

Oil and Gas Shale Area Profiles

October 2013

Since the early 2000s, innovations in horizontal drilling and hydraulic fracturing technology have made extraction of previously inaccessible oil and gas deposits in shale formations economically viable. The resulting shale drilling boom has brought increased oil and gas drilling and production to states and communities in areas roughly outlined by the geographical boundaries of the underlying shale formations. Below are brief profiles for some of these areas and the U.S. Geological Survey (USGS) estimates of continuous oil and gas resources in each area.

Table 1. USGS Assessment Estimates of Continuous Resources

Shale Formations	Oil Billion Barrels (BBL)	Gas Trillion Cubic Feet (TCF)	NGL Billion Barrels (BBL)	Assessment Year
Bakken & Three Forks (MT, ND)	7.38	6.7	0.53	2013
Barnett (TX)	n.a.	26.2	1.05	2003
Marcellus & Utica (OH, PA, WV, NY, MD)	0.94	122.4	3.59	2011 & 2012
Eagle Ford (TX, LA)	0.85	51.9	2.04	2011
Fayetteville & Chattanooga (AR)	n.a.	14.9	0.00	2010
Woodford & Caney (OK)	0.39	29.7	0.26	2010
Haynesville & Bossier (TX, LA)	n.a.	65.9	0.05	2010

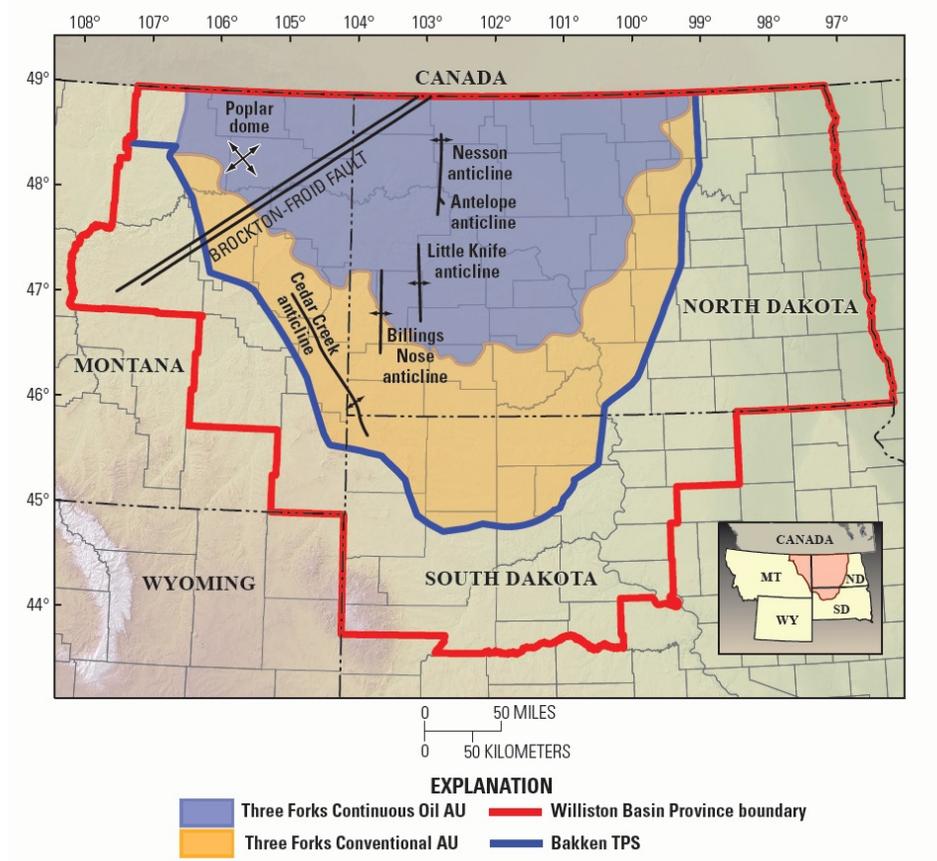
**Table 2. USGS Assessments Table converted to Million British Thermal Units (MMBTU)
In Billions**

Shale Formations	Oil	Gas	NGL	Total Energy
Bakken & Three Forks (MT, ND)	42.8	6.9	2.2	51.9
Barnett (TX)	n.a.	26.8	4.4	31.2
Marcellus & Utica (OH, PA, WV, NY, MD)	5.5	125.2	15.1	145.7
Eagle Ford (TX, LA)	4.9	53.1	8.6	66.6
Fayetteville & Chattanooga (AR)	n.a.	15.2	0.0	15.2
Woodford & Caney (OK)	2.3	30.4	1.1	33.7
Haynesville & Bossier (TX, LA)	n.a.	67.4	0.2	67.6
Permian Basin (TX)	3.0	36.2	3.3	42.5

