

THESIS

THE NEUXUS OF FARMING AND ENERGY: NAVIGATING SOCIAL TENSIONS AT THE  
INTERSECTION OF SUSTAINABLE AGRICULTURE AND UNCONVENTIONAL OIL  
AND GAS DRILLING

Submitted by

Cherilyn Sprague

Department of Sociology

In partial fulfillment of the requirements

For the Degree of Master of Arts

Colorado State University

Fort Collins, Colorado

Summer 2015

Master's Committee:

Advisor: Stephanie Malin

Tara Opsal

Dawn Thilmany

Copyright by Cherilyn Marie Sprague 2015

All Rights Reserved

## ABSTRACT

### THE NEXUS OF FARMING AND ENERGY: NAVIGATING SOCIAL TENSIONS AT THE INTERSECTION OF SUSTAINABLE AGRICULTURE AND UNCONVENTIONAL OIL AND GAS DRILLING

The purpose of this research was to examine how unconventional O&G development is interacting with small-scale sustainable and organic agriculture in Northern Colorado, particularly Boulder, Weld, and Larimer counties. The issues explored are impacts which farmers face as a result of development, the political economic context that small-scale farmers operate under, and how these interactions with O&G development may result in voluntary or forced shifts in identity. By examining these issues, I show how the institution of split estate structures farmer's interactions with O&G development because it dictates how much control they enjoy and how they are able to participate in procedural equity. I hope this research shows the unique challenges that sustainable and organic farmers face when dealing with O&G development, while also illustrating that it is the institution of split estate that impacts these challenges the most.

## ACKNOWLEDGMENTS

I would like to sincerely thank Dr. Stephanie Malin for contributing all of her guidance, patience, and above all else friendship while I completed this lofty project. Dr. Malin has not only helped me grow as a student, but as an educator through my role as her teaching assistant, and most importantly as a researcher through all of the opportunities she has given me to assist her with her own projects. I rediscovered my academic passions through her knowledge of environmental justice and because of this I will take environmental justice throughout my life as more than just an academic endeavor.

I would also like to thank Dr. Opsal and Dr. Thilmany for all of their assistance with this project; I appreciate all of their feedback on my drafts and their presence on my committee.

I would also like to thank the Department of Sociology at Colorado State University and all of the professors who have helped me grow into the person and academic I am today as a master's graduate. Without all of your guidance through difficult coursework, I would not be where I am today. It is an honor to be accepted and nurtured within such a supportive and helpful department and these have been the greatest, but also most difficult, two years of my life.

Lastly, I would like to thank all of my fellow graduate students in the Department of Sociology at Colorado State University for all of their support and encouragement within the last two years. I would particularly like to thank my two best friends (“the fracking sisters”), Alyssa Stephens and Amber Kizewski, for accompanying me along the difficult journey that is writing a master's thesis. I couldn't have gotten through it without you (and I'm sure you probably feel the same), but we did it! Time to go to Elliott's!

## TABLE OF CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGMENTS .....	iii
TABLE OF CONTENTS.....	iv
Chapter I: Introduction.....	1
Chapter II: Methods .....	9
Introduction.....	9
Research Questions .....	10
Background and Research Interests .....	11
Theoretical Approach.....	13
Methods.....	23
Sample of Farms.....	26
Data Collection & Analysis .....	29
My Role as a Researcher.....	31
Limitations .....	32
Conclusion.....	33
Chapter III: Literature Review .....	35
Unconventional Oil and Gas Development.....	35
Regulation.....	38
Unconventional Oil & Gas Development in Colorado.....	45
Possible Problems With Unconventional Oil & Gas Development .....	48
Natural Resource Dependence & Extraction Economies .....	66
Unconventional Oil and Gas Development and Agriculture .....	71
Small-Scale Agriculture .....	71

Natural Resource Development and Small Scale Sustainable Agriculture .....	79
Conclusion.....	82
Chapter IV: Findings and Analysis.....	84
Introduction .....	84
Case 1: Sunnydale Farm.....	88
Case 2: Blueberry Hill Farm .....	101
Case 3: Tanglewood Farm.....	113
Discussion: Research Questions Revisited .....	125
Conclusion.....	141
Chapter V: Discussion and Conclusions.....	143
Environmental Justice Revisited .....	143
Shifting Identities .....	153
Conclusion.....	162
Works Cited Page .....	165
Appendix A.....	198

# Chapter I: Introduction

I would say though that one thing that I observe from the periphery before and where I'm living now is just have undervalued farming is by the society at large and I mean all this work ... I just feel like as a society we are not rewarding farmer's hour time at the level we should be... There's a lot of incentive to sell your farm out... for oil and gas, for something other than farming because... there's not enough compensation for the work that you actually care about.

These are the expressions of a sustainable small-scale farmer in Northern Colorado- putting into words what many small scale farmers in the United States feel, whether they are just beginning their farming operation or whether this has been their life's career. Although many of them feel a strong connection to farming not just as an occupation but as a lifestyle, they are increasingly feeling economic pressure to lease out their agricultural land for things other than farming, such as natural resource development, particularly unconventional O&G development. Small-scale farmer's inability to make a living on farming alone causes farmers to feel not just economically unsupported- but also insufficiently valued by the society that they feed every single day.

For the last fifty years, agriculture has shifted at an increasing pace towards a system that privileges large commodity growers, rather than small scale family farms. The consolidation of agricultural operations is related to subsidy system based on output rather than need; rewarding large scale commodity growers, while disenfranchising small scale growers who because of their small scale and what they grow, earn little subsidy payments. For many farmers, their occupation is not only a job, but a cornerstone of their identity. This is also true for organic and sustainable farmers who often enter into farming to go against the trend of large scale agriculture, instead focusing on the importance of local, chemical free produce, dairy, and meat. Local sustainable and organic farming is a sector of the agricultural sector increasing in prevalence. Although its

significance is increasing, it is still difficult to earn a living just as a small-scale farmer, pushing natural resource development as an attractive way to earn money to continue farming or use towards a safety net for the future.

Natural resource development is attractive to the US as a whole, not just to farmers. The Energy Information Administration (2014) estimates that there are natural gas reserves of 2,203 trillion cubic feet, estimated to be enough natural gas to last the US ninety-three years at current rates of consumption. They also estimate that 2,431 billion barrels of wet natural gas are trapped in shale rock in the United States, while the Niobrara shale alone has an estimated 4.1 billion barrels of shale oil reserves. While the United States explores options to form a progressive, sustainable energy policy, unconventional methods of extracting O&G are lauded as the solution to all of America's energy woes, empowering us to combat our dependence on foreign oil lack while providing Americans in various regions with financially secure livelihoods.

Natural resource development, particularly O&G development, has a long history in Colorado. The state has more than 1/3 of the nation's proven gas reserves, including 20,666 billion barrels of dry natural gas, 705 million gallons of wet natural gas, and an estimated 2 billion barrels of oil reserves (EIA 2014). Most of these reserves lie in the Niobrara Shale, which includes the extremely productive Denver- Julesburg basin of Northeast Colorado and Southeastern Wyoming (BLM 2014). Some of the state's first oil was discovered in southeastern Colorado by the Ute tribe of Native Americans (COGA 2014) and in the 1860s, Florence, Colorado became the first area in the West to host O&G development (Noel 2013). However, many areas of Colorado have been reliant on O&G development in the past, with the industry ultimately "busting," leaving these areas economically depressed. Currently, the rise of oil and gas (O&G) development in Colorado is due to new technology, referred to as

unconventional O&G development, that allows firms to retrieve domestic reserves of O&G trapped in shale rock. The most controversial step of the development process is hydraulic fracturing, of which little is known about the overall impacts and outcomes for communities and the environment for this development. Although this new technology might stretch out the market “bust,” looking at past experiences with natural resource development, it is inevitable that one will occur.

Although hydraulic fracturing is what is focused on in popular media and the press, it is just one part of unconventional O&G development. Unconventional O&G development includes two steps: 1) well development, which includes preparation, drilling, and completion and 2) production, which includes completion transitions, hydraulic fracturing, and flow back (McKenzie et al. 2012). Much of the public response to development is focused on hydraulic fracturing, or the combination of vertical and horizontal drilling, ensuring that producers can extract minute traces of natural gas and oil from shale rock economically. Some proponents of the process frame unconventional processes as environmentally-friendly because each well pad can contain thirty or more wells, each which can be hydraulically fractured ten or more times (Colborn 2012).

Hydraulic fracturing is a drilling technique that uses a mixture of water, chemicals, and sand to retrieve the O&G trapped in shale formations (EIA 2014). Before production, steel surface or casings are inserted into the well between 1,000 and 4,000 feet to prevent chemicals, oil, or gas from entering the water supply. Next, the space between the casing and the wellbore is filled with cement. After the cement has set, drilling is continued from the bottom of the surface or from the intermediate cemented steel casing until the O&G reservoir is reached at around 6,000 to 10,000 feet underground (The Groundwater Protection Council 2014). The hole is then

drilled below the water table and into the shale layer while the chemical mixture is pumped into the well. An average of four million gallons of the mixture of water, sand, and undisclosed chemicals are then hydraulically injected into each well site. The mixture is pushed down the well at a high velocity, opening fractures in the shale rock which allow the natural gas or oil to flow from the shale rock into the well. After the process takes place, between 10 and 90 percent of the fluid used to fracture the well flows to the surface, polluted with the initial chemicals and with contaminants from the shale layer (EIA 2014). After the fluid flows back out of the well, natural gas or oil flows to the surface, then collected and stored for transport and production. Depending on the location of the development, the contaminated fluid is either stored in evaporation pits or storage tanks on site to be treated, recycled, or disposed of or re-injected into the ground underneath the water table (Brown 2014, Ellsworth et al. 2012).

The process of hydraulic fracturing, invented by Halliburton to retrieve O&G out of shale rock, has existed since the 1940s (Davis 2012). Initially, hydraulic fracturing was done through vertical drilling, but technology has improved over the last fifteen years, allowing O&G companies to drill horizontally as well (EIA 2014, Clark et al. 2012). Horizontal wells can extend out 5,000 feet or more into a given shale deposit, while a vertical well can only get to a single vertical slice of shale (EIA 2014). This allows producers to obtain more gas quickly, while earning more substantial profits. This technology, which has instigated the recent boom in unconventional O&G development and facilitated the U.S.'s position as top oil producer in the world, is vital to retrieving natural gas and oil in the Niobrara Shale in Colorado.

However, with new technological advances such as hydraulic fracturing increasingly used, communities are beginning to question whether they want development close to the areas where they live their daily lives. Subsequently, it is appropriate to explore the history of

environmental justice (EJ) in the US through which citizens organize together to protest inequitable distribution of environmental hazards (Cable and Cable 1995) such as those perceived in extractive energy development. Citizens cite environmental, health, and quality of life concerns as some reasons why unconventional O&G development should cease, or at the very least slow down, until we know what all of the potential impacts are. In this case, many individuals impacted by unconventional O&G development seek a type of EJ that privileges the ability of the community and individuals to have equal access to decision making about land use and other related decisions, called procedural equity (Cole and Foster 2001). This allows communities and individuals to make decisions about industrial processes for themselves, rather than having the decision dictated on a national or state level. However, there are conflicts within procedural equity when individuals and communities disagree about the types of development individuals are allowed to host on their property.

Colorado is unique within this debate on unconventional O&G development because of the complex system of ownership of land rights and water rights, which both impact the debate on O&G development. Northern Colorado in particular has been a frontrunner in this conflict between O&G development interests and communities who feel that they are losing control over what development occurs within their borders. This issue is compounded even more because of the split estate system, which is a system of property ownership that separates mineral rights and surface rights. This system privileges mineral rights in land use disputes, causing mineral rights owners to have no choice but to allow development without receiving any of the positive impacts (Spit Estate 2009). This disenfranchises individuals who already feel their sense of agency regarding industrial development diminishing. Fort Collins, Boulder, Longmont, and Broomfield have tried to regain local control of O&G development through moratoria, which were put in

place through ballot measures initiated by activist groups in the respective communities (Wines 2013). Activist groups like Citizens for a Healthy Fort Collins, Eerie Rising, and It's Our Broomfield are fighting for procedural equity, which consists of local control over land use decisions in regards to O&G production. However, the O&G industry argues that the state is the only body with the ability to regulate zoning, pushing them to sue these municipalities (Maher 2014). Most recently, residents tried unsuccessfully to pass a constitutional amendment that would give local communities the ability to zone out O&G development (Tomasic 2014).

Farmers have a particularly important stake in the fight about whether development occurs because much of the land that is suitable for O&G development is agricultural land. Because of the financial constraints that small-scale farmers face, farmers who own their mineral rights are often eager to lease out these rights for the financial benefits that they receive, even if the potential exists for development to damage their health or their land. If farmers do not have mineral rights, they may be forced to allow development on their land without receiving any of the financial benefits that come from signing an O&G lease. The moratoria and continuing politics surrounding O&G development illustrate the debates that exist around land use, environmental justice, and procedural equity, showing that communities, individuals, and in particular farmers have less power in deciding land use than the state and the O&G industry. Farmers also do not feel sufficiently supported by their land grant institutions, the state, or the O&G industry themselves- showing a disconnect between the individuals feeling the impacts of O&G development and those who support and even push this type of development.

Utilizing the qualitative methods of open-ended, in depth interviewing, archival/document analysis, and participant observation, I gained a greater understanding of how unconventional O&G development intersects with small-scale, particularly sustainable and

organic, agriculture in Northern Colorado. My three primary case studies, Sunnydale Farm, Blueberry Hill Farm, and Tanglewood Farm, demonstrate the concrete impacts of unconventional O&G development on small scale agriculture, which related to the themes of identity, impacts and changes to daily life, and political economy. These cases illustrate how farmers' experiences with O&G development were constructed and given meaning through their experiences as mineral rights or surface rights owners, their identities as conventional or sustainable farmers, and the socio-political context of the county which their farm was located in. Through these main themes, I demonstrated how, through using an environmental justice framework, procedural equity is absent for farmers without mineral rights, while those with mineral rights feel empowered through their status as mineral rights owners. Lastly, I used symbolic interactionism and elements of social constructionism in order to examine how farmers reconstructed their identity as sustainable agriculturalists while being surrounded by O&G development and whether they felt these identity shifts were environmental injustices. Ultimately my results led me to question whether in a split estate system, true procedural equity could take place for all parties impacted by O&G development.

My hope is that this research will contribute to a rich body of literature regarding Environmental Justice. Beyond helping to shed light on the impacts of what the unconventional O&G development are, I hope that those in support and in opposition to unconventional O&G development will be able to see how individuals make decisions based on their structural context, perhaps lending a humanity to the opposing viewpoint. I also hope this research is ultimately useful to the farmers whom I interviewed that have little access to the structural benefits and decision making that the O&G industry has and as a result feel that they are inadequately supported by their government and their communities. Lastly, I ultimately hope that

my research will help impact what policy regarding O&G development is passed. If agriculturalists in Northern Colorado are feeling particular impacts from this type of development, then these impacts will be far reaching to other areas of the United States, and even the world, perhaps forcing us to rethink our energy strategy in the future.

## Chapter II: Methods

### *Introduction*

The purpose of this research is to explore the potential impacts of O&G development on small-scale organic and sustainable agriculture in Northern Colorado. My research also explores shifts that occur within sustainable or organic farmers' identities when this type of development occurs on or around their land. I became interested in this topic after I moved to Colorado, where I began studying EJ and working as a teaching assistant in related classes. Unconventional O&G development is a divisive and contentious issue in Colorado, making for a particularly dynamic and policy-relevant project that can potentially help the community I am studying.

In order to complete this research, I utilized triangulated qualitative methods. Specifically, I conducted in-depth, open-ended interviews with my target population; participant observation including farmers' markets attendance and on-site farm visits; and document analysis of newspaper coverage to provide background on O&G development in Colorado and public responses to it. Through open-ended interview data, I established what small-scale organic and sustainable farmers think about unconventional O&G development, whether and how nearby development has affected their farms, whether they have leased out their land, mineral rights, or water rights for development, and whether O&G development has impacted their identities as sustainable or organic farmers. Once my interviews were completed, I crafted a theoretical framework, using elements of EJ theory and research through coding that explained my data. Through my analysis of the shifts in identity of organic and sustainable agriculturalists, I used symbolic interactionism and elements of social constructionism to complement my EJ analytical frame.

Overall, my research helped fill the gap in the literature that exists on the impacts of unconventional O&G development in Colorado. Because the widespread use of unconventional O&G technology that employs a combination of vertical and horizontal development is so new, there is little research done on the potential environmental, health, and social effects that associated technologies may have on Colorado residents and communities. Most of the research on unconventional O&G development and its impacts was conducted in the Marcellus Shale, even though Colorado's Weld County hosts the greatest number of well pads in the country. As such, my project begins to fill a gap in knowledge regarding unconventional O&G development's impacts on small scale agriculture in Colorado, and will be one of the first studies to explore whether a farm's operations – sustainable versus more conventional methods – impact farmers' views on production and/or the impacts of that production on or near their land.

Below, I provide detailed descriptions of the research questions I am asking and the methods I will use to address them.

### ***Research Questions***

1. In what ways does unconventional O&G production interact with small-scale organic and sustainable agriculturalists in Northern Colorado, particularly as compared to effects felt by conventional farmers?

2. (How) do sustainable and organic farmers' identities or operational philosophies shift to accommodate the presence of unconventional O&G production on or near their farms (or in their communities)?

3. Do farmers experience these shifts as environmental injustices?

### ***Background and Research Interests***

A researcher's subject matter often emerges in response to his/her historical context, lived experiences, and intellectual interests (Lofland and Lofland 2006). Even before I began studying sociology, I was interested in how individuals navigate through structure, shifting their identities in a changing social world, especially shifting political and economic variables in sectors like the labor market. My interest in identity and alternative agriculture began when I took Consumer Culture and Sustainable Consumption courses taught by Dr. Laurel Graham as I worked toward my undergraduate degree in Sociology at the University of South Florida. Learning about organic and sustainable agriculture forced me to ask what aspects of sustainability, beyond promises of better health outcomes and enhanced worker safety, might encourage people to begin an organic and sustainable operation as an occupation or hobby or to buy from organic and sustainable farmers as a consumer.

Once I started my graduate degree at Colorado State University, I learned about concepts and research in EJ because of a course taught by Dr. Stephanie Malin. In my previous Sociology training, I was not introduced to EJ concepts and activism – and this new way of thinking sparked my interest. Of particular interest was an article I read by Dr. Malin, which analyzed how farmers in Pennsylvania were economically constrained by farm-related debt so that they often had no choice but to sign O&G leases in order to keep their farms. This made me see EJ in a new light; perhaps EJ is not just individuals having the ability to live, work, and play in clean, safe environments, but it also includes procedural justice and individual autonomy. This perspective forces us to consider alternative ways in which poverty and loss of social safety nets impacts populations differently. I realized that for some people EJ means feeling empowered to make their own choices within the structural constraints they experience. With poverty and inequality as central concerns for EJ scholars and activists, this new perspective may help

identify mechanisms for assuaging structural constraints and limited choices people have as a result.

At the same time, my new life in Colorado made me intensely aware of unconventional O&G production, a set of technologies that were not commonly utilized in the places I lived before. With Fort Collins voting on a moratorium and several of my fellow graduate students doing their thesis projects on different aspects of unconventional O&G development, it only sparked my interest further. With my knowledge about impacts to farming in other regions, my own interest in sustainable agriculture, and my budding interest in EJ, this was a fitting area to study.

In May 2014, I approached Dr. Stephanie Malin about becoming my advisor for my thesis project. I was unsure of exactly how I would marry my interests of identity, consumption, and unconventional O&G development, but it she was beginning a project through the CSU Water Center examining ways in which unconventional O&G development impacts small-scale farmers in Colorado. I thought it would be fascinating to examine how it affected sustainable and organic farmers in northern Colorado, which also enabled me to explore my interest in identities of sustainable and organic farmers in a context that was timely and interesting. I wondered how sustainable and organic farmers shifted their operations or identities to accommodate their new interactions with O&G development going on in their state and possibly even on or near their farms. Did they welcome the development because of the possible financial gains? Did they work to help pass moratoria? Did they sign leases to allow development on their land? Or lease their water? Being a Masters student in Colorado at this particular time was indeed fortuitous, allowing me to explore my interests while engaging in a dynamic area of research.

### ***Theoretical Approach***

To complete this research, I primarily used epistemologies rooted in environmental justice and social constructionism. Though I am adopting these frameworks as guides, I also utilized an iterative, semi-grounded approach to my data collection and analysis. This allowed me flexibility to accommodate developments in the field as I spoke to farmers, visited their operations, and then coded my interview data. This approach also allowed me to report on farmers' experiences in a way that is true to what they have expressed during interviews, while being methodologically sound. An EJ framework enabled me to connect farmer's individualized experiences with larger structural, political-economic issues that may be at play, such as economic marginalization of small-scale farmers. Symbolic interactionism compliments the EJ perspective, because I am interested in seeing how farmers reconstruct their identities based on interactions with other individuals and larger structural constraints that affect their day-to-day business and farming decisions and ethos. Lastly, social constructionism allows me to examine whether (and how) farmers constructed O&G development as an environmental problem.

### **Environmental Justice**

There are several reasons why I chose to employ an EJ framework for a project that focuses on unconventional O&G development's impacts on small-scale sustainable and organic agriculture. Although EJ is a body of research, it also works as an interpretive frame or a conceptual construction (Snow et al. 1986) utilized by people to make sense of their daily lives and their politics. First and foremost, this frame lets me speak to individuals' experiences and the ways that they interpret them without value judgments. EJ literature notes that in cases of contamination, communities and their residents may also feel constrained economically, disabling their agency to speak out against the source of contamination (Capek 1993, Mohai et al. 2009). Rather than making value judgments about people's experiences, open-ended,

qualitative interviews allowed me to see people's experiences through their eyes before I analyzed them from a sociological perspective. Because I believe that the individuals themselves are the source of knowledge regarding their own experiences, qualitative interviewing is important. Berg (1989) argues that although structures, social roles, rules, norms and goals influence individuals, understanding social interactions and negotiation of meanings is vital to understanding individuals' experiences. Because there is a void in EJ and other literatures regarding the impacts of unconventional O&G production on small scale farms, it is especially vital to fill our gaps in knowledge using open-ended qualitative methods, which allow researchers to explore the topic openly with interviewees, thereby beginning to identify some key social and environmental outcomes.

EJ also stresses democratic processes and citizens' rights to controlling their environments in a democratic fashion, while privileging grassroots knowledge generated by people and groups directly engaged with the issues at hand (Sze and London 2008, Cole and Foster 2001, Capek 1993). This does not just occur through citizen science documenting illnesses (Brown and Zavestoski 2004, Brown et al. 2008, Clapp 2002), but through examining procedural equity<sup>1</sup> as well (Cole and Foster 2001). Although I had some preconceived notions about power, agency, land use, and other impacts of O&G development, I let the individuals I interviewed speak to their experiences with how O&G development has impacted them. This orientation allowed me to listen to farmers' experiences without having preconceptions about what development means for them in their daily lives, because it may turn out that democratic

---

<sup>1</sup> Procedural equity refers to individuals having a right to be equally represented in the political arena while also having equal access to decision making about their communities, which includes the right to dictate land use (Cole and Foster 2001)

control over land use and allowing O&G development is EJ for them and as a researcher, I need to respect and appreciate that perspective.

Environmental justice epistemology also allows me to connect the micro to macro, specifically looking at how individuals are both empowered and marginalized by the social structures in which they are embedded. This frame facilitates linkages between micro-level experiences of farmers and their households and more macro-level phenomena, such as shifts in the regional and global energy economy. This often occurs by examining cases of environmental injustice within the historical context that they occur (Mohai et al. 2009), which enables us to examine whether race is the most important in a particular situation, whether contamination occurs before or after certain groups move into a particular place (Mohai and Bryant 1992, Anderton et al. 1994, Been 1994, Downey 1998, and Downey 2006) or whether there are sociopolitical<sup>2</sup> (Bullard and Wright 1987) or economic explanations<sup>3</sup> (Rinquest 2003) for particular environmental injustices (Szasz and Meuser 1997).

Most importantly, employing an EJ framework allows me to advocate for the farmers and communities I research, bringing my work into the realm of public sociology. Burowoy (2005) argues that all sociology should aim to be public sociology, engaging the community with social issues that affect them while providing information from the university as a public good. If Sociology does not engage with the public, instead only engaging with the academic sphere, it is unhelpful to those that we study and to society at large. Public Sociology involves a mutual education; the researcher learns from their subject as their subject learns from the researcher.

---

<sup>2</sup> Sociopolitical explanations focus on whether industry or government chooses communities for toxic waste sites that are less likely to fight against them (Bullard and Wright 1987).

<sup>3</sup> Economic explanations argue that industry puts hazardous waste into low income and minority neighborhoods because real estate is cheapest (Rinquest 2003).

This fits in well with EJ's perspective of individuals having the right to know not just what is going on in their communities regarding potential environmental risks, but also having the ability to participate in decision making related to these risks (Capek 1993). I hope that this research will empower communities by helping them uncover what outcomes are being experienced by small-scale agriculturalists. This approach fits well with aspects of EJ that are peripherally important to this project, like popular epidemiological methods utilized by activists in order to account for citizen's health experiences, scientific findings the public makes, and the value of lay knowledge in addition to professional, "expert" knowledge. Thus, I ask farmers about their experiences, capturing their words and stories, viewing at them as experts of their own experiences, their farms, and the impacts of new industry. I hope that these experiences will be usefully translated into policy and otherwise benefit the public.

Lastly, EJ fits well with my second epistemologies, symbolic interactionism and social constructionism. These lenses helps sociologists identify the ways in which various groups in a society perceive, identify, and define environmental problems and how their identities and livelihoods might interconnect with those perceptions. Through this, I am able to see how individuals assign and re-assign meanings to their social world (Best 1989, Hannigan 1995, Searle 1995), here in the form of their farm operations and shifts in the meanings of being a 'sustainable' farmer when surrounded by industrialized, unconventional O&G development.

### **Symbolic Interactionism**

The theoretical tradition of symbolic interaction, which examines how individuals assign meanings to everyday interactions, enhances my inquiries into shifts in farmers' identities. Symbolic interactionism was derived from pragmatism and George Herbert Mead's work, which is extremely influential within social psychology and micro-sociology. There are four main

tenants of pragmatism; the first tenant is that individuals create reality through their actions within the social world and towards the social world; thus, reality is not “out there” in an objective sense, but is created through individual’s actions. Second, individuals act toward the world based on the success of past actions. Third, individuals define and give meaning to social and physical objects based on their own individual use for them. Lastly, in order to understand individuals, we need to understand how individuals actually behave. Symbolic interactionism borrows three of these tenants, focusing on the individual’s interactions with the world, viewing the individual as a social process, and the individual’s ability to give and interpret the meaning of the social world (Mead 1982).

In my analysis, I focus on Mead’s (1934) symbolic interactionism, with elements of Blumer (1986), who offers an extension on Mead’s theoretical orientations. Mead (1934) and Blumer (1986) illustrated how everyday interactions can uncover facts about social life. While social constructionism focuses on how macro level social phenomena are constructed, symbolic interaction examines how individuals at the micro level creating and recreating meaning. Symbolic interactionism argues that human beings act towards objects in relation to the meaning that these objects are given; these things include physical objects, categories of human beings, institutions, and even knowledge. The meanings of these things arise from the social interaction that individuals have with other individuals. Lastly, these meanings are changed and reconstructed through an interpretative process used by the individual during their encounters with individuals in their daily life (Blumer 1986). Blumer (1986) states:

It does not regard meaning as emanating from the intrinsic makeup of the thing that has meaning, nor does it see meaning as arising through a coalescence of psychological elements in the person. Instead, it sees meaning as arising in the process of interaction between people. The meaning of a thing for a person grows out of the ways in which other persons act toward the person with regard to the thing (4).

Mead (1934) examined these ideas through the concepts of the “I” and the “me”; the “me” is the social self, which operates under an organized set of beliefs, while the “I” is an internal, reflexive response to the “Me”. Blumer (1986) also views the creation of meaning as inherently social; it exists as a form of communication. This view of human action and meaning applies to collective action as well. Individuals engaging in joint behavior also engage in interpretive processes, relating their actions to each other. These interpretive processes occur by individuals not just indicating meaning to themselves, but to one another. Through symbolic interactionism, Mead combined ideas about individualization and socialization, illustrating how they are not dichotomous but work together to form social life (Joas 2001).

A particular aspect of symbolic interactionism, borrowed from pragmatism, relates to the creation of knowledge. Mead did not just argue that meaning is not inherent to social life; he also argued that reality does not exist in an objective sense. Using this framework, reality is not something to be studied by individuals objectively using the scientific method, but it exists and is actively created as individual actors act in and toward the world. Just as meaning is not inherent within social products, symbolic interaction views knowledge as something created through human interactions (Blumer 1980). Symbolic interactionism also recognized how the creation of knowledge is related to power relations through ideology; symbolic interactionism views ideology as the “internalization of the powerful’s definitions of the situation or a joint struggle against those definitions” (Musolf 1992; 182). This definition has the potential to explain why sustainable farmers may internalize certain meanings of sustainable farming in response to power structures.

I will primarily employ symbolic interactionism to examine identity, a contested term within sociology. Identity is of increasing interest academically, perhaps because of the

individualization of social life (Beck & Beck-Gernsheim 2002). Much of the sociology of identity focuses on how individuals construct their identities through institutions of gender, race, class, sexuality (Callero 2003). Identity is vital to the sociological discipline because it offers us a way to examine the individual in relation to the social world they inhabit and interact with, accomplishing the goal of connecting micro level and macro level phenomena (Woodward 2002). For example, Giddens (1991) discusses the materialization of “identity projects,” where individual meaning and social location are a choice and a product of individual effort. Individuals not only create meaning through self reflection, but they use this meaning to engage in future action.

