

TRACKING TRENDS IN UNCONVENTIONAL OIL AND GAS DEVELOPMENT



LUNNEN REAL ESTATE, 2014.

THE BAKKEN



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Introduction

The rapid expansion of U.S. production of oil and gas has been attributed to the use of unconventional oil and gas extraction techniques, including hydraulic fracturing (Vengosh, 2014). First developed in the 1950s, hydraulic fracturing is a process by which hydraulic pressure is used to create fissures in shale rock. Hydraulic fracturing itself is not a drilling process, although it is most frequently employed in conjunction with horizontal drilling (EIA, 2015). It was not until the technique was refined in the 1990s, coupled with a lax regulatory environment, that it came into widespread use (Bierstedt, 2015). The influx of new sources of oil and gas productivity, and resulting geopolitical consequences, have increased the overall supply of oil. This has significantly lowered global oil prices. The consequences of long-term depressed oil prices may destabilize nations heavily dependent on oil, and compound negative impacts on local communities, or “boomtowns,” that have become dependent on oil income.

In the U.S. and elsewhere, hydraulic fracturing has been a highly controversial process.

For this project, our group decided to focus on the Bakken shale play. We observed that, even after we gathered data through scholarly literature and media coverage, much remains uncertain regarding the Bakken. We thought

that by focusing on a single play, we could later draw broad contrasts between energy and socioeconomic trends in the Bakken and the experiences elsewhere.

Our primary interest in the Bakken comes from the fact that unlike the Marcellus and Eagle Ford plays (located primarily in Pennsylvania and Texas, respectively), the Bakken area is very rural with no history of mineral resource development. Thus, the Bakken region consequently lacks the social and industrial infrastructure necessary for mineral resource extraction.

In the U.S. and elsewhere, hydraulic fracturing has been a highly controversial process. Local communities where hydraulic fracturing is occurring have reported a wide variety of social and environmental impacts straining the resources of local communities, from housing to policing to basic social services, while bringing in fewer profits to the communities than anticipated. On the other hand, other communities have reported positive impacts. These positive impacts should not be dismissed, but they may be outweighed by the negative impacts. Films such as *Gasland* and *Dear President Obama* document these responses to hydraulic fracturing from the communities where drilling is taking place.

We were also very interested to compare how local and national perceptions of risk may differ, both to the extent that activists are able to convey their message to a national audience, and the extent to which a local population may (or may not) be better informed than a national audience.



HESS OPERATIONS, N.D.

Through preliminary research, we found that many of the risks of hydraulic fracturing were not well understood: risks that scientists deemed to be very serious and worthy of further examination were often not known or valued by the public. Conversely, other risks that the lay public considered very serious are not deemed so through the results of scientific studies. We wanted to document these differences so that concerned citizens might be able to leverage this knowledge to focus public attention on issues with the greatest potential for coalition-building.

Bass Connections is a uniquely challenging research opportunity. The interdisciplinary

nature of the team permitted us to work with different types of data and information to find interesting connections, and marshal a wide variety of expertise to address various aspects of a complex problem. The contemporary nature of the topic meant that the ground was – literally, in some sense – shifting under our feet. As we progressed in our work and developed the project, we witnessed data trends showing how a fairly long-lasting boom cycle may be grinding to a halt. Therefore, our study became more about tracking the “bust” as oil prices have dropped precipitously in recent months. However, we hope that by compiling this information that we can contribute to better understandings of hydraulic fracturing in the Bakken, and point to significant avenues in which more research is needed.

History of Oil and Gas Development

The Bakken Shale deposit has driven North Dakota's oil production to levels four times higher than previous production peaks in the 1980s. The Bakken Shale play is primarily located in western North Dakota and eastern Montana. It is estimated that the Bakken deposit holds approximately 400 billion barrels of oil equivalent (Bakken Shale, 2016). The Bakken formation is comprised of three distinct sections: lower shale bed, upper shale bed, and a variable middle. The lower and upper shale beds share similar characteristics. The upper shale is organic-rich, black shale with a measured total organic content of up to 40%. The lower shale has total organic compound levels of up to 21% (Tabatabaei et al., 2009).

Production in the Bakken region began when Stanolind Oil and Gas Corporation drilled for oil in 1953. The main region for production was in Antelope field. Outside of Antelope field, the Bakken formation was not targeted by industry because it was known as being "generally impermeable" (LeDever, 1991). The next discovery of oil did not occur until 1961, when Shell Oil Company discovered the Elkhorn Ranch field. Production increased during the 1970s in the Bakken formation in southwestern North Dakota. In 1987, Meridian Oil, Inc. completed the first horizontal well in the Bakken, ending the era of traditional vertical drilling in the shale play (Tabatabaei et al., 2009; LeDever, 1991). As of March 1990, 76.2% of the oil came from only three fields: Antelope, Elkhorn, and Buckhorn. The cumulative amount of oil produced from horizontal wells in the Bakken in March 1990

was 1,700,997 barrels of oil (LeDever, 1991). Horizontal drilling primarily took place in the upper Bakken shale layer from 1987 to 2000. In 2000, horizontal drilling shifted to focus on the middle Bakken (Tabatabaei et al., 2009). There have been three distinct oil boom periods in North Dakota. The first boom took place from 1951 to 1955. According to Weber et al., this boom led to housing shortages and more expensive public services.

Over the past 9 years, more than 2,500 horizontal wells have been drilled in the Bakken region.

During the second boom, which took place from the late 1970s through the early 1980s, residents of North Dakota towns with extensive industry presence tried to remedy the strain on public services. The locals endeavored to build adequate infrastructure and footed the bill. However, this infrastructure became obsolete when the boom ended. Thus, a perceived lesson from a boom cycle is not to invest in long-term infrastructure. One result of communities' reluctance to invest in this infrastructure is the emergence of "man camps" (Weber et al., 2014). A "man camp" could be a barracked in compound, or a random assemblage of tents with no sewage or water. The third boom is occurring now. Over the past nine years, more than 2,500 horizontal wells have been drilled in Montana, North Dakota, and Saskatchewan.