Bakken/Three Forks

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Bakken	3.65	3.1	0.25	2013
Three Forks	3.73	3.6	0.28	2013
Total	7.38	6.7	0.53	

The Bakken shale formation resides in northwestern North Dakota and a few counties at the eastern edge of Montana. The Three Forks formation lies below the Bakken formation and stretches farther south to include the northern part of South Dakota. Although North Dakota has been an oil-producing state for decades, its production prior to 2004 accounted for less than 2 percent of total U.S. production, and the Bakken area counties¹ on average accounted for only 3 percent of the state's production. Since hydraulic fracturing techniques opened up the Bakken and Three Forks formations for drilling, the state's monthly oil output increased more than ninefold in the past decade, and the area now accounts for over 10 percent of U.S. production (over 90 percent of the state's output).



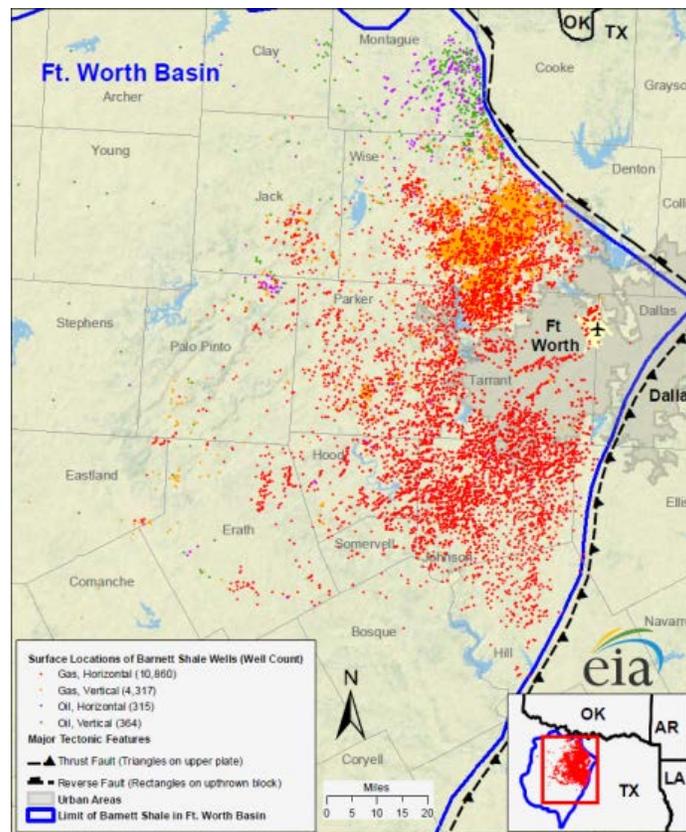
Source: U.S. Geological Survey

¹ Bakken counties for economic indicators include Billings, Burke, Divide, Dunn, Golden Valley, McKenzie, Mountrail, Stark and Williams counties in North Dakota and Richland, Roosevelt and Sheridan counties in Montana.

Barnett

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Barnett	n.a.	26.2	1.05	2003

The Barnett shale extends across an area of about 6,500 square miles west of Dallas in north-central Texas. The Barnett shale was an early pioneer in experimenting with and implementing hydraulic fracturing technology. Horizontal drilling started in earnest in 2003, much earlier than elsewhere, though conventional oil and gas production had been in place in the area for decades. The Railroad Commission of Texas attributes gas production in 24 counties² to the Barnett shale, which increased from 380 billion cubic feet in 2004 to over 1.7 trillion cubic feet in 2012.³



Source: Energy Information Administration

² Archer, Bosque, Clay, Comanche, Cooke, Coryell, Dallas, Denton, Eastland, Ellis, Erath, Hill, Hood, Jack, Johnson, Montague, Palo Pinto, Parker, Shackelford, Somervell, Stephens, Tarrant, Wise and Young.