There are several ways to examine identity; one is employing it to refer to a culture of people, another way is to define it as a collectivity, social category, or a universal culture among individuals. However I will examine identity “with reference to parts of a self composed of the meanings that persons attach to the multiple roles they typically play in highly differentiated contemporary societies” (Stryker and Burke 2000; 284). This definition of identity, borrowed from identity theory, is directly related to Mead’s tradition of symbolic interactionism. Stryker and Burke (2000) state:

In highly simplified form, Mead's framework asserted a formula: ‘Society shapes self shapes social behavior.’ Identity theory began by attempting to specify and make researchable the concepts of "society" and "self" in Mead's frame and to organize these as explanations of specified behaviors; such putative explanations could be tested in systematic empirical research (285).

Using this concept of identity implies that the self is not uniform but complex; it consists of independent and interdependent, conflicting and mutually reinforcing parts (Stryker and Burke 2000). Rather than taking the view that identity is a fixed, naturalistic or essential characteristic of an individual (Cerulo 1997), I am examining the self as a reflexive project. According to

Mead (1934), "It is by means of reflexiveness--the turning-back of the experience of the individual upon himself--that the whole social process is thus brought into the experience of the individuals involved in it" (134). It is through individuals recounting their experiences that the individual is able to make sense of their individual experience within the larger experience of the social, which is what I aim to uncover during my qualitative interviews.

Symbolic interactionism, and particularly identity theory, also aims to explain how the meanings individuals assign to things in their social world relate to their actual behavior. Burke (1991) argues that the identity standard, which is a set of culturally dictated meanings that define their role within a situation, help dictate how individuals assign meanings to their identity. The individual's views about the meanings of the situation may also be different when compared to the meaning within the identity standard. Lastly, it aims to explain individual's behavior, examining the individual's actions as a result of the difference between their perceptions and the identity standard.

### **Social Constructionism**

Separate from the examination of individuals creating meaning through interpretive action is how our social institutions are constructed through individuals. Social constructionism argues that "Every collective becomes a social artifact—an entity molded, refabricated, and mobilized in accord with reigning cultural scripts and centers of power" (Cerulo 1997, 387). Social institutions exist as artifacts of the meanings that individuals create in relation to their social world. Gergen (1985) defined social constructionism through four tenants; the first tenant is that our understanding of the world is given meaning through language, culture, and history. The second is that our understandings are not driven by natural forces, but are a result of active individuals within a social relationship, working together. The third tenant is that common

understanding is dependent upon communication, negotiation, conflict, and rhetoric not empirical validity. Lastly, negotiation of common meanings is a form of social action and is integrated within other activities. It is through these tenants that social constructionism views the construction of knowledge, particularly the idea that even what we consider truth and knowledge is not an objective empirical reality, but is constructed by human beings in their daily life and then cemented into interactions through social institutions.

The social constructionist framework is particularly important for the studies of gender (Bem 1993, Connell 1995, Coser 1986, Epstein 1988), sexuality (Irving 1994, Taylor and Whittier 1992), and race (Davis 1991). Social constructionism does not look at the construction of the self through just the reflexive nature of the individual as Mead argues with symbolic interactionism, but it also takes into account that the individual constructs their identity in response to social institutions that influence them and are influenced by them. This includes the historical and cultural settings where underlying assumptions about the nature of the individual are based (Callero 2003). For example, individuals may construct unconventional O&G development as a problem or a solution, depending on the socio-political context individuals live within, particularly whether they own mineral rights. Social constructionism also allows us to examine how the meanings of the institutions themselves are constructed, enabling us to take examine society and interaction through a macro level analysis.

Hochschild (1983, 1989, 1997) offers us a way to look at historical shifts in the political economy, changes in social settings, and subsequent shifts in self-experience and identity. She examines how individuals shift their self-understandings and self-meanings as changes occur in the labor market and larger political economy. I use Taylor and Whittier's<sup>4</sup> (1992) three steps of

---

<sup>4</sup> Taylor & Whittier's (1992) steps of group construction are: the construction of boundaries that insulate and differentiate non-mainstream groups from the dominant group, the emergence of shared consciousness and goals

group formation along with elements of Foucault (1987) to explain how sustainable farmers construct their identities and re-assign meanings in relation to O&G development. Foucault (1987) argues that individuals internalize the needs of social structures through power and discourse. Rather than power existing in the form of individual actors who use it through coercion, forcing individuals to adhere, it is the individuals themselves who are the diffuse sources of power. Power is diffuse and embodied in discourse, knowledge, and regimes of truth. Therefore it is individuals who fulfill the needs of the power structure through the internalization of what truth entails. This internalization means that power is no longer exercised through force, but through individuals disciplining themselves (Rabinow 1991).

In this project, I interrogate whether and how organic and sustainable farmers feel compelled or constrained to shift their own self-understandings and self-meanings to accommodate the socio-political reality of the energy boom that affects their operations, whether they choose to participate in it or not. Further, given the shifting context of agriculture in the U.S. over the last fifty years, where most small-scale farmers rely on off-farm employment for the majority of the farm family income, it is important to remain open to different impacts to identities that I may not anticipate based solely on previous work (Lobao 1990, Lobao 1996, Lobao and Meyer 2000).

Lastly, in addition to my EJ, symbolic interactionism, and social constructionist frameworks, I adopt selective elements from the grounded theory approach to qualitative research in my approach to coding and analyzing my data. Grounded theorists argue that scientific truth results from observation and consensus within a group of observers making sense of their experiences with empirical reality being the interpretation of meaning created by

---

among nonmainstream groups, and the process of politicization which helps to create and sustain a group's minority status.

individuals engaged in common observation (Suddaby 2006). I used elements of grounded theory during the construction of my codes from the data, not from hypotheses that I created before I examined the data (Charmaz 2011). Unlike the way in which Glaser and Strauss (1967) and Strauss (1987) define grounded theory, I did not employ strict grounded theory which suggests that researchers go into the field without conducting a literature review in order to have a fresh and open mind. This means the researcher will not have the baggage of other empirical findings, theoretical frames, and other concepts that might color how data are interpreted or analyzed. However, I felt that it is important to go into the field with a theoretical framework; this helped me construct questions that elicit the richest narratives and data possible. That said, utilizing this quasi-grounded theory design allowed me to generalize my research to other communities dealing with unconventional O&G development, perhaps making novel connections to findings and outcomes in other states and regions also experiencing booms in production (Neuman 2003).

### ***Methods***

To address my research questions, I employ the qualitative research methods of open-ended, in depth interviewing, archival/document analysis, and participant observation. I chose to use qualitative methods because qualitative research is uniquely situated to gain exploratory knowledge about social phenomena that are still emerging and being defined; these methods help build rich descriptions of complex circumstances that are un- or under-explored in the literature (Marshall and Rossman 2011). It uniquely enables us to fully understand the motives, viewpoints, and actions that people we interview ascribe to their actions (Berg and Lune 2004, Rynes and Gephart 2004, Becker 1996), while allowing us to make parts of the every-day world visible that may have been invisible before the qualitative research (Denzin and Lincoln 2011).

Before conducting interviews or entering the field, I sent my interview guides and other supplementary materials to Colorado State University's Institutional Review Board. This process ensures that my research is being carried out ethically, ensuring no harm to the population I studied.

### **In- Depth Interviews**

The primary research method that I used for this research project is in-depth, semi-structured, open-ended interviews. Conducting in-depth interviews allowed me to gain rich and detailed information, while learning about the distinctive perspectives, motives, and opinions of my respondents. This also allowed me to clarify answers and cater my interview guide to the interview I was doing, dependant on how the conversation went (Rubin and Rubin 2012). Semi-structured interviews enabled me to focus on questions my research team developed in relation to previous research findings and EJ issues, while still giving me the freedom and flexibility to follow the flow of the conversation and treat my interview as a conversation as well. Lastly, Interviewing allowed me to connect analytical categories and literature to respondents' cultural categories and meanings once I begin to code my data (McCracken 1988).

After deciding on in-depth interviewing as my primary source of data collection, I created an interview guide that would best capture the information I wanted from my population. Because my thesis is part of a larger project that began in 2012 with Dr. Stephanie Malin, I was able to adapt previously-used interview guides to better suit my overarching research questions and Colorado-based population. In these interviews, I asked questions about farmers' perceptions of and experiences with unconventional O&G development on or near their land, their perceived impacts to their sustainable operations, and ways in which their identities may have shifted in response to production. For example, I asked whether they feel sufficiently supported and

engaged with by the state, their local community, and the O&G developers in regards to development either on or close to their land. I also inquired whether they feel O&G development conflicts with their identity and ideology as a sustainable farmer, and whether it has changed once development started occurring.

### **Participant Observation/Site Visits**

As an additional primary method to complement my qualitative in-depth interviews, I used participant observation through visiting the farm's stands at farmers markets, along with site visits of the interviewee's farms. Observation is important for qualitative research because it helps the researcher to discover interactions of their subject in their natural social settings (Lofland et al. 2006, Marshall & Rossman 2011), while giving the researcher direct involvement in the social setting they are studying (Marshall & Rossman 2011). Interviewing individuals at their farms was not just more convenient for them, but it allowed me to get a better understanding of the context that they operated within (Becker & Geer 1957). This also helped me ask about things specific to their farms during the interview process I may not have otherwise thought of. Lastly, participant observation helped me gather rich data while studying a sensitive topic, such as unconventional O&G development, that individuals may be wary to fully discuss otherwise (Becker and Geer 1957).

### **Archival and Document Analysis**

As a secondary method to complement my primary methods of in depth interviews and participant observation, I employed archival and document analysis of local newspaper coverage and local and national regulation documents. This helped give the proper context to the data that I gathered during my primary methods of data collection. It has been noted in literature regarding qualitative research that different types of documents are helpful in gaining background

information which helps establish the rationale for the research subject (Marshall and Rossman 2011). This is important for my target research population and subject because the counties in which I completed the interviews – Weld, Boulder, and Larimer - experienced drastically different types of public responses to O&G development. While Weld County leaders and residents are generally quite supportive of the industry, Larimer County residents and leaders typically express more precaution, and Boulder leaders and residents are extremely resistant to development (Handy 2014). In addition, document analysis was vital to help me understand the national, state, and local regulatory process that these farmers operate within on a daily basis.

### ***Sample of Farms***

One of the most difficult aspects of studying farmers with O&G development near or on their property was constructing a sampling frame. I began this process by conducting basic internet searches of small-scale sustainable or organic farms that were located in Larimer, Boulder, and Weld Counties. To conduct this search, I used Google search engine and terms such as “small scale farms Northern Colorado,” “Sustainable Farms Larimer County,” “Organic farms Boulder County” to locate potential interview subjects. In addition to searching for farms with websites, I also did comprehensive searches for non-profits and social media serving small-scale agriculturalists, such as Dairy Farmers of America, Rocky Mountain Farmers Union, Boulder County Sustainable Agriculture Forum, [www.belocalnc.org](http://www.belocalnc.org), and websites covering regional farmers’ markets. Finally, to ensure comprehensive coverage and sampling, I emailed relevant Colorado-based agricultural organizations, such as the Rocky Mountain Farmers Union, Colorado Farm Bureau, and Colorado Fruit and Growers Association for lists of their members.

To assure I reached farmers that were not captured using the above strategies, members of my research team and I attended the Larimer County Farmers Market, Loveland Farmers

Market, and Fort Collins Farmers market, where we recruited small-scale farmers without a substantial public or internet presence. I introduced myself to the individuals running the stands, and I gave them a flier with a brief explanation of the project along with the principle investigator's card in case they wanted to contact her. I also gave them my name and information if they requested it. We also requested contact information, such as business cards, from farmers we met with for our records and so we could follow up to schedule an interview. From this comprehensive set of strategies, my research team and I compiled a database of sustainable or organic, small-scale farmers in Weld, Boulder, and Larimer counties, with some general information such as phone number, address, acreage, whether they were organically certified or not, a brief mission statement or overall explanation of the farm's values if this information was available online.

Once I located small-scale farms in Weld or Larimer counties, I used the Colorado Oil and Gas Coalition's database of drilling permits and well pad locations to determine the distance of these farms from O&G facilities. We excluded farms from our database that were not located within 1-2 miles of an active and producing O&G well. I did this using the GIS application on the COGCC website, which allows you to enter in the farm's address (obtained through internet searches) to see whether wells were located near that address. Aside from locating the wells, I could see whether these wells were producing through the color of the icon. The application also allowed the user to click on the well to access more specific information, such as how long the well had been producing and which company was running it. This was effective when looking up the few producing wells that were in Larimer and Boulder Counties, though less effective in Weld County because of the enormous amount of wells. By initially narrowing down my sampling frame to farms located near O&G wells, I focused on interviewing individuals who

would be most relevant to my research questions. This prevented me from being merely speculative as to how possible O&G development might affect them. With this step completed, I was then able to begin contacting farmers to schedule interviews. Once I contacted all of my farmers who were near development, I expanded to other farmers who were not located near development, but still had important insight into the intersections of O&G development and agriculture.

In addition to locating my sample population through the methods above, I used purposive snow-ball sampling. Purposive sampling is the type of sampling that most qualitative researchers employ because it provides the richest data for analysis. Although this type of sampling is not meant to be representative of your research population, it allows the researcher to choose individuals or groups that can provide you with the most insight into your research questions (Devers and Frankel 2000). Snowball sampling is beneficial because it allowed me to sample from natural interactional units (Coleman 1978) or networks that have formed among small-scale farmers<sup>5</sup>. Purposive and snowball sampling helped identify farmers without a strong public or internet presence, but were nonetheless vital to northern Colorado's agricultural community. This enabled me to reach out to other small-scale farmers who fit my criteria, but were not included in the original sampling frame.

I completed ten interviews for this research project, at which time I reached saturation, or the point where my interviewees began reporting similar things during their interviews with me. From these interviews, I identified and analyzed general patterns and themes regarding small-scale farmers' experiences with unconventional O&G production and its potential impacts on their operations and identities as sustainable farmers.

---

<sup>5</sup> Small scale farmers are defined by the USDA (2014) as small-scale family farms that earn less than \$250,000 in sales.

## **Sample Population**

For this research I completed ten interviews with eleven farmers; one interview took place with two farmers who operated on the farm. Of these farmers, four of them were women and seven of them were men. All of these farmers were perceived by me as White. These farmers were spread out among three counties as well; two were located in Boulder County, four were located in Larimer County, and five were located in Weld County. Four farms hosted development directly on their land, while three farms were located within two miles of development, and two farms had no development within two miles. The farmers I interviewed also represented different types of farms; two farms were conventional, one was certified organic, and seven identified as sustainable. It was a disappointment that I only interviewed one farm with organic certification; however, this is an area for further research in the future. The demographics of these farmers may have impacted my results in ways that are unavoidable and unknowable. I had difficulty acquiring interviews; many farmers did not respond to my requests for interviews for unknown reasons. However, I heard from the farmers that I interviewed that many farmers were not interested in discussing this issue because of the sensitivity of the subject. Because my sample is so small, it is not generalizable to the whole population of farmers in Northern Colorado, but it functions as important initial exploratory research which should be expanded upon in the future.

## ***Data Collection & Analysis***

My data collection began during the interviews, during which I took extensive field notes on the most important subjects the respondents were talking about and what their tone was during the conversation. Before beginning the interviews, my respondents signed consent forms, giving me permission to record the interviews. If respondents agreed, I recorded the interviews using an Apple application called Voice Record that allows for digital storage and transfer of

data<sup>6</sup>. Respondents were promised anonymity and confidentiality during these interviews, with only myself and two other researchers able to access the raw audio interviews and the interview transcriptions. Once I began transcribing, I gave the individuals in the interviews pseudonyms to further protect participants. In social research, there is often the “assurance of anonymity” that the real names of persons, places, etc. will not be used in the research report and will be changed. This is especially important for known researchers, who often need anonymity to gain entree into the field (Lofland and Lofland 2006).

I kept data in the back of my mind as I entered and left the field by compiling field notes and then transcribing the interviews as soon as possible after leaving the meeting. This allowed me to immediately study and analyze the interview setting and material in an informal manner (Lofland and Lofland 2006). Because I already reviewed the literature on extractive industries, communities, and agriculture, I kept in my mind potential themes that may emerge from the interviews. After the first initial reviewing of the transcripts, I jotted down notes of my initial thoughts that popped into my mind about the data. Lofland and Lofland (2006) argue this is beneficial for recording small pieces of analysis, methodological difficulties or successes, and personal emotional experiences during or after data collection that may help with an analysis.

Once all of my interviews were transcribed and possible emergent themes were noted systematically across interviews, I began coding for the specific themes. I read through each interview transcript a minimum of three times to identify themes, code themes, and then identify sub-themes within them. After these initial readings, I extracted and categorized representative quotations from the respective respondents. I coded my interviews by hand using the highlighter function in Microsoft Word into such categories into the categories of “identity,” “impacts and

---

<sup>6</sup> One farmer would not agree to be recorded for privacy reasons; during this interview I took detailed field notes to use as data for my analysis.

changes to daily life,” and “political economy”. This gave me a visual representation of my codes, pulling out particularly useful quotations within the interviews to help support my theoretical framework (Lofland and Lofland 2006). After I coded for my three main themes, I coded each theme into various subthemes to further analyze my data in a meaningful way. Under the code of “identity,” I focused on farming philosophy, motivations for farming, and feelings about O&G development. Under the code of “general impacts and changes to daily life,” I focused on the subthemes of health impacts, impacts to the land, water, and other quality of life concerns. Lastly, under the code of “political economy,” I focused on the subthemes of the economic benefits of unconventional O&G development, importance of domestic fossil fuels, split estate, and regulations.

### ***My Role as a Researcher***

To the farmers I interviewed I was an “outsider,” and for a few good reasons. First, I am not a native Coloradan and thus did not understand the entire history and context that they operate within. Second, I am a graduate student in a different social context than them and I had little experience dealing with rural communities. Thus, at times it was difficult to gain their trust. Loftland and Loftland (1984) argue that often for the researcher perceived as an outsider, it is difficult to gain entry into the field. In order to do this, you need “connections, accounts, knowledge, and courtesy” (25). Although I could do little to help myself in certain aspects of gaining entry, I controlled for “accounts, knowledge, and courtesy”. Before entering the field, I shared a succinct but well-organized explanation of the research before I requested an interview. I also went into the field with some knowledge about the topic, the state of small-scale agriculture in Colorado, and local issues related to unconventional O&G production. I spoke to peers who completed research with farmers in the past, asking them advice on how to present

myself and request interviews so as to get the best response from my interviewees. Perhaps most importantly, I made every effort to extend courtesy to the interviewees by making their participation come with minimal stress and effort on their part. An example of this was completing the interviews at their farms rather than meeting in a different location. I will also send my finished thesis project to them so that they are able to my findings for themselves. This enables the researcher and informant relationship to be reciprocal; while they provided me with information about their experiences, I will provide them with information about the overall phenomenon of O&G development, possibly allowing them to see how their experiences relate to the experiences of their peers.

### *Limitations*

There are some limitations to the qualitative methods I employed during this research. One of the main limitations of this research is the way my sampling frame was constructed and then selected from; the farmers I interviewed were the ones who agreed to be interviewed. My sample was much smaller than anticipated; I conducted ten interviews with eleven farmers. As such, they are not necessarily a representative sample of small-scale farmers in Colorado, nor do they represent all viewpoints and experiences that exist within the region, though these are not the intentions of such an exploratory project. The original goal for this project was to complete interviews during October and early November of 2014. However, because this was towards the end of harvest season and most of the small-scale farmers in my sampling frame were incredibly busy, it was difficult to get interviews during this time. I did not want to further risk alienating potential interview subjects by contacting them too many times during a stressful time of year, so I pushed my interview schedule back to late fall and early winter.

My second challenge was that although this research was part of a larger project funded by Colorado State University's Water Center, a neutral entity, some individuals expressed concern that the project would have an environmental or a pro-oil and gas stance. It is impossible to know whether this was a reason why some farmers did not agree to be interviewed for this project. However, it is a possibility that exists in research about a sensitive topic such as unconventional O&G development. Finally, farmers may have been nervous to speak to me because of all the controversy and tension surrounding this particular issue. Although their information was kept strictly confidential, they may have been worried about being identified as either supportive or critical of O&G development within their social and business circles. These problems are not uncommon when doing research on sensitive issues such as O&G development and I tried to remedy this as much as I could, ensuring farmers that at any time we could talk "off the record" and I would turn off the recorder. In addition, I ensured them that their names along with any names mentioned during the interview were kept strictly confidential.

### ***Conclusion***

Through data I gathered during my in-depth, open-ended qualitative interviews, participant observation, and archival/document analysis, I used EJ symbolic interactionism to construct a theoretical framework of how experiences of small scale farmers in Colorado connect to the macro level analytical themes that exist within the literature I reviewed. *This helped me address my three research questions: What are the impacts of unconventional O&G production on small-scale organic and sustainable agriculturalists in northern Colorado and how does this compare to impacts felt by more conventional farmers in the region? How do sustainable and organic farmers' identities or operational philosophies shift to accommodate the presence of unconventional O&G production on or near their farms (or in their communities)? Do farmers*

*experience these shifts as environmental injustices?* While exploring these questions, I aim to fill the gap in the research that speaks to how O&G development and its impacts may empower or disempower an already disenfranchised community like small-scale agriculturalists. My ultimate goal is to do this while providing my study population with information that may help empower them to directly engage with this topic of O&G development which affects their daily lives so intimately, ultimately producing a piece of public sociology that may be helpful to producing future policy.

## Chapter III: Literature Review

### *Unconventional Oil and Gas Development*

Although in the Niobrara Shale most of the unconventional O&G development is retrieving oil, in most other shale deposits natural gas is being retrieved. Natural gas is framed as a potential bridge fuel that will help address challenges of climate change mitigation (Pacala and Socolow 2004) because it is a clean fossil fuel when compared with coal and oil. However, scientists and environmentalists are concerned that natural gas is misrepresented as environmentally friendly. Unconventional drilling is an especially controversial part of this debate, because although it is argued that natural gas burns cleaner than other fossil fuels, the extraction process is not necessarily more environmentally sustainable or less likely to emit greenhouse gases. The effects of this process on communities, wildlife, and the environment must be more systematically explored, particularly as unconventional methods of O&G extraction such as hydraulic fracturing are increasingly shifting to heavily populated areas.

For this research, I explored potential impacts to organic and sustainable farmers who face unconventional O&G development on or near their land. Do sustainable and organic farmers shift their identities, and even what constitutes their identities, when faced with extractive development? What are the EJ implications for small-scale farmers, particularly as it relates to natural resource dependence, access to mineral and water rights, health outcomes, and impacts to control over their small-scale operations? Researching these questions will address the gap in the literature of how unconventional O&G drilling may uniquely affect small-scale sustainable and organic operations, which already face disenfranchisement because of the difficulties associated with being an organic or sustainable farmer.

## **Advantages & Disadvantages of Unconventional Oil & Gas Development**

Critics and supporters of unconventional O&G development cite several advantages and disadvantages of this type of extraction and energy development. Supporters argue that it provides economic opportunity for rural, impoverished or isolated communities with few options for diversified economic development (Howarth et al. 2011). The gas industry in America accounts for \$385 billion in direct economic activity and almost 3 million jobs (Howarth et al. 2011). In Pennsylvania alone, the shale gas boom produced 29,000 new jobs in 2008, which created \$2.3 billion in revenue and \$238 billion in tax revenues (Kargbo et al. 2010). Domestic development will arguably lead to lower natural gas prices (Jacoby et al. 2012) and without shale gas reserves, it is estimated that the price of natural gas will be 2.5 times higher by 2050 (Sovacool 2014). Lastly, if the US transitions to domestic fossil fuels rather than relying on foreign fossil fuels, it may result in strengthened national security (Howarth et al. 2011).

Besides economic advantages to O&G development, shale natural gas is lauded as a solution to many environmental problems, including climate change. One of the major arguments for natural gas is that it produces less carbon dioxide than other fossil fuels (Howarth et al. 2011). For example, because it only produces only 45% of the carbon dioxide emissions of coal (Hou et al. 2012), supporters hope that it will eventually replace coal (Sovacool 2014). With the abundance of domestic shale gas resources that parallels that of conventional natural gas (EIA 2014), natural gas has the potential to serve as a bridge fuel until a viable renewable energy economy exists (COGA 2014, Howarth et al. 2011, Pacala and Socolow 2004). Many argue that our energy problems will be solved through diversification of energy sources, which includes shale O&G (Howarth et al. 2011). Many concerns that individuals have about O&G development can be quelled with stronger regulation and improved technology. While most accidents are caused by human error, which can be remedied through the employment of best management

practices (Wang et al. 2014), many accidents are caused by faulty technology such as leaky wellheads, blowouts, and holding tanks, which can be made more secure (Howarth et al. 2011).

However, there are many disadvantages of O&G development. The industry's longevity and the technology's economic sustainability are uncertain, partially because it is difficult to accurately measure reserves (Kerr 2010), and because of biased reporting of those reserves (Kinnaman 2011). There is diminishing profitability from existing fields and increasing economic costs of externalities. Gas wells have steep production declines; stable supplies depend on a constant rate of new well completions (Sovacool 2014). The technology used in O&G production is "technically complex, capitally intensive, and financially expensive" (Sovacool 2014: 255), leading to projects going over budget and causing accidents and leakage. There are also concerns about soil, air, and water contamination during and after production (Brown 2014, Osborn et al. 2011, Witter et al. 2008). Volatile organic compounds and radioactive materials can enter into ecosystems through the waste from production when toxic emissions, such as methane, are released (Howarth et al. 2011, McKenzie et al. 2012). Although carbon dioxide lasts longer in the atmosphere (Jenner and Lamadrid 2012), Methane is 25 times more potent than carbon dioxide over a 100 year period (Karion et al. 2013). McJeon et al. (2014) also found that increased use of natural gas had no significant effect on carbon dioxide emissions, casting doubt on whether carbon dioxide emissions are improved by increased natural gas use. There is also a significant risk of seismic activity from the reinjection of flowback fluid (Ellsworth 2012, Karenan et al. 2014, USGS 2014). As a result of many of the environmental concerns, there are significant health concerns such as increased asthma (McKenzie et al. 2012) and birth defects in children born to mothers who live close to wells (McKenzie et al. 2014).

One of the significant disadvantages of O&G development is the nature of boom-bust economies. Because there is a lot of research on the implications of boom-bust economies, it is certain that the shale gas boom happening currently in Colorado (as well as other places) will bust again. Although researchers have pointed out uncertainties underlying the current shale gas boom (Kerr 2010, Hughes, 2013, McGlade et al., 2013, Johnson and Boersma 2013), the repercussions of US shale production have not been examined in a modern context that is different from the pre-shale era.

## **Regulation**

### **National**

Controversy also surrounds unconventional O&G development because no national set of regulations govern the industry. The Energy Act of 2005 allowed unconventional O&G development to be exempt from seven of the fifteen federal environmental regulations that exist nationally, including the Clean Air Act, Clean Water Act, Emergency Planning and Community Right to Know Act, and the Safe Drinking Water Act (EWG 2009, Malin 2011, Energy Policy Act of 2005). This is often called the Halliburton Loophole by critics because its passage was largely due to Vice President Dick Cheney, a former Halliburton CEO (Howarth et al. 2011). Vice President Cheney assembled the Energy Task Force to help form Energy Policy in 2001. Many of the individuals who met with the Energy Task Force were energy executives from companies such as Exxon Mobile, BP, and Shell and recommendations made by these undisclosed energy executives largely shaped the Energy Policy Act of 2005. The names of the individuals who worked on the bill remained a secret because of a Supreme Court ruling that stated that the administrations internal deliberations had a right to stay undisclosed (Abramowitz and Mufson 2007).

Regulations over waste materials such as flowback water also remain unenforced at the federal level. According to the EPA (2014), wastes generated during the exploration, development, and production of crude oil and natural gas are categorized as special wastes by the EPA; thus they are exempt from the federal hazardous waste regulation under the Resource Conservation and Recovery Act. Produced water, drilling fluids, drill cuttings, rigwash, well completion, treatment, and stimulation fluids, and produced sand are some of the things exempt from EPA regulation. The EPA (2014) admits that while certain wastes are exempted from regulation, this doesn't guarantee their safety. In April 2012, the EPA released updated pollution standards for unconventional O&G development sites, hoping that this would ease some concerns about the safety of the process. However, coherent national regulation for unconventional O&G development is still absent, so the regulation largely falls to the states. Each state approaches industry regulations differently, but Pennsylvania, New York, and Colorado provide three illustrative examples of state-level approaches to development and regulation of the O&G industry.

### **Pennsylvania**

Most of the early unconventional O&G development occurred in Pennsylvania's Marcellus Shale, with the first well opened for commercial production in 2005 (Harper 2008). Other states such Arkansas, Colorado, and Louisiana all approached regulation of the shale gas industry in their own way, learning from mistakes of early participants like Pennsylvania (Howarth et al. 2011). The state has largely welcomed O&G development (Smith and Ferguson 2013, Malin 2011), with many influential local policy makers and institutions supporting the industry and individuals leasing out their land and mineral rights for drilling.

The most significant regulatory legislation passed in Pennsylvania was Act 13 in 2012, which was framed by legislators and O&G supporters as enacting stronger environmental protections, while helping the state to become energy independent (PA EPA 2014). However, it prevented Pennsylvania communities from using zoning ordinances to stop natural gas development in their communities with the rationale that it made it too difficult for O&G industries to operate. If communities decided to zone against unconventional extraction methods, Act 13 disallowed these communities from collecting the impact fees that Act 13 introduced given the absence of severance taxes on O&G activity in the state (Smith and Ferguson 2013, <http://www.puc.state.pa.us> 2014). Communities rely on these impact fees because of industry related impacts such as damaged roads, new infrastructure, and inflated cost of living, and boom/bust cycles of housing which make it unaffordable (Merrifield 1984, Davenport and Davenport 1980). Act 13's limitations can force unwilling community members into O&G development. However, as of July, 2014 the Commonwealth Court held that localities, not the state, have the right to regulate O&G development- citing the Pennsylvania constitution which gives individuals the right to a clean environment (NPR 2014).