Each well costs between \$4 and \$8 million. According to case study on the Bakken region by Rankin et al., this suggests that the industry has invested \$15 billion in oil and gas infrastructure in the Bakken (Rankin et al., 2010).

The third boom phase for the oil and gas industry in North Dakota began in 2010. Due to this boom, which is the result of technological improvements in hydraulic fracturing, North Dakota has witnessed significant industry and population change. By May 2012, North Dakota trailed Texas for the state with the highest level of oil production. In addition, according to the Bureau of Labor Statistics, in 2012, North Dakota had the lowest unemployment rate in the country. Furthermore, the oil boom in North Dakota significantly increased levels of immigration. As of 2012, population levels in North Dakota increased to their highest level in 80 years (Weber et al., 2014).

In 2012, one study conducted by Bret A. Weber, Julia Geigle, and Carenlee Barkdull, identified 19 counties in the western half of North Dakota referred to as the “oil patch” (Weber et al., 2014). While there are 19 counties involved in drilling activities, only five counties can be considered

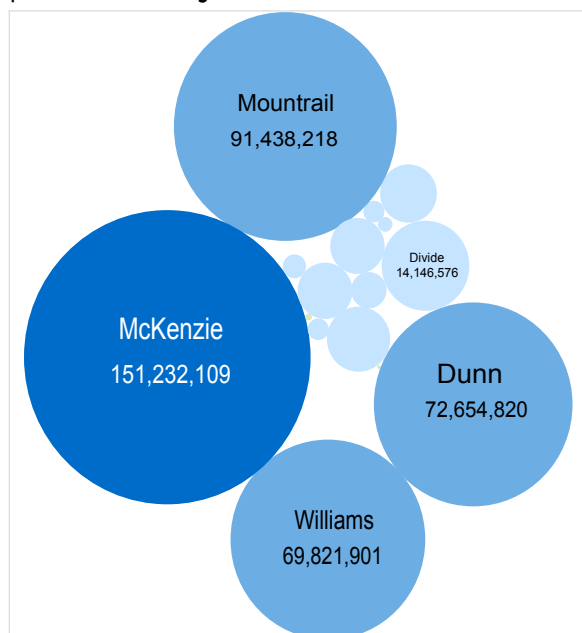
the “epicenter of the patch” (Weber et al., 2014). This includes Divide, Williams, Mountrail, McKenzie, and Dunn counties (Weber et al., 2014). McKenzie County leads development with 23 active rigs, as of December 2015.

According to advocates of the industry, the benefits of the boom include economic development, partnerships with oil companies, decreases in traditional social welfare and cash assistance programs, and the potential for building long-term community capacity (Weber et al., 2014). However, these benefits may not come to fruition in all communities. It is the rural communities within major shale plays that are more likely to bear the burden of the extractive industry’s swift development. This can be attributed to rural communities small political constituencies and underdeveloped infrastructures (Weber et al., 2014).

It is unknown how long the boom cycle will last for the Bakken Shale deposit. As of January 2016, there were 10,438 producing wells, resulting in 1,067,891 barrels of oil being produced on a daily basis (Bakken Shale Deposit, 2016). However, the number of drilling rigs has been decreasing, due to falling oil prices (Bakken Shale Ends, 2015).

FIG. 1: TOP FIVE OIL PRODUCING COUNTIES IN THE BAKKEN IN NORTH DAKOTA - BARRELS OF OIL

Top Five Oil Producing Counties in the Bakken in 2015 (Barrels of Oil)



This figure visually represents the top five oil producing counties in the Bakken region in North Dakota. McKenzie county produced the most oil in 2015, followed by Mountrail, Dunn, and Williams County.

DATA SOURCE: NORTH DAKOTA INDUSTRIAL COMMISSION, DEPARTMENT OF MINERAL RESOURCES, OIL AND GAS DIVISION, 2016.

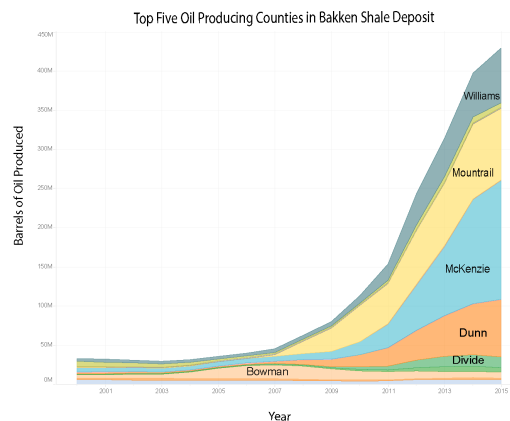
Energy

The five counties that were previously mentioned as the “epicenter of the patch” continued to produce significant amounts of oil in 2015, in spite of the decline in oil prices. Hydraulic fracturing is not the most expensive method of extraction of oil, possessing a break-even point around \$25 per barrel (Rosenberg, n.d.). As a point of reference, Canadian tar sands possess a break-even point around \$30 per barrel, with U.K. North Sea oil breaking even around \$50 per barrel. With this said, though, oil prices have hovered in the \$20-\$30 per barrel range as recent as January of 2016 (Bloomberg, 2016).

Rig count and production experienced declines in 2015, succumbing to the consistently low crude prices.

Existing hydraulic fracturing operations will continue to produce, though oil and gas companies may cease to explore and drill for new oil. Many establish the \$60 per barrel as the point at which it is profitable for exploration and drilling of new wells (Rosenberg, n.d.). Existing wells with high operational costs may need to be shut down, but the largest investment in any hydraulic fracturing facility is the exploration and drilling. Once the initial investment is made, hydraulic fracturing wells can generate profit with generally low operational costs, enabling them to weather a short-term decrease in oil prices.

TOP FIVE OIL PRODUCING COUNTIES IN NORTH DAKOTA



This figure depicts total oil production in the Bakken in North Dakota in 2015 divided by county. Total produced exceeded 400 million barrels of oil. DATA SOURCE: NDIC OIL AND GAS DIVISION, 2016.

