



Center for  
Western Priorities

# Follow the Oil

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# Introduction and Summary

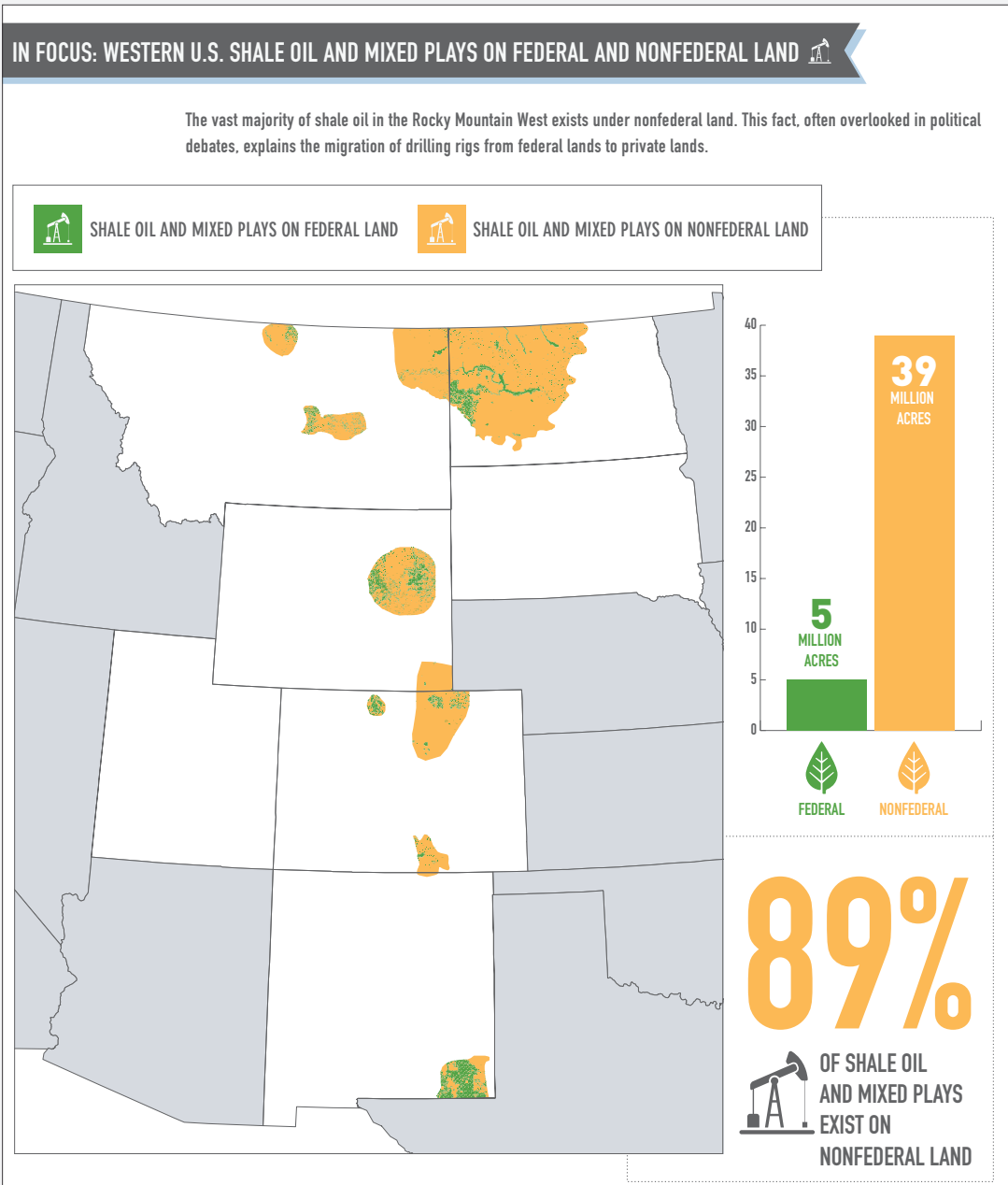
Oil and gas drilling in the western United States has boomed since 2000. As the energy boom has progressed in recent years, drill rigs have moved from federally-owned lands to nonfederal lands, the majority of which are privately owned, but also include some state- and locally-owned lands. This report focuses on the motivations for that shift by assessing the push-pull economics and geological realities that drove the transition.

New extraction methods, such as hydraulic fracturing, have allowed industry to access significant new natural gas resources, creating an increase in production and profits between 2003 and 2008. However, rapid development increased the supply of natural gas, driving down prices, and sending companies searching for other drilling locations and revenue sources.