Besides its limits on impact fees, Act 13 only requires producers to notify land owners twenty-four hours before they begin drilling a well. Surface rights landowners only have fifteen days from the certified mailing notifying them of a permit to object to a well installation on their property. Unconventional wells only need to be located 500 feet from a building or a private water supply (i.e. wells), and this setback can be waived on public land. Lastly, doctors must sign non-disclosure agreements to have access to the full list of chemicals used during the process. Even if they suspect that these chemicals may be making their patients sick, they are unable to disclose this information or they may lose their license (NPR 2014). Act 13 illustrates

how structures work to empower O&G companies as stakeholders, while largely disempowering communities that feel at risk under this development. This is especially problematic because of the potential risks that exist with O&G development, such as environmental degradation and health impacts, which may impact communities negatively, especially without proper regulation and funding of the institutions responsible for regulating, such as the EPA.

### **New York**

New York State has taken a different path and employed the precautionary principle towards O&G development. After environmental and public health concerns about O&G development were raised in 2008, Governor Patterson passed a five year moratorium, or a temporary halt, to horizontal hydraulic fracturing pending further results from the Supplemental Generic Environmental Impact Statement, or the SGEIS<sup>7</sup> (Rinfret 2014). Governor Cuomo eventually passed a permanent ban on the practice, citing the negative health and environmental impacts (Fleur 2014). The New York Supreme Court also ruled that towns can use zoning ordinances to prohibit O&G development. The plaintiffs in that case were Norse energy and a dairy farm, showing that it is not just O&G interests that want to allow development, but also individuals, who want this development on their land for its economic benefits (Oldham 2014). This illustrates that land use disputes are not black and white; while some farmers view EJ and procedural equity as the ability to decide against O&G development on or near their properties, some might want to agency to allow O&G development on their land.

---

<sup>7</sup> SGEIS identified nine main categories that may be impacted by hydraulic fracturing: water resource impacts, impacts on eco systems and wildlife, impacts on air resources greenhouse gas impacts, visual, noise, and community-character impacts, transportation impacts, impacts of naturally occurring radioactive materials in produced water, pipes, and other equipment, and seismicity (Perry 2012)

## **Colorado**

Regulation of O&G development in Colorado continues to unfold amid intense debate. Colorado officials argue that Colorado is the frontrunner of industry regulation in the U.S., striking a balance between questionable modes of regulation in states like Pennsylvania and state-wide moratoria in New York. With on-going battles between the state of Colorado and municipalities over who has the right to zone industrial activities like O&G development, Colorado remains a front runner of contemporary O&G regulation. The Colorado Oil & Gas Commission, or the COGCC, has been in charge of regulating O&G development for over sixty years (COGA 2014). The COGCC sees itself as a mediator between the industry, state government, and the public. However, they create a welcoming atmosphere for O&G development in Colorado; in their own words, “the mission of the COGCC is to foster the responsible development of Colorado's O&G natural resources” (COGCC 2014). Although the COGCC frames itself as responsive to the public’s concerns, many citizens do not feel that their complaints are being represented correctly or being taken seriously (Opsal and Shelley 2014).

Some communities are also trying to retain local-level municipal control over where development occurs and what it consists of in their community. Quinnipiac University conducted a poll in November 2013 finding that 51 percent of Coloradans supported unconventional O&G development, while 34 percent of individuals believed the process was unsafe or very unsafe (2013), illustrating how Coloradans are split on the issue. While some counties like Weld County are supportive of fast-paced O&G development, in 2013 four communities along the Front Range passed moratoria on O&G drilling within city limits (Wines 2013). The O&G development landscape continues to be shaped as court cases against these counties are pending and the future of this development continues to be debated (Udell 2014, Handy 2014).

The concerns of Coloradans dealing with O&G development are similar to those in New York and Pennsylvania navigating O&G development, such as environmental outcomes (Bloomberg and Krupp 2014, Wines 2013, McAllister and Gedrekidan 2013) and public health outcomes (Wines 2013, Lustgarten and Kusnetz 2003, Mckenzie et al. 2014, Mckenzie et al. 2012). A prime concern of disallowing development across the state or as localities see fit is the potential negative economic impacts and job loss (Healy 2014, Duggan 2013) and individuals with resources on their land being unable to sign leases (Oldham 2014). Because of split estate, surface owners are concerned they will be forced into development because the mineral rights owners of their land signed leases (Jaffe 2011). This is of particular concern to farmers because the development has the ability to damage their land (Bauerle 2005). Lastly, individuals have quality of life concerns such as increases in truck traffic, noise, dust, fumes, diminishing property values, and providing the needed infrastructure for development (Chiropolos 2014, Greene 2013). These concerns illustrate the complexity of the public debate surrounding O&G development, with individuals ultimately wanting information about what the potential impacts are and to have a say in how development is carried out in their communities.

In order to deal with concerns, various stakeholders take their own approaches to development, utilizing varying degrees of precaution when deciding how to regulate the O&G industry. The Colorado state constitution contains nothing specific to environmental protection from O&G Development (BLM 2014). However, in 2007 the state overhauled existing regulation to be more responsive to stakeholders outside of the O&G industry by including environmental and health viewpoints and reducing industry representation on the COGCC (Heikkila et al. 2014, BLM 2014). The Colorado Oil and Gas Conservation Act and the Habitat Stewardship acts were also amended so that O&G producers need to consult with the Division of

Parks and Wildlife to minimize negative impacts on wildlife, while also minimizing surface disturbance and fragmentation in important wildlife habitat by incorporating best management practices (COGCC 2014).

The laws from under which O&G operations directly operate under have also changed. In January of 2014, The COGCC adopted new setback rules in response to concerns about O&G development. The existing setback distances of 350 feet in high density areas and 150 feet elsewhere changed to a constant 500 feet setback distance statewide. O&G production also must be 1,000 feet away from “High Occupancy Buildings,” such as schools and hospitals without approval from the commission following a public hearing (COGA 2014). Companies in Colorado must publish the amount of water and concentrations of chemicals used during phases of the production process on FracFocus.org. However, those concerned about O&G development worry that, because this website is funded by the O&G industry, it may be inaccurate (Krupp 2014). In addition, some chemicals and amounts of the chemicals used are not required to be reported because they are proprietary, so only the chemical family is. Although the fracfocus.org website is imperfect, it has made the industry operate a bit more transparently and publicly (Heikkila et al. 2014). These shifts in regulation helped spark the continuing political debate on whether communities have the right to know about development, allowing for greater industry transparency and possibly safer development in the future.

Air pollution is a specific concern where Colorado is considered the frontrunner by policy makers and industry in shaping related regulations. Colorado is the first state to directly regulate methane emissions from well sites (Krupp 2014). These stronger regulations forced companies to strengthen emission controls for storage tanks, dehydrators, and gas tanks from wells, which will help eliminate 95 percent of uncontrolled toxic pollutants and VOCs (Krupp

2014). During production, O&G companies in Colorado are also required to line all wellbores with conductor, surface, and production casing, and must also be verified by a specialized well survey (COGCC 2014). They also must find gas leaks and have them fixed to avoid environmental degradation and health concerns. Those who are cautious about development argue that because this regulation is written by and in support of the industry, it is weak (Krupp 2014). However, supporters of O&G development who are cautious about its potential negative effects hope that other states will adopt these stricter standards, since unconventional O&G development is exempt from many federal environmental regulations.

This regulatory context impacts all residents and stakeholders, but especially Colorado citizens who work on the land, depend on it economically, and who find their livelihoods existing on the same land as O&G operations. Small-scale farmers present an especially unique perspective on these impacts of O&G development in Colorado, and examining their experiences can help us understand impacts of regulations as well as environmental, health, economic, and land use, and other concerns related to the industry. Colorado is a unique case because the regulatory context is well-developed compared to other states, giving us insights into success and failure of various regulatory approaches at the state level, as well as the impacts of state versus municipal control regarding zoning for production.

## **Unconventional Oil & Gas Development in Colorado**

### **The Historical Context**

Colorado has a long history of O&G development; Florence Colorado was the site of the first well drilled West of the Mississippi (Noel 2013). Colorado's O&G development has been a long stream of booms and busts and Florence illustrates this well. The town became prosperous due to extraction, expanding to 20,000 residents in the 20<sup>th</sup> century (COGA 2014) from a

population of 450 in 1887 (Florence Chamber 2014). However, production in Florence “busted” during the mid-1910s while O&G development continued to occur in the rest of the state. For example, in 1901 oil was discovered in Boulder County in the Denver Julesburg Basin, eventually opening up the Front Range of Colorado for O&G development (Birth of Industry 2004).

There are several examples in Colorado that illustrate the boom/bust problem of energy extraction. Perhaps the most illustrative of this is the boom/bust that occurred in Denver during the 1970’s and 1980’s. During the 1970’s, America was in an energy crisis, with O&G becoming expensive and difficult to obtain. The government tried to remedy this by supporting domestic O&G production in states like Colorado (Spehar 2010). In Denver, this led to a surge of wealth for the city and individuals working directly and indirectly with O&G. However, when energy prices dropped in the 1980’s, it led to a “bust” which devastated Denver’s economy, taking the city years to recover (Thompson 2014). Another boom/bust occurred in Parachute Creek, Colorado, where Exxon was running the Colony Shale Project. In 1980, a white paper was released called “The Role of Synthetic Fuels in the United States,” outlining Exxon’s plans of development. However, less than two years after publishing the paper, the project was closed on a day known as “Black Sunday” by locals because it devastated their economy. Because of how dependant the community was on O&G for employment and how they were impacted by the bust, they are weary of another economic bust if development begins again (Spehar 2010).

However, the previous history of energy boom/bust cycles has not deterred the state from continuing to expand its energy production, with Colorado approving 1,250 to 4,443 new wells per year (COGCC 2014). Today over 50,000 wells are managed by the COGCC. The COGCC (2014) estimates that by 2015, because of the considerable demand for land for unconventional

O&G development, there will be 18,700 acres in development. Although it does not appear that the energy boom will slow down in the near future, eventually the current shale O&G “boom” will “bust,” playing out how the boom/bust energy cycles in Colorado have in the past. However, cities like Denver hope through the diversification of their economies, they will avoid the boom/bust cycle that has plagued them in the past (Thompson 2014).

As long as markets remain strong, technology continues improving, and Colorado’s unconventional O&G development is perceived to provide a bridge fuel that addresses concerns over dependence on foreign fossil fuels, production will continue apace and perhaps even grow. An example of this is Wattenberg Field (which includes Weld, Larimer, and the northern suburbs of Denver), Colorado’s most productive natural gas field in the Denver-Julesburg Basin, which was discovered by Amoco in the 1970s (Noel 2014). Wattenberg field is an example where new technology has allowed it to keep producing for forty years, delaying the bust that normally would have already occurred (Dunn 2013). Shale development has been increasing steadily as technology improves and producers are able to get at O&G that is in harder to reach places. Between 2007 and 2012, marketed natural gas production rose 38 percent and crude oil production rose 89 percent within the US (EIA 2014).

Given that 90% of Colorado wells have been hydraulically fractured (COGA 2014), the intense public and political debates regarding regulation, and the interesting implications of systems of private property like water rights and the split estate system, Colorado is an important natural laboratory in which to study the social, economic, political, and environmental impacts of unconventional O&G development. There is little research that exists on the effects of this development, and most of it is in the context of the Marcellus Shale in Pennsylvania and New York. Due to the political climate around unconventional O&G development, it has been

difficult to get public health and environmental assessments of this development conducted. For example, a proposed health and quality of life study in Larimer, Weld, Boulder and Adams counties failed to pass in the Colorado senate in April 2014 because of political pressure by certain stakeholders (Sealover and Proctor 2014).

Colorado's other economic sectors are also implicated in its unconventional O&G production boom in under-studied but sociologically vital ways. For example, the production process intersects with agriculture in the state because of the rapid pace of O&G development and its appetite for land and water. Colorado has 36,700 acres of farmland, which is 3.4% of all of the farmland in the US. Weld County, which is considered the most drilled county in the US, is also ranked fourth in the country for agricultural production (Johnson 1997). 75% of the land in Weld County, which is the state's leading dairy, beef, sugar beets and grain producer, is devoted to farming and raising livestock (<http://www.co.weld.co.us/>). This intersection of O&G development and agricultural production has led to increased agricultural complaints and an increasing desire for farmers to have control over their surface water rights and what happens on their land (Johnson 1997). Without longitudinal studies of the environmental, social, and health consequences of O&G development, it is impossible for legislators and the public to make educated decisions about where and when development should occur. By looking at Colorado as a case study, with its overlapping history of O&G development, agricultural activity, and issues such as land use and moratoria, we can examine important ways in which the industry interacts with the environment, economy, and communities near which it develops.

### **Possible Problems With Unconventional Oil & Gas Development**

As unconventional O&G production processes proliferate rapidly and interact with increasing numbers of communities, these operations come in to contact with more residential

areas, schools, and other parts of the built environment from which energy development is typically distant. Consequently, potential outcomes of O&G development may impact more people than other forms of energy production, even though these potential effects remain understudied. This lies at the core of debates concerning the industry's rapid development versus a more precautionary approach, with some community groups and residents advocating that more studies must be completed on outcomes such as environmental degradation, public health impacts, seismic activity, social disruption, and economic outcomes before development is allowed to occur at such a rapid pace and wide scale in states like Colorado.

### **Environmental Impacts of Unconventional Oil and Gas Development**

The potential environmental impacts of unconventional O&G development are understudied and not yet systematically measured. Supporters of natural gas argue it is environmentally friendly because it burns half of the carbon dioxide as coal (EIA 2014), with problems mitigated through regulation (Howarth et al. 2011). Several wells can exist on one well pad while most of the production occurs underground, cutting down on pollution during the production process (Penn State Extension 2014). But with more than fifteen million Americans living no more than a mile away from a hydraulically fractured well since 2000 (Gold and McGinty 2013), and with anecdotal evidence of ecological, public health, and environmental justice problems, this issue must be examined systematically and over time. Environmental health problems potentially related to unconventional O&G development, which are contested by industry and political stakeholders, are largely related to air and water pollution related to development. Before delving into the EJ concerns linked to environmental health concerns, I will review some major areas of potential environmental concerns. As these potential environmental outcomes impact communities into which O&G development has spread, the implications for

environmental justice and inequitable distribution of risks related to the industry become important empirical questions for sociologists.

### *Water Contamination*

Water contamination is a central issue in popular press coverage of unconventional O&G production. Documentaries like *Gaslands* show individuals whose wells have drilling operations close by being able to light their water on fire. Some scholars have connected this to hydraulic fracturing fluid migrating more than two kilometers into the well water (Howarth et al. 2011). Besides methane migration, there is concern that the metal rich formation brines, flowback and production fluids may also migrate into aquifers (Warner et al. 2012). Methane also has the rare possibility of migrating into water supply through inadequate casings (Vidic et al. 2013). The migration of methane into household well water can be especially problematic in rural and agricultural communities who rely on their water not just for personal use but for their economic livelihoods. These areas often have little to no regulation or oversight of their well water, making it difficult for individuals to have any recourse or to prove that their water was contaminated by O&G production. Since methane exists in groundwater even without contamination, it's impossible to know how much of the methane is from development without baseline testing (Osborn et al. 2011). Methane was found to be substantially higher in water wells that were close to natural gas wells in New York (Osborn et al. 2011) and Pennsylvania (Osborn et al. 2011, Jackson et al. 2013). Flow back fluid may also transfer towards water aquifers a few years after once production is finished (Myers 2012).

There is also the risk of water contamination after the drilling process is completed. While the O&G industry and regulators insist that the risks of water contamination and even radioactivity are low for individuals who work or live near hydraulic fracturing sites (Brown

2014), activists and community members express concerns that the risk might be more substantial than officials assert. Recall that following drilling the well, the injected water, chemicals, and gas return to the surface as “flow back,” which is then stored in evaporation pits or re-injected beneath the surface (Brown 2014). 98% of the chemicals found in the evaporation pits were on the Superfund list or included in the 2005 Emergency Planning and Community Right to Act (Colborn et al. 2011). Although the waste is supposed to be disposed of in special sites, it is suspected that much of it is incorrectly disposed of (Finkel and Law 2011). There is also a concern that this water could be radioactive because drilling releases radium, which may migrate from the sites and into neighboring communities’ water supplies (Ferrar et al. 2013b, Brown 2014, Rowan et al. 2011). An example of this potential contamination occurred in Pavillon, Wyoming, where the EPA (2011) completed a study on potential water contamination from unconventional O&G production, specifically drilling. The report stated that there were high concentrations of benzene, xylenes, gasoline range organics, and hydrocarbons from nearby wastewater pits (Jackson et al. 2013). The USGS confirmed these findings (Wright et al. 2012), but the findings remain contested by industry because of a lack of baseline water testing (American Petroleum Institute 2012).

Other possible environmental problems include soil erosion, loss of fish and wildlife habitat, and loss of recreational areas. Although these problems may be of little interest now because they are “non-market costs”, they will be larger concerns as the legality of drilling on public land emerges in the forefront of the O&G debate (Morton et al. 2004). Understanding possible environmental impacts of development is important when examining its impacts on agriculture because it may affect livestock, crops, and consumers of these products.

### *Seismic Activity & Other Potential Environmental Impacts*

There are other potential negative environmental consequences of unconventional O&G development that are important but extend beyond the scope of this research project. I review them here because they can potentially impact the livelihoods and quality of life of the small-scale farmers in this study. One possible problem is seismic activity from the process of re-injecting the flowback fluid from the O&G development process (Ellsworth 2012, Keranan et al. 2014). Although most of this seismic activity is minimal, the disposal and reinjection of the hydraulic fracturing fluid deeply into the ground can cause earthquakes four or higher on the Richter scale (Keranan et al. 2014, Sumy et al. 2014). In Colorado, seismic activity in the Raton Basin has been increasing since 2001, coinciding with an increase in shale gas development (Rubinstein et al. 2014).

### *Environmental Health Impacts*

Many of the potential health impacts of unconventional O&G development are also associated with environmental impacts. The threat of water contamination is especially problematic because chemicals used in development are found to cause skin irritation, nausea, vomiting, coughing, sore throat, tingling, dizziness, flu like symptoms, headaches, numbness in extremities and convulsions when they are ingested (McKenzie et al. 2012). Osborn et al. (2011) analyzed the health effects of 353 chemicals found in the ‘fracking fluid’ and discovered that 75% of these chemicals may affect individual’s skin, eyes, sensory organs, respiratory systems and gastrointestinal tracts. Further, 40-50% of these chemicals could impact human brain function, nervous, immune, and cardiovascular system functions, and kidneys. In addition, 37% have the possibility of negatively impacting human endocrine systems and 25% may lead to cancer and other mutations. Colborn et al. (2011) also found that many of the chemicals used

during O&G production are dangerous at even one parts per million, and many are toxic at any amount.

O&G development also emits the most Volatile Organic Compounds (VOCs) of any industry in the United States, largely through fugitive emissions (Weinhold 2012). There is disagreement about whether production of natural gas is cleaner because of the different methodologies used to measure fugitive emissions. Fugitive methane emissions are released during the lifecycle of operations, including from gas well completion, routine venting and equipment leaks, losses during processing and transport, and loss from storage and distribution (Howarth et al. 2011). In Colorado, there was an emission inventory showing that unconventional O&G operations accounted for 48% of VOCs, 18% of NOX, and 15% of benzene (Colorado Department of Public Health and Environment 2012), causing significant public health impacts (Clark et al. 2012, Howarth et al. 2011). Researchers estimate that fugitive emissions range from between 2% (Jiang et al. 2011) to 8.9% (Karion et al. 2013) of overall gas produced.

Accounting for fugitive emissions is vital because these emissions make unconventional O&G production less climate friendly over the long term. Although the short-term footprint of shale gas production is smaller than other fossil fuel extraction, over a hundred year period the footprint of shale gas is comparable to other fossil fuels (Howarth et al. 2011). It is also uncertain whether the use of natural gas is cleaner than other fossil fuels; Hultman et al. (2011) estimates that unconventional natural gas has 11% higher greenhouse emissions from electricity generation than conventional natural gas, while Heath et al. (2014) found that shale natural gas has similar emissions to conventional natural gas. Further contributing to emissions, natural gas prices are so low that producers often burn off the excess rather than use it to produce energy (Fershee 2012).

Long-term exposure to VOCs is especially harmful to children whose respiratory and neurological systems are still developing, young adults, and the elderly because it can cause diseases such as COPD and asthma (Lauver 2011). Nervous, immune, kidney, and cardiovascular, and blood systems can also be affected through long term exposure to chemicals used in O&G development (McKenzie et al. 2012). McKenzie et al. (2012) found that rates of non-cancer health impacts from emissions were higher in individuals who lived close to producing wells. McKenzie et al. (2014) also found that mothers who lived near O&G wells had 30 % higher risk of birth defects such as Coronary Heart Disease and neural tube defects. Air pollution from fugitive emissions also had serious economic impacts. Litovitz et al. (2013) estimated that the total regional air quality related damages in Pennsylvania from unconventional O&G development was between 7.2 and 32 million dollars, although no similar studies were done in Colorado (Howarth et al. 2011). While there is little health research on communities with O&G development, there are even fewer studies that look at health impacts of development on O&G workers. However, Esswein et al. (2012) found that exposure to O&G development was harmful, possibly causing silicosis from exposure to dust with high levels of crystalline silica.

It is extremely important for the environmental health impacts of unconventional O&G development to be studied further because they may have unintended consequences on the communities where development occurs. Penning et al. (2014) reviewed the current literature on O&G development and argued that epidemiological research needs to be done on health outcomes for people living near wells. Often when communities suspect people's illnesses are from O&G production, they are forced to sign nondisclosure agreements in order to be reimbursed for health related concerns (Bamberger and Oswald 2012). It is impossible for policy

makers to create adequate policy measures to govern the industry without knowing the full implications of this development.

### **Sociological Concerns & Environmental Justice**

Environmental justice (EJ) describes the academic study of and activist response to potential negative impacts and risks of industrial processes, like O&G production, to communities and marginalized populations. While EJ at its core is a social movement, it is also a framework from which to examine issues related to O&G development such as environmental health effects, land use, and procedural equity. EJ literature often examines the term justice through Rawls (2001) framework of justice as fairness; in this sense justice is not utilitarian, but examines a framework through which inequality is only acceptable if it benefits the worst off members of society. Bullard and Lewis (1996) defined EJ through five principles; the right for individuals to be protected from environmental degradation, prevention of negative environmental health impacts, the burden of proof should rest on polluters to prove they are protecting minority individuals, discrimination should be shown through disparate impact not intent, and action and resources should be used to address unequal impact. However, different stakeholders frame EJ differently. For individuals like Bullard, EJ is about the environment where individuals live work and play being safe. For others, like the EPA, it is about the fair treatment of all minority groups under the law in regards to protection from environmental hazards (Mohai et al. 2011, Bullard and Lewis 1996).

However, many individuals, such as farmers affected by O&G development, argue that EJ is mostly about procedural equity. Within procedural equity, all individuals and groups have the right to access political and social systems to make decisions, such as how land will be used or how zoning will take place (Lake 1996, Sze and London 2008, Malin 2011). Because of the

structural constraints that individuals in natural resource dependent and extractive communities face, EJ activists and scholars may take the view that procedural equity is most important for these communities where poverty is persistent and there is little economic opportunity. For example, this is seen in uranium communities where past uranium booms harmed individual's quality of life, but they support renewed development because of little alternative economic opportunity (Malin and Petrzela 2010). Bullard (1993) and Lake (1996) argue that procedural equity highlights the importance of understanding development through a historical perspective. This framework also helps us understand how in the context of O&G development, communities may support an industry with the potential to harm their health and quality of life. There is also an argument for sustainability within the EJ literature (Bryner 2002, Dobson 1999, Hyner 1998, Faber 1998), which would help fix many of the problems of distributional and procedural inequity; this pushes scholars and communities to think about a social and ecological future where environmental issues are lessened across all of society through sustainability.

EJ as a social movement began in 1982 as a response to environmental racism<sup>8</sup> in Warren County, North Carolina, and environmental classism in Love Canal, New York (Szasz and Meuser 1997, Cutter 1995). The US GAO (1983) and UCC (1987) studies followed, showing that people of color and impoverished populations were more likely to live around toxic waste sites. This ignited scholarly debate among social scientists and illustrating that certain communities are more exposed to potential environmental and health risks than others (Mohai and Bryant 1992). It is still unclear, as seen through the chicken and the egg debate, whether industry locates in places where certain populations exist, or whether minority or impoverished

---

<sup>8</sup> Environmental racism was first defined by Chavis as racial discrimination in environmental lawmaking, enforcement of laws, intentional targeting of minority communities for toxic waste facilities, the authorization of poisons and pollutants in those communities, and the exclusion minorities from environmental movements (Bullard 1990)

populations tend to live where these facilities already are because of the availability of cheap land and housing (Mohai et al. 2011, Sze and London 2008, Bullard 1994, Pastor et al. 2001)

Even with evidence showing that environmental injustice exists, EJ is extremely controversial for several reasons. The first is that mainstream environmentalism often ignored issues of social justice, instead pushing goals of conservation and preservation, which are often associated with and focus on the priorities of the white middle and upper classes. Secondly, there is difficulty proving disproportionate impact. Lastly, when showing that there is disproportionate impact, it is unclear what should be done (Mohai et al. 2011). Although President Clinton issued an executive order that EJ was to be taken into account in all federal policy in 1994, the UCC found that twenty years after their first study on race and toxic waste, the situation had not improved, but was worse than when their original study was completed (Mohai et al. 2011, Bullard et al. 2007).

#### *Contested Illnesses*

Contested illnesses are studied as a subset of EJ. Their existence illustrates a key concern in the EJ community – health disparities, or the ways in which health implications of inequitably distributed environmental toxins are unevenly distributed across society, with minorities and lower classes suffering the most (Brulle and Pellow 2005, Lave 1970, Burch 1976). For example, existing research on health outcomes of segregated, poor neighborhoods shows higher incidence of cardiovascular disease and asthma and higher rates of death (Collins and Williams 1999, Roux et al. 2001). Contested illnesses are defined as illnesses with recognizable symptoms without a clear cause. When dealing with environmental health concerns, illnesses are often not officially recognized or are recognized but not causally connected to environmental toxins that individuals and communities are connecting their illnesses to. It is difficult to connect illness to

environmental toxins because toxicology and epidemiology are uncertain sciences, leaving us unsure how the environment, chemicals, and human's bodies interact (Kroll-Smith and Floyd 2000, Brown et al. 2004).

An important aspect of environmental health movements and contested illnesses is lay knowledge, or knowledge not produced by "experts" in the field, but rather, by individuals who live in the communities where these illnesses occur. These individuals practice street science, or knowledge production that opens up "problem framing and subsequent methods of inquiry of inquiry to local knowledge and community participation" (Corborn 1995: 8). Phil Brown (1997, 1992) coined the term popular epidemiology, which highlights the importance of lay medical knowledge through mapping of contested illnesses, which is often done by activists. One of the first examples of this framework exists within Brown's research on Woburn, Massachusetts, where unusually high cases of childhood leukemia were mapped by citizens. Citizen science, activism, and the avoidance of only using the biomedical model, which focuses on individual's practices and genes, helps individuals get their illnesses recognized as having an environmental cause (Brown and Zavestoski 2004, Brown et al. 2008, Clapp 2002). Brown et al. (2008) also argues that the dominant model of diagnosing disease dismisses the toxic effects of industrial and rural pollution, poor access to care, social deprivation, and other structural issues that foster inequality. The focus on contested illnesses in EJ has created new relationships between community groups and public health advocacy organizations (Brown et al. 2005, Gibbs 2002, McCally 2002, Brown and Mikkelsen 1990).

Given these environmental concerns, contested illnesses related to unconventional O&G production are of interest but are also examined only infrequently in the literature. These outcomes are specifically of interest when we consider EJ implications, since O&G development

may disproportionately affect certain already economically, spatially, or politically marginalized communities (Adams 2012). More research needs to be done on how spatiality produces uneven health outcomes (Brulle and Pellow 2006). In a society with rampant social and economic inequality, citizens often focus on health as an area of concern because it intersects with all aspects of society. Lastly, as environmental regulations and protections continue to be rolled back, the public will be increasingly concerned with environmental health problems, connecting them to larger social concerns (Brown and Zavestoski 2004).

Individuals living near O&G development have instances of contested illness with varied symptoms like nose bleeds, vomiting blood, diarrhea, body pains, rashes, lesions, headaches, light headedness, respiratory infections, and neurological impairment. Individuals have also reported miscarriages, tumors and cancer, which they believe are related to benzene poisoning. These illnesses are difficult to identify, because epidemiologists have not created procedures to look at how to measure the linkages between O&G development and health impacts. Because there is no way to document whether the symptoms are real or not, most of the time these illnesses are viewed as psychosomatic by physicians (Lustgarten and Kusnetz 2011). Academic studies such as McKenzie et al. (2014), Howarth et al. (2012), McKenzie et al. (2012), Colborn et al. (2011), and Howarth et al. (2011) validated some citizen concerns, linking fugitive emissions and chemicals used during the O&G production process to health impacts. This illustrates that more research must be done on the environmental health impacts of O&G development so that disenfranchised communities, such as rural agricultural communities, are not further disenfranchised by negative impacts due to industry. The concept of contested illnesses is important when considering whether unconventional O&G production is safe because

it gives us the tools to look at the diagnosis of illness differently, with the burden of proof shifting from communities and individuals to industry to prove its safety.

### *Land Use*

Another aspect of EJ is land use and property rights, which are vital to understanding O&G development in Colorado and provide important links between unconventional O&G development and environmental injustices related to procedural equity which may be experienced by residents in communities closest to these operations. Research in Pennsylvania (Malin 2011) and New York (Jacquet 2011) focused on property owner's interactions with O&G companies and the land men who negotiate leasing deal with those who own the land that they want to develop. However, in Colorado most individuals do not own their mineral rights. This is because of the split estate system, when surface rights and mineral rights to land are held separately (Split Estate 2009). Split Estate originally occurred in the US because the federal government gave away free land to settlers in the West, while retaining mineral rights in case anything valuable was found underneath that land (Jones et al. 2013). This helped O&G companies extract O&G from private and public properties without many legal limitations and without providing substantial benefit to households nearest production sites. Under split estate, the mineral rights owner is entitled to extract them regardless of what the surface owner wants (Jones et al. 2013, Split Estate 2009).