The current weak oil price has been anything but short-term. Rig count and production experienced declines in 2015, succumbing to the consistently low crude prices. Lynn Helms, director of the North Dakota's Department of Mineral Resources said in November, 2015 that he expects production and rig count to continue to decrease throughout 2016 (Nemec, 2015). Even if prices rebound, it will take quite a while for drilling and production to reverse this downturn. “Many of the rigs that have been idled are being scavenged for parts,” continued Helms. “It is going to take some weeks or months to put all the pieces back together, mobilize the equipment, get the crews back together and be able to get up and running again” (Nemec, 2015).

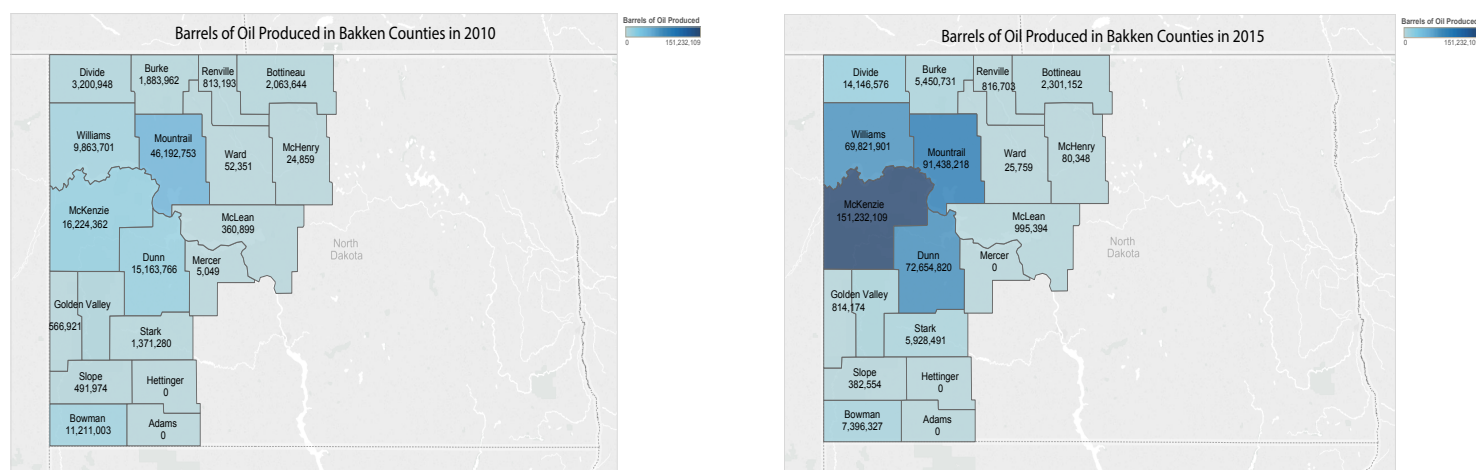


FIGURE 3. OIL PRODUCTION IN THE BAKKEN IN 2015 - COUNTY

This figure depicts total oil production in the Bakken in North Dakota in 2015 divided by county. Total produced exceeded 400 million barrels of oil. DATA SOURCE: NDIC OIL AND GAS DIVISION, 2016.

One of the few benefits of this downturn in prices is that there is an accompanying decrease in pressure to install infrastructure for transportation. Both oil and the associated gas have utilized rail transportation, due to the scarcity of pipeline capacity. Seven years ago, rail capacity available for oil transportation was close to zero. Since that time, rail transportation has become a significant piece of the industry, moving around 50% of oil from North Dakota in late 2015 (NGI's Shale Daily, n.d.). The North Dakota Public Service Commission (PSC) recently approved siting permits for a natural gas liquids pipeline and a crude oil pipeline in order to provide additional transportation options (Nemec, 2016). In addition, a natural gas processing plant is also being planned for McKenzie County to process the resource.

Though these infrastructure investments are much needed, they may not arrive in time to assist with many of the issues facing both the natural gas and oil industry in the Bakken shale formation. The Bakken shale field is primarily known as an oil play, possessing light sweet

crude. Light sweet crude is a high quality crude that requires less intensive refining, similar to West Texas Intermediate crude oil. This valuable crude oil is also accompanied by

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natural gas, much of which is extremely liquids rich. Conventional natural gas is often termed "dry", with shale gas producing any spectrum of dry to liquid rich. Liquids rich natural gas, also known as natural gas liquids (NGL), can provide an additional revenue stream for a hydraulic fracturing operation. Despite the high quality of these resources, inadequate infrastructure and continued low market prices are limiting development, sometimes even resulting in waste of these resources.



NEW YORK TIMES, 2011.

About one-fifth of natural gas produced in North Dakota is “flared,” or allowed to enter the atmosphere without being captured for use as energy (Ford, Wilczewski, & Nulle, 2015). This is often due to inadequate pipeline capacity, compressor stations, and gas-processing facilities in the region. Low natural gas prices also contribute towards flaring, as it makes capturing the natural gas less attractive financially. While flaring is not expressly prohibited under U.S. regulations, it has been linked in to health problems and reduced air quality, which has caused states to implement heavy restrictions. North Dakota has proposed regulations to limit flaring to 15% of production by January of 2016, though this deadline has been extended due to industry pressure (Scheyder, 2015).

During the flaring process, the methane from the well is converted into carbon dioxide (CO₂) by flaring. Though still a contributor to climate change, CO₂ is a much less potent greenhouse gas than methane, which would be produced if the excess natural gas was not flared (known as venting). Many suggest that the decreasing price of natural gas on the market has also

contributed to the use of flaring practices. Prices averaged \$1.99/mmBtu on the Henry Hub spot market in the first quarter of 2016, though they had previously averaged \$4.05/mmBtu from December 2012 to November 2014 (Berman, 2016).

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Low prices are not expected to continue, as many observe the decreasing surplus of natural gas on the market and project prices to rise in the next year or so. Until prices rise for natural gas, or regulations demand it, flaring will most likely continue to be a common practice in the remote Bakken region.

