

SUBURBAN UNCONVENTIONAL ENERGY DEVELOPMENT:
AN EVALUATION OF KEY CHARACTERISTICS BEHIND
PUBLIC TRUST AND RISK PERCEPTIONS

by

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ABSTRACT

The dueling expansions of both hydraulic fracturing and population in the Colorado Front Range have sparked intense political conflict as these two land uses encroach on one another. State preeminence over oil and gas (OG) development, combined with an uncertain policy context, has led many local governments to pursue Memorandums of Understanding (MOUs) as a way of gaining a seat at the table without risking political stalemates with the state. Theoretically, MOUs empower local governments to negotiate Best Management Practices directly with the operators in exchange for a stable regulatory landscape. This analysis builds on prior research evaluating a similar conflict in Erie, Colorado by tracking how the “interested public” – citizens who participated in public hearings on OG – changed their perceptions over time in two communities that experienced an OG conflict while negotiating an MOU. Our data includes observations of the citizen comment portion of local government meetings in Commerce City and Wadley Farms. These comment periods were transcribed and then coded in order to quantify: the number of times major topics of concern were discussed, the instances in which criticism and praise of other stakeholders were expressed, and the stakeholders’ overall stance regarding OG development. These case studies are then used to identify the key mechanisms influencing public perceptions of risk and trust in the industry, state government, and local government.

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CHAPTER 1

INTRODUCTION

Hydraulic fracturing, or ‘fracking,’ has been employed by the oil and gas (OG) industry for decades in order to increase the productivity of wells by opening fissures through which large volumes of deposits can move freely. A comparatively new innovation in OG, horizontal drilling, also works to improve the efficiency of drilling operations by allowing operators to first drill vertically, and then horizontally in order to access large areas surrounding wellsites. This consolidates access to large areas by allowing operators to use fewer wells. While both of these technologies have increased the productivity of OG operations the combination of horizontal drilling and hydraulic fracturing in recent times has enabled OG development in shale gas deposits which were previously thought unreachable¹. These shale gas deposits are commonly referred to as unconventional energy resources because they require stimulation in order to catalyze production of the formation. The coupling of these two technologies has caused a recent boom in unconventional oil and gas (UOG) development, particularly in Colorado which has a long history with the extractive industries. During this time, Colorado has also experienced a boom in population, which has increased by 10% between 2010 and 2016 (US Census Bureau, 2016). These coinciding booms in UOG and population have sparked local conflicts, as new OG wells move closer to many Colorado communities (Kroepsch, 2016).

In response, many communities have sought more control over OG operations at the local level. State preeminence over UOG development, combined with an uncertain policy context has led many communities to pursue supraregulatory agreements such as Memorandums of Understanding (MOUs) in an effort to ease these tensions (Zilliox & Smith, Supraregulatory agreements, 2017). These MOUs empower local governments to negotiate Best Management

¹While citizens in the debate often used the word “fracking” to refer to the new practices of joining hydraulic fracturing with horizontal drilling, our research has indicated that concerns over fracking expand beyond concern over this process alone and commonly include concerns over all stages of OG development. Therefore, in this paper we utilize the term unconventional oil and gas (UOG) development for clarity.

Practices (BMPs) directly with the operators; avoiding political stalemates with the state. As defined by Zilliox, “MOUs are voluntary agreements between operations and local governments. These agreements are used to meet communities’ concerns over local development by holding operators to higher best management practice standards in exchange for expedited permitting process at the local level” (Zilliox, 2016). According to Manaster, in their ideal form “MOUs advance procedural justice, which refers to the fairness of the decision-making process itself, rather than the outcomes: the opportunity for relevant stakeholders to participate, to have access to information, and to feel respected by decision-makers who are viewed to be impartial” (Manaster, 1995).

A review of the literature on the recent UOG boom uncovers discussions about OG development at the national scale, supported by site-specific case studies. It is important, however, to recognize that the conflicts in Colorado, which lies in the Western United States, may differ from those in the Eastern United States due to varying regional characteristics. In her book *Something in the Soil*, Limerick defines the Western region of the United States as having ten key characteristics which set it apart from the rest of the country (Limerick, 2000). Four of these characteristics are vital for understanding the conflict over UOG development in Colorado. First, the Western United States is prone to aridity (Limerick, 2000). This feature has not only had significant implications for development in the region, but also on how its citizens view, and the government regulates, water. In the context of UOG energy, which uses a significant amount of water, the region's aridity poses many challenges and is important for understanding local perceptions of risk. The second important feature of the West is that it contains the bulk of the land still under federal control (Limerick, 2000). This places management of region's UOG development in the hands of a variety of stakeholders, both public and private. Third, the West has a long history with boom and bust economies associated with the extractive industries, including OG. Fourth is the region's involvement with the “commercial and intentional mythologizing of the West as a romantic escape and adventure” (Limerick, 2000). The last two features present dueling narratives for the Western United States with direct significance for how residents understand UOG activity. Their significance for this conflict is most easily seen when viewed side by side.

These dueling narratives splinter perspectives of the region as a place to be kept wild and a resource to be used (West, 2014). They are not only stories but also forces that drive development of the land. The influences of these narratives can be seen both in the region's historic and present economy. The interests of some of the west's leading industries such as agriculture, timber, and natural resource extraction are in many cases almost diametrically opposed to some of the West's other top industries, such as tourism, which depend on the region's wilderness areas. This struggle is particularly evident when examined in terms of land use policies, water rights, and current & legacy environmental issues. These competing narratives also lead to conflicting expectations. Some in the West expect pristine, remote scenery that is far removed from civilization and industrialization. Others expect access to the region's natural resources for more lucrative endeavors. West suggests that, "The region's history consequently is not only about people fighting over who controls resources and whose institutions and values should be honored, but also about conflicting narratives over what the West means and how it should be treated" (West, 2014). We argue that these are also key characteristics of the Colorado we see today, and therefore are significant components of the conflict over UOG development in this region.

Dueling perspectives of the risks and benefits associated with UOG development further complicate this conflict. Some authors have sought to evaluate the risks and benefits of UOG in order to guide policy and public perceptions. Generally, the benefits of this technology are believed to be increased employment, economic growth, energy independence, and decreased carbon dioxide emissions (Wang et. all 2014; Jacquet, 2014; Mayer, 2016; Vengosh et. all, 2014). The significance of these benefits, and their distribution through social classes remains a disputed issue. Some authors have argued that these benefits are short term and followed by long-term economic losses (Jacquet, 2014). Job creation has been one example of how these possible benefits are both uncertain and unevenly distributed. Many studies argue that hydraulic fracturing has significant economic implications for the United States (Vengosh et. all, 2014). One study which evaluates the effects of this natural gas boom on employment suggests that every "million dollars in gas production created 2.35 jobs in the county of production, which led to an annualized increase in employment that was 1.5 percent of the pre-boom level for the average gas boom county" (Weber, 2012). This study also indicated that a number of economic

models might have overestimated the number of jobs created by gas production in the Marcellus shale formation (Weber, 2012).

Literature on the risks associated with UOG is commonly separated into two categories: environmental and social risk. The literature on environmental risks presents four categories of risk associated with this technology which include (Vengosh et. all, 2014):

1. Shallow aquifers contaminated by fugitive gas and water contaminated from hydraulic fracturing fluids or formation waters
2. Surface water contamination from spills
3. Accumulation of toxic and radioactive elements in soil and river sediments
4. Overuse of water resources and possible competition with other uses in water-limited environments.

There is however, a significant amount of uncertainty surrounding the likelihood, frequency, and broader impacts of these environmental risks (Vengosh, Jackson, Warner, Darrah, & Kohndash, 2014). The social risks of hydraulic fracturing have also been separated into four key risk categories which include: rapid industrialization, uneven distribution of costs and benefits, community conflicts, and social psychological stress & disruption (Jacquet, 2014). A comparative review of both the physical and social literature on hydraulic fracturing reveals significant discrepancies between risk perceptions of UOG development both with regard to the public and scientists (Lave & Lutz, 2014). In this context, the conflict over UOG development in Colorado can be seen as a dispute over values, personal identities, and attachments to place.

An initial study by Zilliox and Smith evaluated the community of Erie, Colorado, where two MOU's were created in response to conflicts over UOG development within the community. In line with the rest of Colorado, Erie has experienced rapid growth for over twenty years. "From 2000 to 2010 the town more than tripled from about 6000 to about 20,000 residents" (Zilliox & Smith, Memorandums of understanding, 2017). In her thesis, *Regulating Relationships: Memorandums of Understanding and Unconventional Energy Development in Suburban Colorado*, Zilliox sought to understand the key factors that led to the Erie MOUs successes in reducing tensions between the Erie community and its government. She concluded that while trust in government improved from the time of the first MOU to the time when the second was

established, the MOU alone was not sufficient in establishing the procedural justice to improve trust in the government (Zilliox & Smith, Memorandums of understanding, 2017). Alternatively, it found that, “public trust and a sense of procedural justice rested instead on the implementation of those agreements by a local governing board committed to transparency and public engagement” (Zilliox & Smith, Memorandums of understanding, 2017).

The present thesis builds on prior research by evaluating how public perceptions of the industry, state government, and local government changed in two additional communities – Commerce City and Wadley Farms - which also experienced local conflict surrounding proximal OG development. These case studies are then used to explore key factors influencing both public perceptions of risks and trust of the industry, state government, and local government. The two case studies are described in depth in chapter three (pages 33-36).

The methods for this analysis include a comparative demographic analysis, as well as observation and coding of public commentary at local government meetings which took place during the conflicts in both Commerce City and Wadley Farms. The demographic analysis, discussed in depth in chapter two, pages 17-19, and chapter three, pages 36-37, was based on 2010 census data and focuses on key socio-economic factors including population, growth, median household income, household type, poverty rate, education, race and ethnicity, and occupational profiles. The coding methods for this analysis build on the methods employed by Zilliox (Zilliox & Smith, 2017). A detailed methodology for the coding of citizen comment can be found in chapter two pages 9-12.

This thesis is separated into four distinct chapters. The current chapter serves as an anchor for chapters two and three, providing context for the major research questions discussed in the thesis. Chapter two focuses more closely on the broader factors leading to trust and risk perceptions in the two case studies. Chapter three focuses on how trust perceptions of industry, the state, and local government changed over the course of debate. Finally, the concluding chapter, chapter four, provides a discussion summarizing key results from this thesis, its possible limitations, and future research.

CHAPTER 2

TRUST AND RISK PERCEPTIONS

While hydraulic fracturing has been in practice in the oil and gas (OG) industry since the 1940s, approximately one-third of all hydraulic fracturing operations took place between 2000 and 2014 (EPA). The recent combination of hydraulic fracturing and horizontal drilling has enabled access to unconventional oil and gas (UOG) resources once considered uneconomical due to their high cost and low return on investment². In comparison to conventional resources, UOG formations are effectively continuous, and their development prompted a significant shift in the geography of US energy production (Lave & Lutz, 2014). This UOG boom, in conjunction with major population expansion, has brought development into close proximity with many suburban neighborhoods, stimulated intense public controversy and political upheaval along the Colorado Front Range, including the Denver metro (Kroepsch, 2016; Zilliox, 2016; Zilliox & Smith, 2017; Zilliox & Smith, 2017; Mayer, 2016; Denning, Marlin, & Smith, 2018).

Dueling perspectives surrounding the possible risks and benefits associated with UOG development further complicate this conflict. Existing literature highlights a number of possible risks including: contamination of shallow aquifers, surface water, soil and river sediments, overuse of water resources, rapid industrialization, uneven distribution of costs and benefits, community conflicts, and social psychological stress & disruption (Vengosh et. all, 2014) (Jacquet, 2014). The potential societal benefits associated with UOG are thought to be increased employment, economic growth, energy independence, and decreased carbon dioxide emissions (Wang et. all 2014; Jacquet, 2014; Mayer, 2016; Vengosh et. all, 2014). The significance, likelihood, and frequency of these risks and benefits, as well as their distribution through differently privileged social groups such as classes however, remains a disputed issue. (Vengosh, Jackson, Warner, Darrah, & Kohndash, A Critical Review of the Risks to Water Resoureces

²While citizens in the debate often used the word “fracking” to refer to the new practices of joining hydraulic fracturing with horizontal drilling, our research has indicated that concerns over fracking expand beyond concern over this process alone and commonly include concerns over all stages of OG development. Therefore, in this paper we utilize the term unconventional oil and gas (UOG) development for clarity.

from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States, 2014).

A comparative review of social and physical science literature surrounding UOG reveals significant discrepancies between risk perceptions of UOG with regard to both the public and scientists (Lave & Lutz, 2014). Greenburg, a researcher focused on environment policy and risk analysis, found that uncertainty over the associated risks often causes the public to think that experts are not forthcoming (Greenburg, 2014). Decreased trust in “governing bodies and officials” (Jacquet J. , 2014) and the OG industry (Mayer, 2016; Brasier, McLaughlin, Rhubart, & Jacquet, 2013) strongly correlates with increased risk perceptions and local conflict. Prior experience with the extractive industries has been shown to be another key factor influencing public risk and benefit perceptions (Mayer, 2016; Brasier, McLaughlin, Rhubart, & Jacquet, 2013; Zilliox, 2016) Studies in Pennsylvania and Louisiana show that both real and perceived economic dependency correlated with more favorable public opinions of shale gas (Jacquet & Stedman, 2012), inflated benefit perceptions, and decreased risk perceptions (Ladd A. E., 2014; Malin, 2014). In Colorado, however, risk and benefit perceptions of fracking were found to be independent of economic dependency on industry (Mayer, 2016). Findings from Braiser’s study suggested that agencies interested in constructive conversation with the public about these risks need to develop participatory processes in which mutual respect and trust can build over time (Brasier, McLaughlin, Rhubart, & Jacquet, 2013).