Many property owners in Colorado do not realize they lack ownership over what exists underneath their land until they receive a visit from an O&G company representative, informing them that development will occur (Split Estate 2009, Baurele 2006). O&G companies may need to obtain a surface agreement (Jones et al. 2013, Jones 2009), with reimbursement of damages caused by drilling limited to crops and improvements as mandated by the Stock Raising

Homestead Act. Reimbursement does not include non-agricultural structures, natural vegetation relied upon by ranches, or loss of land value related to the drilling operations (Baurele 2006). When O&G companies are drilling horizontally, they also practice forced pooling, accessing O&G under a piece of land by going through a neighbor's property. The state can also force landowners into leases if a certain percentage of the surrounding land has already been leased (Jaffe 2011). Split estate and forced pooling is problematic in Colorado, where surface rights owners want autonomy over what development happens on their land (Jaffe 2011). For example, in Weld County, Gerrity Oil Corporation was sued by a landowner after being accused of damaging the land-owner's property after drilling for oil, but the Supreme Court of Colorado ruled that the mineral rights owner had the right to use the surface as long as they aimed to cause "minimal damage" (Johnson 1997).

It is important to analyze land use and property rights within an EJ framework. Although EJ focuses on distribution of environmental harms, it also refers to individuals having procedural equity, emphasizing a procedural sense of justice and focusing on individuals' right to speak for themselves, while being represented in the political arena (Cole and Foster 2001). Lake (1996) offers a view of procedural equity which goes further than just individual autonomy and the ability to have a voice in particular decisions; he argues that procedural equity must include a long history of communities participating in the democratic process beyond just single zoning decisions. In many cases, procedural equity means communities are able to democratically make land use decisions (Sze and London 2008). However, in Colorado mineral owners and surface rights owners have unequal equity in cases where goals and motivations of mineral and surface rights owners are at odds. As discussed above, when environmental degradation occurs the surface rights owner has little recourse, while the mineral rights owner has the right to continue

developing the land. Forced pooling is also a great example of procedural inequity, where individuals may feel compelled to sign a lease or risk being shut out of the economic benefits from O&G development (Jaffe 2011).

There is little research on how the split estate affects farmers who are participating in or living in areas where development is taking place, thus more research needs to take place in order for us to gain a better understand of the experiences of individuals interacting with the split estate system. Farmer's ability to allow or disallow development on their land will help dictate what the other impacts will be. EJ is vital when looking at what the impacts of O&G drilling are on farmers because small-scale farmers have a high risk of disenfranchisement. The fear is that through environmental, health, economic, community, and land use problems, this development may cause them to be further disenfranchised.

### *Lease Terms*

Lease terms are another land use-based EJ issue related to .unconventional O&G production. Landowners can be taken advantage of during the process of leasing their land because of complicated leases often leaving individuals unsure of what is reasonable to include in them, particularly if they cannot afford legal representation to effectively negotiate with corporate interests sent to households to negotiate lease terms. Jacquet and Stedman (2011) studied New York landowner coalitions, which organized individuals leasing out their land for development to negotiate lease terms. Because of this, rural landowners became de facto managers of natural resource development, giving them some agency over the terms of O&G development in their community. These coalitions also negotiated legally-binding agreements with the energy companies to set up clean-up terms, which impacted environmental and community outcomes. Coalitions also gave land owners political standing in issues of

development and natural resources. In New York, individuals who were initially offered 50-100 dollars per acre were being offered 2500 dollars an acre once they joined the coalition (Jacquet and Stedman 2011). Land-owner coalitions are also beginning to form in Colorado (Jaffe 2014b), illustrating one potential solution to procedural inequity in Colorado; through coalitions, landowners have the potential to take democratic control over what development happens on their land, making the development work in their favor.

### *Water Consumption and Rights*

Water consumption has emerged as one of the primary environmental concerns related to unconventional O&G production, especially in arid states like Colorado where the dry climate may be a barrier to development (Gregory et al. 2011). Up to five million gallons of water are used to produce one well, depending on the depth of the extraction (COGCC 2014, Clark et al. 2011). However, supporters of O&G development argue that it is less than .1% of overall water consumption in Colorado, with agriculture using 85% of water consumption (COGCC 2014). The water used for development typically comes from nearby surface water or a municipal source, potentially causing water stress for nearby communities (Entrekin et al. 2011). The disposal of the wastewater is also problematic in dry states where the most economical disposal of it is through surface disposal in streambeds or wastewater pits. In extremely dry climates, dumping a lot of fluid on a dry surface can alter the ecosystem, especially in streams that only run seasonally or after rainfall (Bauerle 2005).

Related to the pace of water consumption by O&G development is the contentious issue of water rights. Communities and small scale farmers often compete for water and other resources with large-scale agricultural operators and the O&G industry, especially during dry seasons. This is problematic in Colorado, where there are scarce and over-allocated water

resources for an exponentially growing population. The O&G companies often have a lot of local power because they provide positive economic growth and jobs, enabling them to have input in how policies like water ordinances are written (Finewood and Stroup 2012). According to Howe and Goemans (2003), changes in water ownership in Colorado often occur through informal water markets where buyers and sellers interact through water brokers. Unlike in the Eastern United States, water rights in the West are treated separately from land rights (like mineral rights) and thus can be leased or sold through the appropriations or priority system.

The development of new water supplies is important in the West; water needs to be transferrable from older, less valued uses to newer, more valued uses. Supporters of the appropriation system argue that having water rights separate from land ownership and creating informal water markets allows them to be flexible when different needs emerge over time and as droughts occur (Howe et al. 1986, Anderson and Hill 1997, Easter et al. 1998). In the case of O&G production, water rights are often sold or leased from agricultural operators to O&G development when those operators and ditch companies have been able to transfer their rights or change the permitted uses of their water right (COGCC 2014). The transfer often occurs because it is more profitable for individuals to sell or lease their water rights than to continue farming.

Although industrial development is initiated at the national and global scales, land use decisions and impacts are largely relegated to the local level. Finewood and Stroup (2012) argue that rural stakeholders may fight with fossil fuel developers over the same resources, with O&G firms trying to control the discourse. Because of this, landowners are motivated to lease out their rights or property to extraction firms in order to grow economically. They further argue that this makes individuals see natural resources (like water) in economic terms, rather than as something to be used with the potential of being degraded. A third-party water market has the possibility to

devastate small-scale farmers if it infringes on their ability to afford water for their operations, further disenfranchising small-scale farmers. Water rights allocation may further shift in years to come with continued O&G development, potentially creating a situation in which farmers earn a lot of money leasing or selling their water rights or farmers being unable to obtain water because of high prices.

### **Possible Solutions**

Many possible solutions, such as continuous testing and stricter regulations, can help mitigate the risks of O&G development. There has been a call for O&G companies to start baseline testing water and soil before production begins, which makes it easier for all parties to monitor any changes if and when they occur (Bamberger and Oswald 2012, Jackson et al. 2011). Others call for long-term monitoring of the water supply, using samples from private homeowners and industry with full disclosure of the chemicals used during drilling (Osborn et al. 2012, Jackson et al. 2011). In addition, regular air monitoring around O&G development sites needs to occur (Colborn et al. 2011). Lastly, including unconventional O&G development in federal environmental regulations such as the US Clean Drinking Water Act (Jackson et al. 2011, Wiseman et al. 2009) and passing regulations addressing how close development can occur to surface waters is also needed (Entrekin et al. 2011).

Besides stricter regulation, baseline and continuous testing, scientists argue that more research needs to be done (Wiseman et al. 2011, Colborn et al. 2011). Jackson et al. (2011) offers suggestions for further study on O&G development, including a medical review of the public health effects of methane, creating a national database for amounts of methane, ethane, propane concentrations and other chemicals in drinking water, examining how methane contamination occurs in drinking water, refining estimates of greenhouse gas emissions of methane associated

with shale gas extraction (Alvarez et al. 2012), studying disposal of wastewater, and systematically sampling drinking water wells and deep formation waters.

There are also some solutions outlined by Bamberger and Oswald (2012) related to land use. They argue individuals impacted by development should not have to sign disclosure agreements to be compensated for damages. In addition, the burden of proof should rest on companies to test for contamination before and after development, making it easier for individuals to prove contamination. It is difficult for individuals located near O&G development to have their concerns taken seriously when even if impacts are established, they are unable to share the information with government agencies and regulators.

EJ offers us an important framework from which to examine the issues of environmental impacts, contested illnesses, land use, and water rights. It's important to study the outcomes of unconventional O&G development in Colorado because many of these issues have idiosyncrasies, such as split estate, that are unique to Colorado. Since development will only increase, it is important to research how people's experiences with O&G development intersect with issues of EJ. Through EJ, I will be able to frame problems with O&G development in terms of procedural equity; all stakeholders deserve equal say and protection in regards to development in their communities. This framework also allows me to privilege individual's lay knowledge and experiences, rather than relying on expert knowledge.

### **Natural Resource Dependence & Extraction Economies**

England and Brown argue that rural America is "categorized by two contrasting landscape types- agricultural and extractive" (1992:1). Many communities welcoming of O&G development are historically natural resource dependent communities, which are communities that rely on the extraction and development of natural resources for economic well-being (Peluso

et al. 1994). These communities' economies often go through boom and bust cycles, which are periods of economic prosperity in which particular industries expand rapidly in a short period of time, which are then followed by periods of economic decline. Boom and bust cycles are associated with poverty and instability (Brown et al. 1989, England and Albrecht 1984). Large scale booms tend to reach out to marginal areas, which are abandoned once the price of the natural resource driving the expansion drops (Smith 1986). There is little research on natural resource dependence in the context of unconventional O&G development, although it has been studied in the Marcellus in the boom-bust context, without examining natural resource dependence (Braiser et al. 2011).

While the American public has largely focused on the possible environmental and health impacts related to O&G development and rapid industry expansion, there are other aspects of development that may impact individual's quality of lives as communities and their economies rapidly boom and bust. In boom-bust contexts, immediate community-level problems emerge, including; more increased traffic, population influx (Merrifield 1984, Davenport and Davenport 1980), altered connections to their communities, and community dissatisfaction (Perry 2012, Brown et al. 2005, Smith et. al 2001, Goldsmith 1992, Gulliford 1989, Merrifield 1984).

### **Economic Consequences**

One of the main consequences of extractive industries engaging in development in rural, natural resource dependent communities is persistent poverty due to periods of boom and bust. Persistent poverty<sup>9</sup> exists in places with small population size, low urbanization, and isolation from metropolitan areas (Brown and Warner 1991, Freudenberg 1992). These communities are often subject to periods of volatility and instability (Krannich and Luloff 1991) because of the

---

<sup>9</sup> Persistent poverty is defined by the Economic Research Service (ERS) as counties which have 20% of their population living below the poverty line for thirty years or more.

periods of economic opportunity followed by economic depression once the natural resource they are developing dries up or the demand ceases to exist (Freudenberg and Gramling 1998).

Several issues contribute to persistent rural poverty in natural resource dependent communities, including rural deindustrialization, power of extractive industries over communities, and core-periphery relations between urban and rural areas (Freudenberg 1992, Humphrey et. al 1993, Peluso 1994). Freudenberg (1992) warns that communities should avoid becoming too dependent on one single industry, which is difficult advice for communities to take. Natural resources are likely to be found in remote communities with little economic opportunity with inequality between the extractive industry and communities increasing, while the ability for communities to diversify is lessening. These problems are especially common for agricultural communities, where there is little economic opportunity besides farming and governmental subsidies are disappearing (Meyer & Lobao 1994), potentially making farmers feel pressured to lease their land to O&G development

Once certain types of development come into communities they over adapt, putting money and resources into infrastructure (Freudenberg 1992), which often declines once the extractive industry leaves (Bunker 1989). Lastly, the promise of employment and “good jobs” does not always bear out, as employment in these industries relies on a lot of technology for which individuals need specialized knowledge to use. Many individuals that go into extractive industries also have parents that worked in the same industry, but their experience may not be as rewarding (Freudenberg 1992).

There is little consensus about the extent that O&G development helps communities economically. Kinnaman (2011) argues that the existing literature often assumes all lease money is spent within the state where the resource is produced, recirculating within that state. Many of

the studies on the economic impacts of shale gas are sponsored by the companies doing the drilling. When looking at how natural resource development affects communities, prior cases provide important evidence of instability and dependence. Although high-paying jobs are promised to communities, they are often given to individuals from outside the community that have highly specialized skills; Freudenberg and Gramling (1998) found when Louisiana brought in O&G operations, workers had a schedule which made it unnecessary for them to relocate to the area for employment. In North Dakota, the industry accounted directly for 18,328 full time jobs, indirectly for 46,800 jobs, as well as \$4.9 billion in economy wide personal income, retail sales of \$3.3 billion statewide, and \$822 million in state and local taxes. This translates to 10% of the state's total population working directly or indirectly in O&G related employment (Fershee 2012). Although jobs directly in O&G do not necessarily help the community where development occurs, industry that supports individuals working in O&G development, such as construction, increases in those communities (Braiser et al. 2011).

Growth for these communities does not come without negative consequences. In the Barnett Shale, researchers found that while there were increased revenues, increased property values (Anderson and Theodori's 2009, Theodori 2009), infrastructure improvements and financial gains for individuals leasing their mineral rights (Wynveen 2011), there was also unequal wealth distribution, reduced quality of life (Wynveen 2011, Anderson and Theodori's 2009, Theodori 2009), water contamination, social issues, and truck traffic (Theodori 2009). During shale gas production, there are 1,000 truck journeys needed to bring the equipment and material needed for one well site (MIT 2011), leading to increased truck traffic, noise, and emissions (Zoback et al. 2010). North Dakota also struggled with expensive infrastructure improvements and quality of life problems. Population increase also contributed to increasing

real estate prices, inflation, and increasing property taxes, making it difficult for long term residents to be able to stay in their communities (Weber et al. 2014). In West Virginia, population increase led to increased crime and problems with drugs and alcohol, causing alienation within the community by long-time residents (Fershee 2012). After periods of an influx of industry, community members' satisfaction with the place they live often decreases with social integration of new individuals (Kershee 2012, Brown et al. 2005, Kusel 1991). Although community dissatisfaction in these communities lessens over time, the economic consequences generally remain (Smith et al. 2001).

There have been several related studies done in Colorado. Haefele and Morton (2009) found that drilling in the Rocky Mountains led to environmental, infrastructure, and quality of life problems. BBC Research and Accounting (2008A) performed a study in Mesa, Garfield, Rio Blanco, and Moffat counties in Colorado to document the impacts of the shale gas boom during the late 1970's and early 1980s. They found costs related to energy development were negative for local governments (such as wear and tear on roads and expanding government services). The problem is worsened because most profits occur late in the boom, while the costs occur early (BBC 2008a, BBC 2008b). A related study (BBC 2008b) found that the financial benefits did not outweigh the development costs in Rifle, Colorado. In Colorado (BBC 2008a, BBC 2008b) and Wyoming (Taylor and Foulke 2008, ERG 2007, Pinedale Anticline Working Group 2005), individuals living in these areas pre-boom had difficulty obtaining housing when prices rose. In addition, the wage gap between energy and non-energy workers meant that the increased living expenses impacted non-energy workers the most. In the Marcellus Shale, housing prices declined because of fears about water contamination from O&G development (Muehlenbachs et al. 2014).

Although there is research on the effects of the shale O&G boom in Colorado, it's important for us to study it in the context of agricultural communities. Communities with a history of natural resource dependence, especially agricultural communities, have the ability to be further disenfranchised from their economy and their communities through continued development. Perry (2012) suggests that when the EPA conducts studies on the effects of O&G development, they should not only focus on the environmental implications. Rather, they should take an EJ approach, focusing equally on community concerns like increased traffic, noise, drinking water, etc. She also argues that the effects of regulation and private vs. public ownership of water and water wells must be studied. If these variables were included when researching communities, then policy makers and community members could make more informed decisions about regulation and whether natural resource development is best for their particular communities.

### ***Unconventional Oil and Gas Development and Agriculture***

#### **Small-Scale Agriculture**

In order to understand how O&G development may impact small-scale family farms, it is vital to understand the social, political, and economic context that small scale farms operate within. According to the USDA Agricultural Census (2014), since 2007 the size of the average farm increased 3.8%, while the amount of farmers decreased 4.3%. While 80% of Americans were involved in farming as a profession in 1810, less than 3% are involved with farming as a profession today (Freudenberg 1992, Lobao and Meyers 2001). These statistics illustrate the potential vulnerability of small-scale family farms. Because of this structure, agriculture is looked at as a dualistic system; small scale farms are unable to feed the families that run them, while a few large farms have expanding shares of the market and moderate farms are edged out

of farming completely (Lobao 1992, Lobao and Meyers 2001). However, family farms<sup>10</sup> (including large scale family farms) still make up the majority of farms in the United States. According to the USDA Agricultural Census (2014), “87.1% of U.S. farms (accounting for 57.6% of U.S. farm production) are family farms, which rely primarily on the principal operator and spouse”. Family farms also account for 96% of major field crops like corn, cotton, soybeans, and wheat and in hogs, poultry, and eggs. However, family farms only contribute 62% of production for high value crops such as fruits and vegetables and 75% of production in dairy. Within dairy and high value crops, nonfamily partnerships and corporations are prevalent (MacDonald 2014). In relation, although large scale farms are increasing their share of the market, 94% of farms are considered small family farms with a gross income of less than \$250,000 (MacDonald 2014).

Family farms began to decline after WWII, when 35% of the nation’s farms disappeared. Farmers gradually began to contract out most of their labor (Lobao 1990) and eventually new technologies such as large tractors, fertilizers, and hybrid seeds displaced human labor. Historically, family farms were owned by the farmers that ran them (Goss et al. 1980), but many farmers now choose to rent their land. While corporations rarely own farms, contract farming<sup>11</sup> is growing with 2-4% of off-farm occupation farms operating with contracts, while 7% of small scale farms are contract farms, and more than 40% of family farms operate with contracts (USDA 2014). This includes almost all of the poultry, more than half of the hogs, and one quarter of the cattle in America (Lobao and Meyer 2004, Lobao 1990, Goss et al. 1980).

---

<sup>10</sup> Family farms are defined by the USDA ERS (2015) as “those whose principal operator and people related to the principal operator by blood or marriage own most of the farm business”.

<sup>11</sup> Contract farming is when a corporation contracts with a farmer to produce something specific (Lobao and Meyer 2004).

Although the average size of farms is growing, small scale family farms are extremely important to U.S. agriculture. Family farming is attractive because they have the ability to “self-exploit,” growing crops, such as non-commodity crops, that may not be attractive to large firms (Mottura and Pugliese 1980) and change their consumption amounts depending on surplus (Freidmann 1988). The USDA’s (1998) report called “A Time to Act,” identified several reasons showing small scale farms importance, including preservation of natural resources such as soil, water, and wildlife. Small farms also contribute to biological diversity, foster economic opportunity because of decentralization of land ownership in rural communities, and help promote connections to food. Small family farms also reduce rural poverty and food insecurity, while also helping to maintain a rural nonfarm economy (Bhalla and Hazell 2003). Using the USDA’s framework, small-scale agriculture has the potential to solve many of our environmental, health, and social problems.

Organic and sustainable agriculture is one type of farming that aims to create markets which promote the principles of small-scale agriculture, along with better agricultural working conditions, enhanced consumer health, and preservation of the environment (Allen and Kovach 2000). They also must preserve or improve soil and water quality, wetlands, woodlands, and wildlife without using synthetic fertilizers, sewage sludge, irradiation, or genetic engineering (USDA 2014). These standards were created through the Organic Food Production Act, part of the 1990 Farm Bill. In 2002, the US established national standards for organic production and processing to replace the patchwork set of standards that previously existed (USDA 2014).

### **Farming Subsidies**

In 2006, only 19 cents of every dollar spent on food went to the farmer (USDA 2014), illustrating the small returns that farmers receive. One way that farmers continue to subsist is

through subsidies, which are payments that the government gives to protect farmers from financial hardship through increasing their income. Since 1973 farmers have received direct government payments through subsidies (Kirwan 2009). However, during this same time period, the share of small-scale family farms receiving these subsidies was reduced, while large farms in the U.S. increased their share of these payments (Goss et al. 1980, Krause 1987). Lobao and Meyer (2004) argued that farmers enjoy government support unmatched by other groups. Although the perception is that government subsidies go to small family farms, this is a misconception. According to the Environmental Working Group (2014), from 2009 to 2011 the United States spent \$211 billion dollars for farm payments, 88% of which went to 20% of farms. Although 1/3 of American farmers get subsidies, most of these are large scale commodity farms because subsidy payments are based on production. The top recipients of these payments were Riceland Foods and Farmers Rice Coop, which received over \$1 billion, illustrating that multi-billion dollar agricultural companies are receiving these subsidies, not small farms which are producing few commodities.

Many of the changes in the structure of subsidies occurred during the 1996 Agriculture Improvement and Reform Act, when the US Congress voted to deregulate the farming industry. Although farmers were able to utilize more of their land for farming, the commodity prices they received were often below production. Congress voted on emergency payments to farmers and in 2002 they began making permanent direct payments whenever prices declined, which tripled subsidies to farmers. By 2000, these subsidies made up half of all farm income (Lobao and Meyers 2004). Without government subsidies, small-scale farmers often suffer from persistent poverty because of an agricultural landscape which leaves them unable to make a living on farming alone (Meyer & Lobao 1994).

Because of the restructuring of subsidies and the inability for many small farmers to compete with large farms, 90% of farmers supplement their income using non-farm sources (Lobao and Meyers 2001), while only 10% of total farm household income comes from their farming operation (Hoppe et al. 2001, Mishra, et al. 2002). The lack of stability in farming often causes farmers to seek out other opportunities to earn money from their land, such as using it for natural resource development (Malin 2011) or in certain states like Colorado, selling off their water rights (Gould 1989). Farmers often have difficulty making such decisions because of conflicting priorities and devastating constraints (Peterson 1991). Malin (2011) argued in her study of Pennsylvania farmers that they sign leases because the possible negative outcomes of allowing energy development on their land, such as water contamination, are downplayed. The most important thing becomes potential positive economic consequences from leasing out their land, with the lease payments acting as an informal subsidy. O&G development can also give small-scale farmers a feeling of control, agency, and stability over their livelihoods (Malin 2011, Zoinger and Krannich 2002). Many aging farmers also worry that the next generation is uninterested in farming, making natural resource development more attractive than passing their farms onto the younger generation (Zoinger and Krannich 2002).

As our agricultural system continues to shift, small-scale farms may continue to be disenfranchised through unequal access to the economic, political, social systems. This primarily will occur through lack of governmental subsidies targeted at the small-scale farms that need them and the inability for these farmers to make land-use decisions. This shift will make the continuing study of extractive industry and agriculture vital; as farms continue turn to other industries to make ends meet, they may turn to industries like O&G development for informal subsidization of their farms, regardless of the impacts to their farming operations. In this context,

it is extremely imperative to research the impacts of procedural inequity, as well as using public research to examine ways that farmers can participate in procedural equity.

### **Solutions to Problems with Traditional Large Scale Agriculture**

Lobao and Meyers (2004) argue that it will be consumers, activists, and small scale farmers themselves who will transform American agriculture. Along with shifting government subsidies away from subsidies based on output towards a need based system, organic and sustainable small scale agriculture is lauded as one potential solution to small scale farmer's economic problems. Through organic farming, farmers can opt out of participating in large agribusiness; many organic farmers view this as going back to the "traditional" way of farming (Buck et al. 1997). Although organic agriculture began as a niche market, its market share is increasing. Between 2002 and 2014, there was a 250 percent rise in the amount number of organic farms in the US. In Colorado, there were 217 certified operations in 2012. Organic food sales in the US were also \$28 billion in 2012, an increase of 11 percent from just 2011 (USDA 2014). These statistics demonstrate the increasing prevalence of organic farming and organic food in the United States. There are many reasons why farmers may shift to organic farming; they may want to lower input costs, conserve resources, sell in high value markets, and increase farm income. Although transitioning to organic farming and obtaining organic certification is expensive, it is still extremely attractive to new farmers without a family background in farming who are concerned with protecting their land and health (McCann et al. 2011).

The importance of supporting local, sustainable food is also increasingly prevalent. While organic has a legal definition, the definition of sustainable farming is flexible and often dependent upon individual sustainable farmers and their customers. Ikerd (1993) defines sustainable agriculture as "capable of maintaining its productivity and usefulness to society over

the long run... it must be environmentally-sound, resource-conserving economically viable and socially supportive, commercially competitive, and environmentally sound” (30). A particular aspect of sustainable agriculture is local food; according to the USDA, in 2012 163,675 farmers sold \$6.1 billion in local food<sup>12</sup>. Farms with local food sales represent 7.8 % of U.S. farms, and local food sales account for an estimated 1.5% of the value of U.S. agricultural production.

Unlike organic agriculture, there is no certification for sustainable practices so farmers instead rely on a relationship through face to face with consumers during the purchasing process; 20 % of local food is sold to consumers in direct to consumer channels. Although between 2002 and 2007, the direct to consumer sales of food increased by 32 percent, direct to consumer sales have recently plateaued. This may be because supermarkets are satisfying consumers need for local food or this need has leveled off over time (Vogel and Low 2015). Farmers markets are one direct to consumer sales take place, with farmers markets growing from 1755 in 1994 to 4385 in 2006, with 1/3 of these vendors selling organic food (USDA 2014). Community Supported Agriculture is another popular place where the consumer producer relationship is fostered, with the number of CSAs increasing from 50 in 1990 to over 4,000 in 2014 (Local Harvest 2014). The current trend of CSAs, community gardens, and farmers markets is a way for producers and consumers to have more autonomy over what they buy (Lockie 2009). Although small farms are important within the local food system, the majority of food sold locally is still produced by large farms (Vogel and Low 2015).

---

<sup>12</sup> The USDA (2015) defines local food as “food for human consumption sold via direct-to-consumer (e.g., farmers’ markets, on-farm stores, farm stands, pick-your-own activities, and other farmer-to-consumer venues) and intermediated marketing channels (sales directly to restaurants, grocers, schools, universities and other institutions, as well as sales to distributors, brokers, and other aggregators dedicated to local foods sourcing)”

### **Potential Problems with Sustainable and Organic Agriculture**

Although organic farming is attractive to many farmers, organic farmers also face problems. Since organic farming relies on natural processes, it is susceptible to crop loss. Farmers may face a drop in yields during the three year period of transition to organic agriculture, while not receiving the higher price for their product (Strochlic and Sierra 2007). Organic certification may disenfranchise some small-scale farming operations because it is extremely expensive and small farms are often unable to afford the associated fees. The other obstacles to organic certification are high managerial costs, risks connected to shifting to a new way of farming, limited familiarity with organic farming systems, lack of infrastructure, and inability to capture markets (USDA 2014). Many farmers also disagree with representing the producer/consumer relationship by a label and opt instead to operate sustainable operations, which have no clear definition. Lastly, the USDA's organic label is criticized as allowing agribusiness to co-opt organic farming as an alternative food system, causing it to become mainstream (Buck et al. 1997).

There is also a well founded fear that more organic food grows, the less stringent the certification will become. For example, in 2005 a legislative rider was passed allowing synthetics in organic foods after an organic blueberry grower sued over concern about synthetic ingredients in processed organic foods. This helped large scale organic producers reliant on synthetics, but angered organic farmers who want to keep their product as pure as possible (DuPuis and Gillon 2009). Once organic processed food companies were bought out by large companies the commitment to using organic ingredients decreased (Howard 2009). Organic farmers have already cut corners to increase profits, using multiple cropping instead of allowing the field to have a rest period and mono cropping to increase production efficiently (Guthman 2000). According to the Organic Trade Association (2014), farmers can also use seeds treated with

synthetic fungicides if they are unable to locate untreated seeds and non organic seeds if they cannot find organic seeds. Lastly, if farmers are facing crop failure, they are allowed to appeal to the certification agency to use botanical or other non-persistent pesticides.

### **Natural Resource Development and Small Scale Sustainable Agriculture**

Natural resource development, such as O&G production, may impact organic or sustainable agriculture in unique ways. Much of the land that O&G developers need is owned or leased by farmers, giving farmers pressure to allow development on their land. As discussed earlier, often farmers are willing to lease off their land without much deliberation, especially if they are early signers (Jacquet 2011). However, because of the strict standards of organic certification, any possible contamination could be problematic. If farmers become certified and fail to meet the USDA's strict standards, they may face fines up to \$11,000, as well as loss of their organic certification. Sustainable farmers without organic certification may face distrust from their consumers if they allow O&G development on their land or if development is occurring nearby and there is a perceived risk of contamination.

Bamberger and Oswald (2012) argue that more research on O&G development's impact on food safety must be done because safe setback distances between O&G development and agricultural operations are unknown. This is problematic because development may impact the meat and produce that consumers eat every day. They documented cases where animals exposed to O&G development were not tested before slaughter, thus leaving the possibility that some chemicals used in O&G development were present in animals. Little knowledge exists on acceptable hold times for animals exposed to chemicals used in O&G operations; this information is necessary to have an adequate level of food safety (Bamberger and Oswald 2012).

There is a large gap in the research of what the potential problems with O&G development occurring near or on the same land as our food supply is being produced are.

## **Identity**

Along with the particular environmental and health problems that O&G development near or on organic and sustainable farming land poses, there are identity conflicts with allowing the practice alongside this type of agriculture. In many instances, organic and sustainable farming is as much about identity as it is about the process. Lockie (2009) states:

Much of the appeal of certified organic foods lies not only in their claims to food safety and nutrition, but in their ability to signify a less tangible sense of authenticity- that is, to convey a sense of naturalness, tradition, community, and trustworthiness- as opposed to what is seen as the artificiality and riskiness of industrially produced foods (199).