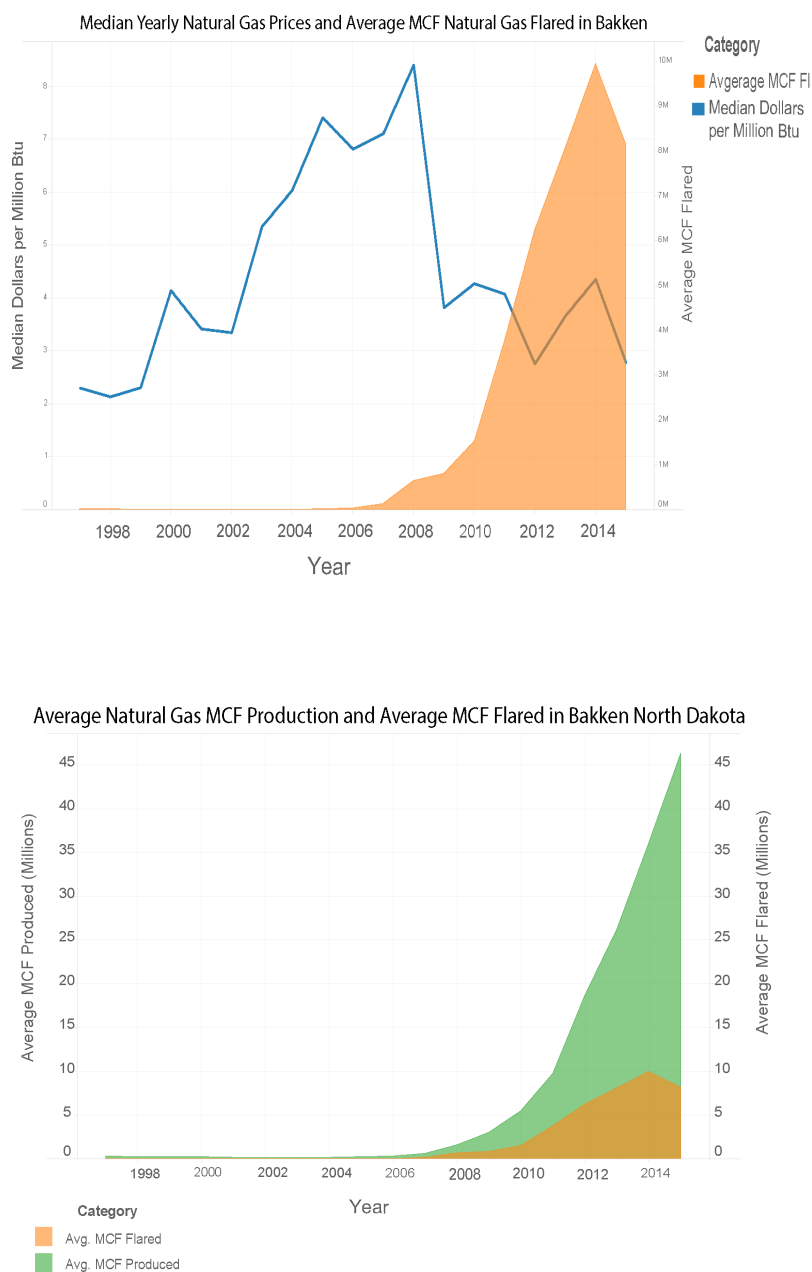


FIGURE 4. FLARING AND ENERGY PRICES

The upper graph depicts how the amount of natural gas flared in the Bakken increased as production increased from 2010 to 2014. In 2014, almost 10 million MCF of natural gas was flared.

The lower graph represents the relationship between natural gas price and production of natural gas. As the price of natural gas dropped, the amount of natural gas flared shows an increasing trend.

DATA SOURCES: ENERGY INFORMATION ADMINISTRATION, 2016; NDIC OIL AND GAS DIVISION, 2016.

Impact of Oil and Gas on Key Demographic and Economic Variables

The recent boom of oil and gas industry in North Dakota not only brought about the increase of energy production and the change of energy prices, but also promoted population growth and economic development in local communities, which had previously suffered from a long-term population shrink and economic recession.

Incentivized by the increasing job opportunities, thousands of people have flooded into North Dakota since the start of the recent oil and gas boom. From 2010 to 2014, the estimated population in North Dakota increased from less than 675,000 to about 740,000. This 9.7% growth made North Dakota the state with the highest population growth rate among all 50 states in the U.S., as the national average population growth rate during this period was only 3.1% (U.S. Census Bureau, 2014).

The growing population gradually shifted the state's demographics. The sex ratio (of males to females) was skewed against females, contrary to the national sex composition. In 2010, the sex ratio in North Dakota was around 1.02. In 2014, the ratio increased to more than 1.05. In addition, the population has been getting younger. The median age of the state decreased to 34.9 in 2014 from 37.0 four years ago (U.S. Census Bureau, 2015a).

Despite the dropping energy price in recent months, the labor market in North Dakota remains attractive. According to Job Service North Dakota data, the state had about 15,000 more jobs than job takers by the end of 2015 (MacPherson, 2015). The abundant job opportunities brought down the state's unemployment rate. Since 2011, the unemployment rate in North Dakota has remained below 3.5%, while the rate for the whole country fluctuated between 5% and 9% (U.S. Bureau of Labor Statistics, 2016).

The benefits brought by the oil and gas boom are highly imbalanced across the 53 counties in North Dakota.

The benefits brought by the oil and gas boom, however, are highly imbalanced across the 53 counties in North Dakota. In general, the 16 counties in the Bakken area, such as McKenzie, Mountrail, Williams, and Dunn, experienced a faster pace of development than the rest of the states. For example, the annual population growth rate for counties in the Bakken was lower than the growth rate in other counties from 2001 to 2006.