³ Railroad Commission of Texas. Newark, East (Barnett shale) Statistics.
<http://www.rrc.state.tx.us/data/fielddata/barnettshale.pdf>

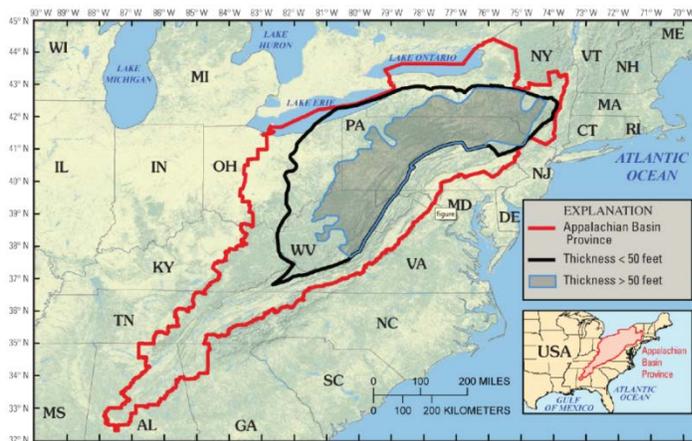
Marcellus/Utica

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Marcellus	n.a.	84.2	3.38	2011
Utica	0.94	38.2	0.21	2012
Total	0.94	122.4	3.59	

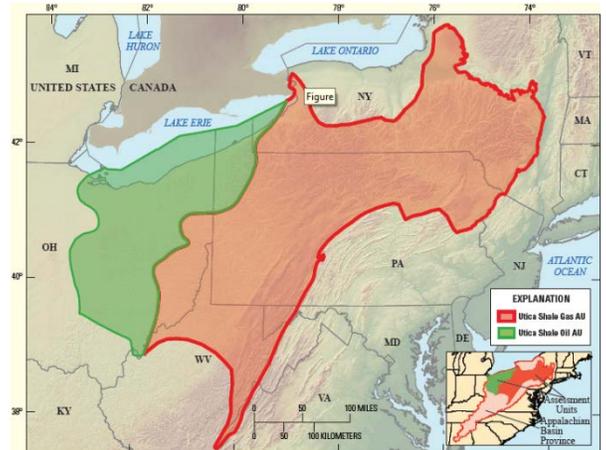
The Marcellus shale spans multiple states from Ohio and West Virginia in the west to Pennsylvania and New York in the east. Since the mid-2000s, new technologies and proximity to major population centers have made the extraction of natural gas economically viable in the region, and production increased more than 10-fold in Pennsylvania alone.

The Utica shale formation is located deeper underneath the Marcellus and roughly covers the same geographical area. Its western part extends farther into Ohio and is estimated to hold close to 1 billion barrels of recoverable oil. Oil and gas prospecting from the shale has started recently and has yet to achieve the scale seen in other shale areas.

Marcellus



Utica



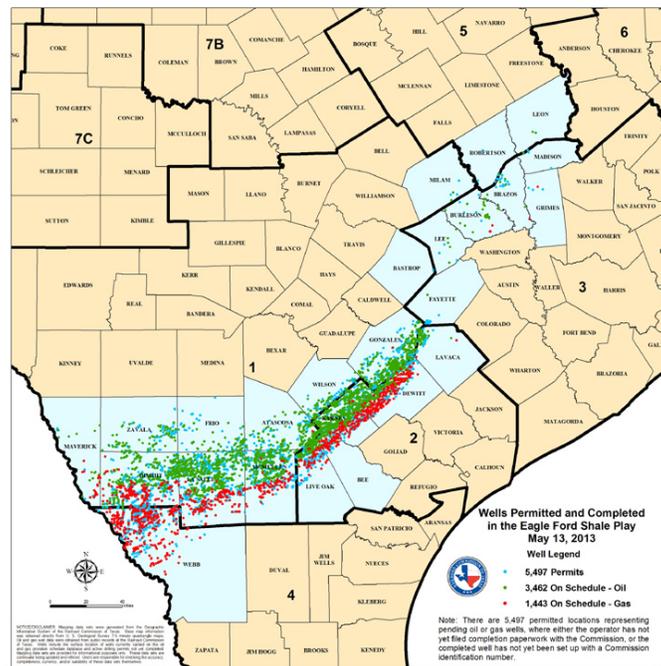
Source: U.S. Geological Service

Eagle Ford

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Eagle Ford	0.85	51.9	2.04	2011

The Eagle Ford shale formation runs from southeastern Texas into southern Louisiana. But energy production to date from this formation is largely in Texas.

According to the Railroad Commission of Texas, the first Eagle Ford wells were drilled in 2008. Since then, the number of producing wells in that region of the state has more than doubled every year to reach 875 in 2012. As of May of 2013, there were about 5,500 well permits on file. Monthly oil production correspondingly increased from about 10,000 barrels in 2008 to over 15 million barrels per month in 2013. Gas production likewise shot upward from under 100 million cubic feet per month in 2008 to over 50 billion cubic feet per month in 2013. Compared with other shale plays, the Eagle Ford shale is often compared with the Bakken and Three Forks formations in terms of its capability to produce oil in addition to gas. While the USGS estimates just under 1 billion barrels of recoverable oil, the Energy Information Administration expects as much as 6 billion barrels of oil production from the Eagle Ford through 2040 compared with 8 billion barrels from the Bakken and Three Forks.