Individuals who farm organically are also doing so because of the fear of chemicals in their food supply, and thus will likely have similar concerns about unconventional O&G development.

Many sustainable and organic farmers subscribe to a type of environmentalism that is both a reflection and product of their job identity. Horton (2003) states:

This sphere of every- day life is an important, and frequently overlooked, part of contemporary environmentalism. Material culture is a hugely significant constitutive component of this sphere of 'the everyday'. Particular objects, and particular ways of living with the material world, are vital to the production and reproduction of both the everyday lives of environmental activists and environmentalism as a whole (63).

Farmers with nearby development may be concerned about how it will affect them.

Traditionally, small scale farmers feel agency through being their own boss while coexisting with nature, which has dissipated with the disappearance of small farms (Garkovich et al. 1995).

O&G development may further eradicate the agency farmers feel from operating in a small, sustainable way.

Consumers also may feel identity conflicts with purchasing sustainably or organically grown food that is produced alongside O&G development. One of organic and sustainable small

scale agriculture's goals is to re-embed agricultural production in social relationships (Raynolds 2000). Although consumers purchasing organic put their trust in a label to know that they are getting an authentic product, consumers buying from sustainable farms must have trust in the producer that the product is safe and authentic. Organic consumers are primarily concerned with the pesticides used in traditional farming, and what the possible health effects of those pesticides are (Lockie 2009, Zadek et al. 1998). Often sustainable and organic farming is a form of "activism," rebelling against the large agribusinesses which make it difficult to be even a small-scale conventional farmer during the twenty-first century. Horton (2003) argues that food is a widespread way that individuals display identity in what he calls green politics, stating "people literally eat their way into identity positions" (64), with alternative agriculture being a form of self-expression (Zadek et al. 1998).

When researching how unconventional O&G production affects small scale organic and sustainable farms, it's important to consider the individuals that participate in this type of "alternative" food consumption, including the consumers and farmers. Organic and sustainable consumers concerned about chemicals may be fearful of how development impacts their food, a valid fear since there is no research on outcomes of O&G development on food. Unconventional O&G development may cause negative physical outcomes, but it also can affect farmers' identities, causing them to shift their self concepts of being a sustainable farmer or their meanings of sustainability. There is an opportunity within the literature for researchers to examine how sociological concepts related to identity may explain through what mechanisms identities shift in relation to social, political, and economic contexts and constraints.

## ***Conclusion***

As demonstrated above, there is a large amount of research on how communities and individuals deal with natural resource development and its impacts. However, because unconventional O&G production has only recently interacted with communities and agriculture, there is little research on what unique consequences will result from this development. Small scale farmers particularly have the potential to be impacted the most because of decreasing farming subsidies and farming profits, which makes O&G an attractive solution to their financial problems. In addition, if they don't allow development on their land, they still may suffer consequences if those around them allow it or they do not own their mineral rights.

The area where the most research needs to be done is on the environmental health impacts that may occur, because they will affect social outcomes, especially if health impacts are contested. Farmers are a particularly vulnerable population because of the ways in which agriculture is changing; it is no longer easy for farmers to make a living with just farming alone. The potential for further disenfranchisement exists if development continues at such a rapid pace and the majority of the land appealing to O&G development is farmland. Colorado is the wildcard in this debate on unconventional O&G development because of the convoluted system of ownership of land rights, mineral rights, and water rights all of which affect the debate on development. Colorado also has a unique regulatory context which aims to be sensitive to all stakeholders concerns, while at the same time being friendly to the O&G industry that has been present in the state since the 1800's.

Taking all of these concerns into account, EJ is the framework which best allows for researchers to study O&G development in a way in which structure and individuals everyday lived experiences intersect. EJ also privileges individual's experiences and lay knowledge in regards to things like contested illnesses, where individuals become citizen scientists, mapping

out diseases to show toxic exposures in their neighborhood. Lastly, EJ allows me to examine procedural equity, asking farmers about whether they feel they have equal access to the political, economic, and social structures that O&G developers do. Most importantly, I aim to establish whether farmers feel they have a choice in their participation in O&G development.

For my research, I will focus on how unconventional O&G development impacts small-scale and sustainable agriculture in Weld, Boulder, and Larimer counties in Colorado. Weld and Larimer have the highest number of O&G wells in Colorado, making them excellent natural laboratories. All three counties also have unique socio-political contexts which are ripe for comparison. Thus, I ask: *“In what ways do unconventional O&G production interact with small-scale organic and sustainable agriculturalists in Northern Colorado, particularly as compared to effects felt by conventional farmers?”*, *“(How) do sustainable and organic farmers’ identities or operational philosophies shift to accommodate the presence of unconventional O&G production on or near their farms (or in their communities)?”*, and *“Do these farmers experience these shifts as environmental injustices?”*

## Chapter IV: Findings and Analysis

### ***Introduction***

Three main themes emerged from my interview data collected from ten farms with eleven farmers, of which two were conventional farms, one was an organic farm, and seven were sustainable farms. These themes offered abundant insights into my main research questions, which include: *“In what ways do unconventional O&G production interact with small-scale organic and sustainable agriculturalists in Northern Colorado, particularly as compared to effects felt by conventional farmers?”* *“(How) do sustainable and organic farmers’ identities or operational philosophies shift to accommodate the presence of unconventional O&G production on or near their farms (or in their communities)?,”* and *“Do these farmers experience these shifts as environmental injustices?”* The first overarching theme related to *identity*, which included how people discussed their motivations for farming, how they saw themselves as farmers, and how unconventional O&G development impacted their identities. The second theme included *impacts and changes to daily life*; the people I interviewed mentioned several related outcomes, including: changes to the land, health impacts, and quality of life impacts. The last theme involved the *political-economic considerations* farmers face, which included: economic constraints that encouraged participation in the industry, impacts to the water market, split estate, and regulation. To best illustrate these themes present within my ten interviews, I first discuss them broadly; I then delve into three case studies that help illustrate different contexts shaping people’s responses to unconventional O&G development. Through these themes, I demonstrate important sociological impacts of unconventional O&G production on small-scale organic and sustainable agriculturalists in northern Colorado.

The first theme presented within my interviews was *identity*, which encompassed different sociological outcomes for the farmers I interviewed. Each farmer I interviewed had different motivations for farming, with many of them having different roles in careers in unrelated fields before entering farming. Most entered the sustainable agricultural system because of concerns over environmental health risks related to the industrial agricultural system or due to their desire to teach others about the importance of knowing where food comes from. Five of the farmers I interviewed believed that unconventional O&G production on or even near their land impacted their identities as sustainable farmers, either causing them to alter their operations' sustainable identities/branding or by forcing them to sell their farms because they felt they would be unable to represent themselves as sustainable with industrial O&G development occurring on their land. Individuals who were welcoming of development reported that O&G production on or near their operations did not meaningfully impact their identities.

The second theme prominently discussed by farmers involved *general impacts and changes to daily life*, which included: health impacts, impacts to the land, water, and other concerns. Water presented a substantial concern for farmers I interviewed, whether that meant changes in the water market (which I discuss in the theme of political economy) or concerns about water quality and contamination. Impacts to the land also concerned farmers, particularly those without mineral rights. Air pollution was also a concern, albeit minor in my interviews. Lastly, quality of life concerns that were identified in the literature like heavy truck traffic, damaged roads, and other community changes were expressed as primary concerns for farmers. This was true for the individuals who allowed development on their land, individuals who had development occurring around them but not directly on their land, and individuals thinking about what the future may be like if development started occurring around them or on their land.

Concerns related to the regional *political economy* of unconventional O&G development, including the subthemes of the economic benefit of unconventional O&G development, importance of domestic fossil fuels, split estate, and regulations were present in some way throughout all of the interviews. Although the O&G industry is widely known as a boom-bust industry, especially in this area of northern Colorado where people have experienced related fluctuations before, few of my interviewees identified this as a point of concern when discussing O&G development. However, even individuals who expressed concerns about O&G development recognized positive, boom-related economic consequences of development in the state, particularly for individuals with mineral rights and the state who gained tax revenue from this industry. Farmers mentioned this in the context of farming, through which they expressed the concern for farmer's inability to make a living on farming alone. Many individuals who had mineral rights felt they acquired a "lottery ticket" in the form of O&G development on their properties – and respondents overwhelmingly felt they should be able to develop their land to either subsidize their farm or to a lesser extent, help them transition into retirement. In addition, farmers noted the benefits to the local economy of O&G development, where many of the jobs are directly and indirectly related to O&G development.

Split estate is one of the primary issues related to O&G development in Colorado; impacted all of my respondents and was thus a prominent theme in all my interviews. Although this is not the case in all of Colorado, the majority of farmers (6) I interviewed had their mineral rights. Interestingly, although they were not personally impacted by the split-estate system, they understood the difficulties that come with unwanted development occurring on your land, especially when trying to farm in a sustainably. However, the farmers without mineral rights felt

they were significantly impacted because they were disabled from exercising control over future development on their land.

Lastly, most farmers I interviewed saw regulation of the industry as problematic, but necessary. In their occupation as farmers, many had negative experiences with government regulation which influenced the way they saw other types of regulation. Most of them preferred state-level regulation to local regulation, arguing that O&G companies do need a uniform set of operating rules to avoid a patchwork of regulation from different localities. However, a smaller number of farmers I interviewed preferred a mixed approach, with the state providing at least a minimum regulatory standard that companies need to follow. In this scenario, if localities wanted stricter regulations or moratoria related to unconventional O&G development, they would be able to. No farmers argued for federal regulation of the O&G industry, except one that thought there should be some baseline federal regulations, which included the O&G industry being subject to environmental regulations it is currently exempt from, including the Clean Air Act and the Clean Water Act.

To demonstrate these complex themes in an engaging way, I will take a case study approach, describing the results of my interviews. Of the ten farms I visited and conducted interviews with the operators, I chose three farms that exemplified the themes I discussed above and demonstrate how these complex issues interact on the ground. Each farm also represents one of the three counties where my interviews took place, helping me to illustrate differences that existed between locations of the farms as well. The first farm I describe is Sunnydale Farm, a small pumpkin and spruce tree farm in Fort Collins, Colorado, aiming to be pragmatically sustainable. The farm in my second case study is called Blueberry Blossom farm, a small pick your own fruit farm outside the city of Boulder, Colorado, was aiming to be sustainable through

agri-tourism. The last farm I discuss is Tanglewood Farm, a small sustainable farm coinciding with O&G development and located in Weld County, the epicenter of unconventional O&G development in Northern Colorado.

***Case 1: Sunnydale Farm***

Sunnydale Farm is a small thirty-five acre farm in Windsor, Colorado, located ten miles southeast from the city of Fort Collins, an expanding market for sustainable farms like Sunnydale. They are currently focused on growing blue spruce trees and heirloom pumpkins, with types such as such as Cinderella, Long Island Cheese, and White Cushaw, which grew in between the lines of blue spruce trees. Although in the past they focused mostly on Blue Spruce trees, over the last few years they expanded their pumpkin crop, selling them at local farmers markets. Sunnydale fills a niche in the community and were the only primarily pumpkin farm that I discovered during my search for interviewees. I met Sara, one of the farm operators, at a farmers market in October, towards the end of the harvest season.

Although Sunnydale Farm is located in Windsor and thus in Larimer County, which has very little development currently, this particular farm signed an O&G lease the previous year. This made it an outlier and important for observation. It also offers a good observation for what impacts could occur in the area if development escalates in Windsor. While Windsor does not currently have a moratorium, nearby Fort Collins (where many of Sunnydale's customers reside) did vote for a moratorium on O&G development that is currently being contested. Most of the wells that are producing are right on the edge of city limits, close to the edge of Weld County, where the majority of unconventional O&G development is taking place.

Sunnydale Farm looked vastly different than the conventional farms I noticed while driving along I-25 during the six months I conducted interviews. When pulling up to the farm,

the first thing I saw was their large farmhouse with pumpkins of all varieties lining the front and back porch, where we conducted the interview. There were large scarecrows as I walked into the yard, along with wheelbarrows filled with flowers. The farm felt comfortable and welcoming. On one side of their farm were the mountains and the other side were new housing developments, which illustrated how O&G development occurs alongside new the housing developments being built all over northern Colorado in response to a booming population. We began our interview outside at a table overlooking the farm and the mountains until it became too cold to sit outside, at which point we were invited into their large farmhouse. Their farmhouse was one of the most beautiful farmhouses I have seen; it had high, wooden ceilings with a Western motif throughout. Their coffee tables were also filled with books with a noticeable farming theme.

My fellow researchers and I completed this interview in early October, right in the middle of harvest season, and Sunnydale Farm's rows of pumpkins were ripe and ready to be picked. Rob and Sara, the operators of Sunnydale Farm, consider their operation a sustainable farm, avoiding the use of all pesticides and spraying herbicides only when necessary. In addition, they employed water efficiency practices such as drip irrigation, which helped with their goal of sustainable water conservation in arid Colorado; this was also fitting with Rob's primary career as a water engineer. They did not have organic certification, citing the difficulty and expense in getting certified as barriers to their participation in the official certification system. Although it was something they expressed interest in, they felt that growing pumpkins and blue spruce trees was a learning process that they had not mastered yet, making organic certification a potential endeavor to be attempted when they felt more confident.

This particular interview was unique because it was with a pair of farmers, a father and daughter with vastly different views about farming and unconventional O&G production. While

Sara wanted their farm to be sustainable because of her environmentalist identity and her ideologies about the food system and farming, Rob was a pragmatic man who saw the allowance of O&G development on or near their land as sensible, economically and ecologically. Sara wanted to keep their farm free of O&G development, while Rob was in favor of development as long as it was done with a reputable, safe company that offered a fair lease. Both Rob and Sara were well-educated on the issue, even with their divergent views, and continued to be educated on it. They represented a microcosm of Colorado as a whole, providing an example of how individuals with different viewpoints are trying to come to a compromise in regards to O&G development and in some senses, the food system in general.

Rob, who was the primary farmer and owner of the farming operation, was an educated man with advanced degrees in irrigation and water engineering. This made him well-versed in Colorado's systems of water rights and prior appropriation and how these systems impact agriculture in the state of Colorado. His daughter, Sara, was a young thirty four-year-old woman who had studied psychology and was involved with social justice work in the Northwest, where she lived for ten years. Sara moved back to her parent's farm so that she could finish the interior of her tiny house, but quickly gained an interest in helping her father with the farm. Sara's tiny house provided insight into what her environmental perspectives might be like; she was extremely concerned about consumption and other environmental issues, feeling a loss of control over the environmental problems that her generation currently faces and will face in the future. While Rob focused more on the on the farm work, Sara communicated with customers through the various farmers markets where they sold their pumpkins. Although they had no CSA, they discussed a potential CSA in the future if they expanded their operation.

When O&G development began moving into the area, Rob did not think that he would be able to develop his land. When Rob was first approached by the O&G industry, he was unaware that he owned his mineral rights. He was unimpressed by the first company who approached him with a leasing opportunity, because they had a bad track record in the area and Rob was not desperate to sign a lease, risking potential damage to his land. However, he was later approached by a second O&G company with whom he was increasingly impressed with, later deciding to sign an agreement with them to allow some O&G production on and near his land. Rob stated:

We had meetings with them, got to know them, we liked the people, and then ultimately the four lots along here... so the deal is a three year deal for the right to drill, and in my own case... this was before Sara got involved, so as I evaluated our circumstance, then I was not interested in a surface right agreement with these guys, so in fact, my agreement on the mineral rights is that there is to be no surface development, explicitly.

Rob signed a three-year agreement with this O&G Company, along with four of his neighbors who are included within his Homeowner's Association (HOA). Although Rob will not host a well-pad on his land because he did not sign a surface agreement, one of his neighbors agreed to host the well-pad that will help the O&G Company access his minerals. Rob also allowed the O&G Company to put a pipeline on his property, which was scheduled to be installed shortly after our interview took place. Although there would be some disruption to his land during the installation of the pipeline, there should not be any negative long-term impacts. Rob's property was unique because he and his fifteen neighbors, who all belonged to the HOA, shared an open space and communally owned their water rights. Although certain things required permission from the HOA, O&G development is not mentioned in the decree because it was written it was before they believed there would ever be O&G development in this area. This meant that Rob did not have to go seek the HOA's permission to begin O&G development on his land. However, he knew that this would be a contentious issue between him and his neighbors, and it had indeed caused community upheaval even before drilling and other production began.

I will now discuss the important themes present in this interview including: *identity*, through which we discussed farming identity and how this was impacted by O&G development; *political economy*, which included the subthemes of economic impacts, water markets, regulation, and split estate; and *impacts and changes to daily life*, which included the subthemes of potential environmental impacts, economic impacts, and quality of life impacts.

### **Identity**

The theme of identity was omni-present throughout the interview with Rob and Sara, who had divergent views on farming while operating within the same farm. As a result of these conflicting motivations to farm, Rob and Sara's identifications as sustainable farming operators were changed in differing ways in response to their lease with the oil company. Rob spoke candidly about how he felt there was no contradiction between allowing development on their land and also representing themselves as sustainable farmers, perhaps because the meaning he attached to sustainability was more of a process than an ideology. Sara, however, felt conflicted; because of the meaning she attached to sustainability there were inherent contradictions and this was something that she was working through internally. Sara explained that no customers inquired about whether O&G development was present on her farm, until I approached her at her farmer's market stand while canvassing for study respondents. She said this made her "both relieved and terrified." It made sense that she had concerns about O&G development interacting with food production because she was also concerned about the chemicals in industrial agricultural food systems leading to negative environmental health impacts. Thus, a concern for chemical pesticides is easily transferrable to a concern for chemicals used in other industrial processes, especially processes operating intimately with our food system.

Sara and Rob embodied many of the debates surrounding O&G development both in the literature and in popular media. Although they were both willing to listen to new information about O&G development in general and on their farm, they both ultimately held to the meanings they attached to their farming identities and their original ideas about O&G development. Rob became more supportive of development through the various programs that he and Sara attended and information he read from local newspapers. Although Sara became less worried about O&G development occurring on her family's farm, partially because it was out of her control, she did not accept it and still felt uneasy about development. She stated:

I wanted to challenge myself... outside of that [environmental] thinking, because I'd grown very comfortable with it... and started to wonder, have I swallowed all this hook, line, and sinker?... What nuances am I missing... I went to multiple protests... without really understanding how fracking worked. So here I was thinking I was a critical thinker, because the world at large says, 'Yay fracking!' I thought, it's important that we pace ourselves, slow down. If we don't know if it's harmful, let's not do it. If we haven't researched it enough, let's not do it. I tend to think our society doesn't look far enough into the future, we're only looking five months or five years down the road, and we should stop what we're doing. But I wasn't researching fracking. I didn't actually know the process... So how critical of a thinker was I? So I come back here, I learn that this process is underway. I didn't know till moving back here that my folks were in conversation with [the oil company], and I was very emotional.

Sara described this dilemma to us in detail. Although Sara tried to remain open minded about O&G development, she had little or no choice because her family's land was going to be developed alongside her sustainably grown pumpkins. She was concerned that her environmentalist perspective was normalized without fully understanding the process of development. Still, she was ultimately against the development of her family's land. Sara stated "I'll be honest with you. I feel like if I could wave a magic wand and make fracking disappear, I would wave it." This illustrated the difficulty agriculturalists like Sara face as they negotiate how to operate on land where O&G development dictates a well-pad on or near their land and often a

pipeline running through it. In this sense, Sara's views paralleled somebody who operates without mineral rights, and thus without autonomy over what occurs under their farm.

This conflict of meaning, identity, and ideology was brought into the open during a troubling situation which occurred after Rob signed the O&G lease. Rob received an email warning that his farm was about to be "outed" for their allowance of O&G development alongside and underneath their pumpkins on their sustainable farm. It particularly concerned them that the email was unsigned – although they assumed it was from an anti- hydraulic fracturing organization. Sara stated:

As a consumer, I would want everything out in the open so I wouldn't want to be on the producing end and be someone that wasn't willing to put anything out in the open. Yet I was shocked and scared when I got an email from someone that filled out the form on our website from an environmental organization... It said we understand you've leased your land to fracking and do you have anything to say for yourself before we publicize this information... That scared me not because I want to keep the fracking secret but because it brought front and center, yeah this is going to affect our operation.

Although Rob and Sara agreed they would never hide the reality their O&G lease, the letter was concerning, particularly to Sara, because of all the emotions surrounding the topic. If customers heard this without allowing Sara or Rob to explain through one on one interaction, they may opt to buy from another farm without development. There is also the potential for this to impact future organic certification, although this was not a current concern. Although Rob saw no contradiction between allowing O&G development on his farm and also continuing to operate sustainability- his customers may construct a different meaning of sustainability, viewing development as an inherent contradiction to this meaning, and ultimately rejecting Rob's identity as a sustainable farmer.

The last aspect of identity present throughout the interviews was Rob and Sara's different attachment to the land and their community. Although Rob did not discuss his attachment to the land, Sara had a multi-generational connection to her parent's land. Because of her emotional

connection to the land, Sara was hopeful that the possibility remained that no development would occur on her father's land. This emotional connection was shown not just through the words she spoke, but through her non-verbal responses to our questions. Although she was comforted as she learned about the process, it was still visible that she thought, through development, her family's land was losing something. She stated:

The Greeley program actually comforted me a lot about the harms associated with fracking... The environmental guy was quoting figures that were very comforting to me as somebody whose family's land was [going to be developed]. I was still very emotional... There were so many tears shed on this issue... So I am worried and I'm conflicted because... I want to do this farming and I want to make this land work for the community and be a part of the local food system.

This quote also illustrates the importance of the community to Sara, which was indicative of her concern for the environment and sustainability at large. Although it was important to protect her father's land for personal reasons, it was also important to protect it because of its significance to the community and what sustainable farming can do for the local food system. The theme of identity within Sunnydale Farm's interview illustrated how motivations for sustainable farming, views about O&G development, and attachment to land impacted their experiences with O&G development and how it impacted their farm.

### **General Impacts and Changes to Daily Life**

The next theme illustrated by Rob and Sara's interview was general impacts and changes to daily life, which includes the subthemes of potential environmental impacts and community impacts. Although development had not begun yet, Rob and Sara knew there would be impacts to their land. However, Rob felt confident that the impacts would be minor and temporary. Rob was protected from many of the impacts because he signed a lease that included only mineral rights - not surface rights. This meant that they would disturb a neighbor's surface to get to the minerals underneath his land. Rob commented that he was initially worried about the impacts of

surface disturbance, but that this was reduced after contract specifics were worked out with his neighbor. Yet before Rob signed the lease, he researched the O&G company that he leased his mineral rights to, focusing on coverage in local sources like the *Greeley Tribune*, a vital source covering Weld County's then-booming O&G industry. Rob also agreed to put a pipeline on his property, which he thought would have minimal impacts. If there were impacts, especially from necessary infrastructure such as pipeline, he was confident they would remediate them and that this remediation would be outlined in his lease agreement.

The tension within Rob's HOA and his neighborhood represents the changes to daily life, and specifically the community tensions, that my evidence indicates emerge alongside rapid and unconventional O&G development in northern Colorado. When asked what the other homeowners thought about O&G development, Rob told us:

The other homeowners in the association... it's the epitome of the discussions we've been reading about and you've been researching... these are my words of course, but people are hugely emotional about this O&G- the horizontal drilling, the- is it safe or is it not? ... Fearful, that's a good word. Yeah, one of the homeowners that's further south... all of our water here comes from Fort Collins-Loveland potable water, piped. Nobody has a well, but he's worried about contamination of his wells, should he ever drill a well, and he doesn't even have a clue that the drilling goes down to 7,000 feet or so... some of his comments were just purely emotionally driven.

Rob described the view that individuals' concerns about O&G development came out of ignorance; he felt they are unaware of the process and their unwillingness to accept it is because of lacking information. Rob described his neighbors' reactions as highly emotional, specifically describing a neighbor being fearful of water contamination when most people within the city are not reliant on well water, but city water; this means they are unlikely to face water contamination. Other than truck traffic from other nearby wells, Sara and Rob noted no impacts to their land. However, O&G development had not begun yet either and their experiences with the O&G company thus far were positive. Although the environmental impacts and changes to

daily life were minimal for Rob and Sara, there was the possibility that they could be more prevalent in the future as development begins on their farm.

### **Political Economy**

The last theme present within Rob and Sara's interview was the political economy of O&G development, which they discussed through issues of economic impacts, split estate, water markets, and regulation. Unlike many farmers who sign O&G leases, Rob did not need the money to keep his farm going because both he and his wife had viable off-farm employment that could subsidize the farm until it began doing better financially. However, he observed that declining a lease was refusing risk free money that could later be used for retirement or to get a place closer to town once they got older. Rob stated:

We own this place, we have this farming operation, we didn't have to sign a lease on the mineral rights and we didn't even know we owned them until four years ago... It's easy to be influenced by the opportunity, especially if you're not turned off by... some of the... anti-oil and gas emotionalism. I sure don't want to close my eyes to issues but on the other hand it's an opportunity, it's like other businesses opportunities that come your way and whether or not you participate is your own personal choice. It wasn't a necessity.

Although Rob did not need lease monies now, this was an opportunity for them to guarantee themselves a safety net during retirement that they would not otherwise have. Because they are at the age to begin thinking about a future where they are not reliant on the farm, it made economic sense for them to potentially risk negative environmental impacts for the economic stability a lease provides, particularly because Rob viewed these risks as minimal.

Although Sara understood the need for her parents to have a safety net for the future, she also considered her future on the farm and whether O&G development might impact what she could do with the farm if and when it became hers. Their differing views show how individuals experiencing the political economic system differently had different concerns- while Rob is

concerned about his economic situation and retirement, Sara is concerned about the long term viability of the farm she may inhabit permanently someday. Sara stated:

You [Rob] are in a time of financial planning for down the road, you are in a different stage of life than I am... Should we get a smaller house in town? And would we be able to continue paying this mortgage? At what time will we stop our income outside of the farm? My being here... there's a chance here that it could work long term and I could start paying into the mortgage if the farming becomes more viable. Then the income from the fracking... wouldn't need to be in the picture... my parents could stay here throughout their lives. My mom was suggesting that there was a choice to be made, when to move to a smaller more manageable location and... if the fracking income could help pay for a caregiver long term. One reason I feel that I'm in this very strange position I'm the daughter of upper middle class parents who have the land that I don't have any entitlement to but I've got a sense of entitlement as an environmentalist. This is our planet that I'm going to have to live on longer than you.

Rob illustrated that although they weren't desperate for income, the economic conditions that exist still made it necessary for him to seriously consider, and ultimately agree to conditions that facilitated (what he viewed as) risk-free income. While Sara understood her father's need to accept O&G monies, she was concerned not only about the economic viability of the farm long-term, but also the environmental impacts to the farm and of the process of unconventional O&G development in general. If unconventional O&G development negatively impacted Rob and Sara's farm, it may be unmarketable and nonoperational as a sustainable farm in the future.

The second subtheme demonstrated was O&G development's impacts on water markets, rights, and prices in northern Colorado. Rob spoke to the impacts on agriculture in Windsor and other Northern Colorado communities through the water market because of his doctorate in water engineering. Rob described the problems as existing mainly during a drought year, when agricultural operators without substantial/senior water rights or the financial means to gain access are unable to lease water because they cannot afford the rental rates that the O&G companies are able to pay. Rob told us that the rental rates went "From \$30 an acre foot to

\$3,000, 100 times more.” However, farmers also leased out their own water to O&G in order to subsidize their farms and benefit financially. Rob stated:

I feel very strongly that farmers want to farm. They do not want to go to Mexico for the winter and/or retire. Farmers want to farm. So if they see some, basically risk free income potential, then they’ll likely avail themselves of it, and they’ll plow it back into their farming operation.

Although it may be true that farmers want to farm, it is clear through Rob’s quote that it is not always financially wise to rely on farming alone, and many farmers are forced to rely on outside income such as revenue generated through the leasing of water rights.

Rob was a unique case in the area of water rights because although he owned his water rights, he owned them jointly with his neighbors. This meant that as an individual, Rob could not lease or sell his water rights – which in a sense protected his share of water from being used for purposes other than agriculture or residential use, either by him or his neighbors. In order for him to lease out his water right, the neighbors would all need to agree. However, with his neighbors’ differing views on O&G development and the contentious situation it has created within the HOA, the leasing of his water rights for O&G development seemed unlikely to occur.

The next sub-theme that emerged strongly was the examination of the regulatory context that the O&G industry operates within. Rob and Sara also expressed divergent views on regulation. Rob took a pragmatic, scientific approach to unconventional O&G development; he argued that was safe if it was done correctly. However, Sara was much more suspicious of the whole process. Rob thought that the state should handle regulation, looking to water rights as a example of how the state has successfully handled regulation. Rob stated:

I like state regulation. I do not like federal government regulation, and that comment right there is probably indicative of the mainstream of the farming community... and the water rights holders just do not like what they would consider excessive regulation... I think that the oil and gas commission... I’m not intimate with the details of how they operate like I am with water rights, but it seems to me they do a good job, and if you go on their- The Colorado Oil and Gas website, you can find out all sorts of good information.

This illustrated that Rob was not a fan of excessive regulations, but he did believe in smart regulation, especially of O&G development with the potential to cause a lot of negative impacts to individuals with less power than the industry, particularly small-scale farmers. He was also impressed by the information that the COGCC provided on their website, talking about the ease of being able to find where abandoned wells close to their property are. Rob expressed trust in the overall regulatory system within the state. Sara also liked smart regulation; she stated:

I appreciate the regulation. If I had my way we'd have... a society with much less government control as well, but I'd be on sort of the left side of it, more anarchic. In this current circumstance we're in, I appreciate the regulation because I feel like individual people without a stake in it, a money stake in it, need a voice, and I don't think the industry will regulate itself.