This study builds on research surrounding public perceptions of risk by focusing on the conflict which erupted in two communities situated along the Colorado Front Range just north of Denver (Figure 2.1). The first conflict, which took place in Commerce City, emerged in November 2011 after a city council member noticed activity at a well in close proximity to Commerce City’s northern Reunion neighborhood. The second conflict occurred within the Wadley Farms neighborhood in the years 2015 and 2016 after Synergy Resources Inc. (Synergy) proposed to build a large multi-pad facility near residents. Our analysis of public comments during these conflicts suggests two key findings that add new perspectives to the existing literature. First, historical ties to the extractive industries did not predict risk perceptions, and second, concerns about distributive justice were more significant than perceived economic

benefit of UOG activity. These findings suggest new pathways for more constructive engagement among industry, state and local government, and citizens.

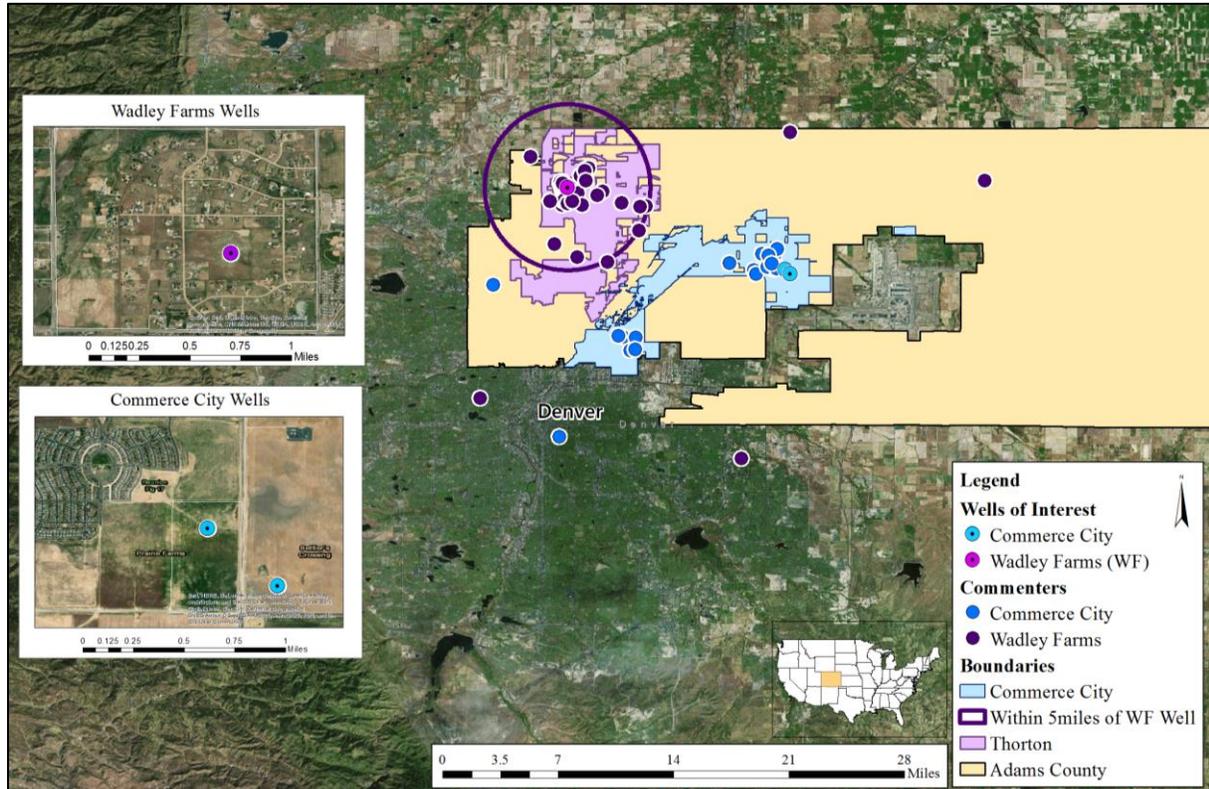


Figure 2.1 Map of Commerce City and Erie Colorado. Figure displays case study areas, commenter addresses, and wells of interest in relation to Adams County and Denver. Only wells central to the controversy were highlighted.

2.1 Methods

The methodology for this study includes the development of a codebook (used for coding of public comment at local government meetings) and a background on the statistical analysis utilized.

2.1.1 Coding of Public Comment at Local Government Meetings

Data for this study draws from observations of the citizen comment portion of City Council meetings in Commerce City and the Board of County Commissioner meetings in Adams County. These comment periods were transcribed and then coded in order to quantify the number of times major topics of concern were discussed, the instances in which criticism and praise of

other stakeholders were expressed, and the citizens' overall stance regarding the development project.

This study utilizes and builds on the coding methods employed by Zilliox in order to evaluate transcript data collected from local government meetings at both sites (Zilliox & Smith, 2017). Coding is a method used to categorize qualitative data according to a common rubric, in this case a codebook. Categorizing data through the use of codebooks is a data analysis methodology commonly used to evaluate survey and interview data. Codes in this context represent the labels used to assign units of meaning to the data (DeCuir-Gunby, Marshall, & McCulloch, 2010). In this study, we did not weight the codes for strength of an individual's opinion. Rather, we used the frequency of a code's use over time as a proxy for the strength of the broader public perceptions associated with the themes of our study.³ To protect against individual's extended comments skewing the frequency of coded data, codes were only assigned once per speaker, even if they brought up a topic multiple times.

The codebook in this analysis was originally developed by Zilliox and is comprised of three separate code groups: citizen concerns, trust perceptions, and public opinion of the development project at issue. The final codebook and criteria for each code can be found in Appendix A.1. Prior to analyzing the data, theory-driven codes were developed based on topics of concern identified through a review of scholarly literature and local news. Sample codes in the citizen concern category include proximity, mineral rights, and climate change. Community-specific codes were then added to the original codebook during observation of local government meetings in Commerce City and Wadley Farms to account for the concerns of these communities that were not included in the original codebook, such as the Rocky Mountain Arsenal, process, and economic consequences. Coding reliability between the first and second authors was established through co-creation of the codebook, cross checking the coding sheet, and jointly analyzing the quotes leading to each code.

³ Our team recognizes that the sample used in this study represents the 'interested' public that shows up to meetings, and not necessarily the public or community as a whole.

In order to faithfully represent *local* citizens' perspectives on development, our team chose to only include commenters who were local residents and who were not directly affiliated with the UOG industry, governing bodies, or activist groups. Proximity to the well and community was also considered in both cases.⁴ In order to only use data representative of the Commerce City residents, this study excluded commenters who resided outside of the Commerce City city-boundary during the conflict (Figure 2.1). Identifying "local citizens" was more challenging in the Wadley Farms case study. While this conflict was centered around the wells within Wadley farms, discussion reached the county level, meaning that all commenters residing within Adams County could be considered local residents. Due to the sparse and uneven spread of local commenters across the County, our team chose to exclude residents outside of a five mile radius from the proposed well site (Figure 2.1) in order to focus on those most directly impacted by the proposed site. In total, our analysis incorporated forty-seven commenters from Commerce City and sixty-nine commenters from Wadley Farms. In this analysis we will refer to this group of citizens, who chose make this issue their own and actively participate in public political processes, as the "interested public". We offer a more in-depth treatment of this term on pages 30-31. We acknowledge that this interested public does not represent the broader public as a whole, but plays a special role in conflicts through direct interaction with government and industry representatives.

2.1.3 Statistical Analysis

This study builds on the previous efforts to obtain a statistical representation of similar coding data (Zilliox & Smith, Memorandums of understanding and public trust in local government for Colorado's unconventional energy industry, 2017). In this case, statistical significance of the coding data was established through hypothesis testing for the difference between two proportions. Those individuals who showed up at the meeting were assumed to represent a random sample of the broader interested public. While we assumed a random sample for analysis purposes, we realize that in practice these commenters may not represent a truly

⁴ Given that these meetings are attended by a wide variety of people, who are not necessarily residents, comments were filtered based on the address given prior to speaking. Only those matching our designated constraints were included in this analysis.

random group. Attributes of the meetings themselves may have arbitrarily filtered those in attendance through aspects such as the time of the meetings, the fact that they were held during weekdays, the location, and the way in which the meetings were announced to the public. The interested public may have been further filtered due to personal constraints such as the possible lack of transportation, discomfort with attending or speaking at meetings, or perceived disenfranchisement.

The null hypothesis in this analysis assumed no difference between the proportions of concern expressed between the two interested communities while the alternative hypotheses assumed that there was. Therefore, rejecting the null hypothesis allows us to conclude that there was a statistically significant difference between the two interested communities in each category. Ninety and ninety-five percent confidence limits were used for rejecting the null hypothesis. P-values were then determined using the cumulative distribution function.

2.2 Results

2.2.1 Trust perceptions

A comparison of the interested public's trust perceptions of industry, state government, and local government is shown in Figure 2.2. Critique of industry, mistrust of industry, and mistrust of the state were observed as the most frequently expressed trust perceptions in Wadley farms, while mistrust of industry, praise of local government, and mistrust of the state were the most frequently expressed trust perceptions in Commerce City. There were no expressions of praise in industry or the state government in either community and expressions of mistrust in local government were infrequent at less than four percent in both communities.

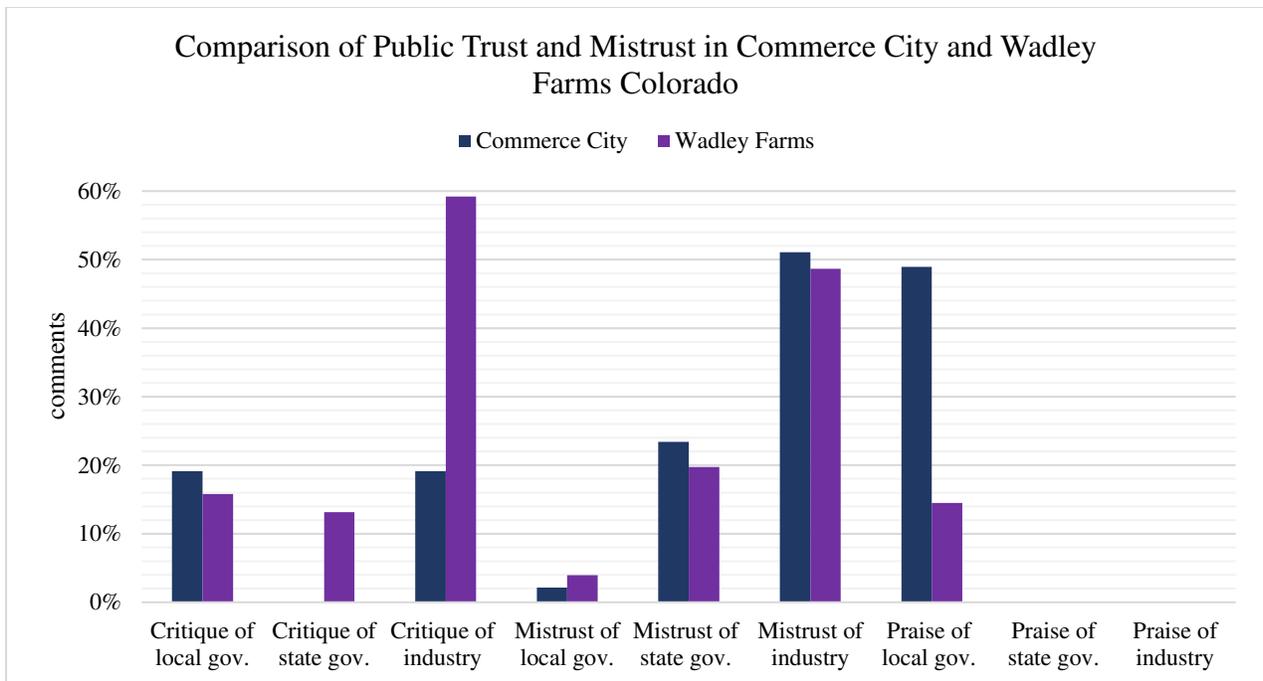


Figure 2.2 Trust perceptions in Commerce City and Wadley Farms, Colorado. Figure displays cumulative coding data for the duration of both the Commerce City and Wadley Farms debates.

Table 2.1 displays p-values for each category. Categories in which the null hypothesis was rejected represent areas where there was a statistically significant difference between the two sets of data. Therefore, critique of local government; mistrust of local government, state government, and industry; praise of the state government; and praise of industry are statistically similar. It should be noted that while these last two categories – praise of the state and praise of industry – are statistically similar, they are also virtually non-existent in both areas. These are summarized in Figure 2.3, where the absolute difference between the two communities varies less than four percent in each category.

Table 2.1 Difference in frequency of trust perceptions discussed in Commerce City and Wadley Farms.

	<i>p-value</i>	<i>A = 0.1</i>	<i>A = 0.05</i>
<i>Critique of local gov.</i>	0.630	do not reject	do not reject
<i>Critique of state gov.</i>	0.009	reject	reject
<i>Critique of industry</i>	0.000	reject	reject
<i>Mistrust of local gov.</i>	0.580	do not reject	do not reject
<i>Mistrust of state gov.</i>	0.628	do not reject	do not reject
<i>Mistrust of industry</i>	0.798	do not reject	do not reject
<i>Praise of local gov.</i>	0.000	reject	reject
<i>Praise of state gov.</i>	1.000	do not reject	do not reject
<i>Praise of industry</i>	1.000	do not reject	do not reject

On the other hand, critique of industry, critique of the state, and praise of the local government are statistically different, with Wadley Farms citizens expressing more critique of the state and industry than Commerce City. The interested public in Commerce City commenters expressed more praise of local government.

