

DISCOURSE DYNAMICS IN COLORADO FRACKING RULEMAKING DEBATES

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By

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Environmental Science (Integrated)

Abstract

The emergence of hydraulic fracturing, or ‘fracking’, in the United States has generated a great deal of controversy and debate in recent years. I conduct a case study of the rulemaking process of Senate Bill 19-181 in Colorado in 2019-2020, which involves a devolution of power from the state to local level, as well as increased regulations on the oil and gas industry. This study addresses a gap in environmental governance and energy geographies literature by examining discourse dynamics in hydraulic fracturing-related rulemakings. Through a systematic analysis of public comments regarding SB 19-181, this study identifies distinct discourse coalitions within fracking debates, as well as key storylines, sources of evidence, and causal stories that are leveraged by stakeholder coalitions to influence rulemakings. This research explores the ways by which fracking debates are framed by stakeholders, the evidence sources of those arguments, and the ways by which stakeholders assert power using these arguments in pursuit of policy goals.

KEYWORDS: (Hydraulic Fracturing, Critical Environmental Discourse Analysis, Discourse Dynamics, Knowledge Engagement, Storyline Analysis, Sentiment Analysis)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED
UNAUTHORIZED AID ON THIS THESIS

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Signature

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Discourse Dynamics in Colorado Fracking Rulemaking Debates

Abstract:

The emergence of hydraulic fracturing, or ‘fracking’, in the United States has generated a great deal of controversy and debate in recent years. I conduct a case study of the rulemaking process of Senate Bill 19-181 in Colorado in 2019-2020, which involves a devolution of power from the state to local level, as well as increased regulations on the oil and gas industry. This study addresses a gap in environmental governance and energy geographies literature by examining discourse dynamics in hydraulic fracturing-related rulemakings. Through a systematic analysis of public comments regarding SB 19-181, this study identifies distinct discourse coalitions within fracking debates, as well as key storylines, sources of evidence, and causal stories that are leveraged by stakeholder coalitions to influence rulemakings. This research explores the ways by which fracking debates are framed by stakeholders, the evidence sources of those arguments, and the ways by which stakeholders assert power using these arguments in pursuit of policy goals.

1. Existing Scholarship

1.1. Fracking and Its Impacts

The rapid implementation of hydraulic fracturing (HF), or ‘fracking’, in the United States has generated intense controversy and debate. While proponents of HF argue that it will “spur economic growth, lead to secure domestic energy supplies, and facilitate a rapid transition from carbon-intensive, coal-based energy generation”, opponents have “focused on adverse on potential adverse impacts on public health, the environment, and communities in close proximity to these energy sources” (Boudet et al., 2014, p. 57). Given the controversy surrounding hydraulic fracturing, the SB 19-181 rulemaking process in Colorado provided an excellent case study to examine the discursive dynamics in HF-related rulemaking debates.

Hydraulic fracturing is a process that originated in the United States in the 1940s on an experimental gas field in Kansas (Jones et al., 2013). In the early 2000s, fracking became employed on a large-scale commercial basis and rapidly grew to represent 40% of U.S. natural gas production by 2012 (Jones et al., 2013), largely due to technological advancements. During the fracking process, a small drilling derrick drills multiple holes in shale rock. Then, a larger drilling derrick drills horizontally for thousands of feet. The drill is equipped with gas sensors to ensure that it stays within the desired geological seam. The actual ‘fracking’ occurs when “the concrete casing of the horizontal pipe is perforated with small explosive charges and water mixed with sand and other proppants

if pumped through the holes at 5000 psi (pounds per square inch)” (Sovacool, 2014, p. 251). This process creates hairline fractures in the rock that can extend up to 1,000 feet from the pipe and allow the desired hydrocarbons to flow back to the surface. The fracking process is typically repeated around 20 times per well, “with each pressurization fracturing a new region of the shale gas formation” (House, 2013). Throughout the fracking process, wastewater is collected and either reused for future fracking or processed and disposed of through sewage systems.

The rapid implementation of hydraulic fracturing, or ‘fracking’, over the past decade has immensely transformed the energy sector in the United States. Prior to the development and utilization of fracking technology, oil and natural gas stores locked in “tight sandstones, shales, and other low-permeability geological formations” were largely considered inaccessible (Jackson et al., 2014). However, advancements in horizontal drilling techniques ‘unlocked’ previously inaccessible hydrocarbons. This shift in extraction and production methodology has caused many analysts to proclaim a “shale gas revolution (Sovacool, 2014). The International Energy Agency predicts the production of unconventional gas to more than triple from 2014 to 2035 (International Energy Agency, 2012). MIT Chemistry Professor Deutch has called the drastic increase in accessible unconventional natural gas the “greatest shift in energy-reserve estimates in the last half century” (Deutch, 2011). In the United States, “mean estimates for the technically recoverable shale-gas resources doubled to 600-1000 Tcf (~ 100 trillion ft^3) in 2013” (Jackson et al., 2014, p. 329), largely due to technical advancements in fracking. Production of oil and natural gas has sharply risen as well: “daily production of natural

gas from US shale formations increased from <30 million m^3 per day in 2005 to > 70 million m^3 per day in 2012, accounting for 39% of domestic natural gas production that year” (Jackson et al., 2014, p. 329). All signs point to the continual rapid growth of unconventional gas extraction and production.

Proponents of fracking often celebrate the job creation, energy independence, and tax revenues that hydraulic fracturing activity can bring to communities (Jones et al., 2013). However, many anti-fracking individuals and groups argue that fracking brings unwanted environmental and social impacts such as “ground and surface water contamination, water demands for drilling, health risks from air pollution, and the danger of earth tremors and land subsidence” (Jones et al., 2013, p. 387). As the fracking industry continues to expand, heated debates between stakeholders are sure to continue. In the next section, commonly cited benefits for HF are discussed.

Reasons for Hydraulic Fracturing

In order to understand why fracking is the center of such a heated national and global debate, it is important to first note its claimed benefits. The main advantage of unconventional shale gas extraction is the sheer abundance of its supply. The United States Energy Information Administration (EIA) estimated that China, the European Union, and the U.S. have access to more than 5760 trillion cubic feet of recoverable gas alone (U.S. EIA, 2011). The availability of cheap natural gas lowers electricity costs and supporting the many industries that rely on natural gas, such as “plastic, agrochemicals, and pharmaceuticals” (Ridley, 2011, p. 28), among others. Additionally, natural gas has a

cleaner environmental footprint than oil and coal, with lower sulfur oxide, nitrogen oxide, carbon dioxide, and mercury emissions. For this reason, many proponents of fracking cite it as a ‘transition fuel’ to a low carbon economy. A 2012 study conducted a lifecycle analysis of the greenhouse gases emitted by shale gas, conventional natural gas, coal, and petroleum. The researchers found that “shale gas life-cycle emissions are 6% lower than conventional natural gas, 23% lower than gasoline, and 33% lower than coal” (Burnham et al., 2012, p. 1). In sum, natural gas a fuel source poses less environmental and public health risks than coal, “the dirtiest fuel that imposes the highest social costs” (Sovacool, 2014, p. 253). Overall, hydraulic fracturing has significantly reduced natural gas prices, provided more energy security for countries like the United States that have significant shale reserves, and possibly results in less emissions than other fuel sources like coal. The next section discusses the potential negative impacts of HF.

Environmental Impacts of Hydraulic Fracturing Near Residential Zones

A major concern for many communities affected by fracking is the potential health and environmental implications of living near a well site. A bounty of anecdotal evidence has emerged of reported nosebleeds, headaches, vomiting, fatigue, burning eyes, and dizziness in individuals living near fracking sites (McDermott-Levy et al., 2013).

However, the amount of studies regarding health and environmental impacts of fracking does not reflect the rapid influx of fracking into residential communities. Many residents, city officials, and researchers have voiced concern for this lack of research. As one Texan city official states, “We really don’t know what the health effects are of drilling in an urban environment” (Gullion, 2017, p. 52). While these calls to action have resulted in

increased research, many more studies need to be done regarding the factors contributing to these anecdotal reports if we are to fully understand how fracking affects residential communities.

Given that fracking involves “injecting millions of gallons of water, sand, and chemicals, many of them toxic, into the earth at high pressures to break up rock formations and release natural gas trapped inside” (Bateman, 2010), concern has arisen regarding the health and environmental impacts of fracking fluids. A number of studies have investigated the contents of fracking fluids to better understand potential threats to human and environmental health, but most gas companies refuse to disclose the full contents of their fracking fluids, “citing confidential business practices” (Schmidt, 2011, p. 350). However, a 2010 study of over 600 publicly disclosed fracking chemicals found that more than 75% were proven to affect the skin, eyes, and respiratory systems (Colborn et al., 2010). Additionally, 40-50% of the chemicals were found to affect the brain, nervous system, immune system, cardiovascular system, and kidneys (Colborn et al., 2010). 37% of them were proven to affect the endocrine system, and 25% could cause cancer (Colborn et al., 2010). An estimate 15% - 80% of these chemicals flow back through the well system to the surface, where the fluid is stored in lined pits, kept in large tanks, or pumped into the ground via deep-well injection (U.S. Environmental Protection Agency, 2010).

Fracking’s environmental and health implication extend beyond the impacts of fracking fluids. Researchers have found evidence of methane leakage (Howarth et al., 2011), water

contamination (Osborn et al., 2011), air pollution (McKenzie et al., 2012), elevated noise levels, and overall increased demands on social and health care infrastructure (Witter, 2010). From a public health perspective, residential fracking poses significant risks to wellbeing, many of which are still being uncovered. Many proponents of hydraulic fracturing argue that fracking for natural gas results in less emissions than coal, and some go as far to say that fracking offers a bridge to a low-carbon future. However, recent research has shown that the oil and gas industry often underestimates methane leakage rates, which has serious implications for the climate. As a greenhouse gas, methane is roughly 30 times more effective at trapping heat than carbon dioxide (Hays, 2014). Recent studies in Colorado and Utah have found fracking methane leakage rates of 9% of total production, nearly double the industry estimate (Tollefson, 2013). Additional research needs to be done to gain a more comprehensive understanding of the true greenhouse gas impacts of fracking, but existing research suggests that methane leakage may pose a serious environmental risk. The next section explores why critical discourse analysis is a helpful tool to examine arguments pertaining to such a complex and hotly contested issue like HF.

1.2. Discourse Analysis Frameworks and Fracking

Critical Discourse Analysis as a Tool to Analyze the Surface Politics of Fracking

Legally speaking, hydraulic fracturing in Colorado is ‘split estate’ issue, meaning “property ownership is split between those who hold title to and often live on the surface of a land parcel and those who own mineral rights (including natural gas) located below the surface” (Davis, 2012, p. 186). This policy was established in large part due to “several land grant and homesteading acts which were designed to encourage Western migration in the early twentieth century” (Sangaramoorthy et al., 2016, p. 30), while retaining mineral rights for the federal government for future development. At first glance, this division of property may appear to simplify fracking debates and conflicts, but in fact, it makes them quite contentious. A significant reason for this contention is that mineral owners access their resources via “drilling pads, road construction, removal of obstructions, or similar actions” (Davis, 2012, p. 186) that often have impacts on the health and wellbeing of the surface property owners. Furthermore, the surface property owners may have concerns over “contamination of water well and to possible family exposure to chemicals released in the air or water” (Davis, 2012, p. 186). While the surface owners may be eligible for financial compensation for damage incurred to their land, they are typically at an economic and informational disadvantage to the oil and gas

industry, which has little interest in protecting surface land health and quality beyond meeting minimum standards required by law. Additionally, the oil and gas industry negotiates leases with individual landowners, so “neighbors often have distinctly different experiences with the industry” (Willow and Wylie, 2014, p. 227). These ‘divide and conquer’ tactics often create tensions between the oil and gas industry and landowners, as well as between neighbors. These tensions, among others, present themselves in fracking rulemakings and debates.

As a result of these ‘split estate’ issues, debates over hydraulic fracturing-related legislation often span science, policy, economics, public health, and the environment. Additionally, as a hotly contested issue, hydraulic fracturing rulemakings often engage “a divergent range of stakeholders across industry, consultancy, NGO, and activist organizations” (Cotton et al., 2014), who strategically construct arguments and storylines to promote certain understandings of fracking in pursuit of policy goals. For this reason, critical discourse analysis offers a valuable lens for identifying and examining stakeholder coalitions, argument storylines, and sources of evidence in fracking debates and rulemakings. Critical discourse analysis provides a framework to identify, engage with, and analyze these discourse coalitions and constructed storylines in SB 19-181 rulemakings, and to assess why some arguments may carry more weight in a policymaking setting than others. By also paying attention to ‘causal stories’, this study examines how “political actors compose stories that describe problems and opportunities, and empower themselves or their allies as the preferred action-takers” (Brante, 1993, p. 226). In such complex and cross-disciplinary debates, these discourse analysis tools prove helpful in identifying and examining the arguments and power dynamics at play.

The next section explains the theoretical basis for critical environmental discourse analysis and causal stories, and why they are applicable tools in this study.

Critical Environmental Discourse Analysis Regarding Hydraulic Fracturing

As fracking debates have become more common, scholars and researchers have taken interest in the ways that fracking is framed, presented, and debated. Critical discourse analysis offers a helpful lens to analyze “shared terms and concepts through which meaning is assigned to social and physical processes” (Hajer, 1995, p. 247). This is especially applicable in fracking debates and rulemakings, during which intensely personal accounts of environmental, social, and economic impacts due to fracking are often utilized in pursuit of a policy goal.

Broadly speaking, discourse analysis is “the analysis of language in use” (Brown et al., 1983, p. 1). Critical discourse analysis (CDA) is an applied version of discourse analysis that is focused on “analyzing, understanding and explaining social phenomena that are necessarily complex and thus require a multidisciplinary and multi-methodological approach” (Wodak and Meyer, 2016, p. 2). By systematically analyzing how language, framing, and evidence is used in fracking debates, CDA offers a useful lens through which to examine the SB 19-181 rulemaking debates.

Extensive research has been done regarding knowledge claims in debates surrounding climate change (Shackley and Wynne, 1996), but there is a significant lack of similar

research in the context of hydraulic fracturing governance. I draw upon Hajer's conceptualization of discourse coalitions in order to identify and examine the key actors, storylines, and sources of evidence utilized in hydraulic fracturing rulemaking processes. According to Hajer, "a discourse coalition is the ensemble of a set of story lines, the actors that utter these story lines, and the practices that conform to these story lines, all organized around a discourse" (Hajer, 1993, p. 47). My research focuses on identifying discourse coalitions in a hydraulic fracturing-related rulemaking through the analysis of public comments. These discourse coalitions were inductively identified via observation and by attending public rulemaking meetings. In addition, discourse analysis is utilized in my study to analyze public sentiment regarding Senate Bill 19-181, as well as to identify key storylines and sources of evidence that are leveraged by stakeholder coalitions to influence rulemakings.

In environmental debates, discourse coalitions often utilize carefully constructed storylines as a means of promoting a certain understanding of an issue. Hajer conceptualized these storylines as "the means through which different elements of physical and social realities are unified into specific, closed problems and given meaning" (Hajer, 1995, p. 56). Cotton expands upon this definition by asserting that "what gives discourse coalitions their power is that the actors group around particular storylines (even though they may interpret the meaning of these storylines differently)" (Cotton et al., 2014). This study identifies and assesses the prominent storylines in SB 19-181 rulemaking public comments in Colorado.