Ultimately, Rob and Sara agreed that some regulation of the O&G industry is necessary or they would "go wild". However, they did not necessarily agree with each other on the extent of regulation or who should enforce regulations.

Another area where their views diverged was on the subject of a moratorium on O&G development, which is of particular concern to them because nearby Fort Collins passed a contested moratorium on O&G development. Rob did not feel a moratorium on the industry was necessary because he felt there was already an abundance of information on the potential impacts, which he did not feel were alarming. Sara supported employing the precautionary principle, halting development until more research is completed on the impacts. She stated:

I love it [the moratorium], I wish it was county wide. I wish it was nation-wide. I wish it was a big pause for us to all say, 'hey, what are the long-term impacts?' The "resource" will still be there for us to do something with it in the future, let's study it at length first...I wish the pace were slower. I wish the scale was smaller and I appreciate the moratoria.

Contrary to Rob, Sara illustrated that she did not necessarily feel that there was enough information on the impacts of O&G development yet, which contributed to her feelings of powerlessness regarding the development on her family's property. The theme of political

economy was demonstrated through Rob and Sara’s views about economic impacts, their experience of owning their mineral rights, Ron’s expertise on water markets, and regulation.

Rob and Sara’s interview illustrated the complexities in the debate on O&G development, especially as they relate to the themes of identity, including motivations for farming and O&G development’s impacts to sustainable identity, the general impacts and changes to daily life, which includes potential environmental impacts and impacts to their daily life, and political economy, which includes economic impacts of O&G development, water markets, and regulation. Their views on O&G development were not as simple as “for” and “against,” but rather they represented nuanced views on an industrial production with the ability to impact their operation in both positive and negative ways. In my analysis, I will extrapolate on how these themes answer my stated research questions.

### ***Case 2: Blueberry Hill Farm***

My second case, Blueberry Hill Farm, was a pick your own fruit farm in Boulder County, located just a few miles outside of the city of Boulder. Although Boulder is located within the highly-productive and booming Denver-Julesburg Basin, there was little development occurring in or around Boulder at this time. Though O&G development is rare and unpopular in the area, Blueberry Hill Farm’s operator, Ken, had O&G development occurring little more than a mile from his farm. As I drove to his farm it was apparent there was also other development in or around Boulder, however the O&G development along the highway was sparse as compared to when I drove through nearby Weld County.

Ken’s farm uses an agri-tourism model, which gave him a unique perspective on the impacts of O&G development. Blueberry Hill Farm was new; it was only opened for a few seasons. I conducted the interview in the living room of his beautiful wooden farmhouse, which

looked similar to many of the farmhouses I visited during the interview process. Ken was a middle-aged man, who had a previous career in community organizing that lasted twenty years until he became disenfranchised and burnt out by the long hours and the difficulty of the work. His grandparents owned a farm in Virginia when Ken was younger, which gave him previous experience in farming. This farm was much different than his small pick your own fruit farm; it was a large six hundred acre conventional farm, which grew corn and hay and raised cattle and hogs. He eventually went to college, returning to the farm during a gap year to get it back on its feet after it had fallen into disarray. Although his parents were happy that he attended college and earned an advanced degree, Ken told me he was “dying to get into farming” because he believed farming would help him obtain what he called the “good life”. His face lit up as he discussed his farm and all of the success he has experienced with it, and he reported he attained the life he dreamed of during his earlier, more stressful career.

It was his upbringing and experiences on his grandparent’s farm in Virginia that sparked Ken’s interest in farming in Boulder, Colorado. His primary interest was in growing fruit, such as blueberries, which were rarely grown in Colorado because of the arid climate. He also grew apples, pears, plums, blackberries, strawberries, raspberries, blueberries, rhubarb, peaches, and a few hazelnuts. He liked to experiment with different products on his farm, such as grape varieties which he hoped to eventually make into wine. He described himself as “crazy” for putting in over 700 plants to start with, but his farm was doing better every year. The idea of a pick-your-own farm came from his childhood in New Jersey, where agri-tourism was extremely popular during the summer and fall. There are few of these in Colorado – so Ken found his niche and surprisingly little competition.

Ken's clientele fit with the demographics of Boulder; his customers were mostly young families, many of them international, who were looking for family-oriented activities to do along with their children, while many others are "foodies," as he described them. Ken described his clientele in Boulder: "There's a lot of foodies and a lot of environmentally well-meaning people... a lot of health nuts. They are very worried about all kinds of things here, so we do have that demographic." Although he did little advertising, he was successful because of grassroots internet promotion. Ken had moms' groups on Facebook who promoted his farm on their group pages with 1,500 members. Although it was not Ken's idea, this was a very effective strategy to spread the word about his farm. Once people came to his farm, they told their friends and his business quickly earned a large following.

I will now discuss the important themes present in Ken's interview including: *identity*, through which we discussed farming identity and how this was impacted by O&G development; *political economy*, which included the subthemes of economic impacts, regulation, and split estate; and *impacts and changes to daily life*, which included the subthemes of potential environmental impacts, economic impacts, and quality of life impacts.

### **Identity**

Ken's identity as a sustainable farmer was central; it impacted how he experienced changes to his farm and his political-economic experiences, while also being intimately interconnected to how he operated his farm and how he viewed O&G development. The first area this was seen was through his farming techniques. Although his farm was not certified organic, Ken worked tirelessly to operate his farm according his meaning of sustainability, which included using no pesticides, little herbicides, and drip irrigation. Ken stated:

It's not sustainable to ruin your soil, it's not sustainable to use too many herbicides or pesticides and I had bees, you lose fifty percent of your bees every year which is going to

happen. You have to be really careful with almost anything you use to keep your bees alive and it's tough not to lose them. I call myself sustainable except for that one drench that I put only on the blueberries and it was a root spray. I never used anything that wasn't Omni certified and but I really am open to using it [the term sustainable] although, it's a little bit of a marketing piece.

After Ken planted his blueberries, they caught a disease that he was unable to rectify with organic chemical, forcing him to use non-organic chemicals to save his blueberries. Although Ken opposed using chemicals on his farm, he was not an ideologue; if it was the most practical to use chemicals during a single instance to save his plants he did it, which was better than the alternative of losing his plants. He also used sustainable watering practices like drip irrigation and as a result most of the water he used for his fruit went back into Boulder Creek. He was suspicious of the organic label and was not overly eager to try to get his farm certified organic. He stated "I just think there is a lot of nonsense in the organic thing... There are a lot of good things, the basic, so sustainable is really what I like. [I like the] the idea of it because that is the basic thing." Although he agreed with the idea of organic, Ken viewed the way that certification forces farmers to adhere to certain practices was not consistently pragmatic. It was also economically rational for Ken to be concerned about chemicals, whether it was pesticides or chemicals used during the O&G production that may interact with agriculture. By raising his fruit sustainably, he could sell to an upper-middle class clientele in Boulder concerned about the negative environmental and health impacts from chemical pesticides and herbicides.

The meanings Ken attached to his identity as a sustainable farmer intertwined with his motivations for farming; these motivations were not financial. In fact, Ken quietly observed that starting his sustainable farm was perhaps not a wise financial decision. However, he wanted to show people that it was possible to make a living farming on a small-scale – and to have fun doing it. He wanted to teach children that farming is "cool" and a viable method of employment

(which was against common views about farming), while also demonstrating the importance of local food. Ken stated:

If we... begin to establish a whole generation of kids who think farming is cool...they think it's fun to do, they're interested in it, and they can make a living in it is my goal... we wanted to create this place where people come and have a really good time and it would be farming and food and it would be local and it would leave great memories about a farm but then maybe some of those kids would grow up and kind of remember... that was really cool of that guy, those folks just did something really cool, it looked like a lot of fun and he was making a living at it and why don't I do that.

This further illustrated how Ken was concerned about using his farm as an educational tool to teach kids about the importance of local food. Underlying this discussion was the idea that a transition to local food would help us transition out of our reliance on fossil fuels, rendering the question of whether to allow unconventional O&G development irrelevant. Although Ken did not have development directly on his farm, what others do around him impacts the climate in which he is trying to meet these goals.

Ken expressed multiple times that he felt that he could not continue farming on this property if O&G development moved nearby or onto his property because the conflict between his identity of sustainable farming and industrial O&G development could not coincide or intersect. There were also practical reasons for this as well. For example, his customers were unlikely to support him, given that his clientele was a demographic extremely concerned about environmental and health issues. This was demonstrated clearly through his customers asking him about the potential impacts from the nearby well. Given this reality, it is very likely that if there were more visible wells closer to his property, more customers would notice and choose not to go to his farm. Ken stated:

There have been two customers who have talked about coming, probably part of the anti-fracking thing and have said 'do you know close you are to this site over here, is that affecting it, I'm a little nervous about this.' I've said yeah I know and I don't know the details, I think I'm far enough away that we're safe but I don't really know that, if you're

uncomfortable go somewhere else... If there was more fracking close to me... I am thoroughly convinced that it would be bad for my ability to market. I think that my farm would be a far less attractive place. It's sort of like houses close to an oil refinery.

Ken's farm's location and his clientele caused him to be worried not only about possible concrete consequences, but unfounded perceptions as well. Even if O&G development did not bring any physical consequences, just the presence of O&G wells would impact his business. If this occurred, he described his concern about his ability to start another farm from scratch because of his age and future health. Ken stated:

What would the value of the property be, could I sell and start over again? I'm getting older... Could I put in another five years of building up a farm to get started? Probably not. So if it became unmarketable, I'm probably out of business. What I could do is to sell to somebody and maybe they would run it or they would do some kind of conventional thing, I don't know.

Ken also illustrated that part of the attractiveness is the location of his farm, which was just a few miles outside of the city limits of Boulder. The location was irreplaceable, particularly because of his business model of pick your own. Unlike if he ran a CSA or another type of small scale operation, his farm might be unsuccessful in another location further in the country where his customers would face a longer drive to get to his farm. He stated:

I have a great location, I'm like four or five miles from Boulder... there aren't that many pick-your-owns in Colorado... If I get a nice place away from fracking out in Addams County somewhere or Weld County and it was a beautiful spot, nobody would come.

Ken's concerns about the environmental impacts of unconventional O&G development and his farming philosophy of connection to nature and farming in a simple, sustainable way were incompatible with this type of unconventional O&G development. He felt concern about chemicals in his food, so he was also anxious about chemicals from O&G development. Ken also expressed unease that his customers may become less supportive of him if development occurred on or around his farm because of the potential for impacts, even if no impacts were present. Although development was occurring 1.5 miles from his land, Ken's main concern was the

possibility of development moving closer to his land, increasing the likelihood that his farm experienced negative impacts. The meanings that Ken attached to his identity as a sustainable farmer, including his motivations for farming sustainability, farming philosophy, and how his customers interpret the meaning of his identity as a sustainable farm are all central to understanding how he experienced impacts and changes to daily life and the political economy related to O&G development.

### **General Impacts and Changes to Daily Life**

Although Ken did not have development directly on his farm, he was concerned about potential environmental and health impacts that were currently unknown, as well as having perceived impacts from an active well located less than two miles from his farm. Ken was well-read on what the literature demonstrated about the potential health and environmental impacts of O&G development, noting Colborn's study in his interview. Most of his concerns stemmed from the lack of information surrounding O&G development, particularly concerning to farmers because the chemicals used during the unconventional O&G process are undisclosed, which added to the uncertainty about the safety of the process. This lack of information directly relates to the impacts to Ken's farm. Although Ken didn't notice any air impacts, Ken was concerned that negative health impacts would show up many years later. He stated:

It's really limited, we don't really know but the little we do know is not positive... it's [the chemicals are] parts per billion and... I wouldn't know if I'm breathing it and nobody's measuring, so I don't like it because I don't know. I don't know if it's going to affect my daughter, is she going to get cancer in 20 years because of this and she'll never know why. I have no idea and because I don't know it pisses me off.

This quotation illustrates that the main impact to Ken and his farm was the inability to definitively know if there were more concrete health impacts down the road, especially health impacts related to air pollution, an environmental health concern which is only now being

studied longitudinally. This also has the ability to impact Ken's life through the stress of unknown health impacts related to this production in the future.

Ken's other main environmental concern was his water well because, as he put it, if his well was contaminated he was "out of business." He did not think his well or his ditch water were currently impacted by nearby development. However, because Ken's farm was located outside of city limits, if he was impacted he was unable to connect to city water, a common option for other communities that suffered contamination from O&G development. Ken stated:

If I lose my well, I really do have a problem... we could drill for another well, but it's very expensive and I'm not sure we'd hit anything. It would make our house useless. So my well really matters because I don't have access to city water. It's not an option... So, without my well, we're gone. So it matters to me what happens with the water geology a lot and I really don't trust the industry. They don't give a shit about me. They really don't... I'm a bug as far as they're concerned... it's not their job to care.

This quotation illustrates his concern about his well water because losing his well would put him out of business, not just disabling him from sustainably farming, but from farming at all. He also related this back to property values, because if he lost his well his property would be effectively useless and difficult, perhaps even impossible, to sell.

A suite of other concerns about impacts to his farm, his agri-tourism business, and his quality of life peppered my interview with Ken. He expressed concern about impacts to soil quality because if his soil was impacted, this may impact his marketability as a sustainable farm. He also noted small changes to his daily life that occurred as a result of nearby development, citing increased truck traffic and the changes to the visual landscape from increasing numbers of O&G wells. Ultimately, Ken felt that if he did suffer negative impacts from the O&G industry, they would not be concerned or worried about him- compounding the anxiety he feels about O&G development currently occurring and development that may occur in the future. These negative environmental and health impacts, as well as negative impacts to his daily life,

## **Political Economy**

Ken expressed awareness of the political and economic systems that he operated within, illustrating several examples of this through the theme of political economy. For example, Ken had an interesting perspective on the O&G industry; he talked about the importance of saving fossil fuels for other uses and asserted that they were more useful for pharmaceuticals and plastics than they were for energy. He worried that society and the O&G companies were extremely shortsighted in the ways they used fossil fuels. He stated:

We value diamonds really highly and they're very valuable. As far as I'm concerned, oil is way more valuable than diamonds. Now it may not be dollar to dollar valuable at this point and we subsidize the oil industry, which is insane, but I see it as a precious resource that we ought to preserve so let's not rush to get it all out of the ground right now... it's not good long term, we need some.

This quotation illustrates that Ken knew how necessary extracting fossil fuels were, but he felt that using them as energy was wasteful when they had other positive uses. He also believed that the O&G industry was sabotaging itself by ignoring a chance to expand their industry to other types of transportation and renewable energy like solar. Instead, they are forced to take a short sighted view because of the structure of the stock market and shareholders, where short term profits of corporations are the most important thing. Because of this, corporations cannot worry about things like long-term gains or environmental impacts of their products. Ken also discussed his own fossil fuel consumption, explicitly noting that he was not anti-oil industry, although he goes through great lengths to limit his fossil fuel consumption. Although he realized that he operates within a system, as an individual he took some responsibility for that system as well.

Ken also voiced his concerns about split estate. Ken was in a unique situation related to hosting O&G development on his property. Ken's property was extremely narrow and because of the setback rules, this meant that they were unable to drill on his property and thus he was never approached about developing his property. For some individuals this might have been a

downside, but Ken saw this as a positive, especially because he did not own his mineral rights. After Ken purchased his property, he researched who owned the mineral rights to his property in order to buy them back, which illustrated how O&G development was a concern of his. However, the company was unwilling to sell the mineral rights to him; they stated they “don’t do that”. Fortunately for Ken, unless the setback rules change in the future, he does not have to worry about O&G development on his property against his desires. Unless any of his neighbors decide to develop their land in the future, he was probably safe from development. However, the issue of split estate was still present on Ken’s mind.

Closely related to the issue of split estate is regulation. Although Ken was in support of the regulation of the O&G industry, his personal history with regulation was complicated. He discussed the difficulty in building the barn on his property because of all of the regulation that Boulder County has in place. According to Ken, senseless regulation nearly doubled the price of building his barn, which diminished the extra funds he saved until his farm became profitable. This is a truly negative impact of some regulation that may put an individual like Ken out of business. Ken discussed meetings where farmers in Boulder County spoke about it being cheaper to buy land in Weld County to build greenhouses than it was to actually build greenhouses on their own property. Ken stated:

This guy just spoke up [and said] I’m a flower farmer, you all know me, I’ve been around, he had been flower farming for thirty years and I needed to put in a greenhouse which I have use by right to do, I have plenty of land to do it. I needed to put a greenhouse in for my flower starts, but the regulations were so extreme that it was cheaper for me to commute to and buy a small piece of property in Weld County just for my green house... because I could build that greenhouse so much cheaper... I could build it at a quarter of the price that it was going to cost me to build it on my own land here.

It is this difficult relationship with regulation that may cause farmers to be more supportive of the O&G industry and less in favor of state-led industry regulation that would help development occur more safely alongside their farms, lessening the above stated impacts. Without a strong

state regulatory system overseeing the industry, there is greater likelihood that negative environmental impacts, such as water and soil contamination, would occur.

Rather than taking the view of promoting excessive regulation, Ken thought we needed smart regulation centered on scientific risk analysis done through public money or public/private partnerships. Ken asserted his firm belief in decisions made based on research, rather than political or economic popularity of an issue or stance. Ken stated:

A lot of what they do is look around at other cities... what are some other places doing, they did this let's do that... they're not talking to anyone who is impacted by it and they don't even Google to see does this even make sense... That is what is happening on regulation, and it makes me worry even more about the fracking because if that's the way they regulate they're not even going to look at the science. They will just look at what did our neighbors do or what's going to upset people the most. Ok, let's do it that way... is there any science to back that up? No, but who cares... that's why people hate regulation.

He expressed particular fear that counties like Weld County, where a majority of citizens and leaders are seemingly supportive of the industry, were not adequately examining the newly released science about the possible negative impacts of unconventional O&G development. Ken thought regulation was best at the state and local level, with a baseline of federal regulation which all states would need to meet, but with the possibility for localities to have stricter standards. He stated:

I mean if there's a danger... we need the regulations and they probably need to come from the highest level of government for the minimum standards. Then from then on, you could allow local control, have both...at least do this [have regulations], this is what we expect everybody to do, and we have that on certain things. We have asbestos, there are certain minimal standards around asbestos but beyond that if a community wants to regulate it more rigorously, they can.

This quotation demonstrates that Ken was not against federal regulations, but that lower levels of government should also have the right to further regulate as they see fit for their communities.

He cited Weld County as an example where individuals and politicians may be adverse to

regulation, making the minimum federal and state standards even more necessary there than in other places.

Ken also demonstrated his strong views about having transparent information available on the impacts through his support of a moratorium – as long as it was a moratorium that was based on “when we are going to know something.” In other words, he wanted a moratorium period extending for a few more years, until more research was done. In this way, Ken employed a precautionary approach to O&G development. He was concerned that in some cases moratoria were reactionary and excuses for a ban, which he spoke about in the context of New York, where hydraulic fracturing was recently banned. We discussed another pertinent case where he felt this was important - vaccinations. This helped illustrate how Ken viewed the issue of O&G development. Ken spoke about Boulder having one of the lowest vaccination rates in the country because parents were concerned about the chemicals in vaccines, without examining the science. He compared some of those who are concerned about unconventional O&G development the same way; they were concerned because of all of the attention paid to the issue, without examining all of the facts; he argued this leads to dangerous polarization. He stated:

If an oil person said I don't think fracking is dangerous, I'd say well why do you think that? Do you know the Colorado public health study, what's wrong with that study, tell me why? Do you have any science background or is this just reactive on your part because you are part of the industry? Those are the questions I would want to know, I wouldn't necessarily agree with them but I wouldn't necessarily disagree with them. So I do think what happens is we get polarized and we don't think... it's the polarization that's actually getting in the way of solutions now and I think it's intentional... I think there are people who have figured out that if we can polarize people enough that we'll be able to do anything we want... I do think that the activists that are just reactionary and not smart are doing a great disservice to the anti-fracking movement.

Because Ken lived in Boulder County, he saw how both sides of the debate around O&G development were problematic, even if he identified more with those concerned about development. Ken experienced the political economy of O&G development through his lens of a

sustainable farmer without mineral rights; he questioned whether the short term economic goals of O&G companies were compatible with their existence as responsible corporate citizens, the justness of split estate, while also supporting smart regulation that was not overly cumbersome.

Ken's interview was rich with discussion that echoed concerns about O&G development, particularly potential environmental, health, and quality of life concerns. The impacts that Ken was concerned about were impossible to separate from his identity as a sustainable farmer and surface rights owner. Ken's identity was not only an important aspect of his farming for philosophical reasons, but there were also economic reasons why this identity was viable for him in Boulder County. It was clear that the introduction of O&G development onto or around his farm would bother him on a philosophical level because of his commitment to sustainability and his inability to control what happens on his land because of split estate, but it would also impact him negatively through loss of customers because of their concerns about O&G development.

### ***Case 3: Tanglewood Farm***

Tanglewood Farm is a sustainable farm in Weld County, the epicenter of agricultural and oil production in Colorado. This was one of the only sustainable farms in Weld County that agreed to an interview, and the themes that emerged through this farm visit were unique.

Although Pam, the primary farmer, did not have development on her land currently, she was surrounded by O&G development occurring on her neighbor's farms. I visited this particular farm in November, after harvest season was coming to a close and the farmers markets and CSAs were closed for the season. Pam was the first woman farmer interviewed for this project (but not the last). She spoke to us in great detail about her family; particularly her special needs son and how that experience impacted her views about farming, industrial development, and life in general. I conducted the interview inside her modest home, while her two small dogs kept us

company in the living room. The atmosphere for the interview with Pam was very casual; she even told me “I can’t stand formality,” which seemed to be common among farmers, but particularly characterized Pam.

Pam’s farm was one of the oldest sustainable farms I conducted an interview with; it was in operation since 1995 and doing business at farmer’s markets since 1996. Pam was from Los Angeles, but moved to Colorado in 1982. She had a lot of experience prior to opening the farm of growing her own food in California. Pam primarily grew fresh, sustainable produce, raised animals without steroids, hormones, and antibiotics, and produced fresh eggs. The farm was a full time occupation for Pam and her husband from its opening, until a hail storm wiped them out in 2003, when her husband “retired” from farming and obtained off-farm employment. Interestingly, her husband worked in the O&G industry as a pipe fitter and water hauler, which added additional complexity to her perspective regarding O&G development. Although Pam did not have development on her property, O&G development was present all around her farm. She spoke of the potential for development on her land in the future in a positive manner.

Pam’s customers and Pam knew each other well; it was clear through the interview that Pam thought of them as friends. Many of her customers purchased from her since she began farming in Weld County, recommending her to friends that were also looking for a CSA to join. Many of them also bought her vegetables right off of her farm through her farm’s twenty-five person CSA. Although this is a smaller CSA, she spoke of the potential for expansion in the future. However, constant weather catastrophes such as hail, which is common in Colorado, prevented them from expanding. To help with weather, they installed hoop houses, which were popular fixes to prevent crop loss by farmers. Most of Pam’s customers either worked at the

University of Northern Colorado or the nearby hospital. When their shares were ready, she either delivered their CSAs or they picked it up at the farm or the farmer's market.

I will now discuss the important themes present in Pam's interview including *identity*, which was illustrated through her motivations for farming and the normalization of a sustainable farming identity, while also supporting the O&G industry. The second theme, *impacts and changes to daily life* was also present through Pam's discussion of the small changes to daily life that industry contributed to, while she also discussed the potential for environmental and health impacts that were currently unknown to her. Lastly, the theme *Political Economy* was the most present throughout my interview; Pam discussed the positive economic impacts of the O&G industry as her main reason for being so supportive of development, as well as discussing the water market, split estate and regulation.

## **Identity**

Pam's identity and the meanings she attached to operating as a sustainable farmer came forth in her interview in several unique ways, as our research team learned about her life experiences and her perspective on the location of her farm, which was surrounded by O&G development. An important part of her identity as a sustainable farmer was Pam's motivations for farming, which were educational and community-oriented. Pam was focused on her farm and business having a community-centered component – particularly important to her because of her role as a mother to a developmentally disabled son. In the past, groups from special needs centers visited her farm, culminating in a fruitful experience for Pam and her visitors. She discussed creating a learning lab where children and disabled individuals can visit the farm and learn about farm life through various activities. It became clear that the experiences her own children and other disabled children and adults could have on her farm were at the center of Pam's

motivations to become a farmer – and continued even through hail storms and other complications. She had plans to put in a pick-your-own strawberry farm, which would also help attract the community to her farm because there are few pick-your-own farms in Colorado and they are particularly rare in Weld County.

Pam's commitment to sustainability on her farm was evident through her farming practices, but also through the ways she discussed her farm. Pam's meaning of sustainability was particularly seen through Pam's aversion to the organic label. Pam was not organically certified, nor did she consider herself organic or want to use that label. She stated:

We are not certified organic because we can't use that word, it's owned now... you have to have [a] license, and the main philosophy or the main reason we do not certify is because the air and the water are not certified organic. We consider ourselves beyond organic, primarily because now organic standards are so lax, that you can call yourself organic if you use organic sprays, which are utilized by all of your big farms, and what they're doing right now, is they're just like chemical farmers, although they use something that the government says is okay to use.

She explained how Tyson chicken helped water down the organic regulations to include many practices that sustainable farmers consider counter-productive to organic practices, such as feeding chickens non-organic feed if the farmer cannot find organic feed or processed “organic” foods, which are only a percentage organic. Pam realized that although she tried to employ practices that were “beyond organic,” there was no guarantee that chemicals did not invade her farm and its products because she was surrounded by chemical intensive conventional farms.

Importantly, Pam related her general views on sustainability and organic labeling to O&G development more specifically. Her meaning of sustainability relied on the practices and processes she employed, regardless of those around her or outcomes. She was unable to keep her crops chemical free due to the conventional agriculture around her, which contributed to her acceptance of O&G development occurring in close proximity to her farm. She consistently

asked: What was the “big deal” about O&G development when her farm is also surrounded by chemical-intensive conventional farms that use pesticides and herbicides? She stated:

I live in farm country. Everybody around me is chemical farmer... the air, I mean, it gets windy- there's no guarantee that I'm not getting anything on my farm that is not organic. I farm based on nature, whatever is natural, I myself do not spray unless I use an insecticidal soap if I find a problem, but rarely have to because I have so much of the other beneficials on my land... if we get a big infestation, pull it out and start over.

Pam's insightful observations illustrated the general pattern for sustainable farmers in Weld County: there was no guarantee that contaminants from conventional farms had not impacted her farm. This was less of an issue in places like Windsor, Fort Collins, or Boulder, where there are fewer conventional farms and a critical mass of small-scale sustainable farmers.

Pam's identity as a sustainable farmer and her views on O&G development were also impacted by her views of fossil fuels and her personal consumption of them. Although she was critical of individuals who “choose” to use fossil fuels but were against O&G development, as an individual and a business owner, Pam did everything possible to be sustainable. For example, she liked renewable energy, particularly solar, but she viewed this through an individualistic lens.

Pam did not see structural reasons why individuals could not use renewable resources, but believed these were individualized consumer choices made by individuals. Pam stated:

People have made the decision. They know what's important to them, or what their priority is... yes, solar is a good possibility, we utilize a lot of solar around our place... It's not a matter of anything except for the fact that people take a priority, and they say, 'well, I don't have to run my air conditioner, yeah it's going to be a little hot, but I should turn my air conditioner [off] because it's wasting a lot of what we don't have, or it's not renewable energy that I'm using, however, I would prefer not to be hot, so therefore, I will use my air conditioner,'... people make a decision, and that becomes their priority.

Again, she related this back to food – people can either choose to buy local, organic food or they can choose to buy from conventional producers; these choices had real consequences for the

system. If individuals decided they want a change, they had the ability through consumer choices to change it, and this included unconventional O&G development.

Even with Pam's expressed commitment to sustainability, she did not view her aversion to chemicals within the food system as contradicting her relative support for unconventional O&G development on or around her land. Instead, she saw her views as completely rational given her location in the middle of conventional farming operations. Pam explicitly stated she did not feel she could control the chemicals used within the O&G development and conventional agricultural operations surrounding her. She learned to accept the things outside of her control, while she did change the things she could control. She stated "From what I see and what I believe... I've learned to sometimes accept things that are- that happen, and then you figure out a way to go around it." This quote illustrated how Pam defined O&G development not as the problem; the problem was individuals' inability to work around the situation that existed. As a result, she did not feel the meaning of her identity was impacted at all because of the normalization of development and other chemical processes related to conventional agriculture.

Unlike other farmers I interviewed, Pam's customers were not concerned about O&G development interacting with agriculture. Pam did not notice customers dropping out of her CSA because of the nearby development, so as of yet her proximity to unconventional O&G facilities did not impact her business. She related this to the trust that she had with her customer base, facilitated by her identity as a local, small-scale agriculturalist. Because she had a personal relationship with her customers, she was able to quell certain fears her customers had. Her customers knew her and thus trusted her in a way that might not occur if you removed the personal connection to the food and the farmer. Pam stated:

I will be as honest as I can be... I've been doing this since 1996... I have people that started with me; I've got people that [have] automatically ordered... I tell them...

because I do not have control of the water and the air... there is never a guarantee, but you can guarantee that I didn't put it, I didn't use it, because I don't, and if you want, you can come out, check it out, and see how I do it. My goal is to teach, because like I said... I want to educate, teach. I want them to know both sides because the only way you can make a decision that makes sense to you, is to know both sides.

She speculated about what would happen if impacts from O&G development increased in the future, making it difficult for her to continue her operation on her land and thereby ensuring that she could no longer farm in a sustainable way. Pam declared that she would make the choice to move in that situation, presenting an individualized solution to a systemic problem. Unlike most small scale farmers, Pam was lucky that she had the financial ability to move. She stated:

If we had to make that choice [moving], we would ... a lot of people can't afford to make that choice, but they probably did not go to the meeting to voice their opinion. It's like voting. We always say- if you didn't vote, keep your mouth shut, because you had a choice. You chose not to bring up the conversation, so don't whine about it... I guess that's the way I feel, we as individuals, we all have a choice, and we make our choices, and if we- if they didn't like it, they should've said something before it happened.