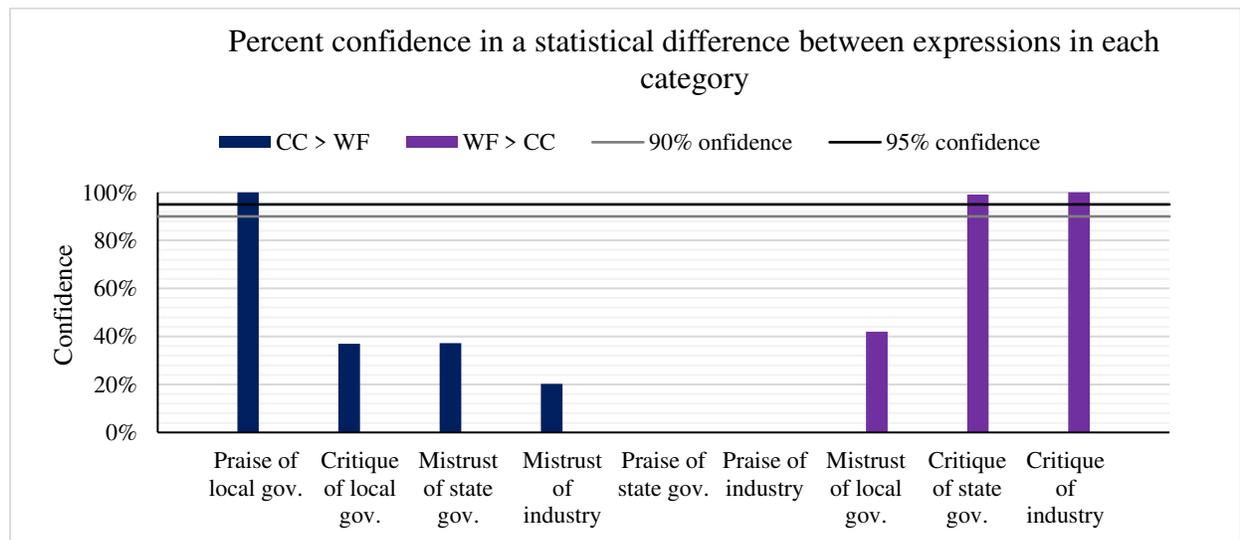


Figure 2.3 Percent confidence in rejecting the null hypothesis that the two communities expressed equal Trust perceptions in a given category. Figure displays a 95 percent confidence level, a 90 percent confidence level, and the percent confidence in rejecting the null hypothesis. Blue confidence columns represent those categories in which Commerce City (CC) displayed a higher proportion of comments than Wadley Farms. Purple columns highlight those categories in which Wadley Farms (WF) exhibited a larger proportion of comments in the respective category.

2.2.2 Risk perceptions

Figure 2.4 compares the topics of concern discussed in Commerce City and Wadley Farms. The top three concerns in both communities were process, human health and safety, and proximity. Topics such as earthquakes, surface rights, climate change, and economic benefits generated relatively low concern.

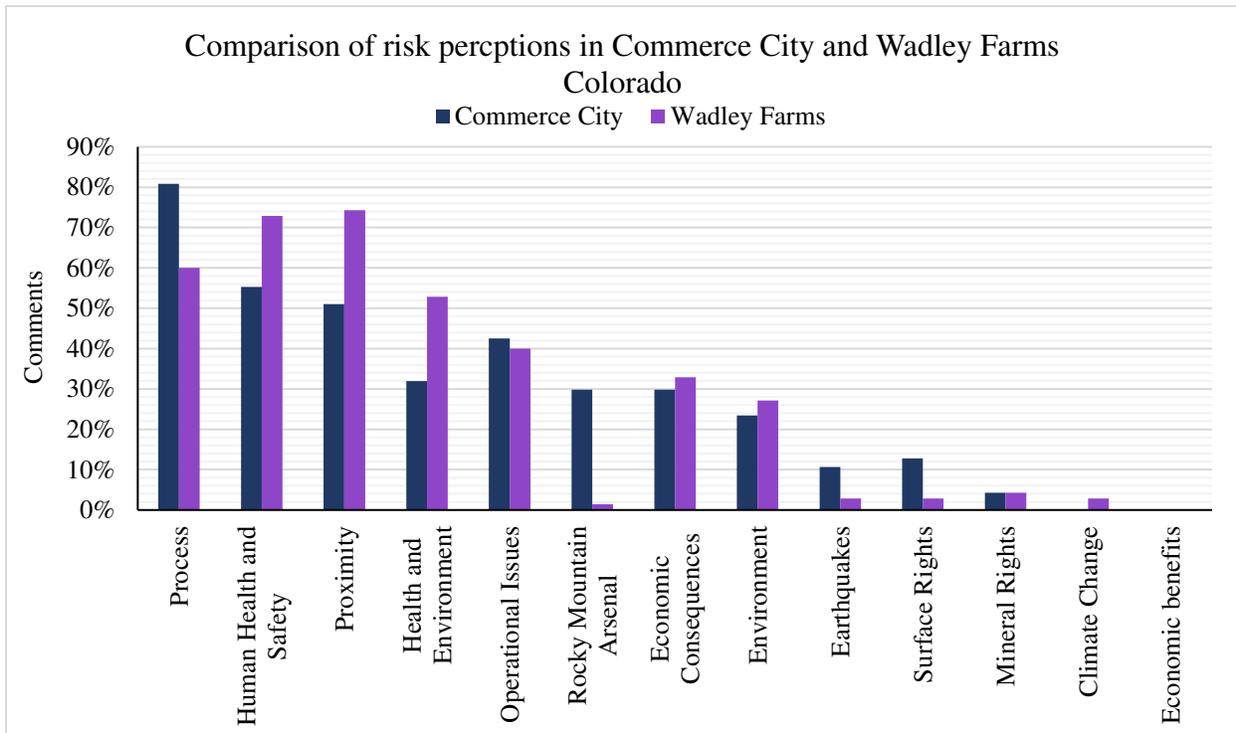


Figure 2.4 Risk perceptions in Commerce City and Wadley Farms, Colorado. Figure displays cumulative coding data for the duration of both the Commerce City and Wadley Farms debates.

Categories in which the null hypothesis rejected using the ninety percent confidence level include process, the Rocky Mountain Arsenal (RMA), and surface rights (Table 2.2). Earthquakes and proximity were also rejected when lowering the confidence level to ninety percent. Therefore, the two interested communities were shown to possess a statistically significant difference in their levels of concern in these categories.

Table 2.2 Difference in frequency of topics discussed in Commerce City and Wadley Farms.

	<i>p</i> -value	$\alpha = 0.1$	$\alpha = 0.05$
<i>Process</i>	0.004	reject	reject
<i>Proximity</i>	0.054	reject	do not reject
<i>Operational Issues</i>	0.528	do not reject	do not reject
<i>Environment</i>	0.841	do not reject	do not reject
<i>Human health and safety</i>	0.189	do not reject	do not reject
<i>Rocky Mountain Arsenal</i>	0.000	reject	reject
<i>Economic consequences</i>	0.955	do not reject	do not reject
<i>Climate change</i>	0.262	do not reject	do not reject
<i>Earthquakes</i>	0.063	reject	do not reject
<i>Surface Rights</i>	0.027	reject	reject
<i>Mineral Rights</i>	0.933	do not reject	do not reject

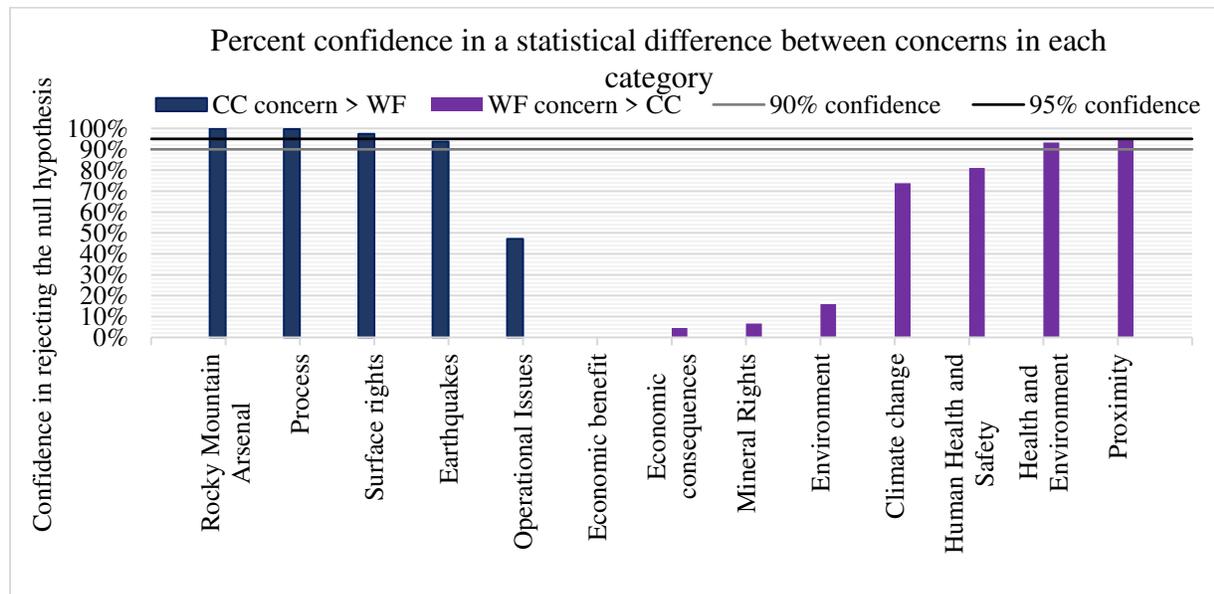


Figure 2.5 Percent confidence in rejecting the null hypothesis that the two communities expressed equal concern in a given category. Figure displays a 95% confidence level, a 90% confidence level, and the percent confidence in rejecting the null hypothesis. Blue confidence columns represent those categories in which Commerce City (CC) displayed a higher proportion of comments than Wadley Farms. Purple columns highlight those categories in which Wadley Farms (WF) exhibited a larger proportion of comments in the concern category.

The interested public’s concern was statistically higher in Commerce City than Wadley Farms with respect to the RMA, process, surface rights, and earthquakes to a confidence level of 99.9 percent, 99.6 percent, 97.3 percent, and 93.7 percent respectively (Figure 2.5). The interested public’s concern was statistically higher in Wadley Farms regarding proximity and health and the environment to a confidence level of 94.5 percent and 93.2 percent respectively.

Both communities expressed relatively similar levels of concern in the areas of human health and safety, operational issues, economic consequences, environment, and mineral rights.

2.3 Demographic influence on risk perceptions

Prior research evaluating trust perceptions in Erie Colorado hypothesized that the community’s education and economic privilege may have influenced the way in which citizens responded to UOG in proximity to their communities (Zilliox & Smith, 2017) (Zilliox & Smith, 2017). Socioeconomic differences between the two communities in this analysis are not, however, seen to have a significant influence on how they responded to nearby UOG.

In order to gauge how socio economics may have influenced trust and risk perceptions, our team created demographic profiles of the two communities using census data. This analysis relied on demographic data from the Thornton area as a proxy for Wadley Farms citizen demographics due to the close overlap of this area with the study area (Figure 2.1). Table 2.3 highlights the socio-economic differences between these communities, in comparison to those of Colorado, for the years in which the respective conflicts occurred.

Table 2.3 Occupational profile comparison of Commerce City, Wadley Farms, and Colorado in (US Census Bureau n.d.).

	Commerce City (2011)	Colorado (2011)	Thornton(2015)	Colorado(2015)
Population	43,539	4,966,061	127,688	5,278,906
Mean household income (\$)	68,090	77,149	80,125	81,356
People with income under poverty level for last 12 months (%)	17.8	12.5	8.9	8.50
High school diploma or higher (%)	75.9	91.7	87.5	90.70
Bachelor’s degree or higher (%)	19.8	38.9	27.0	38.10
Management, business, science, and arts occupations (%)	26.1	36.9	34	40.40
Sales and office occupations (%)	23.5	24.8	25.1	23.80
Service occupations (%)	19.3	16.6	17.7	17.50
Natural resources, construction, and maintenance occupations (%)	16.9	10.2	11.1	9.40
Production, transportation, and material moving occupations (%)	14.1	9.1	12.1	8.90

This analysis exposes a \$12,000 gap between the median income in Commerce City (\$68,090) and Thornton (\$80,125) at the onset of conflict in each location. This gap can likely be attributed to dissimilarities in the communities' occupational profiles, level of education, and rates of poverty. Occupations in the management, business, science, art, sales and office sectors tended to center in Thornton as opposed to Commerce City, while occupations in the natural resources, construction, maintenance, production, transportation, and material moving sectors tended to center in Commerce City. As this trend might suggest, the percentage of residents possessing bachelor's degrees or higher was greater in Thornton than in Commerce City. The same was true of residents possessing a high school diploma or higher. Finally, the percentage of residents living under the poverty level was higher in Commerce City than in Thornton. The occupation, education, and poverty rates suggest that Thornton could be characterized in general terms as being slightly more affluent than Commerce City, with Thornton consisting of a higher percentage of "white collar" jobs than Commerce City, and Commerce City consisting of a higher percentage "blue collar" jobs than Thornton.

Disparities between the demographics in both communities were however not seen to have a perceivable difference on how these two communities responded to UOG in their respective areas. The disconnect between socio-economics and risk perceptions may be due in part to the interested public not inherently representing the public at large in these communities, but a particular subset of it. Therefore, while socio-economics may influence risk perceptions of the public as a whole, this may not register in the relatively small segment of the population that participated in citizen comments. It may also be true that socio-economics is overshadowed by other community characteristics that play a more dominant role in shaping public perceptions of risk. This conclusion seems to corroborate Mayer's findings that many demographic variables (sex, age, income, and education) seemed to be a relatively poor predictor of risk perception in Colorado (Mayer, 2016).