In my study, I also emphasize ‘causal stories’ – “how political actors compose stories that describe problems and opportunities, and empower themselves or their allies as the preferred action-takers” (Brante, 1993, p. 226). This strategy is useful in identifying the strategic selection of evidence that coalitions use to frame and support their arguments. In the words of Metze, “framing is not merely an activity that can be understood but also a discursive political strategy that influences policy actions” (Metze, 2016). The case study of the rulemaking process for SB 19-181 provides an opportunity to examine causal story creation and utilization in real-time as stakeholders strategically frame their arguments in the hopes of achieving their goals. In the words of Cotton et al., “competitive debate over the social acceptability, environmental safety and economic viability of shale gas is drawing in a divergent range of stakeholders across industry, consultancy, NGO, and activist organizations” (Cotton et al., 2014). For this reason, the rulemaking process for SB 19-181 presents a unique opportunity to examine how fracking arguments are constructed and framed by stakeholders. The following section tracks the rise of HF in Colorado, as well as legislation that prompted the passing of SB 19-181.

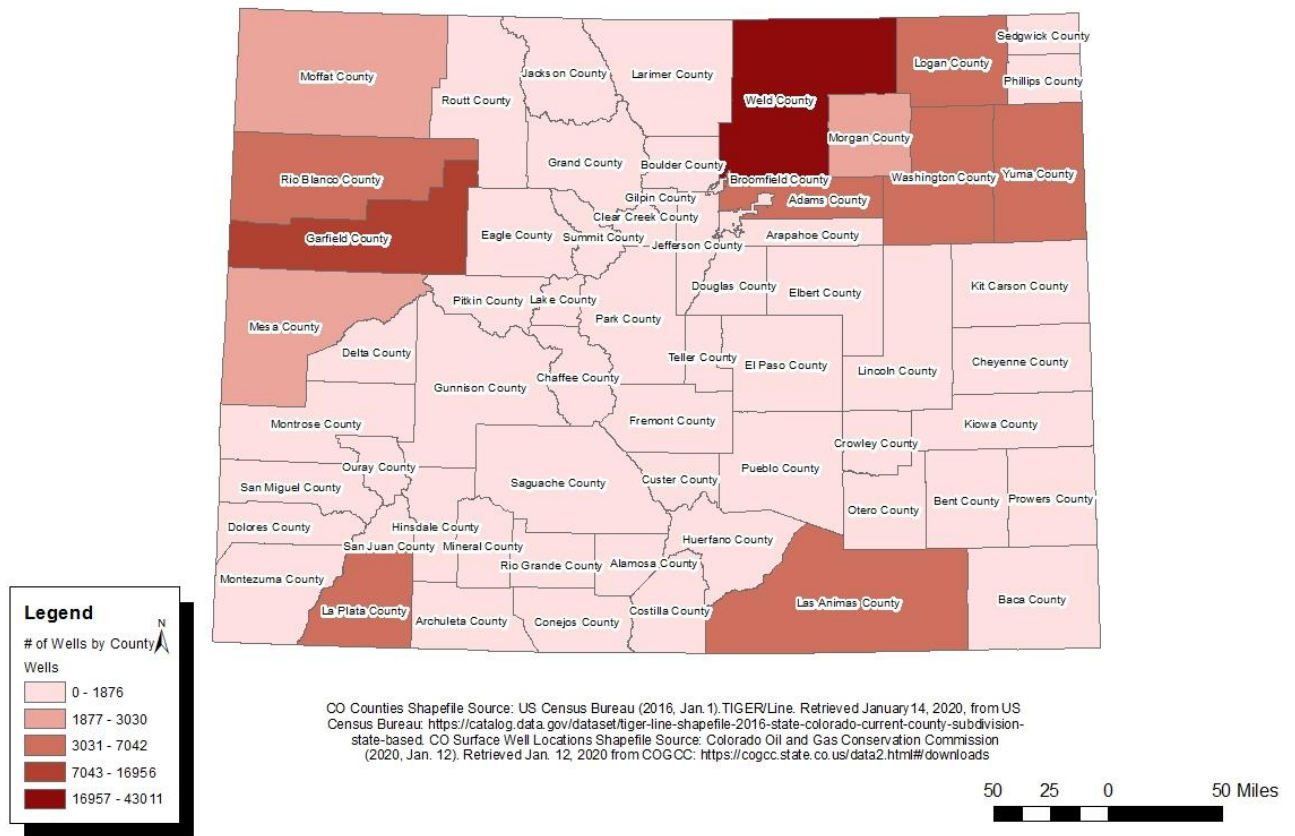
2. Introduction

2.1. Colorado and SB 19-181

Rise of Hydraulic Fracturing in Colorado

Fracking along the Front Range of Colorado is no new phenomenon. In fact, commercial-scale fracking has been utilized in Colorado since the 1970s during large energy booms, primarily on rural agricultural land (Ladd, 2005). However, the implementation of horizontal drilling techniques that allow for a drilling distance of up to two miles underground have enabled the accessibility of oil shale beneath residential communities (Kroepsch, 2015). This new suburban geography of energy production has sparked a number of heated debates surrounding the environmental, social, and economic impacts of fracking. According to a 2018 Colorado Oil and Gas Conservation Commission report, fracking drilling applications in Colorado rose 70% between 2016 and 2017 (Colorado Oil and Gas Conservation Commission, 2018). This trend, along with booming population growth along the Front Range, presents unique regulatory, health, and environmental concerns in Colorado.

Distribution of Fracking Wells in CO by County, 2020



Map 1: Fracking wells in CO counties, as of Jan. 1, 2020. Map created by author.

The rapid permitting of fracking wells near population centers along the Front Range has sparked significant debate in recent years (Map 1). Multiple municipalities along the Front Range had citizen-initiated fracking moratoria on their ballots in 2014, including Boulder, Broomfield, Lafayette, and Fort Collins (Enockson, 2014). In response to these ballot measures, the oil and gas industry spent over \$900,000 to defeat them (Enockson, 2014). Still, all four moratoria passed and the temporary bans were implemented. Shortly after the implementation of these bans, the Colorado Oil and Gas Conservation Commissions sued the city of Longmont because they conflicted “with the state’s interest

in uniform regulation of oil and gas operations” (Enockson, 2014, p. 14). Shortly after the COGCC sued Longmont, they continued to sue Fort Collins and Lafayette and declared their moratoria “invalid on preemption grounds” (Enockson, 2014, p. 15). In all three cases, district judges agreed with the COGCC and ruled the moratoria invalid.

Following these lawsuits, Proposition 112 was introduced with the goal of implementing a mandatory 2,500 foot setback of any oil and gas operation from occupied buildings and to allow municipalities to implement their own, more restrictive, setbacks. However, on November 6, 2018, voters defeated the measure (Ratliff, 2019). The legislative tides turned on November 6, 2018, when Colorado voters elected Democrat governor Jared Polis and swept every major race in the state. “As a result, the legal and political developments discussed above set the stage for oil and gas regulation to be prioritized by the Democratic General Assembly” (Ratliff, 2019). This new focus manifested as Senate Bill 19-181, discussed further in the next section.

The Firestone Event and Senate Bill 19-181

At 4:45 p.m. on April 17, 2017, Mark Martinez and Joey Irwin were replacing a hot water heater in a home basement in Firestone, Colorado. Moments later, a violent explosion destroyed the home, killing them both and leaving two others badly injured (Aguilar, 2019). A National Transportation Safety Board study of the event linked the explosion to a severed natural gas pipeline that leaked into the home’s basement (National Transportation Safety Board, 2017). The flowline beneath the home was listed as properly abandoned by an oil and gas company, but improper life cycle inspections left

the home and community vulnerable to catastrophe. The Firestone tragedy spurred a statewide debate centered on oil and gas safety, as well as regulations surrounding hydraulic fracturing near residential communities.

Following the explosion, and the legal developments discussed in the previous section, Colorado Democrats rewrote state oil and gas regulations with a focus on increasing regulations and community-scale control on oil and gas development. This piece of legislation, named Senate Bill 19-181, implemented sweeping regulatory changes regarding oil and gas activity in Colorado. On April 16, 2019, Governor Jared Polis signed SB 19-181 into law, significantly changing the ways that the oil and gas industry can operate in Colorado. The bill changes the mission statement of the Colorado Oil and Gas Conservation Commission, tasking the group to “prioritize public health, safety, welfare, and the environment over oil and gas development” (Ratliff, 2019). Prior to SB 19-181, the mission statement of the COGCC was to “foster the responsible, balanced development” of oil and gas resources (Colorado Oil and Gas Conservation Commission, 2019). SB 19-181 changes this mission statement and instead directs the COGCC to “regulate the development and production” of oil and gas resources in alignment with public health, safety, welfare, the environment, and wildlife resources” (Colorado Oil and Gas Conservation Commission, 2019).

In addition to changing the mission of the COGCC from ‘fostering’ the oil and gas industry to ‘regulating’ it, SB 19-181 also gives local governments much more power to regulate the oil and gas industry on a local scale. It “revises the Colorado Land Use

Control Enabling Act to provide local governments with explicit authority to regulate the location and siting of oil and gas facilities and other environmental components of oil and gas development, including water quality, air quality, and reclamation” (Ratliff, 2019). It also adds that “a local government’s regulations may be more protective or stricter than state requirements” (Ratliff, 2019).

The passing of SB 19-181 involves a number of rulemakings in order to implement the bill, which are ongoing at the time of this study. These rulemakings involve the Colorado Oil and Gas Conservation Commission (COGCC), the Colorado Air Quality Control Commission (AQCC), and members of the public collaborating to determine how the mandates in SB 19-181 will be put into practice. During the SB 19-181 rulemaking process, the COGCC and AQCC hold meetings during which members of the public can submit formal comments regarding the implementation of SB 19-181. The data that informed this study was primarily collected from these public meetings and the online COGCC public comment website.

3. Methods:

Data collection for this study took place Nov. 18, 2019 – December 16, 2019 in Colorado while the SB 19-181 rulemaking process was ongoing. Public comments were collected at COGCC public meetings, AQCC public meetings, activist group meetings, and the online COGCC public comment website. I created a dataset of the comments and inductively identified seven main stakeholder groups: (1) elected officials; (2) anti-

fracking activists; (3) concerned citizens; (4) business community; (5) farmers; (6) pro-oil and gas industry/anti-SB 19-181 citizens; and (7) industry representatives/employees. In addition to collecting each comment, I also recorded the commenter's: (1) name, if disclosed; (2) official position/occupation, if disclosed; (3) commenter city/county of residence; (4) date/location of data collection; (5) type of evidence cited (ie. scientific evidence, personal experience, laws and regulations, etc.); (6) sentiment analysis Likert score (adopted from Baka et al., 2019); and (7) prevalent storyline(s) used in argument/comment.

3.1. Sentiment Analysis

I conducted a sentiment analysis of the n=154 comment data set to measure levels of support for SB 19-181 among stakeholder groups. Commenter support for SB 19-181 was manually classified on a Likert scale 1-5, where: (1) strongly supportive, no suggestions provided, (2) weakly supportive, suggestions provided, (3) neutral, primarily points of clarification, (4) weakly opposed, suggestions provided, (5) strongly opposed, no suggestions provided. This Likert scale method was adopted from Baka et al., 2019, a similar study to mine that also examines discourse in fracking rulemaking debates. I calculated the average Likert score for each stakeholder group. Then, using GIS software, I mapped average Likert scores with counties in Colorado to show the geographic distribution of sentiments regarding SB 19-181. On the same map, I displayed the number of fracking wells in each county to see if there is a correlation between regional fracking intensity and sentiment scores.

3.2. Argumentative Discourse Analysis

I manually coded all public comments (n=154) to identify: (1) types of evidence cited by members of the public to support their opinions; and (2) the main storylines that emerged among stakeholders. The main types of evidence cited by members of the public to support their arguments include: (1) scientific research; (2) personal experience; (3) laws and regulations; (4) industry know-how; (5) specific event; and (6) specific quote. The prevalent storylines that emerge include: (1) environmental and health impacts of oil and gas; (2) access to information; (3) regulations as a ‘de facto ban’ on oil and gas; (4) prior regulations need time to go into full effect; (5) Coloradans support the industry; (6) political attack on oil and gas; (7) economic benefits of oil and gas; (8) overregulation will threaten the state’s economy; and (9) fracking is safe. I then compared which evidence types were most commonly cited by each stakeholder group. The general framework for this argumentative discourse analysis was inspired by Cotton et al., 2014.

3.3. Assessing Storylines

In order to determine which argument storylines were most prevalent among either supporters or opposers of SB 19-181, I first sorted all comments into two categories: (1) Supporters of SB 19-181 (Likert score < 3); and (2) Opposers of SB 19-181 (Likert score > 3). I then graphed the storylines used by each group to determine which storylines were

the most prevalent. This general structure was adopted from Bomberg, 2007. (It is important to note that I inductively identified the main storylines during data collection. Some comments (n=4) did not follow one or more of the main storylines and were not utilized in this analysis). I then discussed the central themes of each storyline and analyzed the causal stories and causal politics embedded in each main argument.

4. Results:

4.1. Participation and Sentiment Analysis

Limitations of the Data

It should be noted that the comments collected and analyzed (n=154) represent a 28-day sample of a multi month-long rulemaking process. Therefore, these results should be interpreted in the context of a longer process involving many more public comment forums, meetings, and opportunities for debate beyond the scope of this thesis. The majority of the data used in this study was collected at public forums, an online comment submission website, and activist meetings. Therefore, it is important to acknowledge the potential limitations of this data. For one, the COGCC, AQCC, and activist meeting were often held on weekdays during the daytime, meaning that many individuals that work during the day or have families to take care of were likely not represented in those data samples. Additionally, it is likely that individuals with very strong opinions regarding SB 19-181 came to these meetings, while individuals with less severe opinions felt less

compelled to make their voices heard. For this reason, my data may be skewed towards the extreme ends of public opinion regarding SB 19-181. The public comment portal theoretically addressed the issue of individuals not having the time or ability to visit a public meeting to make their opinion heard. However, the public comment portal is somewhat difficult to locate on the COGCC website, and it wouldn't be likely for an individual to stumble across it in their research of SB 19-181. For this reason, it is also likely that the data collected from the COGCC online comment submission portal is somewhat skewed towards the extreme ends of the spectrum regarding SB 19-181.

Participation Analysis

Figure 1 displays the stakeholder groups and their respective number of public comments collected during the data collection period of Nov. 18, 2019 – Dec. 16, 2019. Concerned citizens filed the largest number of public comments (n=67, 43.50 percent of total comments collected). This group is comprised of individuals that are concerned about hydraulic fracturing, and generally support SB 19-181 as a means of regulating the oil and gas industry while making strides towards protecting the environment and the communities that they reside in. These individuals are not affiliated with any official activist, government, or private organization and provided public comments to speak on behalf of themselves or their loved ones. Pro-oil and gas industry/anti SB 19-181 citizens filed the second largest number of public comments (n=43, 27.92 percent of total comments collected). These individuals aren't currently employed by the oil and gas industry but may own mineral rights beneath their land and receive monetary compensation from oil and gas companies for drilling activity. Anti-fracking activists filed the third largest number of comments (n=13, 8.44 percent of total collected

comments). Individuals in this stakeholder group are officially affiliated with anti-fracking organizations such as 350 Colorado, Colorado Communities for Climate Action, Colorado Rising, and others. These individuals tended to speak on behalf of their entire organization, often referencing prior efforts to regulate fracking. Oil and gas industry employees and representatives submitted the fourth largest number of public comments (n=12, 7.79 percent of total collected comments). Individuals in this stakeholder group either work or have worked for an oil and gas company or represent a specific oil and gas company. Elected officials made the fifth largest number of public comments (n=10, 6.49 percent of total collected comments). These individuals were elected to public office in some capacity, ranging from city council to the Colorado House of Representatives. Farmers submitted the sixth largest amount of public comments (n=5, 3.25 percent of total collected comments). This stakeholder group is comprised of individuals that either currently farm in Colorado or formerly did. The business community submitted the least amount of public comments (n=4, 2.60 percent of total collected comments). This group is comprised of Colorado businessowners, contractors, and employees.