A combination of low natural gas prices and new shale extraction techniques inspired industry to look toward a more profitable commodity: shale oil. As a result, oil and gas companies moved their operations to areas where shale oil was abundant and offered the greatest potential profit.

The large majority of shale oil plays exist under nonfederal lands. Mapping of shale resources reveals that 93 percent of all onshore shale oil and mixed oil and gas plays are found under nonfederal lands. Even in the Rocky Mountain West, where more federal land is located, 89 percent of the shale oil and mixed oil and gas plays are under nonfederal lands.

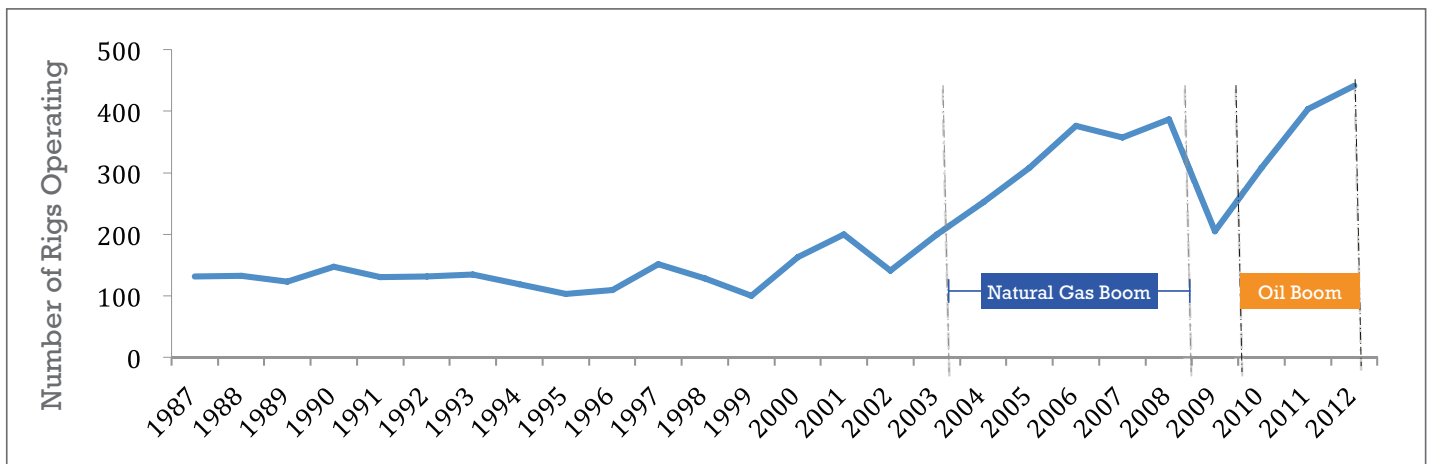
This report demonstrates that the lack of shale oil deposits under public lands and the market-driven movement away from natural gas and towards oil explains recent drilling trends on public lands.



Data Sources: EIA, ESRI, USGS PAD-US 1.2 / Disclaimer: Oil/Gas/Mixed is a general breakout.  
Map Prepared by Rocky Mountain Wild: November 2012. 12-175

Mapping Methodology: We conducted a GIS spatial analysis to determine surface land ownership in the major U.S. shale plays. We overlaid a map of “Shale Gas and Oil Plays in Lower 48 States” with the “Protected Area Database” map of federal and nonfederal lands in the United States.<sup>iii</sup> We calculated the area of each shale play overlapping with federal land and the area overlapping with nonfederal land. Using the best available information we defined shale plays as primarily shale gas or mixed shale oil and gas.<sup>iii/iv</sup>

## ◆ Average Number of Drill Rigs Operating During the Year in Rocky Mountain Oil and Natural Gas Producing States<sup>1</sup>



Baker Hughes, "North American Rotary Rig Counts"

## AMERICA'S OIL AND NATURAL GAS BOOM: TECHNOLOGY, GEOLOGY, PRICE

The exploration and production of oil and natural gas is driven by a combination of technology, geology and price. Technological innovation has opened new resources to development that used to be too difficult or too expensive to extract. Meanwhile, underlying geology—the presence or absence of proven oil and gas resources—has driven companies towards certain areas and away from others. Finally, high prices have made it far more lucrative for companies to expand production into previously uneconomical areas.