This quote illustrated how Pam viewed all aspects of O&G development- she did not think that industrial fossil fuel development would impact her identity because she always had the individual-level choice to either adapt her identity or move to a different plot of land without development on it or surrounding it. It is also important to note that Pam's husband worked for the O&G industry, which perhaps made it difficult for her to have negative opinions of an industry that likely helped her continue her sustainable farm. Pam's identity as a sustainable farmer, including her motivations for farming, farming practices, and views about development help explain how she viewed the general impacts and changes to daily life that she experienced and how the political economy around O&G development impacted her and her farm.

### **General Impacts and Changes to Daily Life**

It was clear as I was driving to Pam's farm that O&G development was happening all around her, some directly near her farm. She described a rig up the street from her that had

difficulty extracting oil. Pam herself already signed an agreement with the industry for an O&G company to run testing on her land, but there was no development on her land yet. She did own her mineral rights, also giving her a particular perspective since she had control over whether she allowed development or not. She assumed that they would reach her land through drilling in the Thornton oil field, but because nothing was signed, she was unsure. She stated:

We allowed them to come and check- nobody's contacted us yet, if you'll notice... right behind us... That is all part of the oil industry. What they do there, so far, they build the big metal pools that they're currently starting to use rather than the water trucks that bringing in water constant, they fill up these big pools and they use that for the fracking.

Although Pam was open to the possibility of O&G development on her land, she had no development thus far. If and when development does occur on Pam's land, coinciding with her sustainable agriculture operation, she did not feel there would be negative impacts associated with it.

Although Pam described some impacts and changes to her daily life that others may view as negative, such as the bright lights and noise in the evenings and increased truck traffic, they did not bother her. Because of all the development occurring around her, Pam normalized all of these changes to her daily life, even though there is no development directly on her property. She described these impacts as a normal and necessary part of life, stating:

It's been going on for years and years- it's expanded for a lot of reasons... we are needing to equip ourselves with more energy and this has become a logical and feasible way of producing more energy, you can't say, yes it's benefiting or no it's not benefiting, it obviously is or they would have stopped if there was not [a] benefit, if there was no interest in it, the chances are it probably would have discontinued.

She saw these minor impacts as the price of the United States having energy independence. She stressed the positive economic impacts of the O&G industry, arguing that if the negative impacts from development were as serious and substantial as some allege, development would had stopped a long time ago. She stressed that this intersection between agriculture and energy

development has occurred for years without an issue- so she was unable to understand the current controversy regarding O&G development.

Although Pam did not view the small changes to her daily life as problematic, she conceded that people – and the industry – were unaware of all the impacts occurring underground, where the majority of O&G development takes place. Pam stated:

We don't know what the impacts are; they're just now trying to do a lot of the research on it. I have customers that either work in the field too and I have one that his job is to go out and check for the environment and the safety of the environment, and he's never found any, you know, round his- where he's checking the air and the air quality and stuff, and there hasn't been any much reaction on that, so he's comfortable buying from us.

This quote illustrates that Pam thought the public was unaware of what impacts might exist from unconventional O&G development. It also illustrated that Pam felt comfortable with development because not just was it occurring around her, but many of her customers and neighbors were intimately involved with the O&G industry. This intimate relationship between agriculturalists and the oil industry in Weld County meant that industry operating alongside her farm wasn't impacting her customer base or her customer's trust in her yet. She trusted her customers who were employed in the industry and told her the process was safe, just as they trusted her to grow her produce in a sustainable way that matched up with their expectations. Pam described this mutual trust as a benefit of buying from and participating in a local, small-scale agricultural system. Pam did not view the environmental and health impacts and the changes to daily life she experienced as negative; she viewed these changes as a symptom of the positive economic impacts that the industry made in Weld County.

### **Political Economy**

Pam's political-economic considerations of O&G development permeated my interview with her. Most of her arguments in favor of O&G development centered around perceived

economic benefits of regional unconventional O&G production. She discussed this on a systemic level, as well as a more personal level. She discussed the difficulties of being a small-scale, local sustainable farmer because her product is more expensive, thus making it more difficult to sell. She paralleled the difficulties farmers face as the U.S. food system becomes globalized with the globalized structure of fossil fuel systems of extraction, production, and trade. Pam stated:

My thinking is not... people should be eating organic, but people should be eating local, and we need to support the people because when all of the farms are either bought up or sold, and there are no farms because they can't afford to grow it because people don't buy from them, and... we're buying from foreign countries, so once everything becomes imported from other countries, do we really think the price is going to stay the same? Look at even now, places like Wal-mart, the prices have gone up extremely high. Now if we ban fracking, totally said we're not allowed to frack, and we eliminated that industry, do we still think our fuel to maintain the US will be the same price?

This quotation demonstrates how Pam's views about the positive economic impacts of O&G development are largely due to her perception that domestic production will lower the price of fossil fuels. She viewed domestic fossil fuel extraction with as much importance as local food production, an important connection within this theme.

Pam also argued that because every American uses fossil fuels, we were all complicit in the system and must accept its negative impacts. She did not view fossil fuel extraction as something that went into a global market- she viewed it as a resource to be extracted, consumed, and used by Americans (and more specifically Coloradans). She stated:

You utilize this [oil] everyday... what is better than banning?... If you're concerned about the product, don't use it... And they know that that's not easy, or they think that's not easy to do. I say well yeah, just stop driving and then it's get an electric car... well we have all the wind generated, but have you ever looked at them, because 99% of the time, they aren't running, and a coal plant not too far from there is popping out more energy than- and where do you think we get that? Gas, right there from those fracking, and then, they're like, 'oh, but it's all going back... it's being sent overseas.' No. It's not. Then their thought is, but well, but we can't stop using it, and then okay, you're right, you probably can't stop using it.

She argued because we all made a conscious choice to participate in the fossil fuel system, we cannot complain about how that energy source is extracted. In Pam's view, it is unfair for individuals who put fuel into their vehicles to complain about unconventional O&G development. Pam reasons that because Americans contribute to the fossil fuel system, we must accept domestic energy development such as unconventional O&G development, even if there are negative impacts as a result of this industrial production.

Connecting energy development to water, Pam discussed how O&G development impacts the water market; she worried about its potential to impact water markets negatively. Because the last few years in northern Colorado were 'wet years', there were few instances of competition over scarce resources in the water market. However, this could readily change in 'dry years.' Pam's water right is one acre-foot, which in recent years was plenty of water for her small farm and led her to refrain from leasing water. Drip irrigation also helped her conserve water, moving her closer to her goal of sustainability. However, she recognized that the rapid expansion of O&G development has the ability to impact her farm in the future through the water market. She stated:

They're [farmers] leasing it to everybody... One of the main ingredients to use in fracking is water... and of course, once it's used... it can't just go back in the system... They have to use water... I guess that could be an impact, using the water, because the more water they use and they can afford to rent, the higher cost it could be for us.

Because Pam was not particularly close to her neighbors in Weld County, she could not say whether they were having negative experiences in the water market because of O&G development. However, she noted that farmers she knew in other areas were not having trouble getting water. Although this was good news for Pam and her farm, in a dry year where farmers were hurting for water, she acknowledged the results would be vastly different.

Pam's concerns over regulation also emerged as a prominent sub-theme related to O&G production's political economy. Although she was not a fan of overbearing regulation, she did not feel that the state was appropriately responsive to citizen's complaints about O&G development. She felt sympathetic to communities that fight to regulate O&G production's practices within their borders, but did not think that communities who banned development within their borders should receive any of the tax benefits from having industry in Colorado.

Pam stated:

They should not receive any benefits from it if they are not producing any benefits... because if people get together and... they vote that they don't want it, that's fine, because the people have made a decision, unfortunately we can't say everybody made a decision because you're not going to get 100%, it's based on what the majority said, but in that case, they should not receive any benefits from the towns and the counties that are drilling and providing that revenue because they're not producing any revenue to be spread around.

This quote illustrated that Pam was not against local regulation of O&G development, but that those communities who choose to zone out O&G development should not receive related benefits. She specifically discussed Longmont, where she felt it was unfair that the state targeted their moratorium because communities had a right to control development without state interference. Pam's views about the political economy surrounding O&G development, including its economic benefits, split estate, its impact on the water market, and its regulatory context were directly influenced by her farm being surrounded by development with little apparent negative impact.

Pam's interview illustrated how a sustainable farm could accept and even embrace O&G development fully in the midst of the controversy surrounding the safety of the practice. Although Pam had no development on her farm, she was open to it because it was already occurring on all of the farms around her without her receiving economic benefits. Although she

was located in a nexus of conventional agriculture and O&G development, she noticed little environmental impacts to her farm and only minor changes to her daily life. She felt that if O&G development created an environment which made it impossible for her to farm sustainably, she had the ability to move to a different location. Her point of view was unique within my interviews; it offered a perspective of how sustainable farmers can normalize and embrace O&G development out of their control.

### ***Discussion: Research Questions Revisited***

Below, I examine how these three cases addressed each of my research questions. While other farms were included in this study, I focused on these three case studies for their utility in representing diversity across small-scale sustainable farms affected by unconventional O&G development in northern Colorado. After I discuss how my case study farms answer my research questions, I will briefly discuss how my other seven cases address these questions as well to offer more depth to my examination.

My first research question asked: *“In what ways does unconventional O&G production interact with small-scale organic and sustainable agriculturalists in northern Colorado, particularly as compared to effects felt by conventional farmers?”* Most of the sustainable or organic farmers interviewed were concerned about the potential for impacts to occur as development continues and perhaps unfolds at a faster pace (though the impending oil bust makes this less likely). Although there were no noted differences between actual experiences with development of conventional and sustainable farmers, sustainable farmers were more concerned about potential environmental impacts in the future. The most significant differences existed between the farmers with mineral rights and those without; farmers with mineral rights were less concerned about impacts from O&G development on their land, while those without

mineral rights had significant concerns about negative impacts. Particular impacts of concern were increased truck traffic, noise, damaged roads, soil contamination, community upheaval, and at times their daily business and farming capabilities.

My findings indicate that mineral rights ownership gave farmers, whether they operated conventional or organic/sustainable farms, a stronger sense of power and control over their land, perhaps encouraging their support for the industry. In contrast, farmers without mineral experienced feeling a lack of control over what occurred on their land. While Rob from Sunnydale farm and Pam from Tanglewood Farm owned their mineral rights, Ken from Blueberry Hill farm did not. Mineral rights ownership not only lent a sense of control and a comfort with the industry's presence for farmers, but also a trust in the industry, regardless of the type of farming operation.

Sunnydale Farm and Tanglewood Farm, both of which had operators in favor of development, were less concerned about impacts from unconventional O&G development than Blueberry Hill Farm, whose operator Ken voiced several distinct concerns about impacts from development. Rob from Sunnydale Farm was concerned about some surface disturbance, explaining why he signed a mineral rights lease, but not a surface rights lease. This meant the O&G company accessed his minerals from another neighbor's property, which erased the possibility for negative surface disturbance from the installation of a well-pad. This illustrated Rob's sense of control over the development that occurred on his private property because of his mineral rights ownership. He not only dictated whether development occurred on his land, but he dictated what the terms of that development were. This also lessened the chance that his land suffered certain impacts such as soil contamination as a result of spills or accidents. Pam from Tanglewood Farm was concerned about damage from the process that was only visible

underground, but overall did not think there were negative impacts happening as a result of development on her neighbors' farms. In Pam's case, a combination of mineral rights ownership and living within a county already saturated by development led her to support and trust the industry without fearing negative impacts of development. In contrast, Sara from Sunnydale Farm was deeply concerned about environmental impacts, such as soil, air, and water contamination. Because Sara had no ownership over her father's farm, she felt little control over how O&G development would occur on her father's farm or what impacts would result from it. Lastly, Ken also felt little control over his land because of lack of mineral rights, increasing his fear over concerns about soil and water contamination, which could impact his ability to farm and health impacts from air pollution.

My findings among sustainable farmers paralleled my findings among conventional farmers when they both enjoyed mineral rights ownership. Those who had mineral rights were less concerned about impacts than those without because they received no benefits while development occurred on their land. Without the ability to receive positive economic impacts, the potential for negative impacts was more difficult for farmers to accept. If negative impacts occurred, farmers without mineral rights lacked recourse against the O&G industry and had no safety net if their land was destroyed, disabling them from farming. Although conventional farmers were familiar with chemical intensive processes on their farms, small-scale sustainable farmers could not risk contamination of the land because of the difficulties of farming without pesticides or herbicides. There were added difficulties for farmers whose customers came to their farms, either through CSAs or agri-tourism, because of customer concerns about O&G development. The inability for farmers without mineral rights to benefit from development

economically illustrated the disempowerment of farmers without mineral rights, who remained more concerned about its potential impacts.

All three case studies illustrated the prevalence of changes to daily life, such as increased truck traffic, noise, and damaged roads, but farmers without mineral rights were more concerned about these impacts. Although farmers shared many of the same concerns, their level of concern was directly related to whether they owned their mineral rights, which gave them complete control over their private property and what impacts they were willing to accept or not. This illustrated how private property ownership gave farmers a perceived sense of control over their interactions with the industry, which farmers without mineral rights did not have.

There were also differences in the levels of trust that sustainable farmers in my three case studies had with the O&G industry, which was demonstrated through farmers discussing how the industry would react if development caused negative impacts to their land. Farmers with mineral rights and thus the ability to accrue wealth from development trusted that the O&G companies would remediate their land if it was harmed. For example, Rob from Sunnydale Farm believed that the O&G company would remedy negative impacts to his farm if they occurred. Rob stated:

They're going to put in a pipeline... it's going to be re-graded and seeded and they're going to pay for that privilege... I don't want to see any of our ground impacted in a permanent way, but I've reseeded that area three times and it's not easy to get grass grow without irrigation, but the terms of that agreement will cover that... if the seed doesn't take, they're going to do it again, right? Whether it's two years from now, or a year from now, or three years from now... you're not even going to know it's there.

Rob trusted the O&G company because his mineral rights ownership allowed him to dictate the terms of the agreement between him and the O&G company. He was legally protected through this agreement if damage occurred. Pam from Tanglewood Farm also trusted O&G companies' abilities to operate as safely and effectively as the industrialized agricultural operations surrounding her organic farm. This trust occurred in response to Pam's farm not only being

surrounded by development, but her everyday interactions with individuals in the industry that assured her it was safe. However, if the O&G industry violated this trust, she believed it was her responsibility to relocate her farming operations.

Farmers without mineral rights did not trust the O&G companies because lacked legal protection against negative impacts, which illuminated the differences in control between mineral rights owners and farmers who only owned the surface rights on their property. Ken from Blueberry Hill Farm, who did not have mineral rights, believed if he suffered negative impacts related to O&G development the responsible O&G company would not remediate his farm or be concerned about the impacts. This led to apprehension about the inability to sell his property or start over at a different location if negative impacts occurred. His feelings demonstrated the lack of trust that farmers without mineral rights have with the industry because they are left legally unprotected if negative impacts occur, which could leave Ken unable to farm sustainably at all. In Ken's view, the O&G industry has not operated as a good neighbor to farmers or individuals-negating any trust he would have that they would mitigate impacts occurring as a result from development without the legal necessity to do so.

The potential for economic security and prosperity provided significant motivation for the farmers in my three case studies, illustrating that small-scale sustainable farmers were motivated by monetary gain just as conventional farmers are. However, how motivational economic benefits were was dependent upon their status as a mineral rights owner. The positive economic impacts from O&G development were a motivation for Rob and Pam; their status as mineral rights owners allowed them to benefit financially from O&G development in a way that others in Northern Colorado are unable to. Ken, who did not own his mineral rights, would receive no financial benefits from his land if development occurred. This gave him little

incentive to accept some negative impacts to his land and everyday life without financial gains. This illustrated how farmers without mineral rights do not just have absence of control regarding development on their farms, but also illustrated that this lack of control causes them to perceive impacts as more serious. In this relationship, mineral rights were more important than surface rights, regardless of which owner would suffer losses from impacts. Within split estate there are different levels of power present within the different types of ownership that are inherent to this property rights system; these differing levels of power take control away from farmers that do not own mineral rights.

My other cases had similar concerns about O&G development, which included water contamination, soil contamination, and air contamination from unconventional O&G development were present. However, level of concern regarding these impacts was directly related to whether farmers owned their mineral rights. For example, a rancher in Larimer County from Dreamscape Ranch, Larry, described the potential impacts, stated:

There's the intrusion on people's property values... there's some degree of air pollution... there's costs on the landscape, certainly, if it's dotted with thousands of wells, that has an impact on the environment... the water use... as a percentage of the water that's in play in any given year on the rental market, it can be a much bigger percentage, and also the way the waste water is disposed... then it removes it from the water cycle, which wouldn't be a problem in a state that had a lot of water. But in an arid state like ours, where they're looking at every drop, then removing water from the water cycle so it can't be reused and is just buried underground is a loss.

Larry was unsupportive of development because he felt negative impacts were likely to occur.

He was one of the few farmers who voiced concerns about intrusion on the landscape more generally, the amount of water that the process uses, and how this may impact the water rental market. This is because Larry's ranch, through a conservation agreement, was ineligible for O&G development, which made him concerned about the larger impacts of development rather

than just the impacts on his land. Sandra, an organic farmer from Pink Flamingo Farms, also discussed negative impacts; she stated:

There's still some small impacts where they've brought in gravel, this farm had zero rocks on it until the oil and gas company decided to gravel their road now we have gravel in our fields where we have problems with our plows and things. So physically, those are some of the things that impact us.

Sandra was unique because she was an organic farmer with mineral rights who was concerned about the intrusion of development onto her land. This illustrated how, although she had control over what occurred on her land, she had no control over what happened around her. Sandra also had some of her mineral rights leased out from previous owners, so she had direct contact with O&G development. In contrast, the conventional farmers within my sample, both of whom own their mineral rights and had development on their land, felt there was little chance of negative impacts from O&G development occurring, nor had they felt impacts thus far. The small changes to everyday life they experienced, such as truck traffic and strangers present on their farm, did not inconvenience them. John, who operated Apple Blossom Orchard in Larimer County, felt a lot of power within negotiations with the O&G industry through his mineral rights ownership, particularly because an O&G lease was not a financial necessity for him. These cases also demonstrated the lack of trust between farmers without their mineral rights and the O&G industry, while farmers with their mineral rights trusted the O&G industry to not only carry out development safely, but remedy any issues that occurred because they had legal protections that individuals without mineral rights do not have.

Economic benefits of O&G development were most important to the farmers I interviewed who held their mineral rights, whether they had conventional or sustainable operations, which paralleled my detailed case studies described above. For example, Tom, a

conventional farmer from The Stone Farm, illustrated the economic importance of O&G development to farmers when he stated:

It's definitely positive... it's cash flow coming in and with the price of these commodities right now, you can't raise corn for three dollars, we're losing money and this is a pretty good shot in the arm to agriculture... Three dollar corn, these farmers aren't buying anything, but the farmers that maybe got a couple oil wells going in or something like that, that is really helping everybody.

John, operator of Apple Blossom Orchard in Larimer County, also discussed the importance of the economic benefits to O&G development. These were important perspectives that were largely absent from my case studies. He stated:

You have these farmers and ranchers in that area who haven't had anything their entire lives, you go out there, and you say 'who in the world would want to be out here?' Now oil has been found, and it's like asking somebody if you won the lottery, would you give the money back? Because that's what they've done. They've won the lottery. They really have... if they own the mineral rights.

John illustrated an important distinction between farmers present in my case studies as well.

Strong support for the industry, due to perceived economic benefits of development, was voiced most frequently by farmers who owned their mineral rights, could benefit directly from development, and perceived themselves as having some control over the terms of development.

These cases studies illustrated how significantly the mineral rights ownership through the split estate system impacts farmers in northern Colorado, whether they are sustainable or conventional farming operations. The institutionalized system of split estate property rights structured farmer's interactions with O&G development. Farmers with mineral rights had the control to weigh the negative and positive aspects of having development on their land; this allowed them to own the decision and the outcomes in a way that farmers without mineral rights could not. In these case studies, whether farmers had mineral rights impacted their views more than their views about the importance of farming sustainably and the fear of their food being grown in a chemical intensive way.

My second research question asked: *(How) do sustainable and organic farmers' identities or operational philosophies shift to accommodate the presence of unconventional O&G production on or near their farms (or in their communities)?* My three case studies displayed divergent outcomes around whether farmers' identities or operational philosophies shifted to accommodate the presence of O&G production. These divergent outcomes were primarily dependent on mineral rights ownership, the location of their farming operations, other aspects of their identity such as their other avenues of employment, and customer perceptions. There were also differences present between conventional and sustainable farmers. While the meanings of some farmer's identities or operational philosophies shifted in response to unconventional O&G production, other farmers held onto their identities closely while development occurred nearby. Although the farmers in my case studies had slightly different operational philosophies and motivations for sustainable farming, there were also many similarities.

As with my first research question, the farmers in my case studies were divided between those with mineral rights and those without. For example, while Rob and Pam shifted their identities as sustainable farmers and their meaning of sustainability to accommodate and absorb unconventional O&G development nearby or on their farms, Sara and Ken did not think that having unconventional O&G development on their farms could coincide with their identities as sustainable farmers. Although Rob and Pam did not note considerable shifts in their operational philosophies or identities due to unconventional O&G development near their land, other statements they made during my interviews with them indicated that they shifted their specific definitions of sustainability to accommodate the proximity of chemical-heavy industrial processes like hydraulic fracturing. Rob and Pam were both accepted and absorbed O&G

development into their meaning of sustainability because they were able to benefit financially from development through their mineral rights ownership. Pam's acceptance was also related to her ability to benefit financially from development and because her husband worked in the industry. Sara and Ken argued that their identities and meanings of sustainable farming would shift in response to O&G development; however, they were unable to compromise on the inclusion of O&G development within their view of sustainable farming. Sara's inability to absorb development into her sustainable farming identity was a result of her identity as an environmentalist, while Ken stated that development on or near his property on a large scale would render him unable to farm sustainability.

Operators' divergent responses and shifts in identity related to each farm's location in northern Colorado. This was most prominently displayed during Pam's interview because her farm operated alongside O&G development for years. Although the technology of unconventional O&G development is new, Weld County has normalized industrial processes, particularly O&G extraction. The political structure of Weld County was also supportive of O&G development, as was the public response. Pam internalized this normalization more than my other two case studies, which were located in counties without a long history of O&G extraction. This was not only because her farm was surrounded by development, but because many of her daily interactions were shaped by the O&G industry. For example, her husband worked in the industry as a pipe fitter and water hauler and many of her customers worked in the oil fields as well. This gave her an intimacy with development not present in the everyday experiences of farmers in Larimer and Boulder counties.

Although Rob was not surrounded by development to the degree of Pam in Weld County, he normalized the chemical intensive process because of his other professional roles, particularly

his highly technical training which made him comfortable with technological processes. The public and political response in Larimer County, particularly in nearby Fort Collins, was not supportive of O&G development, as seen through a moratorium voted on by the citizens of the city. However, there were other parts of the county, such as Windsor, which were more supportive of development. However, Sara, who operated within the same physical context as Rob, did not normalize the industry, representing the alternative side of the debate within the county. Lastly, Ken, who was unsupportive of the process, had not normalized development and through his interview illustrated that he actively worked to avoid normalizing it. Boulder County, where Ken's farm is located, was the most resistant to O&G development politically and through public response. Ken expressed how the concerns of unconventional O&G development operating alongside his pick-your-own sustainable farm of his customer base had the ability to impact his farm throughout his interview.

All three farmers expressed concern over customers' perceptions of buying food grown in close proximity to O&G production. Pam, whose identity as a sustainable farmer and meaning of sustainable farming shifted to accommodate and normalize unconventional O&G development, expressed concern that customers may view her operations differently than she does, as different people move to the area and have not yet normalized O&G development or if nearby production expands. Rob and Sara were never asked about O&G development on their farms by customers, but were threatened by an anonymous email from an environmental organization to release this information to the public. However, while Sara was sympathetic to this concern, Rob dismissed the concerns about O&G development on his farm as "pure emotionalism". Their reactions to others concerns represented their own views about development, but also their roles on the farm. Rob had little face to face contact with customers, while Sara was the "face" of the farm, selling

their products at farmers markets and answering to customer concerns. If O&G development on their farm became problematic for customers, Sara would be forced to address those concerns about development that she herself disagreed with. Ken reported that customers asked him whether nearby O&G production impacted his agricultural operations – particularly because his customers visited his farm as a part of agri-tourism, so the landscape around his farm was central to his business and his identity as a farmer. Farmers were also concerned about customers rejecting their identities as a sustainable farmer if development occurred on their land.

Ultimately, Pam and Rob, because they were supportive of development, argued that their customers didn't need to buy from them if they had concerns. Pam discussed with her customers her close proximity to O&G development and she believed these conversations prevented development from impacting her sales. However, Pam and Rob may argue this because they were benefitting financially from development, which would make up for the few customers they lost because of having O&G development on their land. Their status as mineral rights owners also offered them a sense of control that farmers without mineral rights do not have, which empowered them to own and defend the decision of allowing development on their land.

Other farmers in my sample had disparate meanings of sustainability, farming philosophies and identities, impacted by nuances of farming practices, motivations for farming, where their farms were located, and who their customer bases were. Recall that within my sample of ten farms, two were conventional farmers, one was an organic farmer, and seven were sustainable farmers. Conventional farmers saw little or no conflict between O&G development and their farming ideologies and identities. However, some sustainable farmers experienced substantial conflict. For example, most sustainable farmers that described altruistic motivations

for sustainable, farming practices, such as contributing to local, community-centered food systems, saw their meanings of sustainability and identities being shifted by forced development.

One example was Ben, a sustainable farmer from French Hill Farm outside of Fort Collins, concerned about soil, water, and air impacts impacting his ability not only to be considered a sustainable farmer by his customers, but also his ability to become organically certified in the future. He stated:

I would imagine that if they came and put a well on my property, it would pretty much kill the option of getting certified organic, I'm not 100% sure of the setbacks required for that... I know there's certainly is particular setbacks or distances that would have to be, you know, my property's an acre wide, so you put a well right in the center of it.

Organic certification was central to Ben's farming philosophy; his definition of sustainability excluded using chemicals on his farm and he spoke of the importance of local, small-scale food for the agricultural system. Organic certification also opens important market niches for organic and sustainable farmers and it would allow Ben to access clientele that can pay high prices for chemical free produce.

Although there is nothing within organic certification that states that organically certified farms cannot have O&G development on or near them, it is possible in the future that the certification process may include regulations against development or that customers purchasing organic products will respond unfavorably to O&G development being grown alongside these products. Many farmers I interviewed, whose identities were less accommodating of O&G development, found this possibility a serious threat to their identities and perhaps their businesses' viability in the long term. Sandra, an organic farmer from Weld County, expressed these concerns as follows:

We are starting to have people calling us and say 'is there oil and gas activity around you' and it's like 'yeah of course I don't know of any farm that doesn't in Weld County' and... they don't want to do business with us anymore. I had to admit that right now that

is a very small portion of people that are doing that but I think it's going to start happening more... you'll start to see those phone calls more often now... it's very concerning that I may be losing business because of the O&G activity around me.

Sandra described the dilemma that many sustainable farmers expressed during my interviews: even if her identity was not impacted, her customers might reject her as an organic farm as O&G development alongside agriculture becomes a more controversial issue. Sandra had the most to fear about customers concerns regarding O&G development because her farm had organic certification, which added a complicated layer that farmers who operated just as sustainable lacked.

Conventional farmers did not present this as an issue for their businesses or identities during my interviews with them because their farming processes already include chemical-intensive phases. Their identities were focused on the success of their farms and their abilities to be successful businessmen, viewing the land as a vessel for this success rather than a vessel for social change. While sustainable farmers often viewed themselves as stewards of the earth, or at least their land, conventional farmers did not have the same views about their land. Conventional farmers also had few interactions with customers, not having the chance to interact with them at farmers' markets the way that more sustainable/organic farmers in my sample tended to. Instead, many conventional farmers sold their commodity crops, like sugar beets, wheat, or barley, to wholesalers and larger marketized systems. Thus the concern about customer's perceptions of O&G development was largely absent from their business models.

These case studies, combined with supporting details from my other interviews, demonstrate how sustainable farmers shift their identities in response to O&G development occurring on or near their farms. Whether farmers had the ability to control O&G development through ownership of mineral rights was the biggest influence on whether they thought their

sustainable identity and their meanings of sustainability were incompatible with O&G development. However, the nature of their operation also impacted how their identities and meanings shifted- the very nature of sustainable and organic farming prevented many of the farmers from accepting the chemical intensive process of unconventional O&G development.

My third research question asked: *“Do these farmers experience shifts to their operations and identities as environmental injustices?”* The answer to this research question was also dependent on whether farmers had control and perceived power over whether development occurred on their land or not through ownership of mineral rights. While Pam and Rob felt these shifts were not injustices due to their empowerment through mineral rights ownership, Sara and Rob experienced these shifts as injustices, largely due to their lack of mineral rights ownership and perceived power as a result.

Farmers’ perceptions of justice were related to the amount of control farmers felt over unconventional O&G development near their land and the degree to which they felt their identities would have to shift if O&G production expanded or impacted their businesses for long periods. Ken, who had no mineral rights, experienced this forced shift as an environmental injustice. He felt a loss of control about what occurred around his land, what impacts that would cause, and how O&G companies would respond to those impacts. This lack of autonomy combined with his lack of trust in the industry was experienced as an environmental injustice. His feelings were influenced by the fact that his farming operation was an agri-tourism business. While other farms with O&G development present on them were potentially invisible to customers, Ken’s customers visited his farm. His operation as an agri-tourism business would be less marketable and unattractive to customers seeking sustainable ambiance for their families if it

were surrounded by O&G development, impacting not just his identity as a sustainable farmer, but the physical reality of his operation as well.

