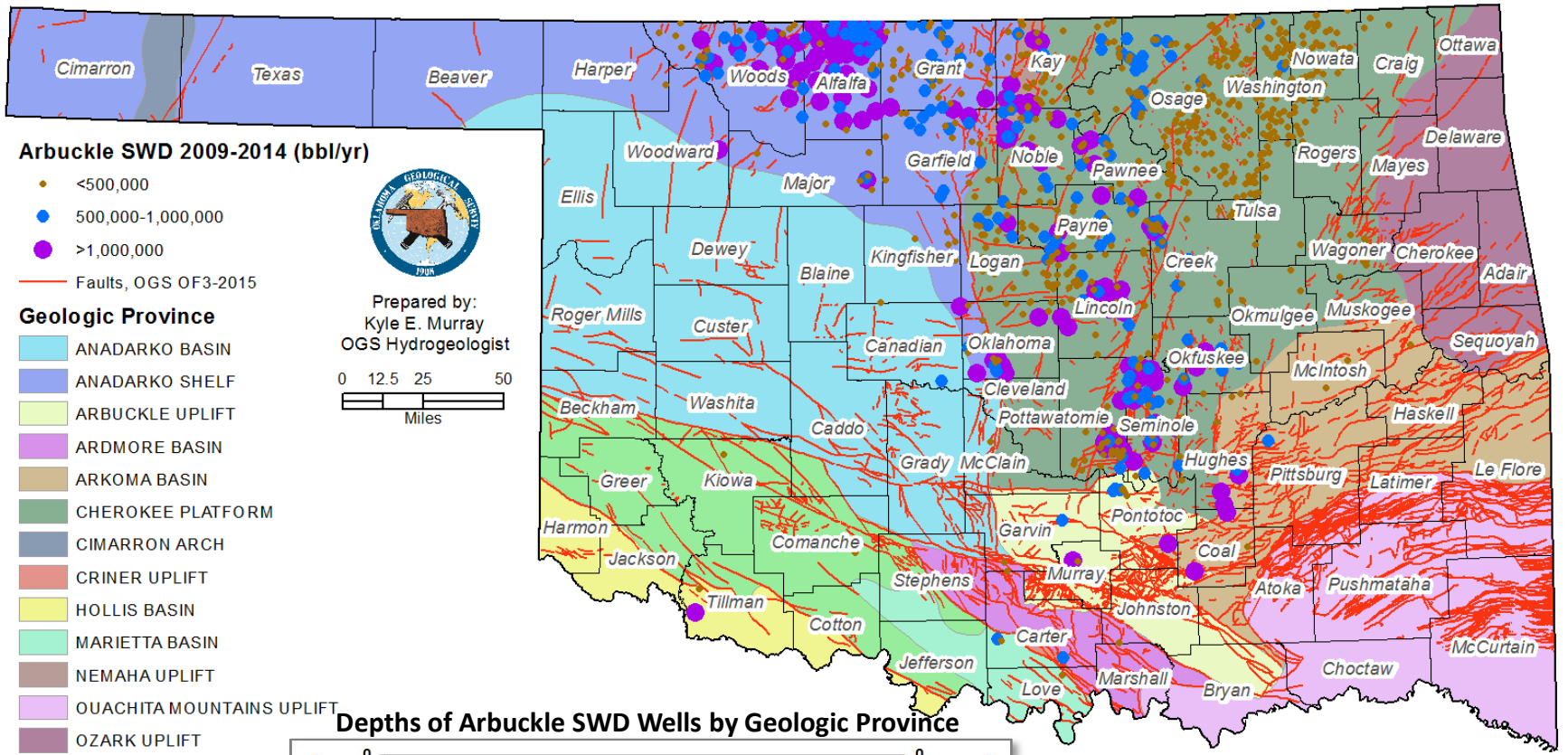


SWD by Zone and by Year

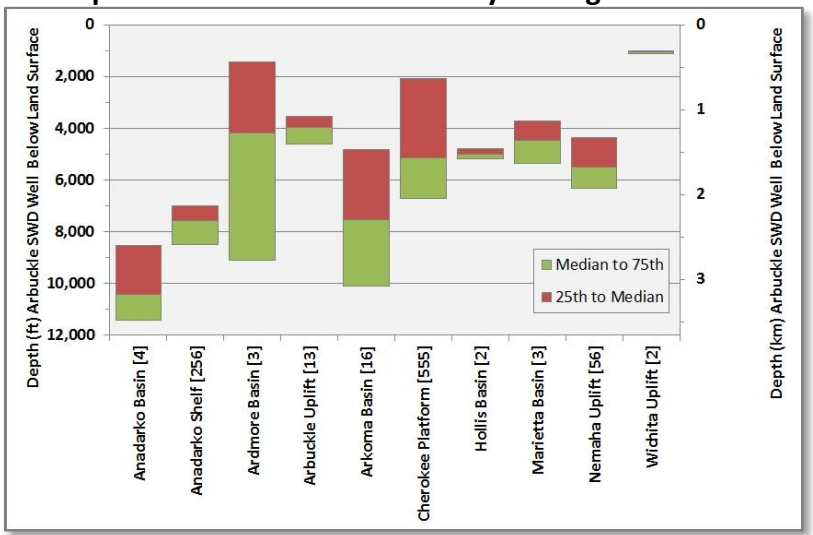


(Murray, 2015 – in preparation)

Arbuckle SWD in Oklahoma, 2009–2014



Depths of Arbuckle SWD Wells by Geologic Province



(Murray, 2015 – in preparation)

Take Home Messages

- Dewatering practices yield more produced H_2O than unconventional shale development
- Rates of H_2O production may be related to market forces
- Pooling and innovative regulatory controls are needed to promote recycle & reuse instead of SWD
- Desalination of produced H_2O is required for beneficial use in other sectors
- O&M costs of SWD are largely a function of transfer or transportation

Contact Information
Email: Kyle.Murray@ou.edu
Website: http://faculty-staff.ou.edu/M/Kyle.E.Murray-1/
Phone: (405) 325-7502