### New Technologies

New drilling techniques—namely hydraulic fracturing and horizontal drilling—have made it technically and economically feasible to tap oil and gas deposits trapped in underground shale formations. Together, shale gas and shale oil, along with tight gas, oil shale, oil sands, and coal-bed methane, comprise unconventional oil and gas resources. The advancement, refinement and deployment of new technologies has significantly increased the resources that oil and gas companies can exploit within the continental United States.

Between 2007 and 2011, shale oil production increased more than fivefold and was a driving force behind the 25 percent increase in U.S. oil production during that period.<sup>v/vi</sup>

Shale gas production has increased significantly as well. In 2000, shale gas made up a meager 2 percent of total U.S. gas production; in 2012 that number had skyrocketed to 37 percent of total production.<sup>vii</sup>

<sup>1</sup>For the purpose of this report, the oil and natural gas producing states in the Rocky Mountains include Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming

**HYDRAULIC FRACTURING:** Hydraulic fracturing, or “fracking,” pumps millions of gallons of water, mixed with chemicals and sand, into a drilled well at high pressures. The fluid opens up fissures in the oil or gas bearing formation, allowing the resource to flow to the surface. Hydraulic fracturing has become the predominant method for extraction; it is used in 9 out of every 10 onshore oil and gas wells drilled.<sup>viii</sup>

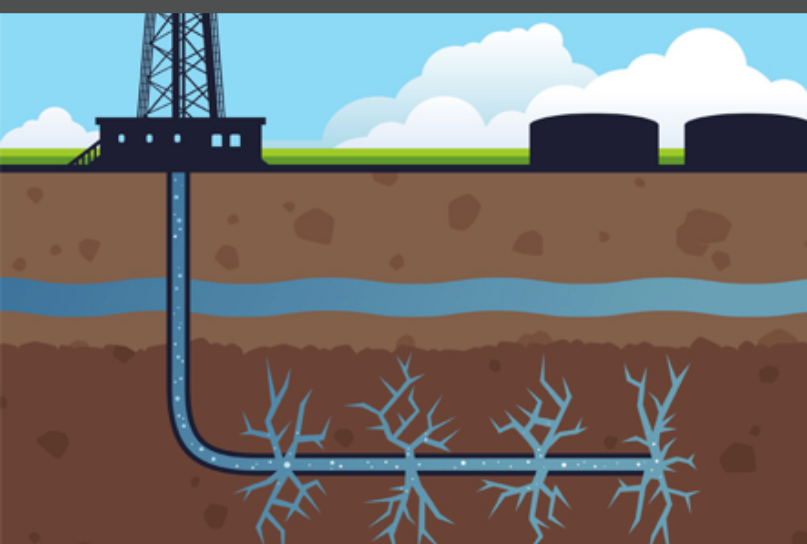
**HORIZONTAL DRILLING:** Until recently, oil and gas exploration and production was limited to vertical drilling. Innovations have allowed drillers to turn their bit horizontally and drill across an oil or gas bearing formation. The well can then be hydraulically fractured horizontally, through the formation, opening up more of the reserve and allowing for more oil and gas to be extracted.

## Geology

Not all shale is created equal. Each ‘shale play’—the deposits of oil and gas trapped between shale rock—has a different composition of oil and gas. Some shale plays are predominately composed of natural gas, others of crude oil, and some are a mixture of both.

Some shales contain dry natural gas, essentially pure methane that can be piped with minimal processing for use in home heating or manufacturing. Wet natural gas shale contains—in addition to methane—natural gas liquids such as butane, ethane and propane. Wet natural gas is valuable because the high value liquids can

### DEPICTION OF HORIZONTAL FRACKING IN A SHALE PLAY



be processed and sold separately from the dry gas component.

## Volatile Prices

When prices of oil and gas are high, it is more lucrative for companies to explore and develop domestic shale gas and shale oil resources.<sup>ix</sup> During the mid-2000s, natural gas prices were favorable in relationship to oil prices. In January 2006, for example, a unit—or barrel—of oil sold at approximately \$65.50, cheap by today’s standards. A unit—or thousand cubic feet—of natural gas sold at around \$8. These high natural gas prices drove aggressive natural gas development between 2003 and 2008.