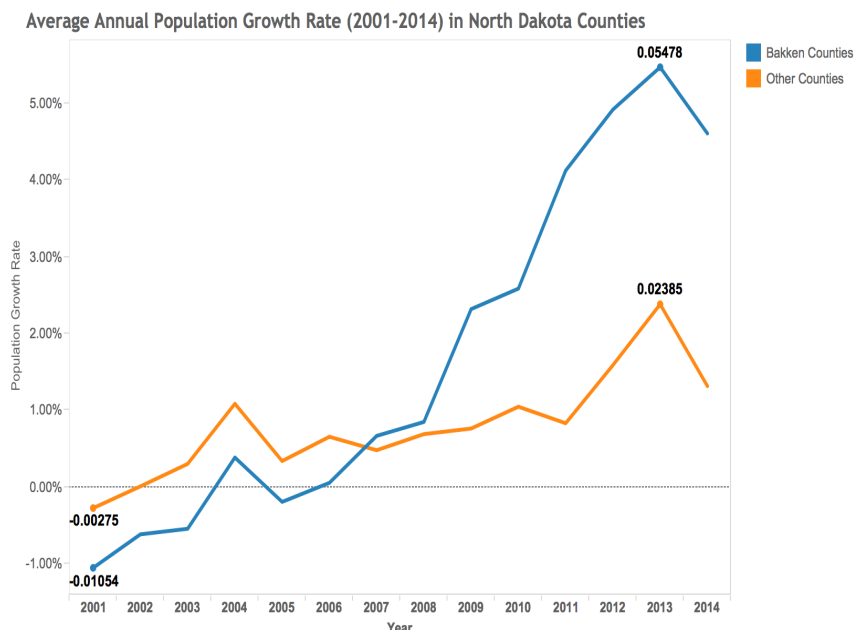


FIGURE 5. POPULATION GROWTH, 2001 - 2014

This figure depicts the average annual population growth rate from 2001 to 2014 in both the Bakken and other counties in North Dakota. Before the start of the oil and gas boom in 2007, both groups of counties had low or even negative population growth rates. As the boom brought more job opportunities, the population growth rate kept increasing, with most increases happening in Bakken counties.

DATA SOURCE: U.S. CENSUS BUREAU

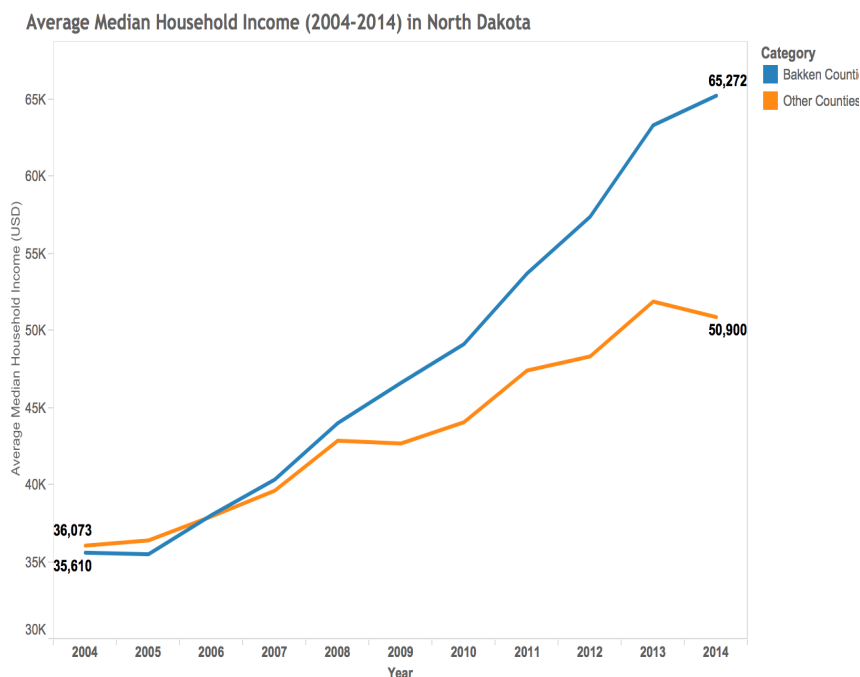


FIGURE 6. MEDIAN HOUSEHOLD INCOME, 2004 - 2014

This figure depicts the average median household income from 2004 to 2014 in both Bakken and other counties in North Dakota. While both groups of counties had a similar median household income in 2004, the gap became wider due to the increasing job opportunities and household income for those counties in the Bakken region. DATA SOURCE: U.S. CENSUS BUREAU

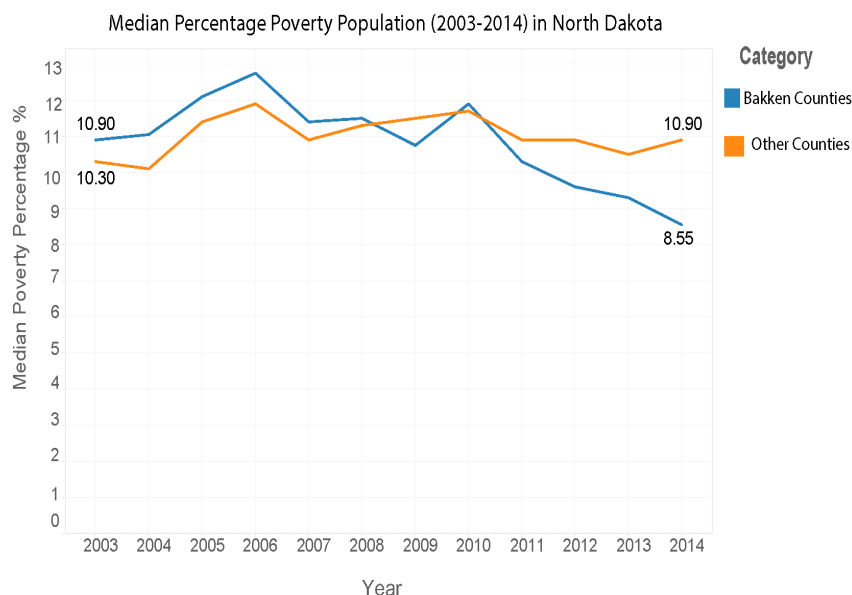


FIGURE 7. MEDIAN POVERTY RATE, 2003 - 2014

This figure depicts the median poverty rate from 2003 to 2014 in both Bakken counties and other counties in North Dakota. Along with the increase of median household income (see Figure 2), the median percentage of population in poverty in Bakken counties decreased by more than 2% from 2003 to 2014. For other counties, the poverty rates did not change a great deal. DATA SOURCE: U.S. CENSUS BUREAU

Starting in 2007, however, the annual population growth rate for Bakken counties kept increasing, and reached 5.478% in 2013. Among all the 16 Bakken counties, McKenzie County has the highest population growth rate – the population size of 10,996 in 2014 was almost double the population in 2001 (U.S. Census Bureau, 2015b).