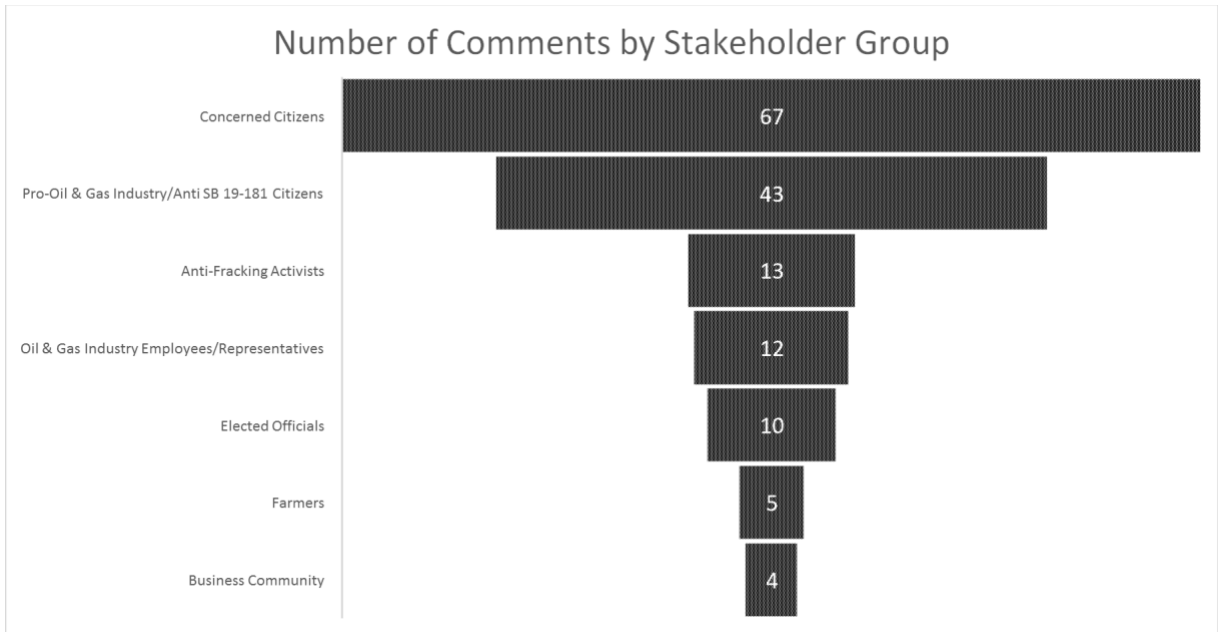


Figure 1: Number of public comments submitted by each stakeholder group during the data collection period. Source: Author’s coding notes.

Sentiment Analysis

All 154 collected comments were manually analyzed and assigned a sentiment score using the Likert scale explained earlier. Figure 1 displays average sentiment scores among each stakeholder group. These stakeholder groups were inductively identified using the data collected. While interpreting this figure, it is important to note that the sample sizes of each stakeholder group vary widely. For example, the average sentiment among the business community was 5.0 (indicating strong opposition to SB 19-181), but the sample size was only 4 individuals. There was only a single comment that expressed neutral sentiment to SB 19-181, while the rest of the comments indicated some degree of favor or dissatisfaction with the Senate Bill. This is logical given that the purpose of the public comment period was to gather input to inform the rulemaking of SB 19-181.

On average, 4 stakeholder groups were strongly opposed to SB 19-181, one was weakly opposed-neutral, and two were weakly in favor-strongly in favor (Figure 2). More specifically, the business community displayed strong opposition to SB 19-181 (average Likert score=5, n=4), as did pro-oil and gas industry/anti SB-19 181 citizens (average Likert score=4.9, n=43), farmers (average Likert score=4.8, n=5), and oil and gas industry representatives and employees (average Likert score=4.63, n=12). Elected officials were the only stakeholder group that expressed a relatively neutral stance on SB 19-181 overall (average Likert score=3.56, n=10). Two stakeholder groups generally expressed support for SB 19-181: anti-fracking activists (average Likert score=1.6, n=13), and concerned citizens (average Likert score=1.55, n=67).

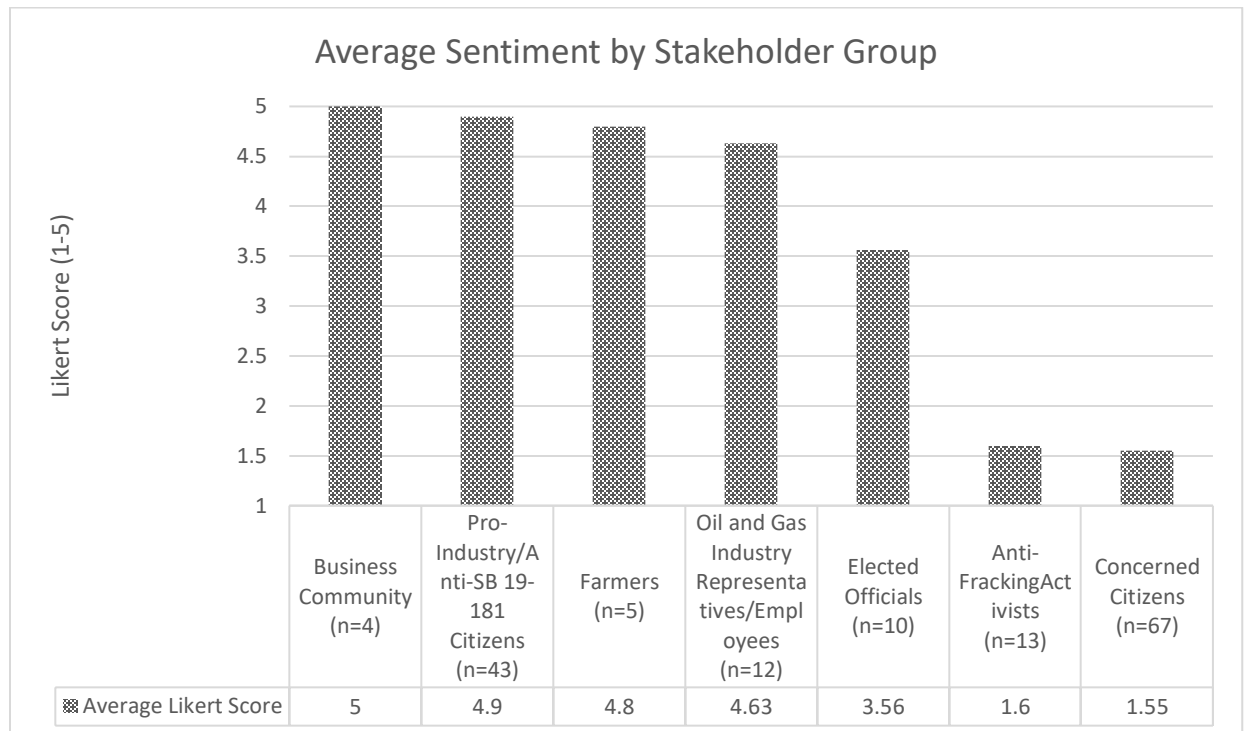


Figure 2: Average Likert sentiment scores by stakeholder group. Source: Author’s coding notes.

Spatial Sentiment Analysis

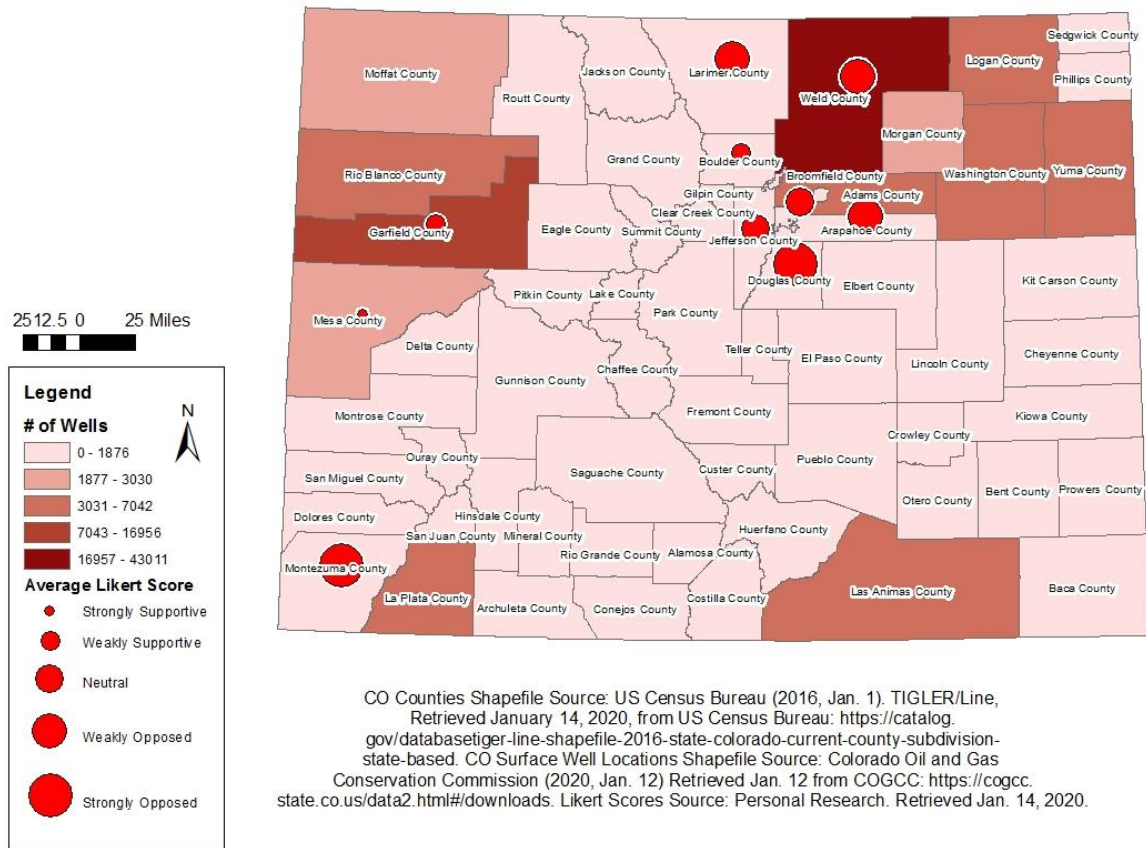
In order to spatially analyze sentiments regarding SB 19-181 in Colorado, I first averaged sentiment scores by county (Table 1) for comments collected during the data collection period. Again, it is important to note that the sample sizes of comments collected per county vary widely.

County Name	Average Likert Score
Montezuma County (n=5)	5
Douglas County (n=4)	5
Arapahoe County (n=12)	4.2
Weld County (n=30)	3.91
Larimer County (n=9)	3.83
Denver County (n=10)	3
Jefferson County (n=4)	3
Garfield County (n=13)	2.5
Boulder County (n=15)	2.1
Adams County (n=13)	2.1
Mesa County (n=16)	1.69

Table 1: Average Likert sentiment score by county. Source: Author's coding notes.

Using Geographic Information Systems (GIS) technology, I created a map displaying two datasets: the density of hydraulic fracturing wells by CO county and averaged sentiment scores regarding SB 19-181 (Map 2). This map provides a visual representation of where hydraulic fracturing activity is concentrated in Colorado and offers a lens to assess whether this may have an influence on average county sentiment regarding SB 19-181. While it isn't reasonable to draw conclusions based on these two datasets alone, my spatial analysis does raise interesting questions and hypotheses that should be explored in future research. One interesting finding of this spatial analysis is that both Weld County and Montezuma County exhibited fairly strong opposition to SB 19-181 but host vastly different intensities of oil and gas activity. Weld County is the most intensely fracked county in Colorado and has an average Likert score of 3.91 (Table 1). On the other hand, Montezuma County has relatively little fracking activity, and exhibits a strong opposition to SB 19-181 with an average Likert score of 5. This finding highlights the complicated relationships between stakeholder groups, fracking intensity, and opinion regarding SB 19-181.

Public Opinion Towards SB 19-181 by County, 2019



Map 2: Fracking wells and average Likert sentiment score in CO, as of Jan. 1, 2020. Map created by author.

4.2. Knowledge Typology and Engagement

Knowledge Typology

This section aims to identify the types of evidence utilized by stakeholder coalitions during the rulemaking process to inform their arguments and storylines. Sources of evidence were inductively determined via manual analysis of 154 public comments.

Figure 3 displays a summary of the findings. I identified seven categories of evidence cited in comments: laws and regulations, personal experience, scientific research, industry know-how, specific quotes, and specific events. Laws and regulations were the

most commonly cited type of evidence (n=70, 36.08 percent of total public comments), which aligns with previous research regarding hydraulic fracturing rulemakings (Baka et al., 2019). This is also logical given that a rulemaking process is an inherently regulatory process, so it would be expected that government knowledge such as prior laws and regulations would hold value in debates surrounding legislation. The category ‘laws and regulations’ includes both references to previous laws and regulations involving oil and gas operations as well as sentiments regarding SB 19-181.

The second most cited source of evidence was personal experience (n=43, 22.16 percent of total public comments). This source of evidence was primarily utilized in the form of anecdotes regarding the safety/danger of hydraulic fracturing and experiences working for oil and gas companies. The third most cited source of evidence was scientific research (n=41, 21.13 percent of total public comments). Commonly cited scientific studies included the IPCC Special Report on Global Warming (IPCC, 2018) and the Human Health Risk Assessment for Oil and Gas Operations in Colorado (Carr et al., 2019). Industry know-how was the fourth most commonly cited source of evidence, which mainly consisted of “soft knowledge” (Baka et al., 1948) regarding the industry practices of oil and gas companies (n=18, 9.28 percent of total public comments). Specific quotes were the fifth most commonly referenced source of evidence and vastly comprised of a reference to the same 2019 quote by Governor Jared Polis (n=15, 7.73 percent of total comments). Specific events were the least-cited source of evidence, typically referencing the 2017 home explosion in Firestone, Colorado (n=7, 3.61 percent of total comments).