As of early 2013, oil prices have remained elevated at around \$95 per barrel, near record highs.<sup>x</sup> At the same time, natural gas prices have fallen significantly and remain depressed at about \$3.30 per thousand cubic feet, about half the 2006 price.<sup>xi</sup> In some situations, companies have chosen to shut down natural gas wells rather than continue operations.<sup>xii</sup>

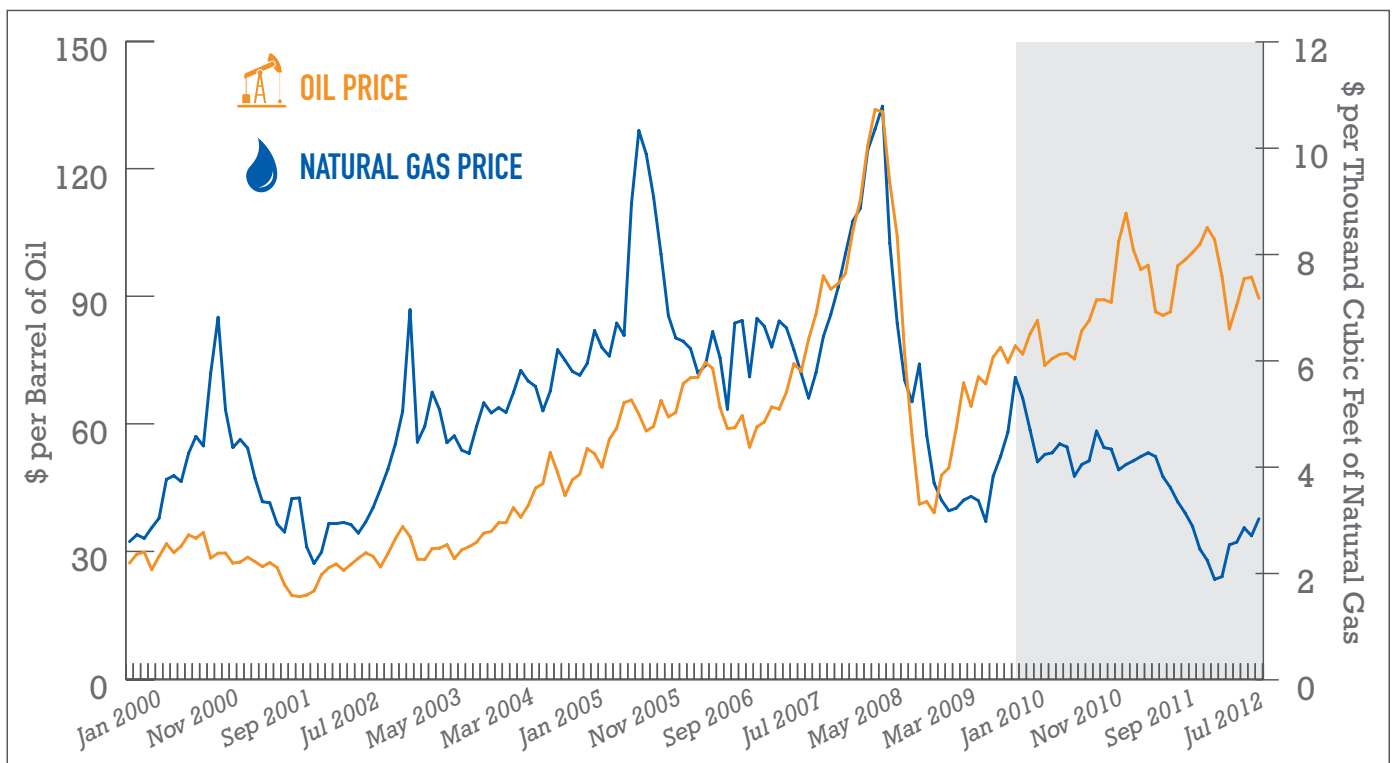
According to a September 2012 *Billings Gazette* article, in Wyoming “coalbed methane production has declined with the waning price of natural gas in the United States. Many operators have idled their wells or asked for suspensions because attempting to produce simply wouldn’t pay off.”<sup>xvi</sup>

## PRICING CRUDE OIL AND NATURAL GAS

Even as oil production in the United States rises, crude oil prices remain high. Oil is a global commodity with prices established by world markets. As Severin Borenstein, co-director of the Energy Institute at the Haas School of Business, explains, “Even a significant increase in U.S. production is a small part of the world oil market.”<sup>xiii</sup>

In contrast, natural gas is a regional commodity. Natural gas prices are much more sensitive to changes in supply and demand.<sup>xiv</sup> Increasing production in recent years in the United States has led to a glut of natural gas, driving down prices.<sup>xv</sup>