2.4 Historical ties to industry do not predict diminished risk perception

The extent to which citizens trust industry has been shown to play a major role in shaping their perceptions of the risks and benefits associated with UOG (Mayer, 2016). Mayer found that "individuals who trust the industry perceive less of every type of risk" and goes on to say that the source of this trust is likely rooted in "the historical economic and cultural importance of

extractive industries in Colorado” (2016: 507). This may hold under certain circumstances, namely when prior experience with the extractive industries has been positive. However, our analysis shows that a community’s history with the extractive industries can also lead to mistrust and heightened risk perceptions in certain circumstances. This was the case in Wadley Farms, where prior negative experience with industry led to heightened risk perceptions and mistrust of industry (Denning, Marlin, & Smith, 2018). The Commerce City case study extends this discussion beyond history with the extractive industries to include history with heavy industry in general, given the community’s prior experience with the RMA. While Mayer’s study focused specifically on prior experience with the extractive industry, our analysis below shows that Commerce City residents based risk perceptions on their non-extractive industrial experience with the RMA. Analyzing how these risk perceptions in Wadley Farms and Commerce City were shaped prior to the debates on UOG requires first understanding their respective distinct histories with industrial activity.

Commerce City is well known for its longstanding industrial activities, which effectively divide the town’s historic southern community from the newer northern neighborhoods. The community is known for being home to Suncor Refinery, the largest refinery in the Rocky Mountain region. Suncor began operations in the 1970s and still plays a major economic role there. Commerce City is also home to the Rocky Mountain Arsenal Wildlife Refuge (RMA), a chemical weapons manufacturing site that was remediated to become one of the largest urban wildlife refuges in the US (U.S. Fish & Wildlife Service, 2015). While RMA was operational from 1942 to 1982, manufacturing and waste disposal practices resulted in “extensive soil, surface water, sediment, groundwater and structures contamination, damage to trees and vegetation, and death to wildlife” (Colorado Department of Public Health & Environment , 2018). In the 1960s liquid waste disposal methods similar to those used by the OG industry today were employed in an attempt to prevent chemical contaminant migration. These techniques were ultimately unsuccessful and led to a series of earthquakes (Evans, 1966). The RMA was placed on the National Priorities List of Superfund sites in July 1987. The resulting site cleanup was led by the Army, Shell Oil Co., and the U.S. Fish and Wildlife Service. The cleanup prompted a dispute over state versus federal authority over the site foreshadowing the current debate over UOG. This conflict eventually led to a Supreme Court ruling recognizing the state's

authority to enforce state environmental law on federal land. Along with the conflict over regulatory authority, the RMA cleanup was also subject to intense local debate within the Commerce City community (Interstate Technology Regulatory Council, 2017). The contaminated soils cleanup phase of the process was completed in 2010, only one year prior to the conflict examined in our case study.

In contrast to Commerce City, Wadley Farms is not known for being an industrial area, though it has also had experience with the extractive industry. Since 1993, multiple OG wells had been drilled either in or around Wadley Farms (COGCC, 2018). Most operations proceeded without any major issues, and aside from an incident in 2013, the COGCC only received complaints about noise, lighting, and road conditions. During this time, Bayswater Exploration and Production performed production testing at a well site approximately 1,500 feet from Wadley Farms (Ernst v. EnCana Corporation, 1013). A resident, Christina Herz, noticed shortly after the production testing that her water turned orange, and believed the contamination came from Bayswater's activities after changing her water heater and pipes to no avail. Although the well had not been fracked for several years prior to 2013 according to Bayswater vice president Don Barbula, the COGCC responded by testing the water (Ernst v. EnCana Corporation, 1013). The COGCC concluded that there was no evidence connecting the OG operations with the condition of Ms. Herz's water (COGCC, 2013). Still, this event triggered many other Wadley Farms residents to request water testing, eventually leaving the community with a negative connotation of OG activities (COGCC, 2013).

The above history shows that in the case of Wadley Farms, positive trust perceptions of industry are likely predicated not simply on prior experience with the extractive industry, but also on the nature of these experiences. The relationship between one citizen's prior experience with extraction in Wadley Farms and their resulting heightened mistrust of the extractive industry is highlighted by the following comments:

I'd like to make at least one or two comments about previous activities of the oil companies in our neighborhood. The noise pollution during their activity is horrendous even though the properties are widely spread, it can be heard throughout, that kind of work can be heard throughout the entire subdivision while that activity is going on. Secondly, these roads are bus stops for all the children in the neighborhood and the amount of activity that is going to occur on those roads

which you are currently trying to upgrade, which will be immediately degraded once this activity begins. Probably at your cost, and our cost, and not the oil company's. It seems to be inappropriate for our community (Wadley Farms resident #1, 8 September 2015).

Another Wadley Farms resident commented that:

When Bayswater started their fracking on the Wadley Farm's 35 acres that we're talking about, my husband and I were sitting at the front window, listening to the ground rolling, watching the steam and the noise coming through the skies. We watched the tankers take out the oil and the very next morning, our water well was contaminated by orange and rust. We turned on our bathtub, our sinks. Everything was flowing red. We immediately called a drilling company to come out and check what was wrong. They had to go in and take out pipes and replace them and it didn't help. Then we called the commissioner's office and they investigated it, but they concluded that they couldn't prove that it was Bayswater that caused the problem. So, what did we do? We had to go and get a Culligan system to clear up the water, but you see, the explosions they do in the ground causes the ground to shift, and we were the people that were impacted by the ground shifting and causing this problem. And ever since then, we've had problems with our well (Wadley Farms resident #2, 8 September 2015)

These quotes show how prior negative experiences with the extractive industry can precipitate concerns over future development, calling into question Mayer's (2016: 750) finding that individuals living in areas with historical experience with the extractive industries "perceive less of every type of risk." Extrapolating these results may suggest that choices made by industry today have the potential to lead to mistrust and heightened risk perceptions for future proposed development projects.

The Commerce City case builds on this finding by showing that trust and risk perceptions can also be influenced by experience with industrial activities not directly related to extraction. The community's history with the RMA significantly influenced residents' perceptions of risk with respect to new UOG development. Some citizens drew specific comparisons between past activity at the RMA and the methods used in UOG. For instance, concern over potential seismic activity was voiced by one citizen, who stated that "the army years ago stopped the injection wells at the arsenal due to earthquakes and there was no solid proof that fracking will not cause further earthquakes in our city on the ground that is already fragile from the prior earthquakes from the injection wells" (Commerce City resident #1, 19th December 2011). Other citizens had more general concerns about the potential for unintended

consequences, such as one who stated, “Knowing the history of the arsenal should tell us that only hindsight is truly 20/20. Perhaps this time it’d be best that we all took a real good look before we leaped this time” (Commerce City resident #2, 28 November 2011) Coding data also supports this conclusion, showing heightened concern over the RMA, operational issues, and earthquakes in Commerce City, in comparison with Wadley Farms (Figure 2.5). This may be an especially important outcome for Colorado in general given the state’s long history with a broad range of industrial development beyond the extractive industries.

2.5 Distributive justice, not economic benefit most significant

Disputes over hydraulic fracturing have been largely framed as debates in which communities weigh the perceived economic opportunities of development against the perceived socio-environmental risks (Ladd A. E., 2014) (Ladd A. E., 2013) (Vengosh, Jackson, Warner, Darrah, & Kohndash, A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States, 2014). The significant lack of balance between public concern over the risks and economic benefits in Figure 2.4 seems to indicate that citizens do not view the debate through this same lens. On the contrary, the imbalance between the perceived risks and economic gains seems to indicate that depicting this debate as a simple balance of risks and benefits may be too simplistic.

Contrary to the current framing of this debate, citizens in both communities did not seem to actively weigh perceived economic gains with perceived risks. While there were rhetorical remarks about understanding the economic benefit more broadly, individuals’ comments indicated that it was not a personal concern for them. In fact, citizens in both communities were highly concerned with the possibility of *negative* economic consequences which might accompany development within their communities (Figure 2.5). This sentiment was highlighted by a resident who stated:

Aside from the obvious health concerns, has anyone taken into account the detrimental effects this could cause on our property values, and the possibility of further expansion in the Northern Range, a place I located my family with faith that that would be a growing and prosperous area, where my family could be raised? Will future residents and businesses want to establish themselves with this kind of activity in their backyard? (Commerce City resident #3, 21 November 2011).

More broadly, citizens were concerned that OG development within their community could have significant ramifications for the communities' economies including declining property values, reduced investment in the area, limited growth, and strain on town resources and amenities. In short, while industry has focused its outreach on the economic benefits of OG activity, and literature assumes that residents view economic impacts associated with OG in a positive light, our research shows that in fact many residents anticipate the economic impacts to be negative.

Concern over distributive justice, in this case the distribution of risks and benefits, may have also led to increased distrust of industry in these communities. This connection is exemplified by one citizen comment that:

The company tonight mentioned everything of what they want, but they never mention what they will give back to our community. They never mentioned how they're gonna leave these properties after there's nothing there. They never clean them up, and they never give back to the communities because they move on. We are here, we elected you. Don't you dare give an inch because they'll take a mile (Commerce City resident # 4, 18 June 2012).

The concern over unfair distribution of benefits and risk is further exemplified by another citizen's appeal to the Adams County Commissioners: "It is not common sense planning, it is not for the common good, as our new neighbor they are forcing us, not asking us, to make a sacrifice that is unparalleled to offer the value and security of our homes and well-being of our families for their own profit" (Wadley Farms resident #3, 4 August 2015). These comments indicate that the framing of these debates as a simple balance of the risks and benefits is too simplistic. Furthermore, our results indicate that *who* benefits from the development projects is an important distinction in the conversation.

These results corroborate other research in Colorado by Mayer who found that "risk and benefit perceptions, at least in the case of fracking, are relatively independent of economic dependency" (Mayer, 2016). He surmised that this decoupling of risk and benefit perceptions from economic opportunity was caused by the lack of public relations efforts to construct an economic identity around the UOG industry in Colorado. Our research indicates that heightened efforts to build an economic case for UOG may not serve to mitigate conflict in these communities.

2.6 Conclusion

Despite the technology's almost eighty year history, the risks and benefits of hydraulic fracturing are still a point of contention, both in the research and public spheres. This chapter compares two communities situated along the Colorado Front Range - Commerce City and Wadley Farms - in order to better understand key factors influencing public risk perceptions surrounding UOG development. Statistically significant differences were found between the two communities with respect to trust perceptions of industry and government: Commerce City displayed more praise of local government, while Wadley Farms showed more critique of state government. Statistically significant differences were also found with respect to risk perceptions specifically around process, the Rocky Mountain Arsenal, and surface rights. These differences did not appear to be rooted in demographic differences between the two communities. Instead, they may have been based on their different historical ties to industry and perceptions surrounding distributive justice.

This analysis builds on prior research evaluating public risk perceptions in a number of areas. First, while some studies suggest that communities with historical experience with industry have decreased risk perceptions, our study found that this is predicated on the type of historical contact. In Wadley Farms negative previous experience with the extractive industry prompted increased risk perceptions among residents. Through evaluation of the Commerce City case we found that industrial activity simply perceived as similar to UOG operations can also shape risk perceptions, and that negative historical experience with such industries may also increase risk perceptions. These results add to prior research which linked historical ties to industry with decreased risk perceptions and increased benefit perceptions (Mayer, 2016) (Brasier, McLaughlin, Rhubar, & Jacquet, 2013), and emphasize the importance of the perceived quality of these interactions. Second, while community reactions to UOG have been framed as simple balances of risks and benefits (Ladd A. E., 2013; Ladd A. E., 2014; Vengosh, Jackson, Warner, Darrah, & Kohndash, A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States, 2014), results from this analysis indicate that the conflicts over UOG in these communities speak to a much larger conversation on how the impacts, both good and bad, are distributed. This result challenges the idea that building an economic case for UOG may serve to mitigate conflict.

Instead, recognizing the roots of present trust and risk perceptions through an evaluation of historical industrial contact, and addressing those concerns through transparent processes based on distributive justice may better serve the purpose of mitigating conflict.

Thus far we have focused on trust and risk perceptions that resulted from the debates in Commerce City and Wadley Farms, and used these end results to perform a statistical analysis. However, future research should address the many underlying relationships between stakeholders including industry, the state, local government, and communities, which influence trust. Understanding these complex relationships would require a pivot away from a focus on end results, and towards the relationships as they evolved over the course of the debates. In order to better understand these relationships, chapter three makes use of a transient study, using trust as a focal point. Chapter three adds to the conclusions of chapter two, and puts forth several key findings by again comparing Commerce City and Wadley Farms. These findings have implications for the use of MOUs, perspectives of trust in government, the magnitude of concerns in the debates, and distributive justice.

CHAPTER 3

TRUST OVER TIME

The combination of hydraulic fracturing and horizontal drilling has provided the oil and gas (OG) industry new ways to access unconventional oil and gas (UOG) resources which were previously left undeveloped due to the high cost of operations and low returns on investment. This newfound access has caused an unparalleled boom in domestic OG production, and transformed the geography of US energy production (Lave & Lutz, 2014). In the state of Colorado, this ongoing boom in UOG development has been met by a second geographic transformation: a massive expansion of residential areas driven by population growth. Over a four year period from 2010 to 2014, the population of Colorado increased by ten percent (US Census Bureau, 2016). These corresponding booms in UOG activity and population, and the resulting competition for land between industry and residents, has led to intense public controversy and political upheaval along the Colorado Front Range, including the Denver metro (Kroepsch, 2016; Zilliox, 2016; Zilliox & Smith, 2017; Zilliox & Smith, 2017; Mayer, 2016; Denning, Marlin, & Smith, 2018).