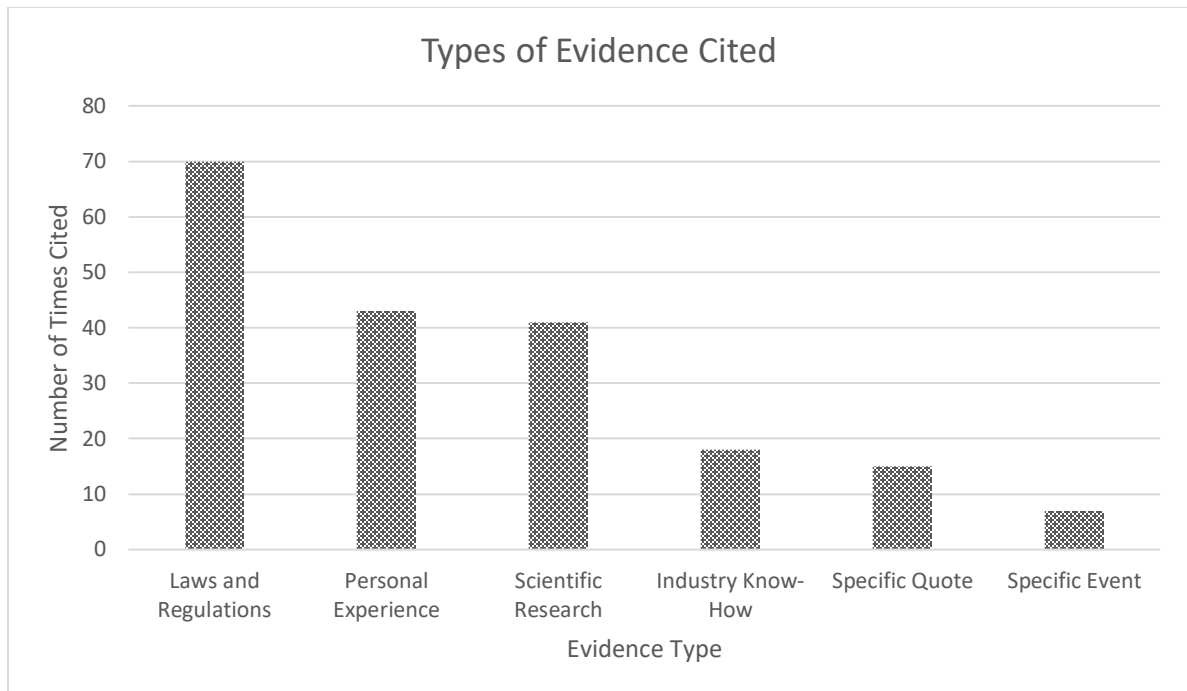


Figure 3: Types of evidence cited in public comments. Source: Author’s coding notes.

Knowledge Engagement by Stakeholder Group

The goal of this section is to identify the ways in which stakeholder groups interact with evidence sources while engaging in rulemaking arguments. The following sections identify the most commonly cited sources of evidence by each stakeholder group in SB 19-181 rulemaking public comments. These findings are summarized in Figure 3.

(1) Pro-SB 19-181

Supporters of SB 19-181 most commonly cited scientific research (n=33), personal experience (n=31), and laws and regulations (n=29). These findings are summarized in Figure 4. Supporters of SB 19-181 were identified if the Likert score of their comment was less than 3, indicating positive sentiment towards the legislation.

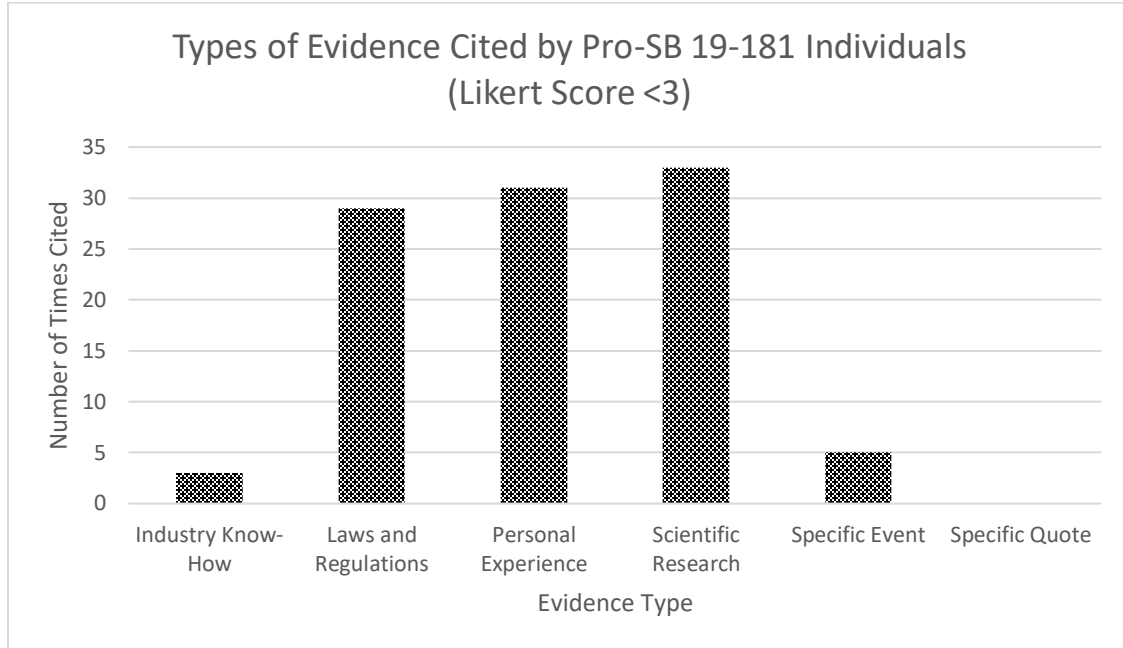


Figure 4: Types of evidence cited by supporters of SB 19-181. Source: Author’s coding notes.

(2) Anti-SB 19-181

Opponents of SB 19-181 most commonly cited laws and regulations (n=41), industry know-how (n=15), a specific quote (n=15), and personal experience (n=13). These findings are summarized in Figure 5.

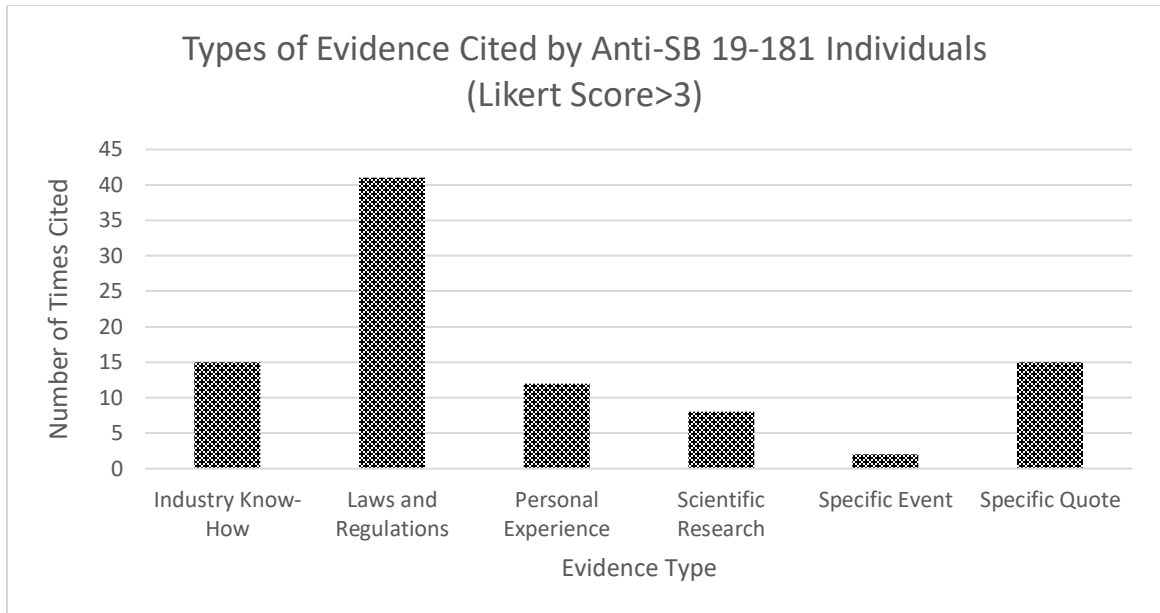


Figure 5: Types of evidence cited by opposers of SB 19-181. Source: Author’s coding notes.

(3) Elected Officials

Elected officials most commonly cited laws and regulations (n=6), industry know-how (n=2), personal experience (n=2), and scientific research (n=2). These findings are summarized in Figure 6 below.

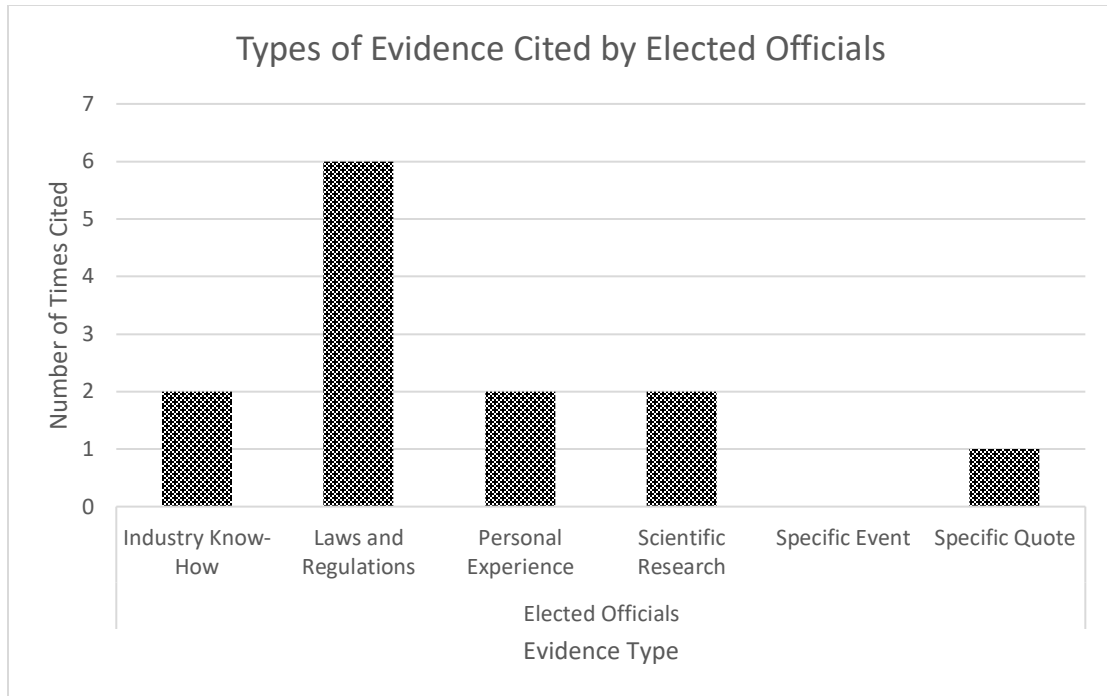


Figure 6: Types of evidence cited by elected officials. Source: Author’s coding notes.

(4) Activists

Anti-fracking activists most commonly cited scientific evidence (n=8), personal experience (n=3), and laws and regulations(n=2). These findings are summarized in Figure 7 below.

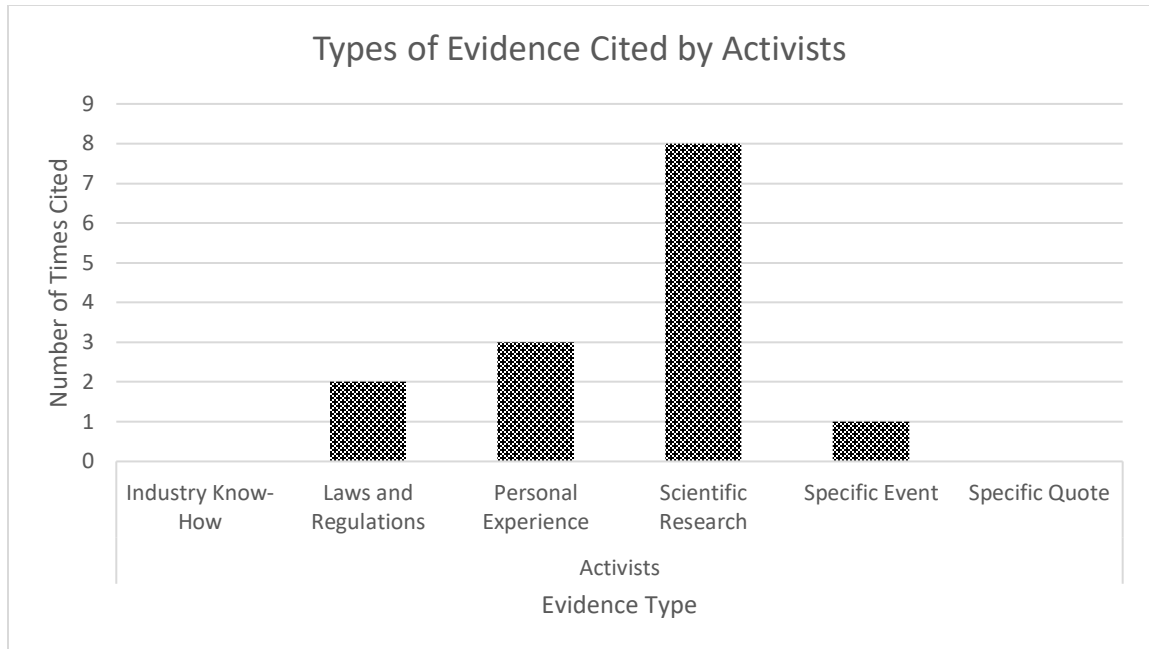


Figure 7: Types of evidence cited by anti-fracking activists. Source: Author’s coding notes.

(5) Concerned Citizens

Concerned citizens most commonly cited scientific research (n=27), personal experience (n=27), and laws and regulations (n=19). These findings are summarized in Figure 8 below.

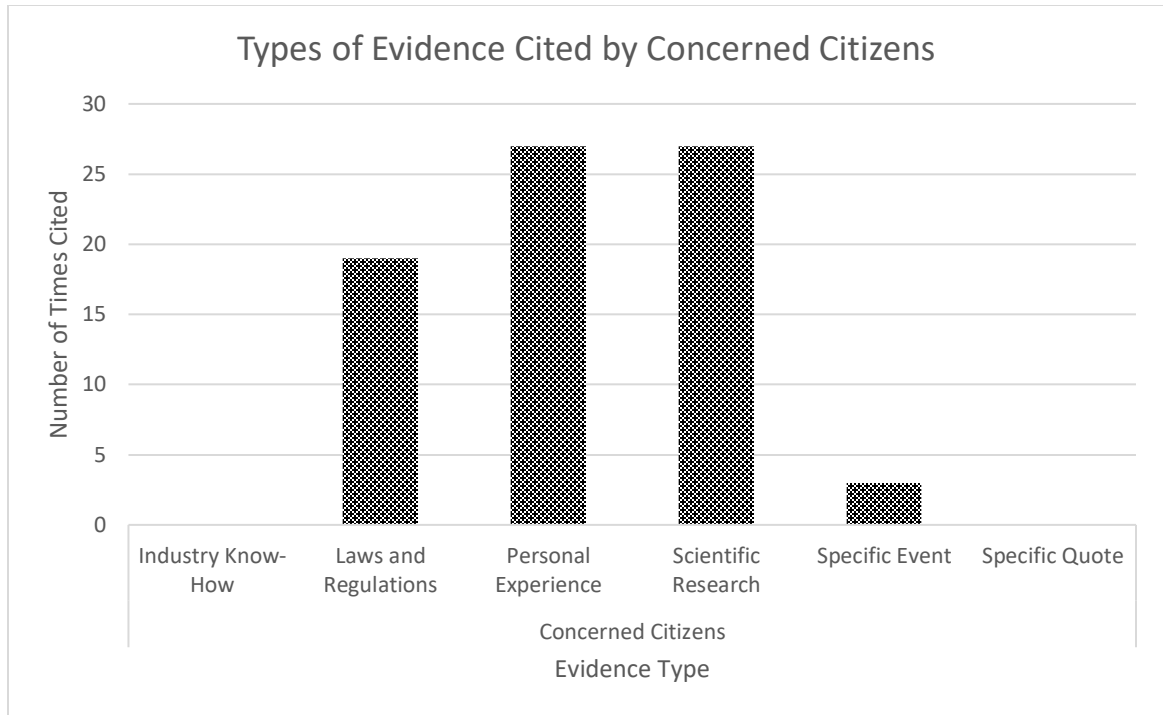


Figure 8: Types of evidence cited by anti-fracking concerned citizens. Source: Author’s coding notes.