The change of median household income in North Dakota demonstrates a similar trend as the population growth. Before the oil and gas boom, counties both in and outside the Bakken had an average median household income of around \$35,000. Starting from 2006, the median household income in Bakken counties kept increasing by year, despite the negative impact of the financial crisis on the economy in 2009. In 2014, the median household income in Bakken counties reached \$65,000, which was about 30% higher than the median household income in the rest of North Dakota counties (U.S. Census Bureau, 2015c)

Along with the increasing median household income in Bakken counties is their dropping poverty rate. In the 16 Bakken counties, the median percentage of residents below the poverty line decreased from 10.9% in 2003 to 8.6% in 2014. For other counties, however, the percentage increased from 10.3% to 10.9% during the same time (U.S. Census Bureau, 2015c).

Due to the limited data availability, this report only shows the demographic and economic impacts of oil and gas development on local communities in North Dakota. However, it is important to understand that changes brought by the boom reach far beyond these areas. Environmental impacts, rising crime rates, and the shortage of affordable housing are all results of the Bakken shale development, and should be analyzed in further research.

Public Opinion and Unconventional Oil and Gas Development

There remains a great deal of scientific uncertainty about the risks and benefits of unconventional oil and gas development. Through preliminary research, we found that many of the risks of hydraulic fracturing were not well understood – risks that scientists deemed to be very serious and worthy of further examination were not known or not valued by the public, and other risks that the lay public considered very serious but scientific study had determined to be of less concern (North, 2014; Clarke, 2015). For example, scientists recently uncovered that hydraulic fracturing uses less water than anticipated. The implication of such studies is that the risks of contamination from fracking chemicals may be overstated, but the risks of fluids from “flowback” or “produced water” may be much higher than previously thought (Vengosh, 2014). Similarly, the risk

What messages are being communicated in the use of these terms in media and other public sources of information?

of earthquakes has proven to be a salient concern; many environmental groups perceive earthquakes as confirmation of heretofore unseen or unknown environmental harm (Keranen et al., Montgomery).

Depending upon the context of the situation, this pervasive scientific uncertainty can be leveraged to the advantage of social justice activists who wish to limit the environmental harms caused by mineral resource extraction. Scholars have demonstrated that the ways that the media interprets and conveys benefits and costs has a tangible effect on the public opinions of fracking (Clarke et al., 2015). In this section of the report, we have attempted to reflect colloquial use of the term “fracking” to refer more broadly to unconventional oil and gas development. Though we recognize the charged political nature that the term now carries, it is also used in a colloquial sense by researchers and regular citizens alike.

Other scholars have noted that the term “fracking” or “fracing” is often used to levy a broader critique on the oil and gas industry that is not limited to the actual process of hydraulic fracturing. Distinctions between conventional and unconventional oil and gas development present further barriers to understanding for the lay person who may not identify the qualitative distinctions between the methods of resource extraction (Graham et al., 2015). What messages are being communicated in the use of these terms in media and other public sources of information?

We sought to determine if newspapers are following the trend of the general public in associating fracking with negative risks and hydraulic fracturing with benefits (Clarke et al., 2015). If the media tends to portray ‘fracking’ in a generally negative light, activists have an opportunity to amplify the messaging contained in the media to their own advantage. This phenomenon in which triggering events or ideas work to amplify the negative perception of risk has been referred to as the “social amplification of risk” (Kasperson, 1996). Activists, which we refer to as the vocal opponents of fracking, must work against the general political weight of industry voices and associated majority support of fracking (Ladd, 2013). Activists who oppose hydraulic fracturing attempt to garner public support of their cause through these social-amplification techniques in order to counter the relative political influence of firms.

Although fracking is a contentious political issue, ample literature indicates that the plurality of public opinion is, however, ambivalent or skeptical (Ladd, 2013; Boudet et al., 2014; Boudet et al., 2016). With increased coverage, determining how media describe the benefits and impacts of shale gas development offers insights if activists leverage this uncertainty to their advantage. Therefore, we also looked towards local newspaper coverage to determine if more anti-fracking groups arose and were able to broaden their reach in our given time frame. We suspected that by identifying variances in tone and extent of coverage of hydraulic fracturing issues, we might find relative differences in local and national opinions of hydraulic fracturing as a technique and unconventional oil and gas as an industry sector.