### Oil and Natural Gas Price Comparison (January 2000—July 2012)



Energy Information Administration, “Cushing, OK West Texas Intermediate Spot Price” & “U.S. Natural Gas Wellhead Price”

## DRILLING RIGS ARE FOLLOWING THE OIL TO NONFEDERAL LANDS

Low natural gas prices coupled with elevated oil prices have moved industry away from natural gas and towards development of shale oil resources.<sup>xvii</sup>

Oil and gas companies continue to make business decisions with these market factors in mind. Bill Barrett Corporation's second quarter report to investors in 2012 included this statement:



*“The second quarter [of 2012] was again challenging due to low commodity prices, with May regional natural gas prices hitting a low not seen since September 2008... In this environment, we continue to focus on building the oil component of our portfolio.”<sup>xviii</sup> - Bill Barrett Corporation*

The Denver-based Pioneer Natural Resources explained to investors in a third quarter 2012 statement that its “drilling program continues to focus on liquids-rich drilling, with only 10% of the wells designated to hold strategic dry gas acreage in response to the current low gas price environment.”<sup>xix</sup>

Similarly, the Chesapeake Energy Corporation explained to its investors, “During the past four years, Chesapeake has substantially shifted its drilling and completion activity to liquids-rich plays in response to strong U.S. oil and NGL [natural gas liquids] prices and relatively weak U.S. natural gas prices. During 2012 and 2013, the company projects that approximately 85 percent of its total drilling capital expenditures will be invested in liquids-rich plays.”<sup>xx</sup>

### NATURAL GAS LIQUIDS

Most natural gas extracted from the ground contains methane, in addition to valuable natural gas liquids (NGLs): *butane, ethane, propane, isobutene, and pentane*. Some shale gas plays hold significant reserves of NGLs, while others are made primarily of methane. Shale gas plays with a significant liquid component are called *wet gas* plays; shale gas plays composed primarily of methane are called *dry gas* plays. Companies remain interested in developing NGL-rich plays because the market price for NGLs remains high.<sup>xxi/xxii</sup>

Companies are strategically shifting away from natural gas development—particularly in low-value dry gas zones like those found in western Wyoming, western Colorado and eastern Utah—towards those areas with established shale oil resources or mixed shale oil and gas resources, despite whether the lands are publicly- or privately-owned. A 2011 presentation by the energy market analytics company Bentek Energy to the National Association of Regulatory Utility Commissioners demonstrated that companies are chasing profits by shifting drill rigs away from dry natural gas plays and towards shale plays with oil and NGLs.<sup>xxiii</sup>

The shift from natural gas to oil is apparent in places like western North Dakota, where the Bakken shale oil play is developing at a breakneck pace. Since 2009, the number of drilling rigs operating in North Dakota has increased by nearly 300 percent.<sup>xxiv</sup> The reason behind the Bakken shale boom is well-established: The Bakken is estimated to hold more oil than any other area in the lower 48 states and is the largest continuous accumulation of oil ever assessed by the United States Geological Survey.<sup>xxv</sup>

Industry is aggressive in its pursuit of crude oil in the Bakken. Yet as new oil wells yield associated natural gas, producers in North Dakota often treat the gas as waste and burn it off—or flare it—rather than capture, process and sell it. Low natural gas prices and a lack of adequate pipeline capacity in the state cause producers to flare 35 percent of the natural gas produced in the Bakken shale.<sup>xxvi</sup>

According to Troy Anderson, lead operator at a North Dakota gas-processing plant, companies flare natural gas because “it’s cheap.” Anderson told the *New York Times*, “Pipelines are expensive: You have to maintain them. You need permits to build them. They are a pain.”<sup>xxvii</sup>

Despite the trend away from natural gas production, industry has not completely abandoned natural gas development. Oil and gas companies are still attracted to shale gas plays if they hold valuable natural gas liquid resources. In eastern Colorado for example, industry is developing the liquid rich Niobrara shale, which contains both crude oil and natural gas liquids.