(6) Business Community

The business community most commonly cited laws and regulations (n=4) and industry know-how (n=3). These findings are summarized in Figure 9 below.

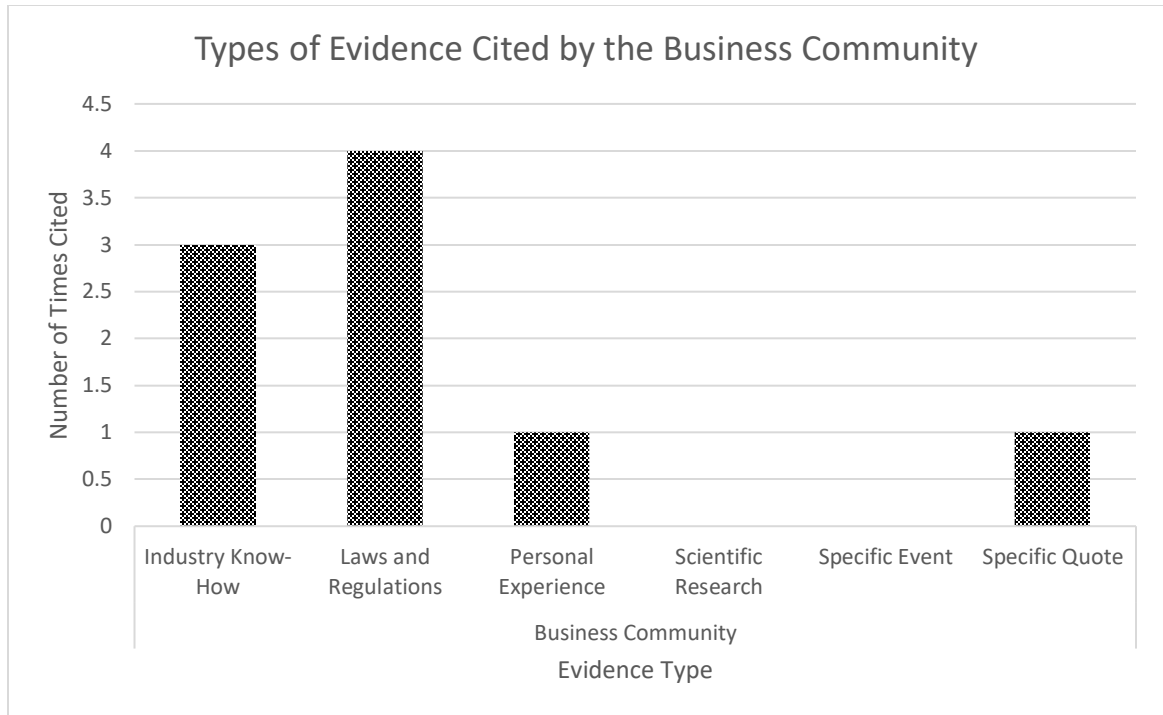


Figure 9: Types of evidence cited by members of the business community. Source: Author's coding notes.

(7) Farmers

Farmers most commonly cited personal experience (n=3) and scientific research (n=2).

These findings are summarized in Figure 10 below.

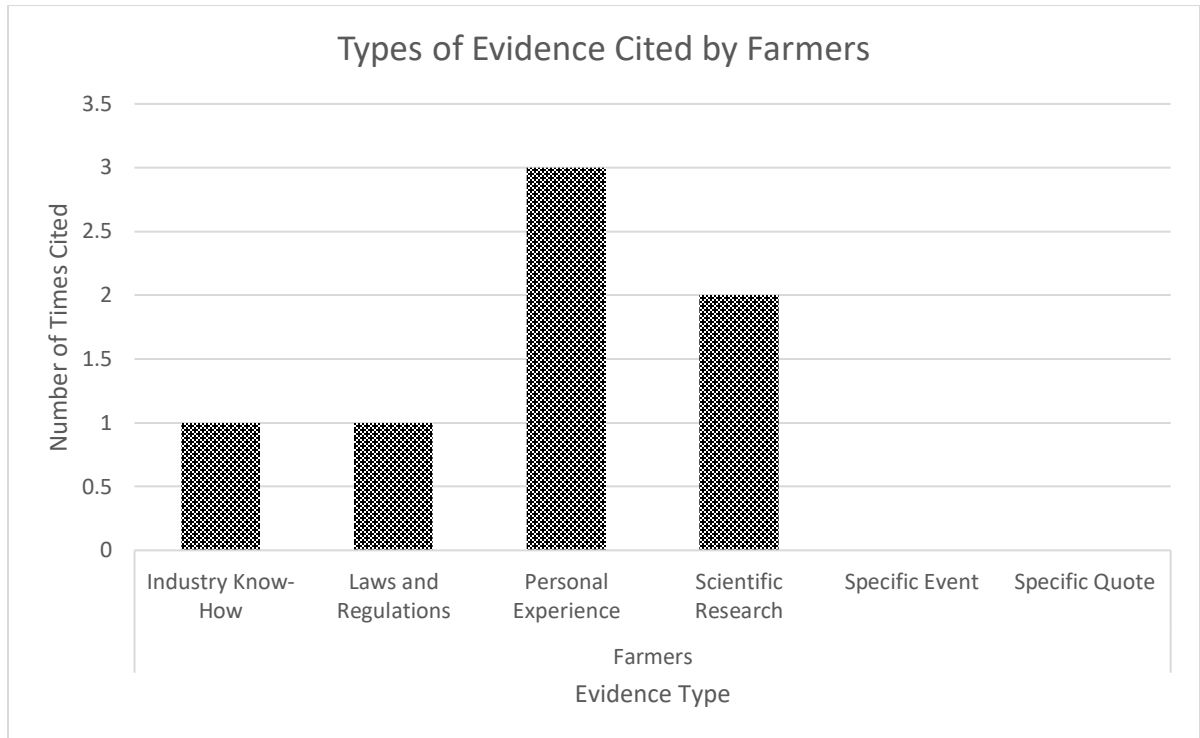


Figure 10: Types of evidence cited by current or former farmers. Source: Author’s coding notes.

(8) Pro-Oil and Gas Industry/Anti SB 19-181 Individuals

Pro-oil and gas industry/anti SB 19-181 individuals most commonly cited laws and regulations (n=29) and specific quotes (n=13). These findings are summarized in Figure 11 below.

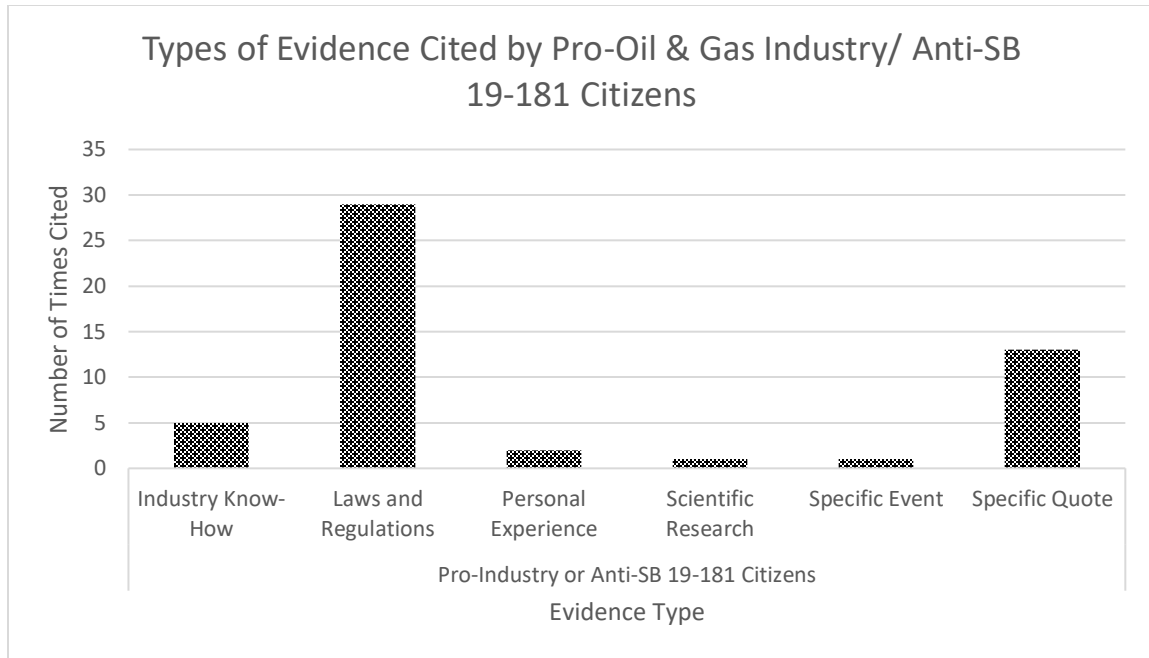


Figure 11: Types of evidence cited by pro-oil and gas industry/anti SB 19-181 individuals. Source: Author’s coding notes.

(9) Oil and Gas Industry Employees/Representatives

Oil and gas industry employees and representatives most commonly cited industry know-how (n=7) and personal experience (n=4). These findings are summarized in Figure 12 below.

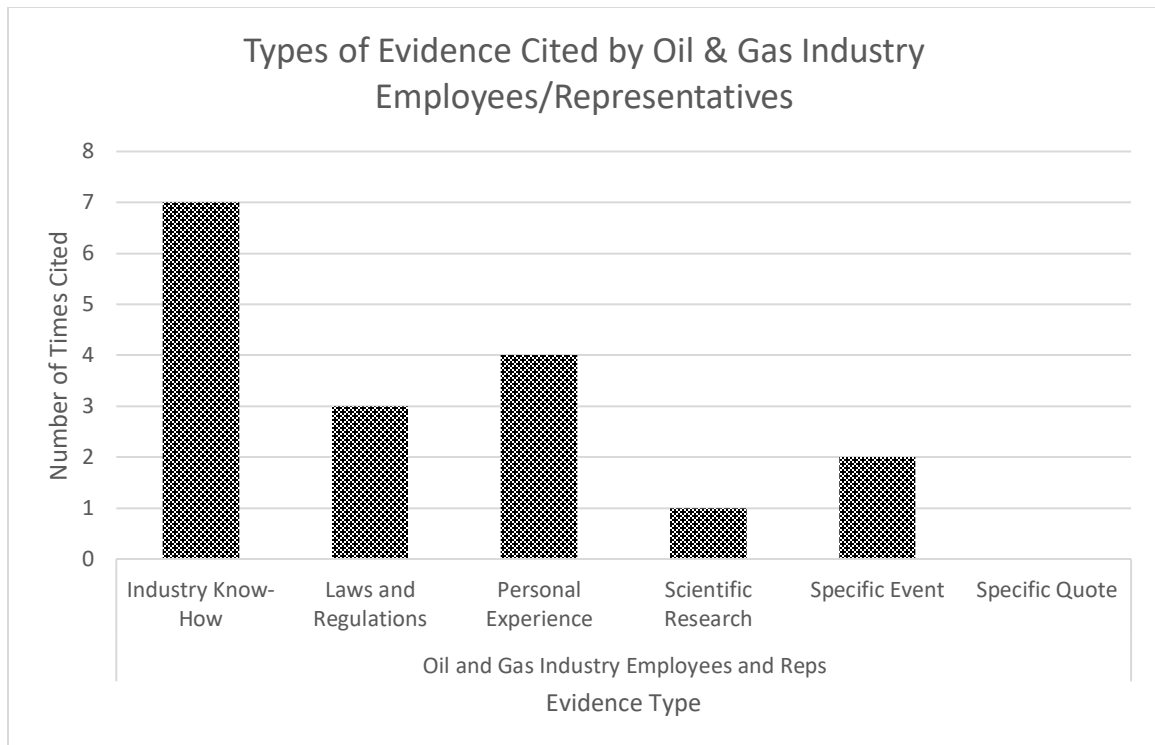


Figure 12: Types of evidence cited by current or former oil and gas industry employees and representatives. Source: Author’s coding notes.

4.3. Assessing SB 19-181 Storylines

This section aims to assess how stakeholder coalitions utilize storylines in their arguments regarding SB 19-181. Hajer conceptualized these storylines as “the means through which different elements of physical and social realities are unified into specific, closed problems and given meaning” (Hajer, 1995, p. 56). This analysis is intended to explore how different stakeholder groups utilize these storylines to promote their own policy goals in the context of the SB 19-181 rulemaking comment period from Nov. 18, 2019 – Dec. 16, 2019. It also identifies and assesses the causal stories embedded in each storyline.

Pro-SB 19-181 Storylines

Arguments in favor of SB 19-181 typically included one or both of the following storylines: (1) concern over the environmental and health impacts of oil and gas activity; and (2) supporting increased access to information regarding well locations, flowlines, and oil and gas facilities. As shown in Figure 13, the ‘concern over environmental and health impacts of oil and gas activity’ storyline was utilized most commonly amongst supporters of SB 19-181, appearing in 75 percent of their public comments (n=66), while the ‘increased access to information storyline was utilized in 25% of public comments (n=22). The following sections will analyze which stakeholder groups most commonly use each storyline, the key elements of each storyline, and the causal stories embedded in each.

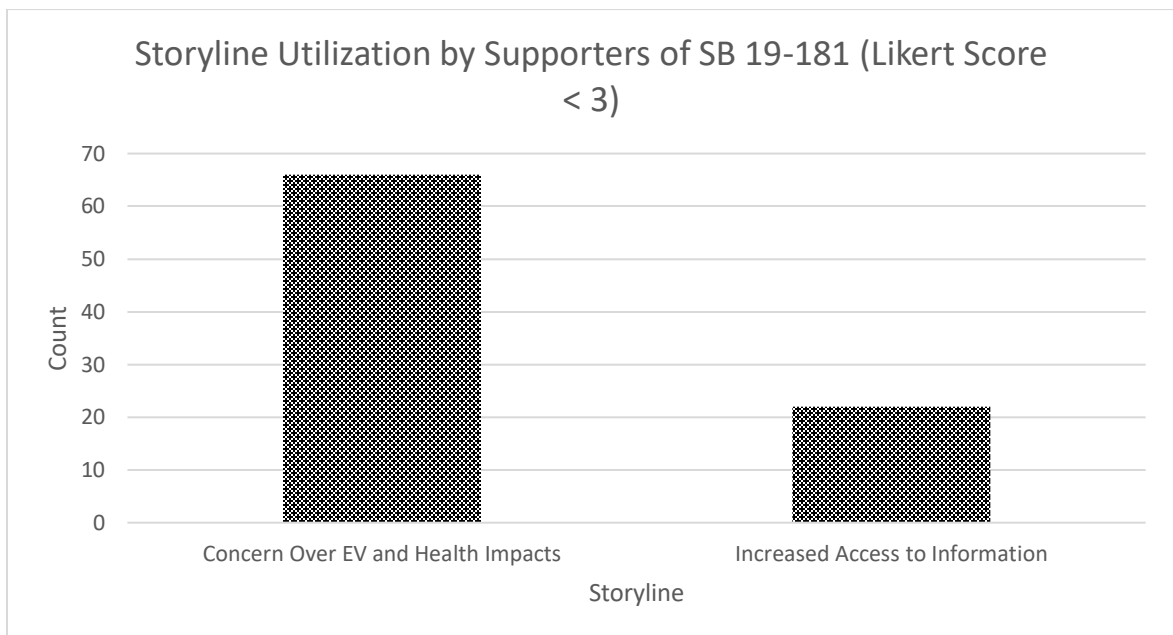


Figure 13: Storylines used by supporters of SB 19-181 (Likert score < 3). Source: Author’s coding notes.