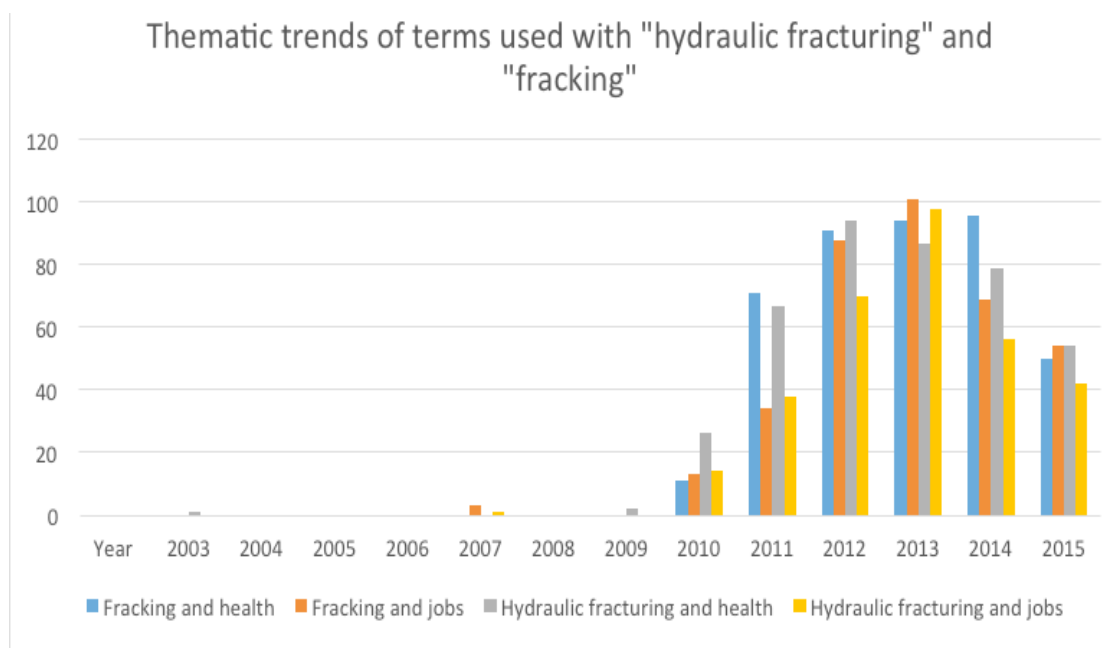


FIGURE 8: USAGE OF HYDRAULIC FRACTURING AND FRACKING IN NEWSPAPER COVERAGE

This figure depicts the trends, over time, of how newspapers report on shale gas development in North Dakota. We compared the use of “fracking”—negative connotation—and “hydraulic fracturing”—positive connotation—with benefits and impacts which have connotations in and of themselves. We hypothesized that “jobs” would more likely be referenced in conversation with benefits, while “health” would be coupled with costs. DATA SOURCE: AMERICA’S NEWS.

Stakeholders are divided over fracking on the local, state, and federal levels ((Blair, Weible, & Heikkila, 2016). Shale gas firms laud the economic benefits of expanding fracking. The certainty with which they claim to have mitigated the environmental impacts frames fracking in an even more positive light (Boudet et al., 2014). Media outlets that are more likely to view fracking in a positive light are also more likely to laud the economic benefits and omit risks, thus speaking to their underlying ideology (Blair et al., 2016). On the other hand, activists are liable to center their arguments on the uncertainty around fracking, focusing particularly on how risks have not been minimized. Both proponents and opponents of fracking used their rhetorical strategies to draw support to their side.

In North Dakota, we have observed similar trends. As fracking became more politicized, the process has also become more contentious.

In Figure 8 (previous page), we coupled the incidences of North Dakota newspapers using “fracking” versus “hydraulic fracturing” with benefits and impacts. As we saw the uptick in shale gas development coverage, a conversation about the benefits and costs of fracking increased as well. Coverage peaked right around the point when natural gas was booming in the state. However, the general movement of terms coded as negative and positive seem to rise and fall at the same rates. In other words, public health risks and job benefits are being talked about with similar frequency. This depends upon the timing of booms and busts. When people perceive a boom and attribute much of the economic growth to fracking, then anti-fracking campaigns amplify the rhetoric that costs outweigh the benefits (Boudet et al., 2016). Conversely, firms emphasize the certainty with which they believe the industry will come back during busts. Overall, uncertainty remains about the topic, and despite the political