Source: Railroad Commission of Texas

Fayetteville/Chattanooga/Woodford/Caney

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Fayetteville	n.a.	13.2	0	2010
Chattanooga	n.a.	1.6	0	2010
Woodford	0.39	28.6	0.25	2010
Caney	n.a.	1.1	0.01	2010
Total	0.39	44.6	0.26	

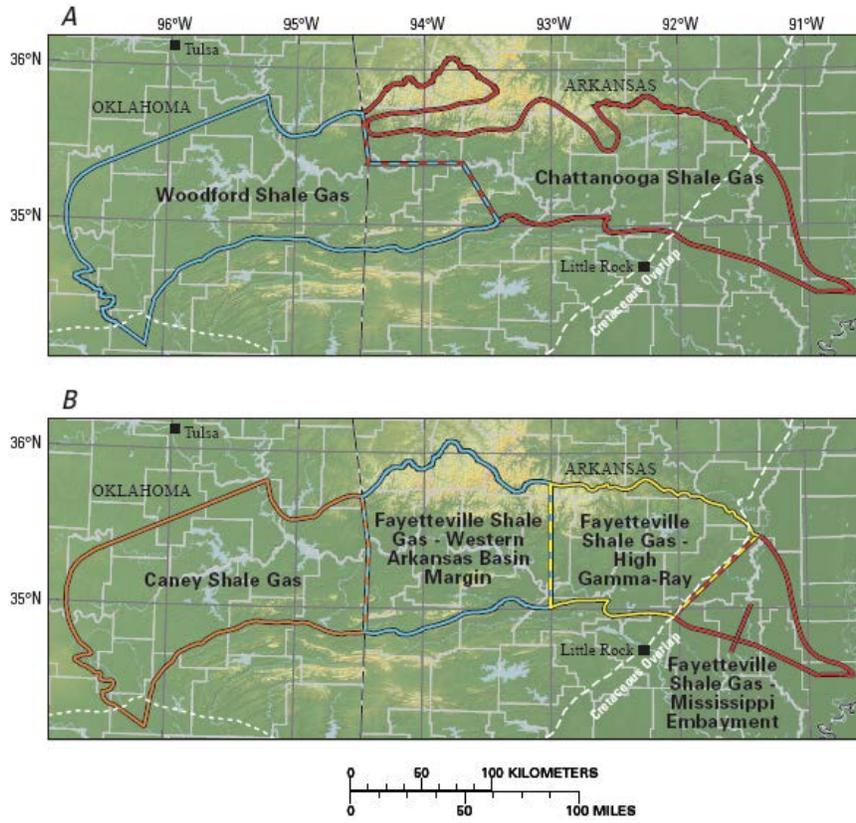
The Fayetteville shale is located in the eastern part of the Arkoma Basin that straddles Oklahoma and Arkansas. The Arkansas Oil and Gas Commission attributes gas sales from 12 counties⁴ to the Fayetteville shale, of which Cleburne, Conway, Faulkner, Van Buren and White are the largest producers. According to its statistics, natural gas sales from the Fayetteville shale increased from about 100 million cubic feet in 2004 to over 1 trillion cubic feet in 2012, more than tripling in volume every year.⁵

Roughly the same area as Fayetteville, deeper underneath is the Chattanooga shale, estimated to hold over a trillion cubic feet of gas. It is laterally equivalent to the more famous Woodford shale on the Oklahoma side of the Arkoma Basin but historically has not been a focus of exploration activity.

Drilling has been under way in the Woodford shale formation, located in central to southeastern Oklahoma, for about 10 years; only the Barnett shale in Texas has produced natural gas longer. The shale formation spans several basins, including the western half of the Arkoma Basin and the southeastern part of the Anadarko Basin. The Caney shale formation sits on top of Woodford on the Oklahoma side of the Arkoma Basin and is laterally equivalent to the Fayetteville shale.