(1) Concern over Environmental and Health Impacts

The ‘concern over environmental and health impacts’ of hydraulic fracturing storyline was the most commonly utilized storyline among supporters of SB 19-181 (Figure 13). The terms used while framing an issue matter immensely in rulemaking debates. Almost all of the stakeholders who utilize this storyline refer to the process of hydraulic fracturing as ‘fracking’. This finding is consistent with Bomberg’s findings in a similar hydraulic fracturing-related rulemaking debate, in which opposers of HF used the term ‘fracking’, “a cruder term conveying a harsher, slightly obscene resonance” (Bomberg, 2007, p. 81).

Concerned citizens and members of activist organizations used this storyline the most often, appearing in 78% and 77% of their comments, respectively (Figure 14). Elected officials and farmers also used this storyline in their arguments, appearing in 30% and 20% of their comments, respectively (Figure 14). These stakeholder groups united around a pro-SB 19-181 storyline of shale gas extraction as a threat to the environment, human health, and climate. As shown in Figure 7, activist groups overwhelmingly used scientific research regarding the ill effects of HF while referencing this storyline. Scientific studies referenced include the IPCC Special Report on Global Warming (IPCC, 2018), the Human Health Risk Assessment for Oil and Gas Operations in Colorado (Carr et al., 2019), and oil and gas industry documents. Calls for additional scientific research into the environmental and health effects of HF were also common among activists. On the other hand, the concerned citizens stakeholder group referred to personal experience just as often as scientific research while utilizing this storyline (Figure 8). While many of these

concerned citizens referenced the same scientific studies mentioned earlier, some individuals cited contaminated soil and water samples that they collected themselves. This reflects Toerpe's findings of a rise in citizen science in recent years (Toerpe, 2013).

Members of the concerned citizens group also cited the adverse health and environmental impacts experienced by themselves or loved ones from living near hydraulic fracturing sites, referencing asthma, bloody noses, fatigue, and even death. Many residents complemented their personal experiences with scientific evidence as a means of crafting more credible arguments. An example is given by a resident from Adams County (2019):

As a long-standing resident of North Adams County, my asthma has worsened over recent years. I am not alone in experiencing continued health issues. These are the exact symptoms detailed by the recent CDPHE report on human health effects in proximity to oil and gas drilling. This will only be exponentially compounded in Adams County where the drilling of several hundred more wells is scheduled.

Many concerned citizens also referenced their love for the clean air in Colorado, and their fear that hydraulic fracturing will threaten it now and into the future. Others expressed their fondness for Colorado wildlife, and their experiences of seeing less and less wildlife around them due to oil and gas infrastructure. Given that 37 percent of concerned citizens cited personal experience (Figure 8) in their arguments, accounts of illness, adverse health conditions, and environmental impacts are prominent in this storyline. Overall, the

‘concern over environmental and health impacts’ of hydraulic fracturing storyline tended to utilize a combination of scientific evidence and personal experience to depict SB 19-181 as a means of regulating a threatening and ‘dirty’ industry.

By framing themselves as the victims of the oil and gas industry, many users of this storyline created powerful causal stories that positioned themselves as the “preferred action takers” (Brante, 1993, p. 226) in regulating hydraulic fracturing. These individuals often “compose stories that describe harms and difficulties, attribute them to actions of other individuals or organizations, and thereby claim the right to invoke government power to stop the harm” (Brante, 1993, p. 282). In doing so, stakeholders often make a clear and compelling case as to why SB 19-181 would be an appropriate and timely measure to regulate an industry that they view as harmful or destructive.

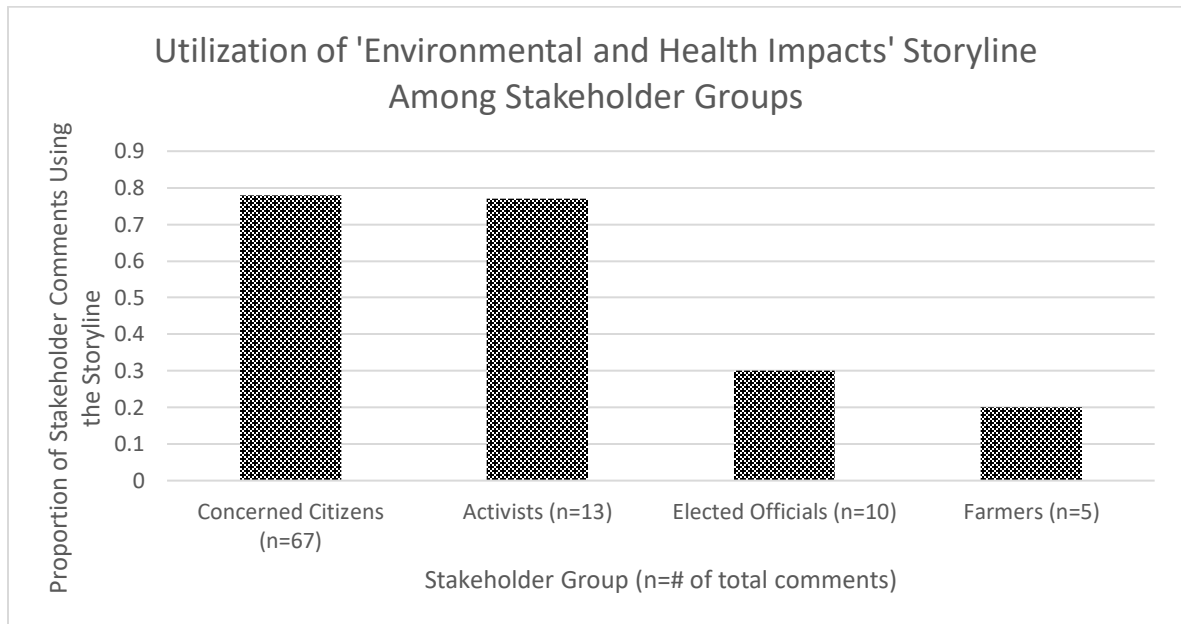


Figure 14: Utilization of ‘EV and Health Impacts of Hydraulic Fracturing’ by stakeholder group. Source: Author’s coding notes.

(2) Supporting Increased Access to Information

As shown in Figure 13, the ‘increased access to information’ storyline was the lesser used storyline among supporters of SB 19-181 and the only major alternative storyline to the ‘concern over environmental and health impacts’ of the oil and gas industry storyline. The concerned citizen stakeholder group utilized this storyline in 31% of public comments (total comments = 67), while farmers utilized it 20% of the time (total comments = 5). Figure 15 summarizes these findings. The users of this storyline are typically united by the premise that SB 19-181 is a beneficial piece of legislation in that it increased public access to information regarding hydraulic fracking infrastructure locations. Many users of this storyline express desires to extend the requirements of SB 19-181 to include alerting citizens and homeowners of their proximity to HF infrastructure, with many individuals citing the Firestone explosion as a reason to add this requirement.

Many advocates of this storyline fear that without adequate access to information regarding HF infrastructure, local governments won’t be able to effectively govern oil and gas activity in their jurisdictions. As one Arapahoe County resident states (2019):

We continue to insist all flow lines be mapped and monitored, and that the information be made available to local jurisdictions. The locals may make more specific monitoring requirements of the industry, but without adequate information on flow lines and gathering lines, it will be nearly impossible for them to advocate for and protect their citizens.

Another user of this storyline referenced the Firestone event as a reason to increase access to information regarding HF infrastructure (2019):

On April 17, 2017, a leaking gas line caused an explosion at the Martinez's home in Firestone. Both Mark Martinez and Joey Irwin were killed. Erin Martinez suffered serious injuries. Communities want to know: Where are other flowlines located?

Users of this storyline utilize causal stories and causal politics to frame themselves as victims to the wrongdoings and secrets of the oil and gas industry, therefore urging the COGCC to require more aggressive information disclosure in SB 19-181. By referencing both the Firestone event and portraying the oil and gas industry as keeping important information from Colorado citizens, members of this storyline effectively characterize the oil and gas industry as secretive and untrustworthy. By assigning responsibility to the oil and gas industry for the Firestone event and for keeping information from the public, they simultaneously urge the COGCC to force the oil and gas industry to disclose additional information while empowering themselves as “fixers of the problem” (Stone, 1989, p. 295). Rather than relying on evidence to construct a case for themselves, members of this storyline instead created a causal story highlighting a gap in information and data to argue for their policy goals.

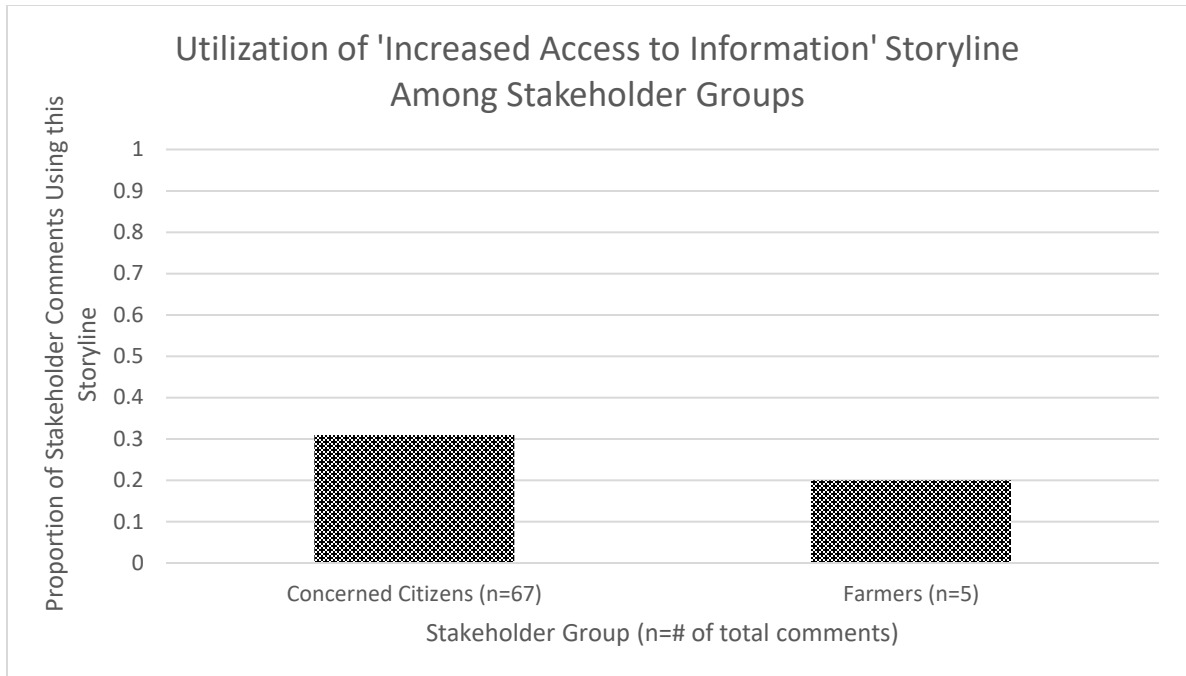


Figure 15: Utilization of ‘Increased Access to Information’ storyline among stakeholder groups. Source: Author’s coding notes.

Anti-SB 19-181 Storylines

Critical arguments against SB 19-181 typically included one or more of the following storylines: (1) prior regulations need additional time to go into effect before implementing SB 19-181; (2) SB 19-181 is a political attack on the oil and gas industry; (3) overregulation of the oil and gas industry will threaten Colorado’s economy; (4) hydraulic fracturing is proven to be safe; and (5) Coloradans support the oil and gas industry. Figure 16 summarizes storyline utilization by opposers of SB 19-181. The following sections will analyze which stakeholder groups most commonly use each storyline, the key elements of each storyline, and the causal stories embedded in each.

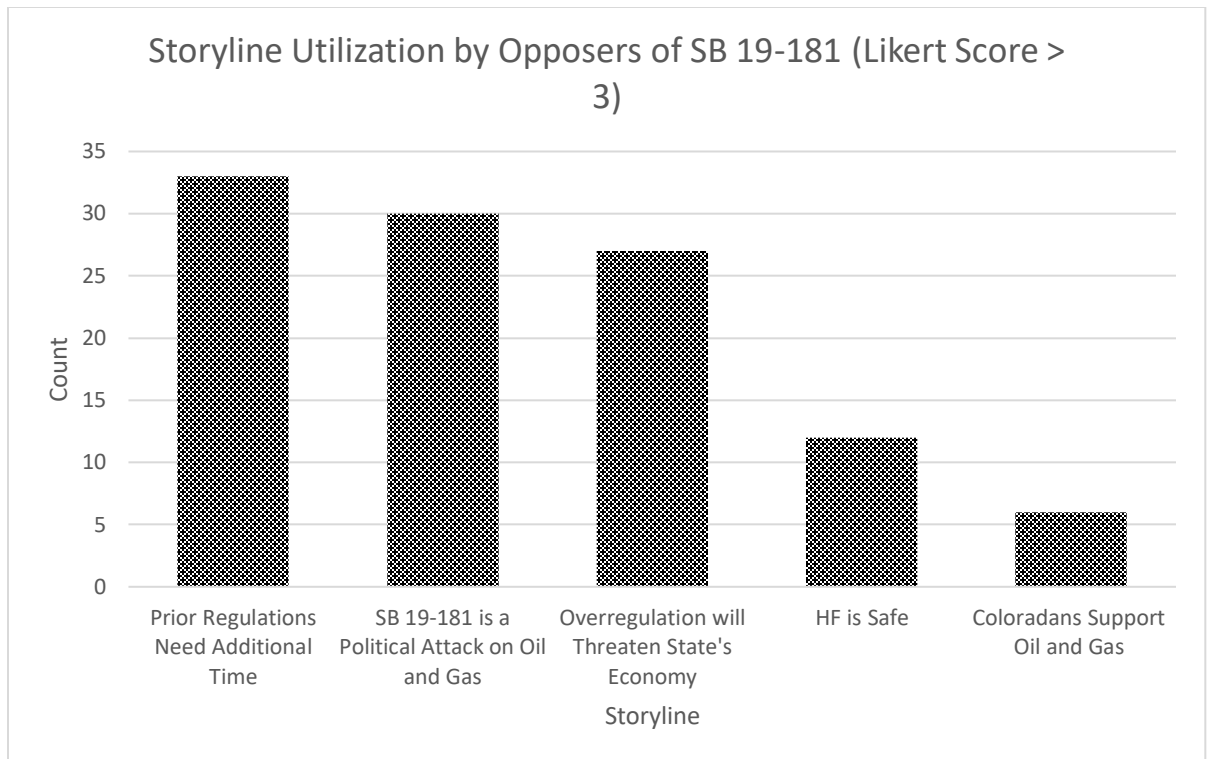


Figure 16: Storyline utilization by opposers of SB 19-181 (Likert score > 3). Source: Author's coding notes.