The conflict over suburban UOG development is further complicated by an uncertain political context, in which state preeminence over OG development is both ill-defined and highly contested. State preemption, in combination with concerns over the effectiveness of the state regulatory agency, has led many communities to seek increased local control over development. While some communities have enacted moratoriums and bans, others have turned to Memorandums of Understanding (MOUs) in order to gain a seat at the table while avoiding political stalemates with the state. MOUs are voluntary agreements in which operators agree to Best Management Practices (BMPs) requested by the community in exchange for an expedited local permitting process (Zilliox, 2016). The Colorado Oil and Gas Conservation Commission (COGCC), the state regulator, and a number of operators have sanctioned the use of MOUs in an effort to mitigate conflict with local governments and the public.

Despite the support for these agreements, MOUs have not been effective at quelling concern over UOG development. One study evaluating MOUs in Erie, an affluent Front Range

suburb, found that citizen trust in government increased over the period of the MOU, but in response to a local government turnover rather than the MOU itself. In contrast, trust in industry actually declined (Zilliox, 2016). This finding is significant because decreased trust in “governing bodies and officials” (Jacquet J. , 2014) and the OG industry (Mayer, 2016) has been shown to strongly correlate with increased perception of risk and local conflict. The relationship between trust and risk perceptions is discussed in more detail in chapter two of this thesis.

Whereas the Erie study examined a single city, this article provides a comparative analysis of two additional communities: Commerce City and Wadley Farms, both located in Adams County, Colorado. This comparative analysis allows us to investigate how trust in OG operators, as well as in government bodies, changed over time in two communities that were both negotiating UOG MOUs as they dealt with an UOG conflict. These communities were characterized by differing demographic profiles, historic ties to industry, and participatory processes. Rather than attempting to gauge trust perceptions from these communities overall, our analysis focuses in particular on what we call the “interested public” that participated in public hearings related to UOG. Despite the differences between the two cases, our analysis indicates that trust in industry and trust in the state government did not improve in either case. Trust in local government did improve in the town with historic ties to industry and a city council that allowed for more meaningful public participation in the MOU negotiation. These results are significant because they give insight into the factors that influence whether public trust perceptions either improves or diminishes over the course of UOG conflicts.

3.1 Methods

This study relies on data from observations of the citizen comment portion of local government meetings in both Commerce City and Adams County (Figure 3.1). Commerce City meetings were held by the Commerce City city-council and Wadley Farms meetings were held by the Adams County Board of County Commissioners. City Council meetings in Commerce City were held in the city’s courthouse on Monday evenings at six o’clock. Meetings for the Wadley Farms debate were held at the Adams County Government Center in Broomfield Colorado at 9:30 am on Tuesdays. Toward the onset of the conflict in both communities, discussion of UOG took place throughout the meetings. As time went on, discussion of UOG was consolidated to specific agenda items in which the local government officials discussed

relevant information and then provided a time for citizen comment. Attendees of these meetings included a wide variety of stakeholders including: local residents, Colorado residents, activist group representatives, industry representatives, and COGCC representatives.

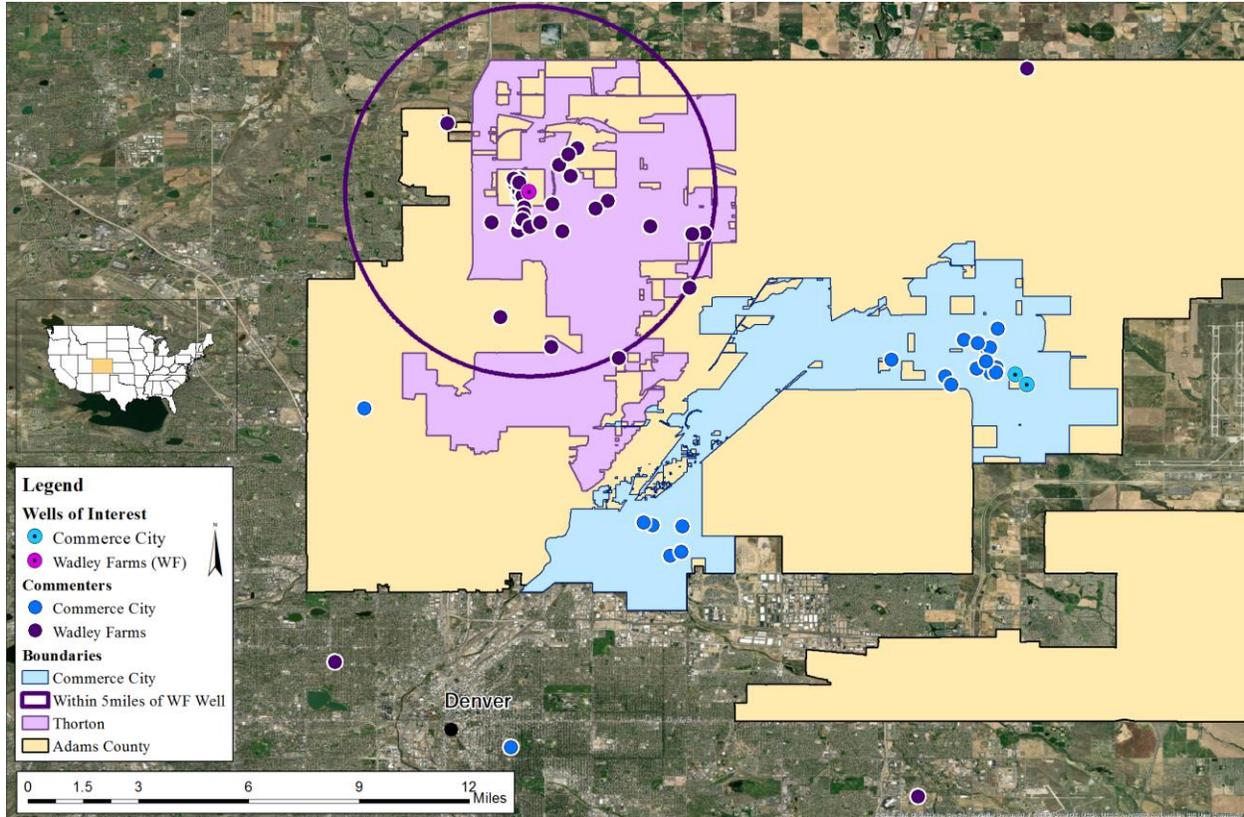


Figure 3.1 Map of Commerce City and Wadley Farms Colorado.

For this research, comment periods for the Commerce City and Wadley Farms meetings were transcribed and coded by Marlin and Denning respectively. They then assigned trust perception codes – including praise, mistrust, and critique – to those comments in order to quantify the frequency with which citizens expressed trust perceptions of the government bodies and industry. This serves as a method for gauging changes in public perceptions of government and industry over time (Zilliox & Smith, 2017). Codes were only assigned once per speaker, even if they brought up a topic multiple times, so that an individual’s extended comments would not skew the data for the group of commenters as a whole. The codebook in this analysis was originally developed by Zilliox and later revised by Marlin (as discussed in depth in chapter two, pages 9-11). The final codebook and criteria of each code can be found in Appendix A.1. In this codebook, the praise code also incorporated expressions of trust, and was

therefore used as an indicator of trust in this analysis. We analyzed commenter's perceptions of three key groups: industry, local government, and state government. Citizen comments referring to specific industry members, specific corporations, or industry more generally were grouped together as industry codes. Those referring to the COGCC, the Colorado Governor, or the broader state government were grouped into the state government codes. Citizen comments referring to individual city council members, commissioners, city staff, or the local government in general are categorized under the local government code group. In addition to the quantitative coding data, the following analysis includes quotes from the transcribed meetings to provide a better sense of how and why citizens made the comments that they did.

To gain a sense of "public" perceptions rather than those of issue advocates, coding data evaluated for this analysis was only taken from local residents who did not have direct ties to the UOG industry, governing bodies, or activist groups. To define "local," this study excluded commenters who resided outside of the Commerce City city-boundary and residents outside of a five mile radius from the proposed well site in Wadley Farms (Figure 3.1). The total number of commenters in Commerce City and Wadley Farms were 47 and 69 respectively.

We call this group of people an "interested public." Advocating for greater nuance in how scholars of social movements understand "the public," Hess previously called for distinguishing "mobilized" and "lay" publics, which refer to individuals actively engaging in social movements or those presenting their own individualized views (Hess, 2014). In our cases, however, we found that many commenters fit both these categories and that the commenters included individuals who could be categorized into both groups. We use the term interested public to refer to individuals who make an issue their own, taking on a personal stake in these projects so much so that they actively participate in public political processes such as hearings and meetings. We acknowledge that this interested public does not represent the public as a whole, as most citizens do not participate in these public processes. Yet understanding the perceptions of this interested public is important for two reasons. First, as the most active political participants in their communities, they may play a key role in shaping public perception in general through their relationships with other residents. Second, as participants in public processes, they are the citizens with the most frequent and substantial interaction with government officials and industry representatives, thereby shaping how local governments

respond to state preemption. Therefore, understanding these perspectives is a vital step towards understanding the drivers behind the conflict over suburban UOG development and its potential alleviation.

3.2 Literature Review

Public trust in the government has eroded in almost all advanced industrial democracies. In his work evaluating study of social transformations of trust, Social Scientist Dalton attributes declining trust in governments to changing expectations of governments and citizens who are “committed to democratic ideals, but critical of how contemporary democracies fulfill their own ideals” (Dalton, 2005). He argues that, “We have entered a new period when governments must confront a public skeptical of their motivations, doubtful about the institutions of representative democracy, and willing to challenge political elites. The ‘new civic culture’ of advanced industrial democracies is thus fundamentally different from the cultural model of the past” (Dalton, 2005).

The trend of declining trust in government is highly visible in the United States, where trust has been declining over the latter half of the twentieth century (Dalton, 2005). The lack of trust in the U.S. federal government was highlighted in a 2015 study showing that only nineteen percent of Americans believed they can trust the government always or most of the time, and fifty-five percent of participants believed that ordinary Americans would do a better job of solving the nation's problems than the government (Pew Research Center, 2015). While the trend of declining trust is also evident in perceptions of state and local governments, it is less dramatic over the same time period. Overall, Americans have significantly more favorable views of state (53%) and local (63%) governments than of the federal government (28%) (Pew Research Center, 2013). This trend also crosses party lines. Republicans and Democrats have similar views of state and local government, with only one and four percent differences respectively. There is however, a twenty-eight percent difference between Democrat’s and Republican’s views of the federal government, with Republicans generally more critical (Pew Research Center, 2013).

Understanding the global trends of declining trust in government is of great significance when applied to the conflict over UOG development in Colorado, where regulatory authority over OG development lies with the state. Colorado has charged the COGCC with “fostering the

responsible development” of OG resources while ensuring the “protection of public health, safety, and welfare” (COGCC, 2014). Yet the COGCC has been widely criticized by citizens for being more accountable to industry than Colorado citizens (O'Connor, 2014; Zilliox & Smith, 2017). After an exhaustive review of COGCC complaint data O'Connor argued that the State provides the façade “that industry is well regulated while simultaneously minimizing the culpability of industry or the reality of the harms that they cause” (O'Connor, 2014). In a review of public preferences for the governance of UOG, social scientists Mayer and Malin found that most Colorado residents supported a nested regulatory regime which blends different levels of government, while still allowing for local control (Mayer & Malin, 2018). This finding suggests that the current efforts to concentrate regulatory power with the state run counter to public preferences in Colorado.

Prior research would suggest that negative views of the COGCC and industry would negatively influence public opinion of suburban development projects. A review of literature evaluating the possible risks to communities from shale gas development found that diminished trust in governing bodies and officials was strongly correlated with heightened risk perceptions, stress, and reports of both physical and mental health problems (Jacquet J. , 2014). Trust in industry has also been found to influence perceptions of the risks and benefits associated with unconventional energy (Brasier, McLaughlin, Rhubart, & Jacquet, 2013; Mayer, 2016). Mayer's study of risk perceptions of UOG development in Colorado, found that “individuals who trust the industry perceive less of every type of risk” (Mayer, 2016). Another study evaluating risk perceptions of natural gas development in the Marcellus shale in the eastern U.S. found that distrust in the OG industry is strongly related to higher perceptions of risk (Brazier 2013). Together, these findings suggest that constructive conversations about risk require public processes that generate trust among citizens, government, and industry.

Mutual trust and respect can be difficult to generate in context in which lay and expert knowledge is differentially valued, and government and industry representatives hold a deficit model of the public. Greenburg, whose research focuses on environmental policy and risk analysis, found that uncertainty about the risks associated with development is a major stumbling block and often causes the public to think that experts are not forthcoming. He argues that further research aiming to better understand the influence of trust on energy development should aim to

better understand the strengths and vulnerabilities of the people and organizations responsible for building or losing that trust (Greenburg, 2014). In an attempt to do just that, Zilliox's analysis of public comments at town meetings in Erie found that while trust in the local government improved during the time from the first MOU to the second, MOUs alone were not sufficient in establishing the procedural justice necessary to improve trust in the government (Zilliox & Smith, 2017). To the contrary, Zilliox found that "public trust and a sense of procedural justice rested instead on the implementation of those agreements by a local governing board committed to transparency and public engagement" (Zilliox & Smith, 2017). One major limitation of generalizing the Erie case study's to the broader discussion over UOG conflict is the community's relative economic and educational privilege when compared to other areas where UOG has taken place. The comparative analysis presented here thus builds on this previous research by evaluating how trust perceptions in two demographically distinct communities changed over the course of debate over proximal UOG development.

3.3 Conflict Background in Adams County

This analysis focuses on two communities situated along the Colorado Front Range just north of Denver (Figure 3.1). The first conflict, which took place in Commerce City, emerged in November 2011 after a city council member noticed activity at a well in close proximity to Commerce City's northern Reunion neighborhood. The well was located within an unincorporated enclave governed by nearby Adams County (Figure 3.1), and therefore, notice had been sent to Adams County instead of nearby Commerce City. Lack of notice, coupled with concern over the impacts of development to nearby residents, prompted a highly contentious eight month review of the city's OG regulations. This review aimed to increase local control over development within the city's current jurisdiction, its growth boundary, and areas outside but adjacent to Commerce City neighborhoods. The city planned to enact a moratorium on development within the town in order to "give city council, city staff, members of the community, [and] members of the OG industry an opportunity to review together" (City Manager Brian McBroom, 19 December 2011).