Perhaps the most prominent shale play—the Marcellus shale—remains attractive for natural gas production because like the Niobrara, the Marcellus is rich in NGLs. The Marcellus shale, which underlies parts of Pennsylvania, Ohio, New York and West Virginia, has the added benefit of low production and transportation costs, thanks to its proximity to some of the largest gas-consuming cities in the country, including New York, Boston and Philadelphia.<sup>xxix</sup>

Rising production in the Marcellus is directly competing with production in the Rocky Mountain region, which currently pipes natural gas to the Northeast. Low-cost production in the Marcellus has likely displaced higher-cost natural gas production in the Rockies.<sup>xxx</sup>



*In the rush to drill North Dakota's Bakken shale oil play, companies are flaring natural gas as a waste product rather than installing infrastructure to capture and sell the gas.*



## ENERGY EXPLORATION OPPORTUNITIES ON NONFEDERAL LAND

### SHALE OIL AND MIXED PLAYS IN THE U.S.

BY ACREAGE  
**85**  
 MILLION  
 ACRES,  
 NONFEDERAL

**6**  
 MILLION  
 ACRES,  
 FEDERAL

= 10 million acres of nonfederal land = 10 million acres of federal land

**93%**

OF SHALE OIL AND MIXED PLAYS EXIST ON NONFEDERAL LAND

**7%** shale oil and mixed plays on federal land **93%** shale oil and mixed plays on nonfederal land

### SHALE GAS IN THE U.S.

BY ACREAGE  
**204**  
 MILLION  
 ACRES,  
 NONFEDERAL

**22**  
 MILLION  
 ACRES,  
 FEDERAL

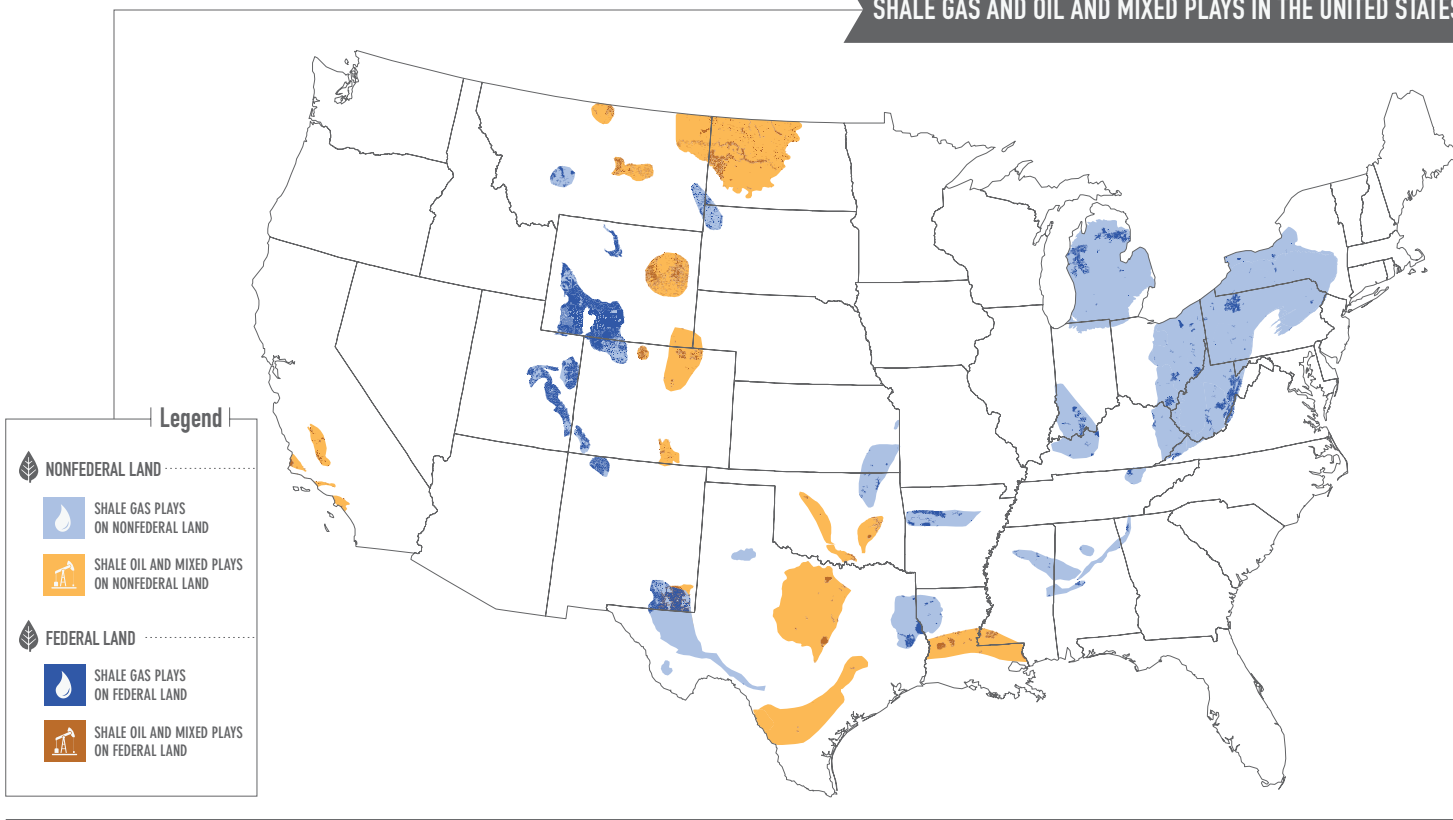
= 10 million acres of nonfederal land = 10 million acres of federal land