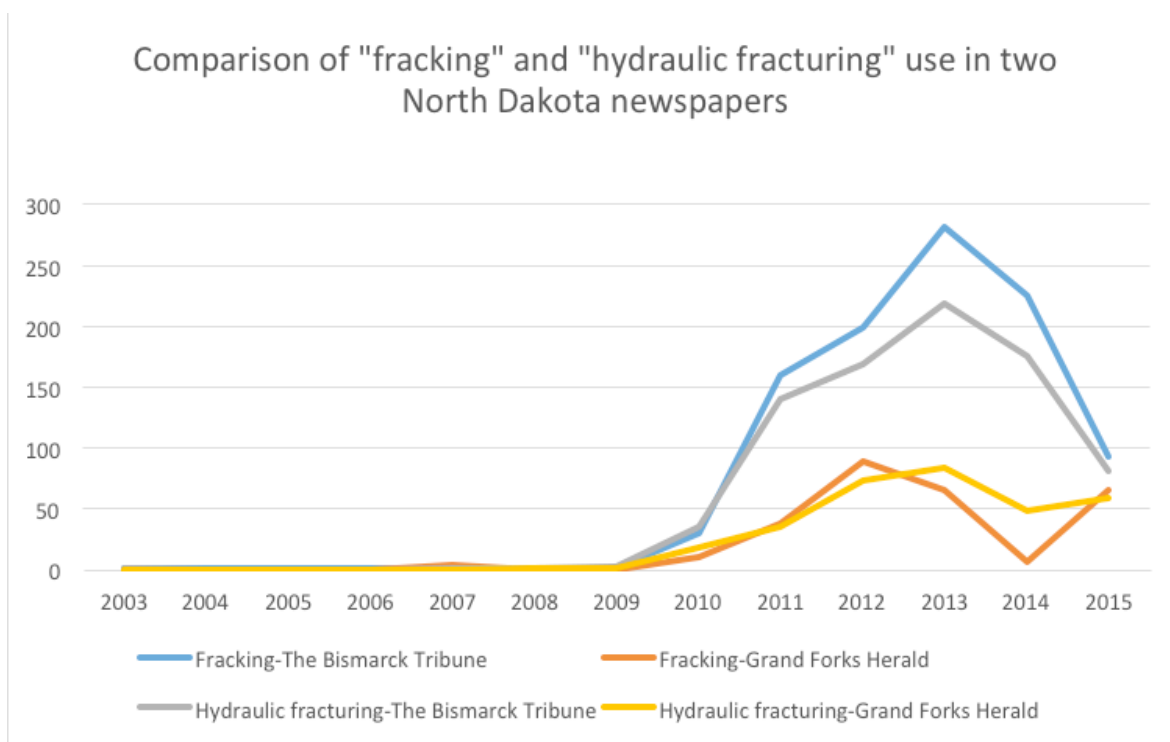


FIGURE 9: USAGE OF “FRACKING” AND “HYDRAULIC FRACTURING” IN NORTH DAKOTA NEWSPAPERS

This figure depicts how often two North Dakota newspapers mention “fracking” vs. “hydraulic fracturing” in their articles. They were selected as the two newspapers that covered shale gas development the most frequently, thus offering the largest sample sizes for observing trends. A general uptick of local coverage continues and peaks at 2013 before dropping to much lower levels. DATA SOURCE: AMERICA’S NEWS.

leanings of North Dakota newspapers, a definitive public stance on fracking is not emerging. Coverage has amplified both potential benefits and costs, while also pointing to the contentiousness of the issue. As Figure 9 indicates, the most prolific local newspaper publishing about shale gas development—the *Bismarck Tribune*—uses fracking more often than hydraulic fracturing. Increased negative framing of fracking allows activists to more readily amplify their cause. As a part of a larger movement against mineral resource extraction, anti-fracking activists also seek to amplify their messaging to national sources. We have observed that while activists have played a role in increasing local coverage, the trend has not translated into national coverage. Broadening the scope of the conflict would benefit activists that hope to garner support from stakeholders living outside North Dakota. Our data suggests that efforts to amplifying the issue even outside the site of oil and gas development has proven difficult: the *Bismarck Tribune* is located in the heart of oil and gas development in the Bakken, while the *Grand Forks Herald* is located on the opposite side of the state, and consequently runs far fewer articles. The national and local disparity in coverage reveals contrasting value placements on fracking and the limitations of activist social amplification techniques.

While newspaper coverage has documented a broad range of negative social impacts, it is arguable that there has not been a single “focusing” (Birkland, 1998) or “triggering” (Graham 2015) event, such as the meltdown at Three Mile Island or the Deepwater Horizon explosion, that would capture national attention in a sustained way and

would prompt dramatic changes in the industry. Dramatic depictions of environmental harm and water contamination have successfully raised broader awareness of the issue.

While activists have played a role in increasing local coverage, the trend has not translated into national coverage.

Moreover, the increased frequency of earthquakes in places with no history of such seismic activity may become an important factor to unite local communities against hydraulic fracturing (Keranen et al. 2014, Montgomery 2015). Based on our examination of the methods used for mineral resource extraction and the implied negative social impacts, the likelihood of a dramatic crisis or environmental disaster as a consequence of unconventional oil and gas development seems to be very high. It remains to be seen whether or not social activists will be able to mobilize that future event to enact lasting, positive change for their community.

Future Implications

A recent documentary entitled *Dear President Obama* implores the outgoing president to take action on fracking, implying that only a lame-duck president with months remaining in office can make a meaningful move on the issue. Given the intense political polarization surrounding an issue like hydraulic fracturing, there is - unfortunately - a great deal of truth in this strategy. One of our goals in conducting a study of the Bakken was to try and understand what was happening in order to determine how our findings compared with the narrative presented by activists, policymakers, and the media. Our research has convinced us that there is a plausible path between unchecked, unregulated oil and gas development and the absolutist rhetoric of a moratorium. However, successfully navigating that path will require communication and coalition-building that would be unprecedented in the current climate of intense political polarization.

Firstly, acknowledging that hydraulic fracturing methods are now part of 'the mix' to meet U.S. energy needs may be an important first step to build a larger coalition towards a well-regulated industry. Activists seeking the appropriate policy levers to halt or undermine fracking in their region are currently struggling to 'amplify' the risk beyond their local communities. We suspect rather than trying to unmake an entire industry through the imposition of local or state-level moratoria, it may be more politically viable for activists to assess how the industry can be improved and held accountable through local, state or even federal regulations, depending on the issue. This may prove to be especially important where political will is not united.

Secondly, policies must be built on scientific data rather than political rhetoric, and that data must be gathered in a systematic way as to be useful and reliable for all concerned. Moreover, that data can then be used to set priorities and eliminate more serious risks associated with hydraulic fracturing, such as earthquakes and air quality issues from natural gas flaring.

Conventional wisdom and media hype might suggest that falling oil prices would presage, if not a reduction in the 'boom,' an all-out 'bust' for local communities whose economies depend on oil and gas production. Yet our findings suggest otherwise. Energy markets are volatile, and the emphasis on the boom-bust cycle ignores the day-to-day reality of the industry. Investments and contracts for new wells that were made well in advance of the price drop are unlikely to be canceled, and wells already in operation are unlikely to cease production. However, by the same token, the price drop is likely to have a chilling effect on future investments in new wells, which will in turn contribute to an eventual rise as the number of new wells levels off.

Today, millions of Americans live near an oil or gas well (Gold et al., 2013). While this statistic is often used to shock, it should also indicate that this practice is widespread and here to stay. Communities should consider long-term planning to manage the rapid influx of capital now, while assuming it might not continue at that rate forever. Similarly, industries should have a vested interest in maintaining a positive relationship with the communities they inhabit. Scientists and environmental policymakers have an obligation to communicate their findings not just in academic journals, but at town hall meetings. Meaningful dialogue among groups with divergent opinions is not easy to accomplish, but it is an urgent necessity.

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Note on terminology: Throughout our report, we use the phrase “Bakken counties” to indicate the 16 counties in which active drilling is occurring. These sixteen counties are: Dawson, McCone, Richland, Roosevelt, Sheridan, Billings, Bottineau, Burke, Divide, Dunn, Golden Valley, McHenry, McKenzie, McLean, Mercer, Mountrail, Renville, Stark, Ward, and Williams.