In response to the city's planned actions, the COGCC and Hillcorp, the well's operator, negotiated a voluntary moratorium with the City in which Hillcorp agreed to halt activity at the well of interest and refrain from any fracking within or nearby the community during MOU

negotiations. The City chose to enter into the voluntary moratorium and proceeded to develop a land use review committee, similar to a task force, to develop recommendations for the town. After a number of contentious and ineffective meetings, the committee was dissolved and the City staff proceeded in creating City regulations by way of individual stakeholder meetings. In the end, Commerce City implemented a three-pronged regulatory approach to govern UOG development within the city. This approach included: 1) updating the land development code to match COGCC regulations; 2) requiring operators to sign an extraction agreement with the city; and 3) enrolling in the local government designee program so that they would receive notice of future UOG activity in the area⁵. The city's extraction agreement mirrored an MOU in everything but name and served as a "boilerplate" for negotiating with operators who were interested in developing in Commerce City. Since these negotiations initially took place however, there has been no further development within the city, and the only activity at the well as of 2018 has been a number of changes in ownership.

The second conflict occurred within the Wadley Farms neighborhood in the years 2015 and 2016 after Synergy Resources Inc. (Synergy) proposed to build a large multi-pad facility near residents. Wadley Farms exists within an enclave of unincorporated Adams County and therefore, while it is surrounded by the city of Thornton, it is governed by the county. Consequently, this conflict played out at the county level, as citizens from a number of communities expressed their concern over development during the Adams County Board of County Commissioner Meetings. Six months prior to the conflict, Adams County commissioners had updated the OG regulations and created an MOU with little community involvement. In the updated regulations and MOU, the commissioners did not consider the implications of placing a large multi-pad facility near residents' homes. This lack of community involvement, along with the proposal for 21 wells to be built within 500 feet of homes, was the catalyst for the Wadley Farms conflict (Denning, Marlin, & Smith, 2018).

⁵ The COGCC's local government designee (LGD) program which provides a liaison between the COGCC and the local government. Participation in this program allows local governments the access training, receive OG information, notification from the COGGG and operators regarding proximal development, legal standing in COGCC matters, and consolation and comment opportunities (COGCC Departement of Natural Resources, 2014).

The community responded by pressuring county commissioners for the next five months to not sign an MOU with Synergy, and instead to enact a moratorium on new UOG permits. This resulted in the commissioners enacting a six-week moratorium while they sought outside legal counsel to determine the extent of their own local control. At the end of the moratorium, the commissioners updated the permitting process to include more community involvement, an alternative site analysis for wellpads in urban mitigation areas⁶, a full-time OG liaison, and a full-time OG inspector. Although these changes significantly improved the permitting process, the static nature of the MOU and the inability to change without full consent of OG operators hindered the ability of the agreement to negate conflicts (Denning, Marlin, & Smith, 2018). Shortly after the commissioners enacted the changes, Synergy sold the surface and mineral rights to Ward Petroleum (Denning et al, 2018). Ward Petroleum decided to attempt 3 mile horizontal drilling from another well site, Ivey, which is over 1,500 feet from residential homes to retrieve the OG from underneath Wadley Farms (Taylor, 2017). The decision to use the Ivey site served to calm conflict among Wadley Farms residents, who viewed the Ivey site as a safer alternative due to its increased distance from the community. This sentiment did not however extend to the county, which saw a new conflict arise just months after the new MOU process and OG regulations were enacted.

3.4 Demographic comparison

To identify if and how case-specific characteristics influenced public perceptions of government and industry in Commerce City and Wadley Farms, our team constructed demographic profiles of the two communities using census data. Demographic data for the Thornton area (Table 3.1) was used as a proxy for citizen demographics in the Wadley Farms area due to the close overlap of this area with the study area and the unavailability of demographic data on a neighborhood basis (Figure 3.1).

⁶ An Urban Mitigation Area is defined as an area where either A) At least twenty-two Building Units or one High Occupancy Building Unit are located within a 1,000' radius of the proposed OG Location; or B) At least eleven Building Units or one High Occupancy Building Unit are located within any semi-circle of the 1,000' radius mentioned in section (A) above. Operations taking place in urban mitigation areas are subject to more strict regulation (COGCC, 2014).

Both Thornton and Commerce City have experienced rapid population growth over the last two decades, during which time Commerce City’s population almost tripled and Thornton’s almost doubled (US Census Bureau, 2017). These rates significantly exceed that of the state, which grew by 30 percent over the same period. A likely cause of the escalated population growth rate in these areas is the combination of their close proximity to Denver and their availability of open land suitable for residential development. Demographic data for these two communities was collected from the year in which each respective UOG conflict began, and then compared to Colorado demographics at that time, in order to properly contextualize the numbers within a significant and continuous population boom (Table 3.1). In 2011, near the beginning of the conflict in Commerce City, their population was approximately 43,539, and the household median income was \$68,090. In 2015, at the beginning of their conflict over UOG, Thornton’s population was almost triple that of Commerce City with an approximate population of 127,688. Thornton also had a higher median income (\$80,125) than Commerce City at the debate’s onset. Both communities, however, had a lower median household income than the Colorado average, with Commerce City lagging the state average by approximately \$9,000, and Thornton lagging by approximately \$1,000.

Table 3.1 Demographic comparison of Commerce City, Wadley Farms, and Colorado in (US Census Bureau, 2017).

	Commerce City (2011)	Colorado (2011)	Thornton(2015)	Colorado(2015)
Population	43,539	4,966,061	127,688	5,278,906
Family households (%)	76.8	72.5	74.0	72.8
Median age	29.1	35.9	32.60	36.30
Mean household income (\$)	68,090	77,149	80,125	81,356
People with income under poverty level for last 12 months (%)	17.8	12.5	8.9	8.50
High school diploma or higher (%)	75.9	91.7	87.5	90.70
Bachelor’s degree or higher (%)	19.8	38.9	27.0	38.10
% Hispanic or Latino: of any race (%)	48	20.4	32.20	21.10
% White one race (%)	73.6	83.9	88.30	84.20

The \$12,000 gap in median household income between these two communities is likely due to differences in occupation, education, and poverty rates, but also may be affected by broader economic factors such as the national post-recession recovery. But despite significant differences in their demographics and experiences with development, both communities expressed concerns over UOG development in close proximity to citizens' residences and sought greater local control over it.

3.5 Results

In figures 3.2 through 3.4 below, each number on the X axis represents a public meeting. The meetings are arranged in chronological order. The eight meetings in Commerce City took place over 9 months, and the 16 meetings in Commerce City took place over 7 months. The gray bars represent the total number of comments at each meeting to give a sense of the relative significance of the theme in relation to the meeting as a whole. Note that Wadley Farm's tenth meeting contains significantly more public comments than any of the others. Increased attendance stemmed from the county commissioners' aim to hear presentations and public comments from all relevant stakeholders (e.g. operators, community members, activist groups, industry groups, neighboring local governments, etc.) at that particular meeting. In total, the meeting attracted over 500 attendees (Aguilar, 2016). As per the coding procedure set forth previously, we only coded data for the commenters who resided in the defined area and did not have direct ties to either industry or activist groups.

3.5.1 Mistrust of industry

Figure 3.2 suggest that perceptions of industry among the interested public in both communities were dominated by critique and mistrust. In Commerce City, expressions of mistrust and critique of industry increased over the course of negotiations and seemed to mirror the trend of increasing praise of the Commerce City local government. In Wadley Farms, expressions of mistrust and critique of industry were a significant component of the discussion throughout the negotiation process. Throughout the debates in both communities, critique and mistrust were always the most frequently expressed perceptions of industry, while praise of industry remained virtually non-existent.

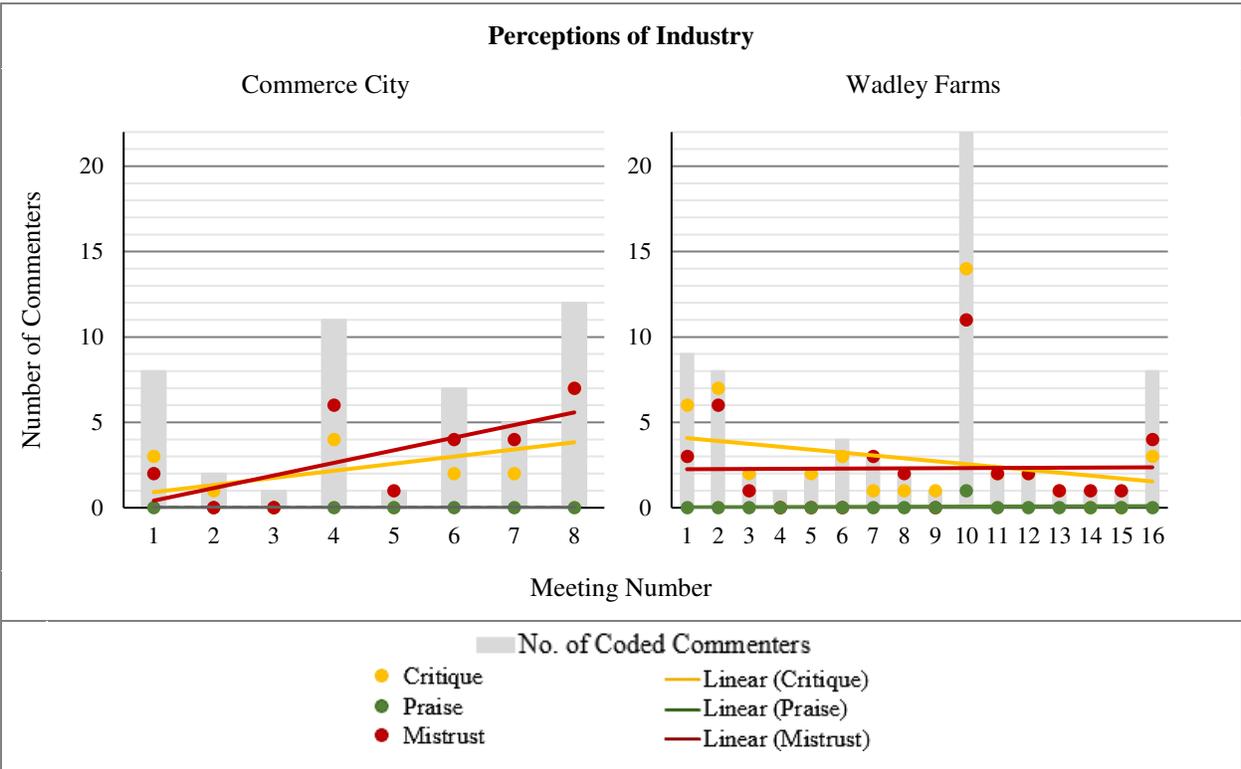


Figure 3.2 Changes in expressions of trust in industry. Figure displays changes in the number of times the comments from Commerce City (left) and Wadley Farms (right) residents incorporated expressions of trust, mistrust, praise, and critique of the OG industry.

3.5.2 Mistrust of the state government

Figure 3.3 suggest that similar to perceptions of industry, perceptions of the state government were predominantly negative in both case studies. Mistrust dominated the discussion over praise, which was again effectively non-existent. Note that while the comments surrounding the state government were predominantly negative, they were also were infrequent and delayed over the course of both cases.

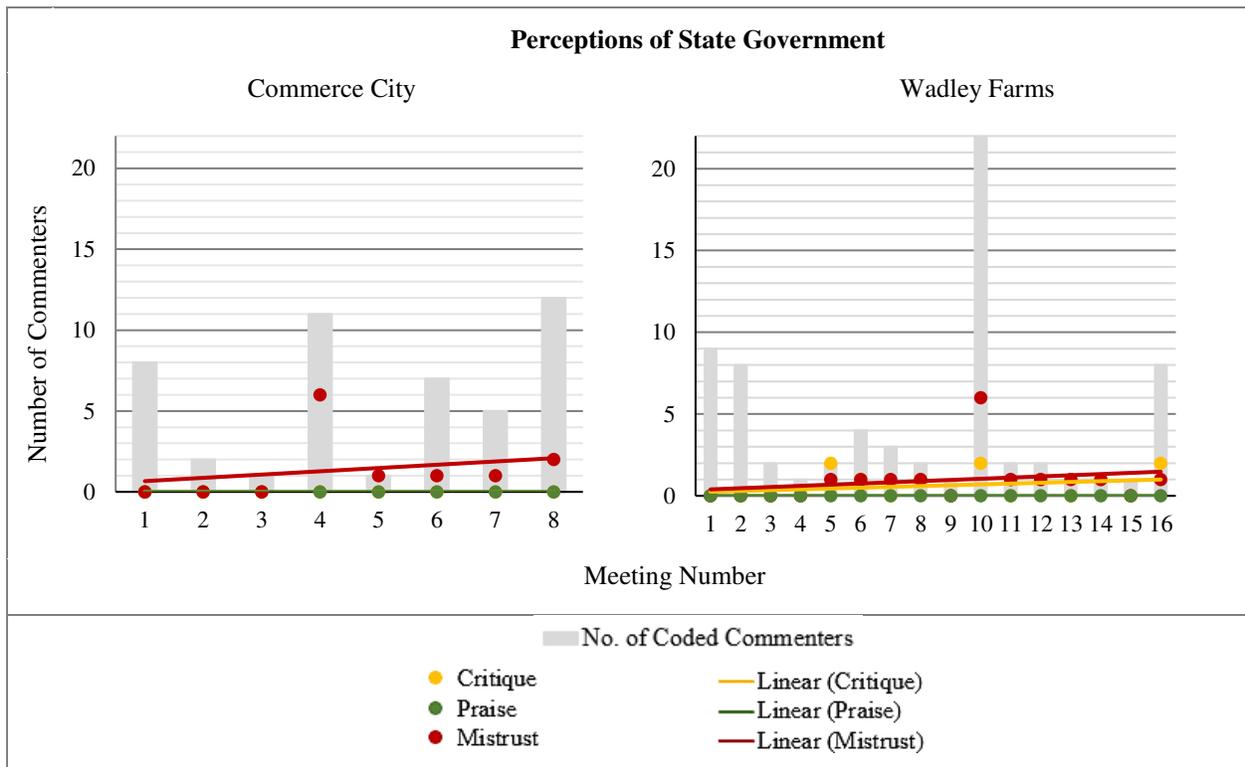


Figure 3.3 Changes in expressions of trust in state government. Figure displays changes in the number of times the comments of Commerce City (left) and Wadley Farms (right) residents incorporated expressions of trust, mistrust, praise, and critique of the state government.