(1) 'Prior Regulations Need Additional Time'

As shown in Figure 16, the 'prior regulations need additional time to go into effect' storyline was the most commonly utilized storyline among opposers of SB 19-181. All members of the business community used this storyline in public comments (total comments = 4), 53% of Pro-Oil & Gas Industry/Anti-SB 19-181 Individuals (total comments = 43), and 25% of Oil & Gas Industry Representatives and Employees (total comments = 12). On May 25, 2018, Governor Hickenlooper signed SB 18-167 into law, which placed increased regulations and accountability on oil and gas operators and utilities for underground oil and gas infrastructure. The users of this storyline are typically united in the premise that SB 18-167 had not had enough time to be fully implemented, and that SB 19-181 should not be discussed until prior legislation is in full

effect. Many proponents of this storyline also claim that Colorado’s regulatory environment is already overly strict on the oil and gas industry, and that SB 19-181 is unnecessary.

The business community uses this storyline the most often, appearing in 100% of their public comments (note that total comments = 4). Pro-oil and gas industry/anti SB 19-181 citizens use this storyline in 53% of their public comments (total comments = 43), and oil and gas employees and representative use it in 25% of their comments (total comments = 12). These findings are summarized in Figure 17 below.

Users of this storyline typically follow into two groups; those who simply state that SB 19-181 is unnecessary given prior legislation, and those who weave in the ‘SB 19-181 as a political attack on the oil and gas industry’ storyline. The first case is illustrated by a comment submitted by a Summit County resident (2019):

Thanks to then Governor John Hickenlooper, Colorado in 2018 implemented the nation’s most stringent and comprehensive rules for oil and gas flowlines and production piping systems. Fast forward to 2019, and here we are again – redoing regulations that haven’t even taken full effect yet.

A comment submitted by a Jefferson County resident (2019) illustrates the other commonly used tactic of combining the ‘prior regulations need additional time’ storyline with the ‘political attack on oil and gas’ storyline:

The Polis administration seems to be working on a backdoor way of either shutting down the oil and gas industry, or just making the regulatory environment so unpleasant that the industry chooses not to do business here. Case in point: additional considerations for flowline rules despite the fact that they were just updated.

Users of this storyline crafted entirely different causal stories depending on whether they weaved in the ‘political attack on oil and gas’ storyline. If users simply argued that SB 19-181 is unnecessary due to prior regulations, their causal story was significantly weaker since they didn’t position themselves as the victims to any specific actor. They indirectly placed blame on the Colorado Senate for passing SB 19-181 but didn’t directly place blame on any particular actor or group. However, those who combined both storylines tended to place blame directly on Governor Polis, who they asserted was sneakily attempting to attack the oil and gas industry via SB 19-181. By claiming that SB 19-181 is an intentional effort by Governor Polis to drive business out of Colorado and eliminate jobs in the oil and gas industry, this causal story pushed “a problem into the realm of human purpose” (Stone, 1989, p. 292) with a specific opponent.

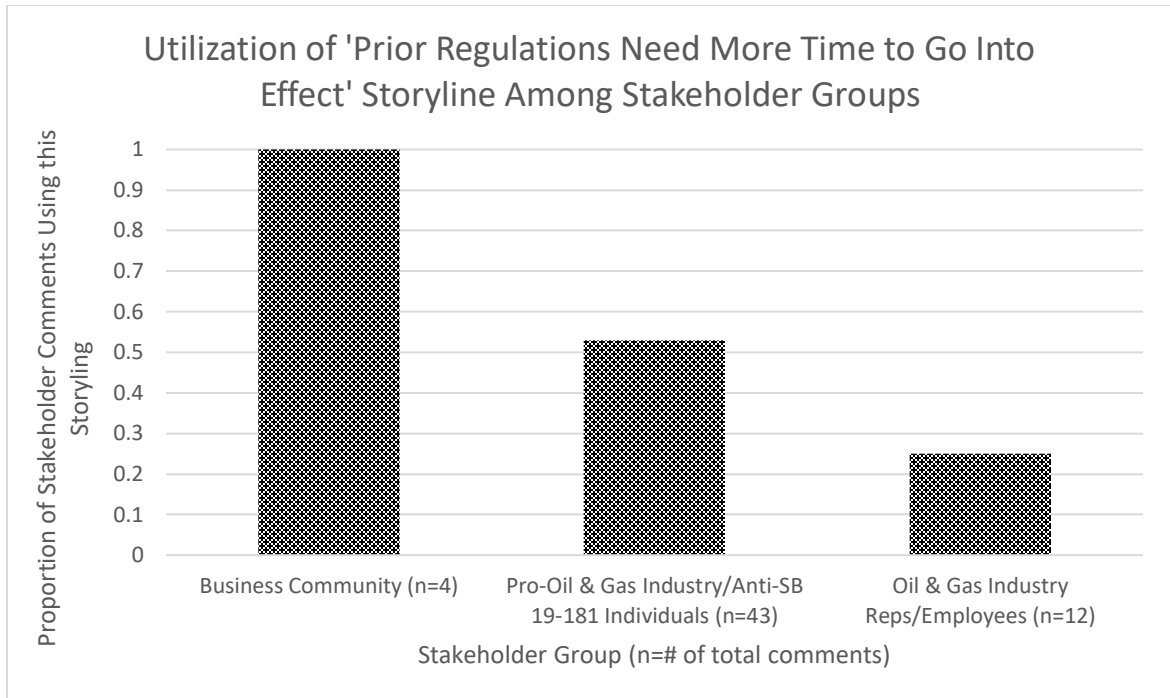


Figure 17: Utilization of ‘Prior Regulations Need More Time to Go Into Effect’ storyline by opposers of SB 19-181. Source: Author’s coding notes.

(2) ‘SB 19-181 is a Political Attack on Oil and Gas’

As shown in Figure 16, the ‘SB 19-181 is a political attack on the oil and gas industry’ storyline was the second most commonly utilized storyline by opponents of SB 19-181. 56% of pro-oil and gas industry/anti-SB 19-181 citizens (total comments = 43), 50% of the business community (total comments = 4), and 40% of elected officials (total comments = 10) utilized this storyline in their public comments. These findings are summarized in Figure 18. Interestingly, Oil and Gas Industry Employees and Representatives were not recorded utilizing this storyline. The users of this storyline are typically united in the belief that SB 19-181 is an effort by Governor Polis to harm or completely eliminate oil and gas development in Colorado. A significant number of

individuals using this storyline referenced the same exact 2018 quote from Governor Polis given at a COGA (Colorado Oil and Gas Association) event:

Dan Haley, president of the COGA, asks Polis: “Can you still drill for oil in a blue state?” to which Polis responds, “Yes. It’s a silly question. It’s like asking, ‘Can you build a solar farm in a red state?’ It just doesn’t make any sense. Energy isn’t inherently political, it’s inherently economic.” (Woodruff, 2019).

Users of this storyline tended to isolate the word ‘silly’ from Polis’s response, claiming that he wasn’t taking the concerns of the oil and gas industry seriously. They also often claimed that SB 19-181 is an intentional effort by Polis to significantly hinder oil and gas production in Colorado. These two arguments are illustrated by a public comment submitted by an Arapahoe County resident (2019):

Senate Bill 19-181 was sold as a way of enhancing safety and public confidence, not as a wholesale ban on the industry. I think it’s reasonable to call Governor Polis’s tone dismissive and condescending as he repeatedly called industry concerns ‘silly’. We’re concerned that more rules are tantamount to a de-facto ban.

By simultaneously characterizing Governor Polis as an enemy to oil and gas production and SB 19-181 as a de-facto ban on oil and gas production in Colorado, these individuals created impactful causal stories that placed blame directly on Polis for passing SB 19-181

in an effort to harm the oil and gas industry. By using these causal stories in tandem, many members of this storyline created impactful and direct causal relationships between SB 19-181, Governor Polis, and the future of oil and gas development in Colorado. According to Stone, the strongest claim a stakeholder group can make in causal politics is that another actor intentionally caused them harm, which members of this storyline typically did (Stone, 1989).

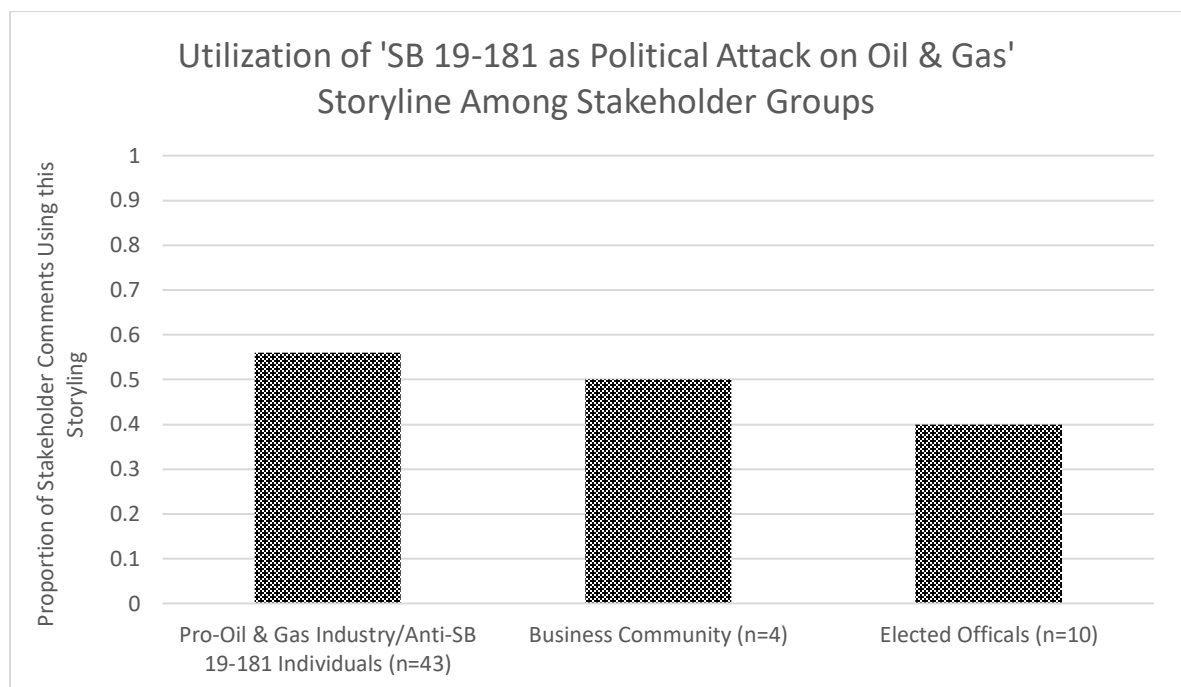


Figure 18: Utilization of ‘SB 19-181 as a Political Attack on the Oil and Gas Industry’ storyline among stakeholder groups. Source: Author’s coding notes.

(3) ‘Overregulation will Threaten the State’s Economy’

As shown in Figure 16, the ‘Overregulation will Threaten the State’s Economy’ storyline was the third most commonly utilized storyline by opponents of SB 19-181. This storyline was utilized by 60% of farmers (total comments = 5), 50% of the business community (total comments = 4), 44% of pro-oil and gas industry/anti-SB 19-181

citizens (total comments = 43), 40% of elected officials (total comments = 10), and 33% of oil and gas industry representatives and employees (total comments = 12). These findings are summarized in Figure 19 below. The users of this storyline were typically united in the belief that SB 19-181 will overregulate oil and gas development in Colorado, causing oil and gas companies to leave the state. Proponents of this storyline often argue that the oil and gas industry generates valuable income for the state of Colorado and provides thousands of safe jobs. This argument is illustrated by an elected official from Weld County (2019):

Oil and gas is important to families for their income, important to families for their schools. I ask that we keep that in mind as we move forward today. Let's try to find the midline balance between the importance of 181 and the reality of the lives it will be affecting. I hope we find that middle ground that satisfies the majority.

By linking oil and gas development to benefits for Colorado families and schools, users of this storyline craft effective causal stories that associate the passing SB 19-181 with threats to the education system, employment, and family wellbeing in Colorado. In doing so, users of this storyline and causal story indirectly blame SB 19-181 for job loss and harming the Colorado education system. Users of this storyline rarely cite specific studies or evidence of how such a Senate Bill would impact jobs or education, but they matter-of-factly claim that jobs will leave the state of Colorado if SB 19-181 is implemented.

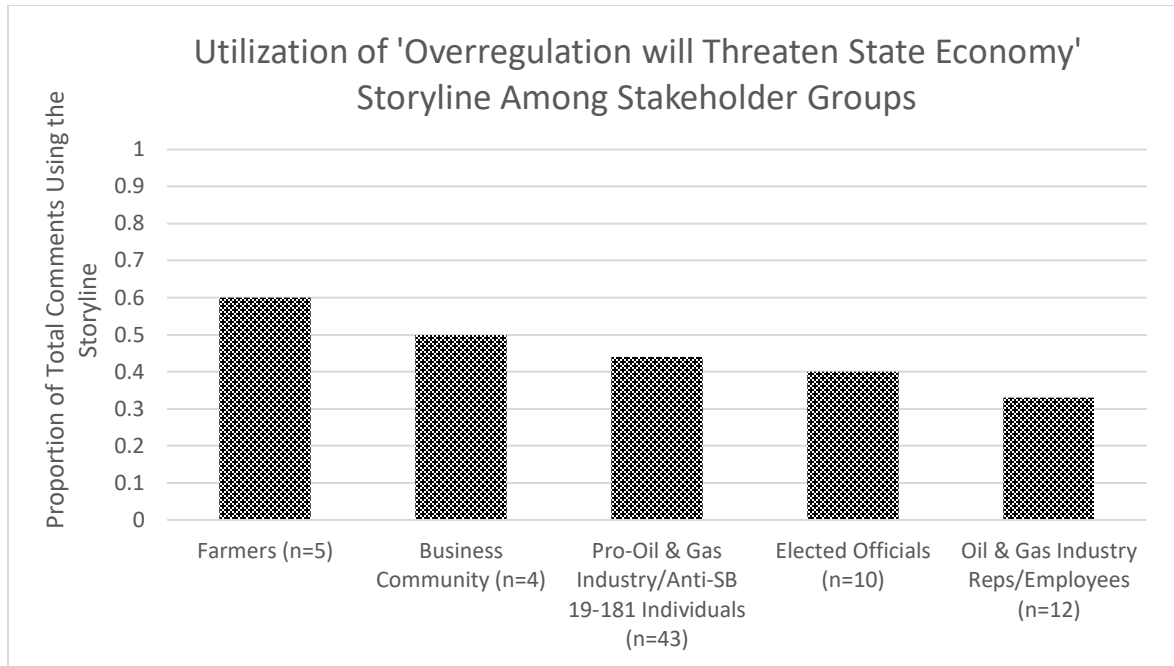


Figure 19: Utilization of ‘Overregulation will Threaten the State’s Economy’ storyline among stakeholder groups. Source: Author’s coding notes.

(4) ‘Hydraulic Fracturing is Safe’

As shown in Figure 16, the ‘Hydraulic Fracturing is Safe’ storyline was the fourth most commonly used storyline among opponents of SB 19-181. This storyline was utilized by 60% of farmers (total comments = 5), 50% of the business community (total comments = 4), 44% of pro-oil and gas industry/anti SB 19-181 individuals (total comments = 43), 40% of elected officials (total comments = 10), and 33% of oil and gas industry representatives and employees (total comments = 12). These findings are summarized in Figure 20 below. The users of this storyline tended to be united in the belief that hydraulic fracturing activity has become immensely safer over time, and that it poses no threats to the environment or human health. An example of this argument is shown by a public comment submitted by a Mesa County resident and employee of the oil and gas industry (2019):

I work in the oil and gas industry and like many other people that live in Colorado, I want to breath fresh air and drink clean water. Fortunately, I get to experience the whole process from when the well is drilled to where the gas is processed and then shipped by way of pipeline. Nowhere in the process is the environment being damaged. The company I work for goes above and beyond to protect the environment.