**90%**

OF SHALE GAS PLAYS EXIST ON NONFEDERAL LAND

**90%** shale gas on nonfederal land **10%** shale gas on federal land

## SHALE GAS AND OIL AND MIXED PLAYS IN THE UNITED STATES



Data Sources: EIA, ESRI, USGS PAD-US 1.2 / Disclaimer: Oil/Gas/Mixed is a general breakout. / Map Prepared by Rocky Mountain Wild: November 2012. 12-17



## SHALE GAS AND SHALE OIL LIE UNDER NONFEDERAL LANDS

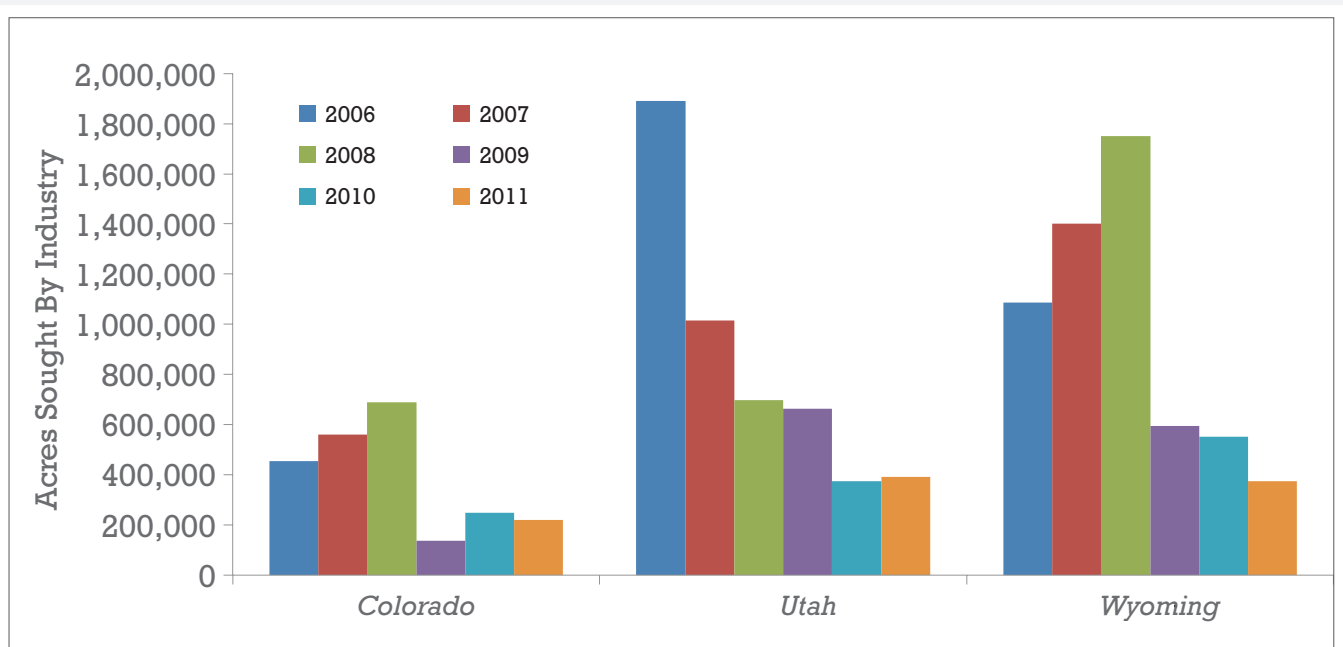
The majority of shale resources in the United States that are the most attractive under current market conditions are located under nonfederal lands, not federal lands. Nonfederal lands include privately-owned lands, along with some state- and locally-owned lands. Nationwide, 90 percent of all current shale gas plays exist on nonfederal lands, with only 10 percent located on federal lands. Even starker, almost all shale oil resources exist on non-federal lands. Only 7 percent of current shale oil and mixed plays are found on federally-owned lands with the remaining 93 percent on nonfederal lands.