3.5.3 Mistrust of local government

Figure 3.4 suggest that although both communities' comments surrounding the perceptions of state government were dominated by mistrust and critique, these communities displayed quite different perceptions of their local government. In Commerce City, praise of local government was the dominant perception expressed by citizens. Over the course of the debate these expressions of praise increased in frequency, a trend that was accompanied by decreasing critique. By contrast, the local government in Wadley Farms received some praise toward the beginning of negotiation, but this appeared to be replaced by more general critique over time. This slight change may not represent a significant trend, due to the low frequency of comments in this category throughout the duration of the meetings. Expressions of public

perceptions of local government in Wadley Farms were somewhat infrequent in comparison to Commerce City.

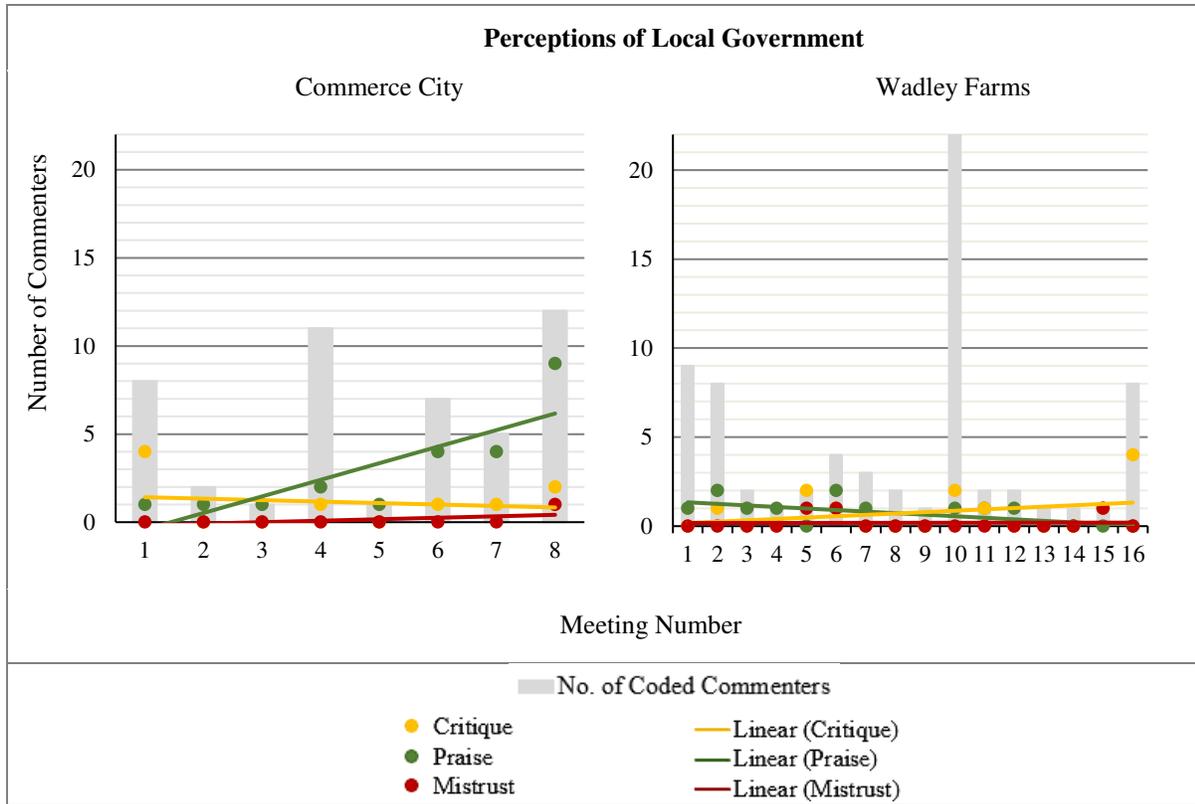


Figure 3.4 Changes in expressions of trust in industry and the government. Figure displays changes in the number of times that the comments of Commerce City (left) and Wadley Farms (right) residents incorporated expressions of trust, mistrust, praise, and critique of the local government.

3.6 Comparative Analysis of Trust and Public Perceptions

3.6.1 Trust perceptions of industry over time

Debates in both communities were dominated by negative perceptions of industry (Figure 3.2). Mistrust perceptions toward the beginning of the Commerce City debate were grounded in frustration over the lack of notice of drilling activity at the well. However, over time this frustration transitioned into expressions of mistrust of industry as a whole – a sentiment exemplified by one citizen who stated near the end of the debate, “We know that we cannot trust the OG industry as they are making astronomical profits that they have no intention to let anyone

interfere with” (Commerce City resident #1, 18 June 2012). Expressions of critique and mistrust of industry were also rooted in negative personal experiences with specific industry representatives, as highlighted in the following comment, in which a citizen critiques the participation of a Colorado Oil and Gas Association representative (Casper):

COGA, and COGCC, and industry, they all tell us they care about our children. Do they? You mean as evidence tonight when Andrew Casper's name suddenly appeared on front of the list of those who want to speak tonight? ... Do actions speak louder than words? In this case, yes. A young man with lots of energy and agendas to fulfill, he chooses to speak first. And when he could have taken a noble gesture and recognized all the children present in this evening's audience, he opted to plow through with his agenda, his concerns, his objectives, all at the top of his list. Where were mine, my family, the children? Does industry care? Do their actions match their promises? You tell me (Commerce City resident #2, 18 June 2012).

In Wadley Farms, mistrust and critique of industry remained a dominant and steady feature throughout debate, with a particular focus on Synergy Resources Inc. and COGA. Some of the major drivers behind these perceptions are illustrated by a citizen who said, “While neighbors and parties involved in negotiations can have differences of opinion, they should operate under the principles of fairness, transparency, and as good neighbors, at least do no harm. Synergy Resources Corporation is doing none of these” (Wadley Farms resident #1, 8 Sept 2015). Another citizen remarked, “In this case, I believe Synergy is trying to create the illusion that they are communicating with the community. Poorly informing the community. And then when people don't show up to the meeting, they can take that as somewhat of a testament to the fact that people are not interested” (Wadley Farms resident #2, 8 Sept 2015). This comment suggests that the citizens of Wadley Farms were not only critiquing industry actions, but perceived industry as behaving in ways that were inherently untrustworthy.

3.6.2 Trust in state government over time

Similar to perceptions of industry, perceptions of the state government were predominantly negative in both Wadley Farms and Commerce City (Figure 3.3). This shared negative perception of state government is likely rooted in the commonly held view that the state government had sided with the industry. This perception is exemplified in a comment by one citizen who stated before Commerce City city-council:

I have a question for the COGCC, why are they not being neutral? Being a regulatory body why are they coming here tonight supporting the industry? Why don't they just say, 'Here are the facts, you decide'? They're coming here and saying, 'We're leaning towards the industry, we want you to postpone this moratorium.' That's wrong to me. (Commerce City resident #3, 19 December 2011)

Another citizen commented that they “left the meeting with the distinct impression that the State was going to do as they wished...Until the consequences became disastrous enough to put us all at risk” (Commerce City resident #4, 23 January 2012). This sentiment was also seen in Wadley Farms, as exemplified by one citizen’s comment that “the COGCC is not fulfilling half of its mission, the protection of public health, safety, and welfare, including the environment and wildlife resources” (Wadley Farms resident #3, 22 March 2016). Another citizen asked that “Adams County redefine its general MOU to better clarify it [and address] things the COGCC didn't have the backbone to protect Colorado citizens from.” They went on to make the case that “just because the COGCC regulations allow for these industrial sites in residential neighborhoods, doesn't mean that it is right.” (Wadley Farms resident #4, 26 January 2016).

While the comments in both Wadley Farms and Commerce City questioning the COGCC’s impartiality were negative in nature, they were also somewhat infrequent. Taken out of context, this may seem to indicate that the communities were not as a whole dissatisfied with state government or that the state government was simply not central to the discussion, given that the meetings were held locally. However, a closer look at the citizens’ comments reveals another possible cause: the state was seen as not only untrustworthy, but too concerned with its own self-interests to alter its position. This may have pushed citizens to focus their energy less on changing the state’s position, and more on appealing to the local government for support – a tactic which was seen as much more likely to succeed. This interpretation is supported by a Commerce City commenter who stated, “The Colorado Oil and Gas Commission has already proved to the residents of Reunion in our community that they cannot be trusted.” The citizen then went on to thank the local government for “caring more about your citizens than an industry that constantly proves self-serving” (Commerce City resident #1, 23 January 2012). Another Commerce City citizen voiced this sentiment by rhetorically asking city council, “So, tell me, why should I waste more time only to be frustrated with how little the bureaucracy [state government] cares about my humble concerns?” (Commerce City resident #5, 19 December 2011). This sentiment was also evident in Wadley Farms, as evidenced by one citizen’s comment

that, “You said to contact our Senators, we will do that. But just know that we have a Governor who is supportive of this. So it's gonna [sic] take the voice of our communities and of you to help us to get the sites out of our neighborhoods” (Wadley Farms resident #5, 24 Nov. 2015). Taken together, these quotes suggest that even though citizens of both communities voiced opposition to the COGCC only infrequently, this was likely not because they trusted the COGCC, but because the agency was viewed as biased in favor of industry and difficult to change.

These results corroborate previous research evaluating the COGCC complaint data, which found that while many citizens saw that “regulations were important and necessary,” they simultaneously viewed the “the existing state regularity structures and processes as futile” due to the COGCCs “contradictory mission” and “economic investment in continual production” (O'Connor, 2014).

3.6.3 Trust in local government over time

While both Commerce City and Wadley Farms held similar perceptions of the state, they differed in their views of their respective local governments (Figure 3.4). In Commerce City, citizen comments reflected a high frequency of praise of local government, indicating an overall high level of trust in local government. This perception is likely rooted in the view that local government was working on behalf of the community, as evidenced by one comment which directly thanked city council for their support:

Over the last few days, I was able to see some of you in action during what could only be described as a stunning turn of events in my own neighborhood, Reunion. I want to personally thank [City Council Members] for taking action when we were scared and confused, and when we were feeling helpless and not knowing where to turn. You did not have to do what you did. The well that's being fracked was not even in Commerce City. It's in Adams County (Commerce City resident #1, 21 November 2011).

A number of other citizens explicitly communicated their trust of local government, with one saying, “I trust the judgment of you all. I know almost all of you all, and I ultimately trust your judgment to do what's right for us. I got to express my concern earlier. I just wanted to let you know that I trust your judgment” (Commerce City resident #6, 23 January 2011).

The increasing frequency of citizen praise of local government, along with decreased criticism, indicates that the perception of trust of Commerce City’s local government continued

to improve over the course of the debate. This trend is likely associated with the citizens' appreciation for local government's efforts to reach a solution. As one citizen stated:

Members of our group [Commerce City Unite Now] will say good and bad things about the agreement, but we do appreciate the time that was put into it. They worked hard to craft the codes that will serve the interests of the citizens, and then at the same time that's stepping on the toes of the industry (Commerce City resident # 3, 18 July 2012).

It is notable that this trend of increasing trust occurred despite widespread doubt over the ability of the regulations that emerged throughout the conflict to protect residents. Public comment over UOG development ended with the passing of a final extraction agreement that many believed was insufficient, yet represented a step in the right direction. Their preference for local, over state, control persisted, as exemplified by one appeal to the Commerce City city-council in which a citizen remarked:

I have really battled [with] whether or not I really support this Land Development Code amendment because I'm not sure it fully protects us to the extent that it possibly could. And so I just really urge you all to really strongly consider whether or not this is doing the best that you possibly can.... I will say I believe it's a step in the right direction and I hope that this is a work in progress and that if we get more information down the road, and this isn't working, that there is room for adjustments and amendments (Commerce City resident #7, 18 July 2012).

While trust of local government in the Commerce City debate was characterized by positive expressions of praise, the discussion in Wadley Farms was largely lacking in this area. The few comments surrounding trust perceptions were largely dominated by critique. The negativity and overall lack of comments surrounding public perceptions of the local government in the Wadley Farms debate is likely due to the commonly held view that while the local government was listening, they were not taking action. Some citizens perceived that beyond taking no action, local government was actually serving to facilitate inappropriate industrialization. As one citizen expressed,

The MOU Adams County has negotiated offers our neighborhoods no additional protections. Given the aggressive pace of oil and gas development in the northern front-range area, given that our neighbors, our surrounding jurisdictions offer much greater protection to their communities, if you, the Adams County commissioners, do not actively protect our residential communities, you are, by default, encouraging their industrialization (Wadley Farms resident #6, 8 September 2015).

In addition to these criticisms, there was also a trend of slightly declining praise of local government in Wadley Farms, which taken together could indicate that perceptions of local government became more negative over the course of the debate. If true, this would represent the only instance in either community – or the original case study in Erie – where there was a reversal of local trust over the course of conflict and MOU negotiation.