Users of this storyline often claim that supporters of SB 19-181 aim to vilify the oil and gas industry, and that insufficient evidence has been provided to prove that HF is dangerous. They also tend to associate low rates of workplace injuries in oil and gas work with HF being safe in general. Users of this storyline typically cite personal experiences working for the oil and gas industry as reason enough to generalize that HF is a safe practice overall. The causal stories constructed following this storyline tend to be relatively weak, since they rarely cite any particular studies or sources of evidence. They also tend to shift blame for SB 19-181 on all individuals who oppose HF, rather than a more identifiable target like an individual or small group.

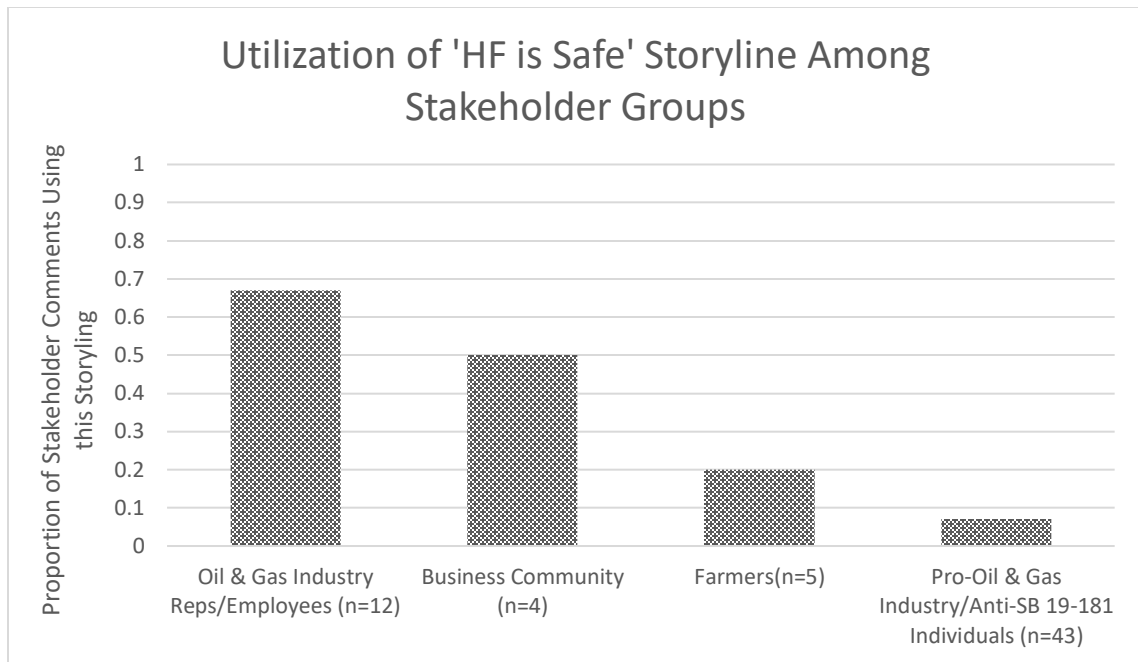


Figure 20: Utilization of ‘Hydraulic Fracturing is Safe’ storyline among stakeholder groups. Source: Author’s coding notes.

(5) ‘Coloradans Support the Oil and Gas Industry’

As shown in Figure 16, the ‘Coloradans Support the Oil and Gas industry’ storyline was the least utilized storyline in the rulemaking process. This storyline was utilized by 30% of elected officials (total comments = 10), and 7% of pro-oil and gas/anti-SB 19-181 individuals (total comments = 43). These findings are summarized in Figure 21 below. Users of this storyline tended to be united in the argument that generally speaking, most Coloradans are in support of oil and gas development, and that SB 19-181 goes against what the majority of Coloradans want. This argument is illustrated in a public comment submitted by a resident of Larimer County (2019):

I’m compelled to ask the commission as they consider new rules what is actually necessary, and what is serving a political agenda which a majority of Coloradans

reject. It's weird, considering we just completed new regulations under the Hickenlooper administration.

As this comment demonstrates, users of this storyline tend to weave the 'SB 19-181 is a Political Attack on Oil and Gas' storyline into their arguments. Interestingly, no users of this storyline cited specific polls or surveys to substantiate the claim that a majority of Coloradans support oil and gas development in Colorado. As a result of this, the central causal story in this storyline is less effective than it could have been if specific evidence was provided. This argument shifted blame on to the state legislators that passed SB 19-181 by accusing them of taking actions against the general will of Coloradans. Again, substantiating these claims with evidence would have made this argument far stronger in a rulemaking setting.

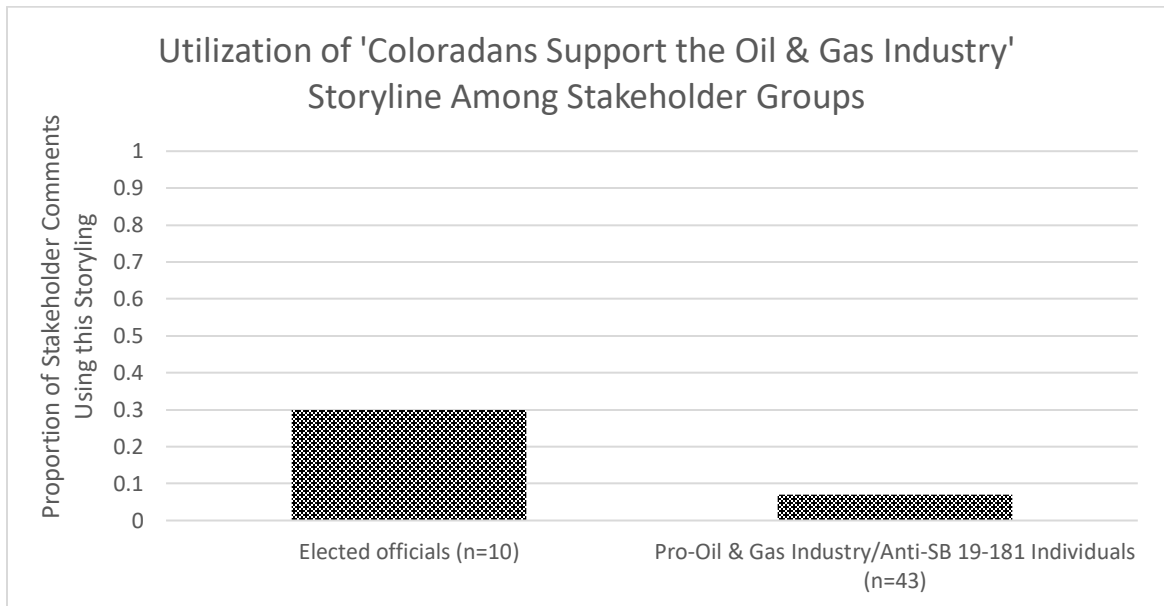


Figure 21: Utilization of 'Coloradans Support the Oil and Gas Industry' storyline among stakeholder groups. Source: Author's coding notes.

5. Discussion

5.1. Emphasis on Government Knowledge

Through the knowledge typology analysis previously explained, this study found that the most commonly cited source of evidence in public comments were prior laws and regulations, which appeared in 36.08 percent of all public comments analyzed during the data collection period (Figure 3). Personal experience was the second most commonly cited source of evidence, appearing in 22.16 percent of total public comments (Figure 3). Scientific research followed closely behind, appearing in 21.13 percent of total public comments (Figure 3). These results indicate that government knowledge is perhaps privileged in rulemaking debates regarding the environment and HF. These findings are reminiscent of research performed by Baka et al., 2019, which found “a clear hierarchy of claims that privileges government knowledge above all other categories of evidence cited (Baka et al., 2019, p. 1956). This is logical since prior laws and regulations hold value in debates surrounding legislation.

These results largely counter Lave’s finding of increased “horizontality” of environmental knowledge production and utilization (Lave, 2015). Lave notes the rise of “a new regime of knowledge production” (Lave, 2015, p. 244) in which environmental knowledge produced outside of academia and government is gaining legitimacy. Instead, my research finds an emphasis on verticality; that hierarchical government knowledge and legislation is privileged in rulemaking debates surrounding oil and gas. However,

given that personal experience was cited slightly more often than scientific evidence, the trend of increased legitimacy of knowledge produced outside of academia and sources of authority may be partly supported by my research. Additional research should address how knowledge legitimacy is changing over time in rulemaking contexts, and the factors contributing to these changes.

5.2. Differing Storylines, Shared Goals

The storyline analysis performed in this research demonstrates how a wide range of stakeholders can unify in support or opposition to a piece of legislation for varying reasons. This was most evident when analyzing the storylines utilized by opposers of SB 19-181. Figure 16 shows that those who opposed SB 19-181 did so for one of five major reasons. Although members of these storylines may not agree on the particulars of each other's arguments and causal stories, they were unified in their opposition or support of SB 19-181, usually strongly so. See Figure 2 for a visual representation of each stakeholder group's average Likert sentiment score and note that all but one group has an average sentiment score within a 0.6 range of the maximum or minimum score. These results demonstrate points made by Hajer (1995) and Baka et al. (2019) that "seemingly disparate stakeholders can align to forge coalitions over shared meanings" (Baka et al., 2019, p. 1946).

These findings raise the question of whether less unified storylines result in more effective arguments in a rulemaking setting. In order to assess this, a potential study

could track whether plural storylines are more effective than singular storylines. By tracking the entire rulemaking process and its results, this study could assess which side was more effective in achieving their policy goals.

5.3. Varying Unification of Stakeholder Comments

One major finding of my research is that different stakeholder groups exhibited varying degrees of unification behind evidence sources. In other words, certain stakeholder groups rallied behind similar reasons for either supporting or opposing SB 19-181, while other stakeholder groups had more diverse reasons for their opinions. For example, concerned citizens supported SB 19-181 for a wide range of reasons, including personal experience, scientific research, and prior laws and regulations (Figure 3). They tended to cite these sources of evidence fairly evenly across each category. On the other hand, pro-oil and gas/anti SB 19-181 citizens argued against the bill by primarily citing prior laws and regulations and occasionally by citing a specific quote by Governor Polis (Figure 11). The pro-oil and gas/anti SB 19-181 stakeholder group was generally more unified behind these two sources of evidence, while the concerned citizens stakeholder group had a wider range of comments and sources of evidence cited.

These findings raise the question of why some stakeholder groups may be more unified behind similar comments or sources of evidence than others. The pro-oil and gas/anti SB 19-181 stakeholder group tended to rally behind prior laws and legislation, indicating some degree of organization and prioritization of this knowledge source. They also

mentioned the same exact quote from a Governor Polis speech in 13 of their comments (Figure 11), indicating a high degree of organization and unification behind this evidence source. On the other hand, concerned citizens submitted a wide range of comments and cited more diverse evidence sources, indicating less organization and unification behind particular evidence sources. One potential reason for this discrepancy in unification is that the concerned citizens stakeholder group was significantly more diverse in terms of self-identification. This group was comprised of homeowners, parents, a former oil and gas engineer, a former chemical engineer, a former biologist, nurses, a botanist, and a number of other self-identified positions. The pro-oil and gas/anti SB 19-181 stakeholder group had only three individuals with self-identified positions, with all other individuals simply claiming to be residents of a particular Colorado county. This discrepancy in stakeholder occupational diversity could be a contributing factor to the difference in stakeholder unity behind particular evidence sources. In other words, stakeholders with more diverse experiences and backgrounds may tend to have a wider range of arguments and reasons to either support or oppose a particular bill.

These findings suggest that additional research should be done regarding stakeholder unification in rulemaking debates, and the additional factors that contribute to a stakeholder group's tendency to cite the same sources of evidence in arguments. One suggested area of focus would be to perform a discourse analysis on the news and information sources used by each stakeholder group to assess the prevalence and impact of these narratives in rulemaking debates. For example, it would be valuable to perform a discourse analysis on pro-oil and gas/anti SB 19-181 news and information sources to

better understand how SB 19-181 is being framed and narrated to this stakeholder group. It would be reasonable to suspect that the Governor Polis quote was emphasized by anti-SB 19-181 information sources as a primary reason to oppose SB 19-181. It would also be valuable to analyze how different information and news sources promote public comment opportunities during rulemakings, and whether this has a significant impact on stakeholder participation in the public comment process.

5.4. Causal Story Effectiveness in Rulemaking Debates

A key finding of this research was the identification and assessment of causal stories embedded in argument storylines. In the storyline analysis section, each causal story was described and analyzed based on Stone's criteria for an effective causal story (Stone, 1989). According to Stone, the most effective claim a stakeholder group can make in causal politics is that another actor intentionally caused them harm. My research found that members of the 'SB 19-181 is a Political Attack on Oil and Gas' storyline use this claim the most effectively, since they shifted blame directly on Governor Polis for perceived job loss and economic insecurity. On the other end of the spectrum, members of the 'HF is Safe' storyline rarely cited any specific evidence and shifted blame for SB 19-181 on all individuals who oppose HF, resulting in a relatively weak causal story.

This research identifies a novel causal story that expands upon Stone's work (Stone, 1989). This type of causal story was utilized by members of the 'Supporting Increased Access to Information' storyline, who argued that SB 19-181 is a beneficial piece of

legislation in that it increased public access to information regarding hydraulic fracking infrastructure locations. They shift blame to the oil and gas industry for the Firestone event and keeping information from the public. However, rather than relying on evidence to support their causal story, they instead highlight the lack of information. Stone argues that in order to successfully assign blame on an actor for a specific harm caused, “purpose must always be demonstrated with evidence of the actor’s wishes or motives” (Stone, 1989, p. 290). However, I argue that highlighting a lack of evidence can also serve the purpose of demonstrating an actor’s hidden wishes or motives in causal politics. In this case, members of the ‘Supporting Increased Access to Information’ storyline both supported SB 19-181 and implicitly assigned blame to the oil and gas industry for harm caused by oil and gas infrastructure by focusing on the secretive behavior of the industry. The findings of this study warrant future research regarding the effectiveness of the causal stories outlined in Stone’s work and in my own.

6. Conclusion:

The controversy surrounding hydraulic fracturing and the implementation of SB 19-181 in Colorado provide a unique opportunity to analyze the process of discourse dynamics and its potential effects on the rulemaking process. This study identifies the key discourse coalitions in rulemaking debates, as well as the storylines, sources of evidence, and causal stories utilized by stakeholder groups. The findings here align with Hajer (1995) and Baka et al. (2019), who found a hierarchy that privileges government knowledge above other sources of knowledge in rulemaking debates. These findings are in contrast

to Lave's (2015) findings of increased 'horizontal' of environmental knowledge production and utilization. This study also adds to Stone's (1989) causal story framework by identifying a novel causal story that shifts blame for a problem on to another actor by arguing that a lack of evidence or information demonstrates intentional harm and secret motives. The findings of this study warrant future research regarding the effectiveness of varying sources of evidence in rulemaking settings, the shifting legitimacy of evidence sources and storylines, and the factors contributing to stakeholder unification. The implementation of SB 19-181 marks a dramatic policy change to the regulatory environment of oil and gas operations in Colorado. As the impacts of fossil fuels and climate change become more widespread and prominent, legislation like SB 19-181 may act as a forced transition towards cleaner energy production, environmental regulation, and more localized decision making through policy regulations.

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