Even in the Rocky Mountain West, where much of America’s federally-owned lands are located, only a very small percentage of high-value shale oil resources lie beneath federal lands. Approximately 44 million acres of the Rocky Mountain West encompass a shale oil or mixed play. Of that, 39 million acres—or 89 percent—is nonfederal land, while only 5 million acres—or 11 percent—is federally-owned.

It is no surprise then that the development of shale oil resources has resulted in a shift away from drilling on public lands towards nonfederal lands. As industry has set its sights on shale oil plays, the number of federal acres sought by industry for leasing has declined sharply. An important part of the leasing process on federal lands is the ‘Expression of Interest,’ in which industry nominates certain lands for the federal government to make available for lease. By expressing its interest in specific parcels, industry determines the scope of leasing on federal lands. If industry does not nominate a parcel of land for oil and gas development, then the federal government is unlikely to put the parcel up for auction.

Since 2006, industry has requested less and less acreage on federal lands in areas predominated by natural gas plays, like Colorado, Utah and Wyoming.

◆ **Acreage Sought by Industry CY 2006 – 2011**



Bureau of Land Management, [Industry Expression of Interest](#).

## CONCLUSION

Depressed natural gas prices and high oil prices incentivize profit-driven companies to drill for crude oil over natural gas. In a quest to expand oil operations, companies have moved away from less profitable natural gas plays towards oil plays that are largely located on nonfederal land. The shift away from drilling on public lands is market driven.

In the future, price volatility and market dynamics could lead to a renewed demand for drilling on federal public lands. However, so long as natural gas prices remain low and oil prices remain high, companies will continue pursuing development of shale oil where the best resources exist—on nonfederal lands.

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<sup>ii</sup> U.S. Geological Survey. (2012). National Gap Analysis Program, Protected Areas Database. Retrieved from <http://gapanalysis.usgs.gov/padus/>.

<sup>iii</sup> U.S. Energy Information Administration. (2011). Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays. Retrieved from <ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf>.

<sup>iv</sup> U.S. General Accounting Office. (2012). Information on Shale Resources, Development, and Environmental and Public Health Risks. (GAO Publication No. GAO-12-732). Retrieved from <http://www.gao.gov/assets/650/647791.pdf>.

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<sup>vi</sup> IHS. (2012). America's New Energy Future: The Unconventional Oil and Gas Revolution and the US Economy. Retrieved from <http://www.ihs.com/info/ecc/a/americas-new-energy-future.aspx?ocid=anef-21350:consulting:print:0001>.

<sup>vii</sup> *ibid.*

<sup>viii</sup> Ehrenberg, R. (2012). "The Facts Behind the Frack." Science News. Retrieved from [http://www.sciencenews.org/view/feature/id/343202/title/The\\_Facts\\_Behind\\_the\\_Frack](http://www.sciencenews.org/view/feature/id/343202/title/The_Facts_Behind_the_Frack).

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<sup>x</sup> U.S. Energy Information Administration. (2013). Petroleum & Other Liquids: Cushing, OK WTI Spot Price FOB. Retrieved from <http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=M>.

<sup>xi</sup> U.S. Energy Information Administration. (2013). Natural Gas: U.S. Natural Gas Wellhead Price. Retrieved from <http://www.eia.gov/dnav/ng/hist/n9190us3m.htm>.

<sup>xii</sup> Voge, A. (2012). "Wyoming Threatens to Pull Coalbed Methane Permits." Billings Gazette. Retrieved from [http://billingsgazette.com/news/state-and-regional/wyoming/wyoming-threatens-to-pull-coalbed-methane-permits/article\\_95dd3496-a7f9-5acc-a850-bf98f8ffac0c.html](http://billingsgazette.com/news/state-and-regional/wyoming/wyoming-threatens-to-pull-coalbed-methane-permits/article_95dd3496-a7f9-5acc-a850-bf98f8ffac0c.html).

<sup>xiii</sup> Plevin, L., Zuckerman, G. (2012). "U.S. Oil Boom Falls Short of Pump." The Wall Street Journal. Retrieved from <http://online.wsj.com/article/SB10000872396390443624204578056563506705412.html>.

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