The ways in which the meetings were conducted varied greatly between the two communities, which may have contributed to their divergent perceptions of local government. In the Adams County hearings that provided the platform for the Wadley Farms debate, citizens were given a strict three-minute comment period in which they could appeal to their county commissioners. Once their time was up, citizens often left the podium without any direct responses or follow up questions from the commissioners regarding their concerns. In these meetings commissioners also disproportionately emphasized outside stakeholder groups at the expense of citizens, as highlighted by the January 26th meeting in which organization groups were giving 8 to 10 minutes for presentations. These presentations were given at the beginning of the meeting which ultimately lasted over 8 hours, eventually ending at two in the morning. Given that citizen comment was scheduled to follow these presentations, the meetings meant that many citizens interested in commenting left by the time their name was called.

Commerce City citizens were also officially allotted three minutes to speak, but the mayor would frequently allow speakers to go over their time on nights that hydraulic fracturing was a topic of discussion. On some occasions, the councilmembers turned the timer completely off, allowing citizens to speak as long as they wished. Unlike the meetings surrounding the Wadley Farms debate, direct responses including commentary, follow up questions, and answers to citizens' questions were common in Commerce City. In this setting the mayor frequently allowed dialogue between the council members and speakers, so long as both sides were being respectful. On a number of occasions the city council went so far as to reach out to each individual on the list asking them if they had children in the audience or if they would be willing to move down the list in order to allow those with children to go first. These small gestures did not go unnoticed and appeared to strengthen the trust between citizens and their local government representatives.

These findings suggest something interesting about the relationship between trust of local government and trust of state government: mistrust of the state may have pushed citizens to focus their energy on appealing to the local government for support. In this way, mistrust of the state may be seen as a factor for shaping public opinion on which government bodies should have the right to control development. As one citizen stated, “We are home rule city and I want to say that I feel it's really necessary that someone, some municipality is willing to step up to the plate and challenge the authority of the state. Why do we have municipalities if we can't govern ourselves or protect ourselves?” (Commerce City resident #5, 18 June 2012). It is also possible that residents’ focus on engaging local government was due to their view that the key concerns were local in nature. Figure 3.4 suggests detachment from more regional and national conversations, for example, in the absence of common risk perceptions, such as climate change, that are central to the larger statewide and national debate about UOG. Our data suggest that these community debates are not a referendum on the larger discussion on fossil fuels, but instead turn on questions about local control.

Trust in these local entities may have also been influenced by the willingness of these local governments to contest and push the limits of state authority. In the Wadley Farms debates, the Adams County commissioners decided to not push the limits of their own control for fear of lawsuits, and therefore did not take actions the residents believed were necessary. In contrast, the Commerce City city-council aimed to push the limits of state preemption while minimizing the risk of legal action. These responses to the citizens’ wishes for increased local authority over UOG likely influenced trust perceptions of these agencies; leading to increased trust of local government in Commerce City and decreased trust of local government in Wadley Farms. In this way, trust in both the state and local governments may hinge on their ability to respond to mounting pressures for a more multi-leveled approach to regulating UOG.

3.7 Conclusion

In Colorado, the coinciding booms in population and UOG production have incited conflict over land use, as industrial and residential development encroach on one another. In response to this trend, many frontline communities have turned to MOUs as a way to gain local control over UOG without risking political stalemates. This study evaluated two demographically distinct communities, both with MOUs, in order to understand whether and

how the interested public's perceptions of the government and industry bodies responsible for OG development change over the course of conflicts. The socioeconomic differences ultimately ended up playing a less significant role than hypothesized by prior research (Zilliox & Smith, 2017), with four key findings emerging instead.

First, while MOUs have been put in place with the aim of improving community relationships with industry and state government, our study suggests that most of these relationships actually worsened over the course of the debate. Perceptions of industry were primarily negative in both communities throughout the debate, and that mistrust of industry actually increased over time in Commerce City. This finding corroborates the results of the prior research in Erie (Zilliox & Smith, 2017). This mistrust of industry appeared to extend to mistrust of the state, as the commenters synonymized the COGCC with industry due to the prevailing sentiment that the COGCC was biased in favor of UOG development and prioritized development over residents' concerns. According to the existing literature, this heightened mistrust may lead to increased risk perceptions and further conflict sounding UOG development in these areas. These results underscore the importance of regulatory agencies' independence from those industries which they oversee, and highlights one major vulnerability of the COGCC: their seemingly contradictory mandate to facilitate the development of UOG resources while simultaneously ensuring public health and safety.

Second, our results underscore the importance of disaggregating "trust in government" in general to distinguish among levels of government. In both communities, mistrust of the state may have played a factor in citizens focusing their energy on appealing to the local government for support. In this way, mistrust of the state may be seen as a driver for public opinion concerning which specific levels of government should have the right to control development. Yet, while residents in both communities expressed a preference for local government control over UOG development, the two communities did not share the same perceptions of trust in their local governing bodies. Commerce City residents expressed trust of their own city government, whereas Wadley Farms residents expressed mistrust of their county government as well as the state government. We propose that this difference is at least partially grounded in the distinct ways in which the local governing bodies handled public engagement. While the County Commissioner in the Wadley Farms debate enforced strict meeting protocols for public

comment, Commerce City actively relaxed theirs and allowed citizens to speak for longer periods, facilitated constructive dialog between themselves and commenters, and altered meeting formats on the fly to improve citizens' ability to be heard. We believe that these more inclusive approaches led to improved trust in the Commerce City case. This engagement strategy may serve as a useful model for other entities involved in similar debates.

Third, we conclude that trust perceptions of industry, state, and local government either remained generally constant or were amplified throughout the course of the debate. That is to say, if the majority of comments at the beginning of the debate expressed trust of local government, with a small minority expressing mistrust, the majority either remained constant or increased its share by the end of the debate. At the individual level, there were no instances of commenters "changing their minds" to the point that they switched from trusting to mistrusting an entity, or vice-versa. In Wadley Farms there may have been a slight change in individuals' perceptions of local government, but the low number of commenters in this area limit the strength of this conclusion. This may be due to the short duration of these studies. Future longitudinal studies may help to gain a better understanding of the larger trends associated with trust and public perceptions over UOG.

Finally our results suggest that at the heart of the debate over UOG in Colorado is the question of who has the right to control such development. The public preference for local control found in this study corroborates Mayer and Malin's finding that the current efforts to concentrate UOG regulatory power with the state are not in line with the public's preference for more regulatory autonomy at the local level (Mayer & Malin, 2018). If these community debates over UOG are not chiefly a referendum on fossil fuels, but instead about local control, they may represent a microcosm of the broader erosion of trust in large governing bodies (Dalton, 2005). Our study builds on prior research by signaling the importance of public perceptions of local government, as trust in those bodies actually improved in two of the three Colorado communities where this research methodology has been applied.

A major shortcoming of research in energy development is the lack of knowledge surrounding how entities' characteristics affect their ability to either build or lose trust (Greenburg, 2014). The present study sheds some light on that gap by preliminarily showing that

the community with more open and participatory public processes and more historic ties with industry also experienced improved public perceptions of local government over the course of the conflict. Future research should incorporate a more longitudinal approach and a higher number of case studies in order to test this relationship on larger geographic and time scales. Such knowledge will aid researchers and other stakeholders in understanding the key factors underlying how trust perceptions affect relationships involving proximal UOG development.

CHAPTER 4

CONCLUSIONS AND FUTURE RESEARCH

Coinciding booms in UOG and population along the Colorado Front Range have sparked local conflict as OG and communities encroach on one another. In reviewing the literature, disputes over UOG development in the Western United States appear to differ from those in the East due to four regional characteristics including: the arid climate, prominence of split estate and federal lands, a long history with the extractive industry, and contradictory perspectives over the west as a place to be kept wild and a resource to be used. In this way, conflict over UOG development in the Western United States can be seen not merely as disputes over facts, but also values, personal identities, and attachments to place. Uncertainty over the possible risks and benefits associated with UOG only serve to amplify these conflicts.

These conflicts have been further complicated by an ill-defined regulatory landscape predominantly under state control. In response, a number of communities have sought increased local control over development, and many have turned to MOUs in order to ease tensions and gain local influence over state-controlled OG development without risking political stalemates with the state. An initial study by Zilliox which evaluated MOUs in Erie found that these agreements can effectively improve relationships if they address community concerns, are enforceable, and foster meaningful community engagement. In her thesis, *Regulating Relationships: Memorandums of Understanding and Unconventional Energy Development in Suburban Colorado*, Zilliox sought to understand the key factors that led to the Erie MOU's successes in reducing tensions between the Erie community and its government. She concluded that because of a regime of openness, collaboration, and a fuller consideration of all issues, Erie was able to produce a more effective agreement (Zilliox, 2016). This thesis adds to this work by identifying key factors influencing public risk and trust perceptions in two additional communities: Commerce City and Wadley Farms.

Our analysis found that socioeconomic differences between Commerce City and Wadley Farms did not play a significant role in predicting risk and trust perceptions in either case. Risk perceptions were instead seen to be most highly influenced by historical ties to industry and

perceptions surrounding distributive justice. Findings from analysis of the two case studies builds on previous research which linked historical ties to industry with decreased risk perceptions and increased benefit perception in two significant ways (Mayer, 2016; Brasier, McLaughlin, Rhubart, & Jacquet, 2013). First, it was found that prior *negative* experience with industry can have the opposite effect of prior positive experience by increasing risk perceptions. Second, it was found that in terms of risk perceptions, communities can use prior experience with more general forms of industrial activity as a proxy for UOG activity. Results from this analysis also indicate that increased risk perceptions may hinge on a perceived unfair distribution of risks and benefits. In this way conflicts over UOG in these communities speak to not a simple balance of risk and benefits, but instead to a much larger conversation about distributive justice.

By focusing in on how trust perceptions changed over the course of debate in chapter three, we were able to identify a number of factors influencing trust perceptions of the extractive industry, state government, and local government. Firstly, while MOUs are sanctioned by the state as a way of mitigating conflict, our study suggests that the community members' perceptions of all three entities (industry, the state government, and local government) predominantly worsened over the course of the debate. These results appeared to be mostly centered on the perception that the state was too closely aligned with industry; underscoring the importance of autonomy between these regulators and the industry. Despite an overall decline in trust of these entities, trust of the Commerce City local government was seen to improve, likely due to their inclusive approaches. Secondly, given the significant difference in perceptions of the state and local government, our study highlights the importance of distinguishing between different levels of governance when analyzing public perceptions of these entities. Finally, our results suggest that the question of local control and who has the right to control development is at the heart of the debate over UOG in Colorado.

One of the major limitations of this work is the relatively short duration of these studies. Therefore, future longitudinal studies of these communities would serve the important function of contextualizing the findings of this study. This research is also limited by the small number of case studies analyzed and could be strengthened by a broader analysis of the Colorado communities which turned to MOUs, and those that chose to implement moratoriums. Future work should also look more deeply at Commerce City's approach to community engagement and

evaluate the specific mechanisms through which collaboration can influence these process and their outcomes, in order to better understand the mechanisms behind effective collaboration.

While this thesis has identified a number of important takeaways surrounding UOG conflicts, there are still many unanswered questions. We recommend that further research in this area focus on identifying how people affected by these agreements judge their successes and weaknesses, and evaluate how well this aligns with those identified in the literature. Such research could utilize and build on the methods employed in this thesis.

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APPENDIX A

Table A.1 Codebook and Criteria of Citizen Concerns

Code	Criteria
Proximity	Mention of concern over the proximity of OG to homes, schools, neighborhoods, etc.
Operational issues	Mention of concern over operational mishaps (faulty casings, spills, explosions, and chemical use), nuisances (noise, light, vibration, and traffic), BMPs (chemical disclosure), water use, and waste management.
Health and environment	Mention of concern over environmental pollution and its impacts on public health.
Rocky mountain arsenal	Mention of concern over impact of OG activity on the Rocky Mountain Arsenal.
Human health and safety	Mention of any acute or long-term health problems arising from industry activity, including industrial accidents, or specifically in reference to children's health and safety.
Economic benefits	Mention of OG development positively impacting the economy.
Economic consequences	Mention of OG development negatively impacting the economy including reduced investment into the area, growth, property values, and strain on town resources and amenities (e.g., parks, trails, schools, emergency response, etc.)
Climate change	Mention of climate-change related issues (e.g., carbon footprint, CO2 emissions, global warming, etc.).
Earthquakes	Mention of concern over OG activity causing earthquakes.
Process	Mention of concern over the process being rushed, lacking information, lacking collaboration, lacking local control, or lacking sufficient scientific and expert analysis.
Surface rights	Mention of concern over the rights of surface owners, land owners, or the community at large being infringed upon by OG activity.
Mineral rights	Mention of concern over the rights mineral owners to use, develop, and benefit from their mineral rights.
Critique of local government	Direct criticism of specific local government official(s) or local government as a whole (rather than proposed legislation).
Critique of state government	Direct criticism of specific state government official(s), state government as a whole, or the COGCC (rather than proposed legislation).
Critique of industry	Direct criticism of specific OG industry representatives(s) or OG industry as a whole (rather than proposed legislation).

Table A.1 Continued

Mistrust of local government	Comments indicating that the local government had been dishonest, had not behaved in good faith, was deceitful, or had harmful motivations.
Mistrust of state government	Comments indicating that the state or COGCC had been dishonest, had not behaved in good faith, was deceitful, or had harmful motivations.
Mistrust of industry	Comments indicating that the OG industry had been dishonest, had not behaved in good faith, was deceitful, or had harmful motivations.
Praise of local government	Either direct or general praise of local government or local government officials.
Praise of state government	Either direct or general praise of state government or state government officials.
Praise of industry	Either direct or general praise of OG industry or OG industry representative.