⁴ Cleburne, Conway, Faulkner, Franklin, Independence, Jackson, Johnson, Pope, Stone, Van Buren, White and Woodruff

⁵ State of Arkansas Oil and Gas Commission. Fayetteville Shale Gas Sales Information.
<http://www.aogc2.state.ar.us/Fayprodinfo.htm>



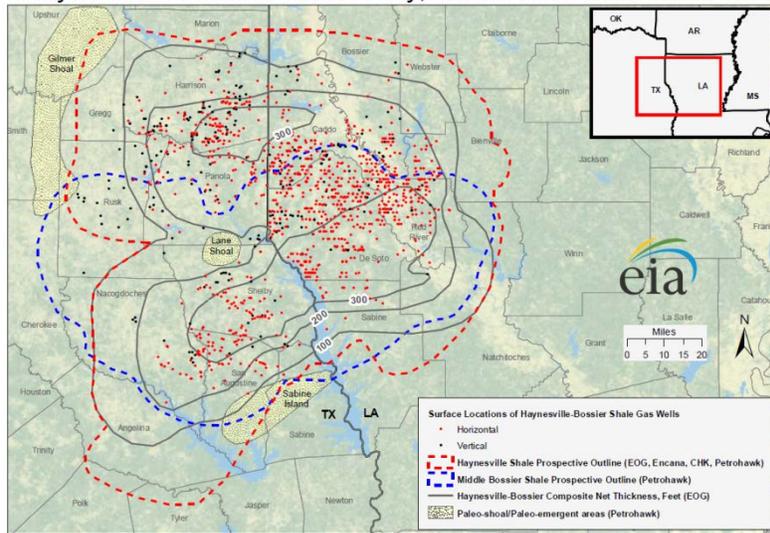
Source: U.S. Geological Survey

Haynesville/Bossier

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Haynesville	n.a.	60.7	0.04	2010
Bossier	n.a.	5.1	0.01	2010
Total	n.a.	65.9	0.05	

The Haynesville and Bossier shale formations are located in northwestern Louisiana and eastern Texas. The discovery of the deeper Haynesville shale was first announced in 2008 by Chesapeake Energy. According to Platts, the ensuing drilling activity skyrocketed from 28 rigs in 2008 to a peak of 186 rigs in 2010. As of May 2013, the Louisiana Department of Natural Resources reports over 2,200 producing wells on the shale, while the Railroad Commission of Texas has over 1,000 well permits on file in the area.

Haynesville-Bossier Shale Play, Texas-Louisiana Salt Basin



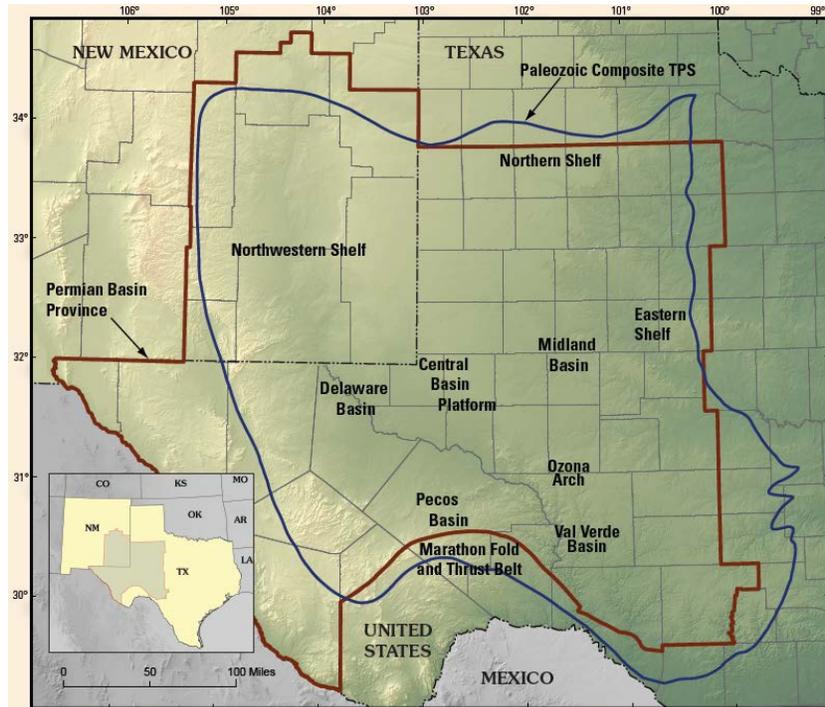
Source: Energy Information Administration based on data from HPDI, TX Railroad Commission, LA Dept. of Natural Resources, Operators. Updated May 26, 2011

Source: Energy Information Administration

Permian Basin

USGS assessment area	Oil (BBL)	Gas (TCF)	NGL (BBL)	Vintage
Permian Basin	0.51	35.4	0.79	2007

The Permian Basin in western Texas and southeastern New Mexico has also long been a significant oil- and gas-producing area. Major shale gas plays include activity in the Woodford, Barnett and Wolfcamp formations in the Delaware and Pecos basins, while shale oil extraction is active around the Spraberry formation. According to Baker Hughes, well over half of the rigs in Texas are currently operating in the Permian Basin, representing over a quarter of the U.S. total.



Source: U.S. Geological Survey

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