In contrast, Rob felt his identity as a sustainable farmer could accommodate nearby unconventional O&G production. He did not experience the shift as an injustice because he was in control of development near his land. Similarly, because Pam had normalized O&G development and accepted it near her land, her identity did not require a substantial shift and thus no perceived injustice resulted. As with Rob, Pam had the choice to allow development on her land and own her mineral rights. She argued she made an individual choice to remain in her home, even with development occurring around it, and did not believe she was constrained to accept O&G development. Instead, her normalization made it feel, well, normal.

The other farmers in my sample followed the same pattern: ownership of mineral rights allowed them to control what occurred on their land and the degree to which their identities and the meanings of sustainability these identities dictated had to adapt to O&G production. The greater sense of empowerment let them feel empowered where others felt threatened, marginalized, or exposed to potential environmental injustice. If farmers lacked this control, these shifts in identity were experienced as environmental injustices because of lack of procedural equity. Sandra, an organic farmer from Pink Flamingo Farm in Weld County, was surrounded by development and strongly demonstrated this issue of control. She stated:

Farmers should be able to have more of a say in what happens around their land. Unfortunately, we just don't have any, because we are dealing with billion dollar companies, we just don't have any recourse when things go wrong, really the only ones that have been sort of successful have been the farmers with tons of money.

She explained that the farmers most marginalized by development are small-scale farmers without their mineral rights and with junior water rights, if any, given that they had little ability

to control or stop looming development on or around their farms. Ron, a conventional farmer from Harmony Farm in Weld County, also discussed this; he stated:

You have leverage. Some of these guys, they have no say, so the landowner says ‘well this is how we’re going to do it.’ All the landowner wants to do is get the money and they don’t care too much about the farmer. Some of these guys have been hit pretty hard by that.

Through this quote, Ron described the importance of control not only for farmers without mineral rights, but tenant farmers who do not own the land they farmed. Tenant farmers have less control than those without mineral rights because they do not own surface or mineral rights, which disabled them from any control over development alongside their crops. This is an understudied issue because tenant farming is becoming increasingly prevalent. All of my farms illustrated the importance of autonomy and procedural equity for farmers having EJ while allowing or disallowing development.

For my three case study farms, along with my subsequent interviews, the farmers without mineral rights perceived shifts in their identities as forced and, consequently, as environmental injustices. However, farmers with mineral rights ownership did not experience significant identity shifts, as they more often accepted development, and thus did not perceive any slight shifts in their identities as environmental injustices. Most of them felt if they allowed development, then whatever changes occurred were just. Pam even argued individuals who were unhappy with development had the choice to move, and as a result rapid development and its impacts to sustainable farmers were thus was not environmental justice issues. These results bring up problems of procedural equity, which will be further discussed in my conclusion.

### ***Conclusion***

My three case studies, along with my other interviews, illustrated important distinctions in the ways farmers experience unconventional O&G production in relation to their agricultural

operations and identities. These distinctions were split among sustainable versus conventional farmers and those who owned their mineral rights versus those who did not. Conventional farmers were less concerned about environmental impacts from development as compared to their sustainable counterparts because of their intimate relationships with chemical processes. Thus, their identities as farmers did not shift at all. Sustainable farmers with mineral rights were empowered through their status as mineral rights owners to control development on their land, often shifting their operational identities as sustainable farmers to normalize development, while enjoying economic benefits as a result. Sustainable farmers without mineral rights felt disempowered through this status, struggling with the inability to control negative impacts on their land resulting from development, resulting in forced shifts in identity that were experienced as environmental injustices. Most of them questioned, or downright denied, that they would be able to continue farming using their meanings of sustainable if negative impacts from O&G development occurred. Farmers without the ability to control O&G development encroaching on their farms forced them to feel a loss of control that may be described as procedural inequity. Farmers wanted a say in what development occurred on (and to a lesser extent around) their land. These results demonstrate that it is not just the development, but the structural institution of split estate, that creates the inequality between mineral rights owners and those individuals that just own surface rights, regardless of whether they are farming sustainably or not. Ultimately, farmer's experiences with O&G industry were structured by the amount of control they had, through mineral rights ownership, over what happened on their private property. My results from these in-depth qualitative interviews offer important additions to the literature on unconventional O&G development and the wider theoretical considerations of Environmental Justice as a framework from which to examine these issues, which I examine in my Conclusion chapter.

## Chapter V: Discussion and Conclusions

In the previous chapter, I discussed how northern Colorado farmers I interviewed have navigated their interactions with O&G development, how their identities as sustainable farmers were challenged and changed by this development, and whether they interpreted these shifts as environmental injustices. What do their experiences contribute to the academic and public debate surrounding O&G development, both in Colorado and across the United States? In order to answer this question, I will revisit my theoretical frameworks of Environmental Justice (EJ) and Symbolic Interactionism with elements of Social Constructionism. Using these frameworks, I will draw inferences of how my research adds to the body of knowledge regarding environmental justice. I will also explore the ways that individuals recreate meanings around their identities in response to social, economic, and political structures beyond their control. These discussions will allow me to offer suggestions for future research and potential solutions to the problems uncovered during my interviews with sustainable agriculturalists.

### *Environmental Justice Revisited*

Although much research within the realm of EJ focuses on illustrating and fixing distributional inequity, another significant thread of research focuses on uneven access to political and social institutions that zone industrial processes, or procedural justice. I will focus on explaining how my research helps fill gaps in the EJ literature related to procedural equity for agriculturalists involved in O&G development, whether directly or indirectly. Lastly, I will discuss the sometimes contradictory notions that exist within procedural equity, which inevitably lead to conflict among stakeholders with different ideas about development and level of control

and power over what development occurs on their own land, perhaps illustrating how we need an overarching sense of justice that precedes even procedural equity within EJ.

These three case studies represent different aspects of the debates within procedural equity and different household responses to them. Procedural equity is vital to EJ because it acts as an interpretive framework which privileges individual's perceptions about experiences when examining whether a particular situation is environmentally just (Snow et al. 1986). The discussion of O&G development in Northern Colorado, however, contributes evidence to the debate discussing whether procedural equity is possible when different stakeholders with different levels of control have different ideas about what true procedural equity entails and what a results oriented version of EJ looks like. Farmers with mineral rights in Northern Colorado have control over their individual properties, and thus procedural equity, when making decisions about O&G development on their farms. Farmers without mineral rights lack this control and thus lack procedural equity, leading to more concerns about impacts outside of their control.

Cole and Foster (2001), Lake (1996), Capek (1993), and others argue that procedural justice exists when individuals and communities are part of the democratic process, particularly when they participate in those decisions that dictate zoning laws and other decisions related to locations of industrial processes. Lake (1996) offers an important distinction of his definition of procedural equity; true procedural equity must include not just the single decision of whether to allow certain types of industrial development in communities, but all of the decisions before, during, and after this decision. In order to accomplish this, it is necessary to shift the way we examine these injustices; we must understand the ways in which farmers and rural communities interacted with extractive development in the past and how industry acts as a normalized part of everyday life. This perspective helps us to account for all of the structural issues reaching into

history that form the procedural inequity which exists today, such as certain groups being systemically disenfranchised from participating in the democratic process of zoning industrial activity or even individuals having a say in what development occurs on their private property. In the case of O&G development, it does not just mean citizens interacting with O&G development having a say in the single decision of whether to allow development on their land, but also how industrial operations interact with their communities and the economic and political structures that they operate within on an everyday basis.

### **Case #1: Sunnydale Farm**

If procedural equity is defined as individuals having a say in land use decisions and thus autonomy over one's land, mineral rights owners enjoy procedural equity over what development occurs on their land and how it is carried out, illustrating how they have a say in procedural equity around development decisions. Sunnydale Farm represents both sides of this debate: Rob, through ownership of mineral rights, has complete procedural equity over his farm as primary operator, while Sara, essentially a tenant farmer, has no procedural equity over her father's farm. Rob personally feels that he has a strong and central role in decision making about development on and near his land, lending his perception of the situation a strong sense of procedural equity. Rob owns his mineral rights and there are no local zoning ordinances against O&G development in Windsor, Colorado so he makes all decisions regarding O&G development on his property. His membership in an HOA, which cooperatively owns portions of mineral rights and shares of senior water rights, also offers him unique benefits when signing a lease. Because Rob and his four neighbors signed leases together, he negotiated and signed a lease at top market value. This is similar to landowners in other states who join rural landowner coalitions in order to get fair (and even top market) leases (Jacquet and Stedman 2011). Rob

received another important benefit; since four of his neighbors also signed leases, he declined taking on potential surface disturbance with a surface use agreement. Instead, the O&G company will access his mineral wealth through his neighbor's land, mitigating his own potential impacts.

Rob is also a unique case financially because he was not “forced” by economic vulnerability to lease off his mineral rights to development, unlike many farmers who sign leases (Malin 2011). Rob's case is not a traditional case of “job blackmail” (Bullard 1993). This is because Rob and his wife both have viable off-farm employment, which puts them in a different category than farmers whose entire livelihoods, both socially and economically, are connected to their farms. Rob's farm is not his career, but a vehicle for retirement. In Rob's case, his reliance on off farm employment was not a sign of being economically vulnerable, but instead, allowed him to exercise complete control over his land and his farm. However, for many farmers, off-farm employment is necessary to subsidize their farming operations, which acts as their livelihood. Although Rob's off-farm employment empowered him, according to the USDA (2015), in 2012 the majority of farm household income was earned off the farm and “median off-farm income is projected to increase 4% in 2015 to \$66,360” (USDA 2015) illustrating the larger structural issue with small-scale farmers' inability to support themselves through farming alone. Individuals with mineral rights who are not desperate for lease monies are enabled not only to have a say in whether to allow development, but under what terms: for example, Rob waited until an O&G company with a positive reputation offered him a lease that is on the high end of the market price of mineral leases in the area.

However, there are also complications within the case of Sunnydale farm; particularly regarding the other members of Rob's HOA and his daughter, Sara. Rob and four of his neighbor's, who were members of their HOA and owned their mineral rights and were in favor

of allowing development on their land. However, the remainder of Rob's HOA own traditional subdivision homes without mineral rights ownership. Rob's neighbors were concerned and upset about the prospect of development on Rob's land and their own land, which has the ability impact their homes. This is illustrative of the larger debate occurring within Colorado; individuals in subdivision homes are fearful of O&G development encroaching on their property. It also illustrates that the subject of procedural equity is complicated; although Rob has the ability to control development on his land, other members of his HOA have no control over what occurs on their land, no access to the benefits from O&G development that Rob receives, and no voice in the process. Rob signing a lease also makes it more likely that O&G development will occur on these neighbors' land in the future, perhaps even against their wishes. This type of situation where neighbors experience unequal power over their own land also creates community tensions. Even if Rob's neighbors may not experience development on their land, environmental impacts do not recognize landowner borders; O&G development may impact neighbors whose mineral rights are leased to the industry against their say or if they just reside close to the development on Rob's farm.

Sara, a co-operator of Sunnydale Farm, also personifies the complexities within the debate of procedural justice. Sara makes an overarching case for sustainability when she argues against development on her father's farm. She feels development is inherently unjust because it infringes on future generations' abilities to meet their needs and their ability to live in healthy environments. Sara's view of justice as sustainability is one of the main critiques of procedural equity as individual or community autonomy. In other words, the conflict between Rob (a mineral rights holder) and Sara (not a mineral rights holder but, essentially, a tenant farmer) highlights a central tension within the debates surrounding EJ: Is there a point where concerns

about environmental sustainability, or a more precautionary approach to O&G development, override individual property owners' rights to host development on their property? Sara's ideas about sustainability represent a view of sustainability present within the EJ literature, a definition of sustainability that highlights the human and social dimensions of environmental issues. Hyner (1999) argued that sustainability means "acknowledging the interdependency of social justice, economic well-being and environmental stewardship. The social dimension is critical since the unjust society is unlikely to be sustainable in environmental or economic terms in the long run" (64). Although Sara understands the economic argument for fast-paced unconventional forms of O&G development, she believes that ultimately this process is unsustainable, socially, economically, and environmentally. This characterizes some of the overarching arguments present within the literature regarding procedural equity versus sustainability. For example, Pena (2005) argues procedural equity must take into account community's procedural equity, while framing this procedural equity as a say in decision making that ultimately works towards sustainability. However, what if these procedural equity and sustainability are at odds? Within our current structure which forces individuals and communities to privilege economic well-being over other types of well-being (Dobson 1999, Faber 1998), such as environmental health, it is unlikely that communities will choose sustainability through procedural equity unless our social and economic structure changes, incorporating and even privileging environmental concerns over economic concerns.

### **Case #2: Blueberry Hill Farm**

Non-mineral rights owners lacked control over what occurred on their farms, which left farmers without mineral rights feeling like they did not enjoy the procedural equity that farmers with mineral rights enjoyed. Blueberry Hill Farm and its operator, Ken, illustrate how access to

procedural equity is completely absent for some farmers. Because of Colorado's system of split estate, which separates mineral and surface rights ownership (Baurele 2006), Ken has no control over whether development occurs on his farm, and thus no procedural equity. Although the political and public support for unconventional O&G development is absent in Boulder County as compared to Weld County, O&G development may occur there in the future. One way for individuals and communities to exercise autonomy over what occurs on their land is through local zoning ordinances, such as the moratorium passed in Fort Collins, Colorado. However COGA, the lobbying group for the O&G industry, is taking communities who voted against O&G development within their borders to court. This is a violation of the type of procedural equity that Cole and Foster (2001) argue is necessary; it is not just individuals who have a say over development, but communities as well. Within the property rights system of split estate and the resistance of the state to allow communities to control decisions about development, Ken is forced to allow development and cope with the potential consequences that may arise from that development, demonstrating how he lacks procedural equity as an individual level, but also on a larger community level. The inability for individuals and communities to have autonomy in these situations, combined with lack of knowledge and transparency about the process of O&G development and its impacts, leads to long-term social and psychological impacts (Perry 2012), which are of interest to EJ scholars and need to be studied further in the context of split estate.

### **Case #3: Tanglewood Farm**

Tanglewood Farm, operated by Pam, illustrated another complexity of the debate around O&G development and procedural equity. If procedural equity is having a say, and ultimately self determination, over an individual's private property, Pam has complete procedural equity. She has control over what development occurs directly on her farm because she owns her

mineral rights. However, Pam's farm was surrounded by O&G development present on her neighbors' land, many of them conventional farms. Although she can choose to allow or disallow development, she may still suffer impacts from neighboring development. Although this may not bother Pam because she can benefit economically through mineral rights ownership, it was a concern for other sustainable farmers operating within the county, surrounded by development. While Pam is in favor of development, she does not feel that community level procedural equity occurs within our institutions or that community concerns surrounding development are responded to adequately by the industry, but more importantly, nor within the state. For example, as Opsal and Shelley (2015) argue, she feels the state is not responsive to resident's complaints about O&G development, nor does she feel the state has the right to tell communities they must allow development.

As discussed earlier, England and Brown argued that rural America is "categorized by two contrasting landscape types - agricultural and extractive" (1992:1), illustrating the difficulty of rural communities or individual agriculturalists to refuse development and the complexities of obtaining "true" procedural equity within this context. Pam normalizes the potential presence of O&G development on her sustainable farm in Weld County because she is already surrounded by development and chemical intensive agriculture. Weld County is an agricultural community with a long history of extractive development operating side by side agricultural operations at large. Pam cited positive economic impacts and employment as two reasons to support the industry. Although it is rarely individuals already living in rural communities who become employed by O&G companies, other adjacent businesses do experience economic gains (Brasier et al. 2011). As discussed by Malin (2011) in the context of shale gas development in Pennsylvania, Pam's farming operation (indirectly) and the county at large is helped financially from the O&G

industry. The complication of economic dependence on an industry on procedural equity is also seen within other extractive industries, such as uranium (Malin and Petrzela 2010).

Lake (1996) asks us to reconsider these complicated situations as instances of environmental injustice and “job blackmail” as Bullard (1994) calls them; if a community (or individual) is economically dependent on an industry, which also burdens them with negative environmental impacts and agrees to host the industrial development for self-preservation, is that a case of successful procedural equity? For example, Tom, a conventional farmer from Weld County discussed ways in which the industry helped farmers survive during years when corn was very cheap; constraining them to accept development but empowering them economically. Pam experienced this through her husband’s employment within the O&G industry; his off-farm employment allowed her to continue farming during less profitable years and to continue contributing to the overall economy of the county. This investment in farmers by the industry allows farmers to spend money in their communities, helping industries unrelated to O&G development to survive. This is essential within counties such as Weld County that are dependent upon money generated from agriculture. Lake (1996) states, “From the community’s perspective, rejecting the waste dump on environmental equity rounds might lead to the literal extinction of the community otherwise unable to sustain itself economically, where extinction is certainly antithetical to self-determination” (161). Although “job black-mail” may be occurring, examination of the context that individuals and communities operate under is vital. Allowance of an environmentally hazardous industry still has the potential to be EJ as individual (or community) autonomy, especially if the community’s survival is at risk without the economic development that comes along with the environmental risks of industrial development.

These three case studies illustrate the complexities within the examination of an individual or community's involvement within procedural equity. Through the examination of these three unique case studies, one wonders: in what ways might procedural justice and EJ conflict with one another, especially when economic considerations, even vulnerabilities, are considered? These three case studies illustrate the difficulty of obtaining EJ in a context when different stakeholders have different experiences and beliefs about what EJ is and different levels of power and economic privilege. This is particularly true in the case of "job blackmail" (Bullard 1994), where individuals are forced to privilege economic wellbeing over environmental concerns, constraining the process of procedural equity further. Lake (1996) argues that reconciliation of these difficult situations must be a primary goal of EJ research; he stated:

A commitment to the principle of environmental justice requires that we make sense of these situations. A viable theory of environmental justice must be able to reconcile those apparent contradictions in the... scenarios where local autonomy prevails in some cases but it is overridden by an external sense of justice in others (161).

Is self-determination the deciding factor of procedural equity – or is there an underlying sense of justice, as Rawls (2001) argues, that precedes or overrides it? Is it enough for individuals to have a "say," when individuals (such as mineral rights owners versus non-mineral rights owners) have differing levels of power within decision making? Although my three case studies do not answer this question, they contribute to the literature that examines these complexities. It may be that only through dismantling structural inequities, and perhaps even altering our extreme form of neoliberal capitalism which privileges economic well-being above many other variables, that true procedural equity and EJ will be reached. Perhaps Pena's (2005) definition, which argues that EJ is "about the ability of local cultures to assert control over their own space (and places) by exercising freedoms to organize production and consumption in sustainable and equitable patterns that derive from self generated ecologically and culturally appropriate norms," (144) is

what scholars and communities should aim towards. While communities' and individuals' situations and views are taken into account, they are looked at through the lens of environmental injustices "not being in anyone's backyard" through the push towards the precautionary principle and ultimately, sustainability (Bryner 2002). However, this may be impossible within an institution such as split estate, where mineral rights owners' desires are taken into account, while surface rights owners are ignored when considerations related to O&G development are examined. This push towards sustainability is difficult, perhaps even impossible, within our current system which privileges economic benefits above all other factors within procedural equity. Thus, farmers with mineral rights with an economic interest in allowing development override farmers without mineral rights, who might have other concerns central to their views about O&G development, while also having no control over what occurs on their land.

### ***Shifting Identities***

Mead (1934) argued, through the framework of symbolic interactionism (SI) that reality is not made up of social facts, but is created and recreated through interactions and relationships. This framework extends to the meanings we attach to our social lives and most importantly, individual's identities. Identities shift and are recreated through new interactions, relationships, and information (Searle 1995). Social constructionism is distinct from SI, but intersects with this perspective, examining categories, social problems, and institutions not as static, nor their properties as inherent; Cerulo (1997) states "the social constructionist approach to identity rejects any category that sets forward essential or core features as the unique property of a collective's members" (387). Lastly, Foucault (1984) compliments these perspectives well because he also argued against identity as an inherent feature of individuals, instead he argued that individuals construct their identities around power and discourse. He stated: "The individual, with his

identity and characteristics, is the product of a relation of power exercised over bodies, multiplicities, movements, desires, forces” (180).

Using SI, I was able to examine the ways that farmers construct their identities and their meanings of being sustainable farmers, through their other careers and roles, their spatial locations, their customers, and ultimately whether they owned the mineral wealth under their land, demonstrating SI’s idea that identity is not inherent and static, but flexible. I also examine how sustainable farmers differentiate their identities from conventional farmers. Lastly, through social constructionism, I observe how farmers perceive, identify, and define environmental problems and how their identities and livelihoods interconnect with those perceptions.

My three case studies offer evidence to support the notion that identities are not static with inherent characteristics, but are created through shared meaning and are reconstructed through time and place. During my interviews, I saw evidence for Taylor & Whittier’s (1992) three-step process of construction of a group identity. Although they were discussing social movements around non-mainstream sexuality, I argue Taylor & Whittier’s framework applies as well to other social groups aiming to resist other mainstream social institutions, in this case conventional agriculture. In this way, symbolic interactionism and social constructionism interact to form meanings about not just individuals’ identities, but the institution of sustainable agriculture as a whole. Their first step is the creation of boundaries that insulate and differentiate non-mainstream groups from the dominant group. The sustainable farmers I interviewed distinguished themselves from mainstream agriculture practices through the avoidance of chemical intensive farming and the use of drip irrigation. In certain areas, sustainable consumers also help construct these boundaries.

The second step in this identity creation is the emergence of shared consciousness and goals among nonmainstream groups. This was seen through the farmers' discussions, particularly Pam, Sara, and Ken about the importance of local food and transforming the food system. The meaning they attached to their farms was their employment of them as avenues of education to help foster this transformation. This was not seen in conventional farmers, who viewed their farms as livelihoods, but not mechanisms for any type of social change. The shared goals of sustainable farms, creating markets which promote the principles of small-scale agriculture, enhanced consumer health, and preservation of the environment, particularly soil and water quality (Allen and Kovach 2000), were present regardless of their views about O&G development.

Lastly, the process of politicization helps to create and sustain a group's minority status. Sustainable farmers feel extremely politicized, not only are they going against the conventional agricultural system by farming in a labor intensive way with little chemicals, they are also not supported to the same extent as conventional agriculture by political and social systems. There are two major points of politicization that they discussed; the first is lack of government support for more traditional subsidy systems previously available (that are finally evolving to different forms of market support) and the second is convoluted regulation which makes it difficult and expensive for them to operate. Farmers discussed the difficulties of operating with little government support, financial or otherwise. This is one reason why extractive development is attractive to some individuals, especially because sustainable farmers operations are more vulnerable without the use of pesticides and herbicides. Without government support, a single bad growing season may impact their operations significantly. Farmers were also concerned about convoluted regulations, which from their point of view lacked a pragmatic purpose,

existing only to make their operations more difficult to run. Expanding on Taylor and Whittier's (1992) ideas about group construction, I will explain how sustainable and organic farmers assigned and re-assigned their meanings of sustainability and their identity in response to O&G development is occurring (or not occurring) around their land and how these identities corresponded with how they behaved within their own social contexts (Best 1989, Hannigan 1995).

### **Case #1: Sunnydale Farm**

Farmers with mineral rights reconstituted their identities and meanings of sustainability in ways that made their farming ideologies inclusive of unconventional O&G development in response to the social world around them. Sunnydale Farm, operated by both Rob and Sara, is unique because its main operators held two conflicting views of sustainability, shaped in important ways by other considerations like mineral ownership. While Rob's definition of sustainability is re-assigned meaning so it did not conflict with chemical-intensive development, Sara's meaning of sustainability could not coincide with this development. These meanings were created as a result of their unique social environments, group memberships, and differing roles. They also experienced opposing levels of control; Rob was completely in control over the capital resources of the farm, and thus development decisions, while Sara had none at all. Rob's identity and alternative role as an expert in water engineering also enables him to be comfortable with technical approaches to natural resource use, including extractive processes. His identity as a sustainable farmer was not a result of a strict environmental ideology, but as part of his views about efficient farming, both financially and environmentally. This concern with efficiency was a result of Rob's engineering identity. Therefore, his meaning of sustainability was constructed strictly as the avoidance of chemicals on his farm. However, other aspects of his identity

overrode his aversions to chemicals when examining how his identity was reconstructed as a result of O&G development. His identity influenced whether he socially constructed O&G development as an environmental or social problem.

Sara, the co-operator of Sunnydale Farm, identified with sustainable farming because it resonated with other aspects of her identity that were founded on a social justice perspective. Sustainable farming is her small way of helping contemporary agricultural markets move to a more localized food systems less dependent on fossil fuels, both through the transportation of that food and the production of it through chemically heavy pesticides and herbicides. Sara also openly discussed her identity and role as an environmentalist, which interacts and informs her relationship with O&G development. While her father normalizes development, Sara is unhappy that Rob's farm contributes to the same energy system she resists in her own life as part of her social justice identity. However, Sara has no control over what occurs on her father's farm because she operates as a tenant farmer; she feels her identity as a sustainable farmer would either be forced to shift or she would no longer be able to engage in sustainable farming on this land in the future. In the end, Sara resisted recreating her identity as a sustainable farmer in response to the power and influence of the industry and the hegemony of development within the state- and even her father. It will be interesting to see if she is able to continue this resistance once development begins on her father's land, or whether the reflexive process of recreating meaning will force her to become inclusive of development. This case illustrates how individuals with different worldviews and identity constructions, but operating within the same physical context, respond to the same phenomena in divergent ways, either altering or keeping their own self concept of their identity.

## **Case #2: Blueberry Hill Farm**

Blueberry Hill Farm, operated by Ken, exhibits another instance where sustainability is used as a technique of resistance against our fossil fuel dependent culture, while also existing as a key component of Ken's farming identity, demonstrating Taylor and Whittier's (1992)'s three steps the most concretely of all my case studies. While some individuals normalize development, Ken resists reconstructing his identity or his meaning of sustainability to become inclusive of O&G development on personal and professional levels. This is especially important for Ken because of his lack of mineral rights; although he could not control whether development occurred on or around his farm, he could control his response to it.

Sustainability is not just a lifestyle for Ken; it is also a cornerstone of his personal identity. This identity is also a response to the homogeneous meaning and construction of identity in the nearby city of Boulder. This confirms Stryker and Burke's (2000) elaboration on Mead's ideas about the ways in which identities respond to social life; they argue that identities remain stable and salient over time if these identities are given the support and context in which to thrive. For example, Serpe and Stryker (1987) found that university students behaved in agreement with their identities held before university if they had opportunities to behave in agreement with these identities while attending university; however, if they were unable to do this their identities shifted. Although the current U.S. economy and infrastructure encourage consumption of fossil fuels, Ken's customers and (to some extent) his local community and economic infrastructure supported it. Boulder's community planning website even cites sustainability as one of its primary goals, illustrating the local culture surrounding this issue. His customers practice boundary maintenance and the creation of shared meaning not just through the rejection of pesticides and herbicides, but through the rejection of O&G development and sustainability coexisting. This is further seen through Ken receiving questions about O&G

development around his farm by perspective customers, who he believes did not come to his farm because of nearby development. This is interesting when compared to Pam who operates in Weld County; Ken has very little development occurring near his far and most individuals visiting his farm would not realize he was located close to development unless they sought this information out.

Ken also he feels his status as a sustainable farmer is extremely politicized. Although “on paper” the city of Boulder was supportive of sustainable farming, Boulder County and its public officials made farming sustainably difficult because of expensive regulation. It is this that made Ken felt like he had “minority status”. It is also his negative views of O&G development that contributed to this “minority status”. Although within his county he shares the prevalent view, within the farming community at large, he is an outlier. This meant that if he is forced to allow development on his land, through lack of mineral rights, he would need to shift his identity as a sustainable farmer to become inclusive of O&G development- a shift those visiting his farm may or may not accept. It is the local culture, which maintains the boundaries and shared meanings of sustainability, which enables Ken to currently hold onto his meaning of sustainability. Ken also internalizes that meaning of sustainability, which is exclusionary of O&G development, rather than the dominant paradigm which argues for the necessity of O&G development. Farmers without mineral rights resist an identity shift accepting of development, holding onto their identities as sustainable farmers more through refusal of continuance of their sustainable operations alongside O&G development. It is because of these things that Ken socially constructs O&G development as a social and environmental problem, rather redefining his view of sustainability to be inclusive of it.

### **Case #3: Tanglewood Farm**

The last case study, Tanglewood Farm, represents the most unique finding of this research. Pam completely shifted her self-concept and identity as a sustainable farmer, along with her meaning of sustainability to accommodate and include chemical-intensive unconventional O&G development surrounding her land. Pam is concerned about the negative impacts of America's chemical-intensive food system, and influenced by the various roles that make up her identity, particularly her role as a mother (specifically to her special needs child), educator, and long-time sustainable farm operator. However, Pam's farm and her livelihood are located in the center of Weld County's conventional agriculture and O&G development.

Pam could respond to this context in two ways: the first is to relocate her farm to an area without the risks associated with O&G development and the second is to accept the inevitability of some impacts from neighboring O&G development, even accepting development on her own land for the economic benefits it provides. Although Pam views her self concept of her farming identity as static, she has redefined her meaning of sustainability and her personal identity construction around that meaning. This renegotiation of meaning confirms Mead's ideas about identity; it does not operate as a static entity, but is reflexive as the individual interacts with the world around them. The individuals most important in practicing boundary maintenance and creation of shared meaning, her customers, validate her reconstruction of sustainability because they are intimately involved in the O&G industry, sometimes even employed by the industry. It is through these experiences that she "renegotiated her rules of inclusion" of what sustainable farming is and what meanings were attached to these practices (Cerulo 1997; 398).

Although she perceives her identity of a sustainable farm as a minority status in a county dominated by conventional operators, she internalizes and constructs this not as a social problem but as a personal challenge. Her feelings about O&G development are a result of power and

discourse (Foucault 1984); unlike some farmers, she does not need to be forced into acceptance of development. Instead, she internalized the discourse that argued unconventional forms of O&G development are not just safe, but *necessary*; effectively disciplining herself into participating in current economic and power structures. In this case, as Foucault argued, power is carried out by individuals doing everyday activities; we all participate in power relations when we participate in things the “system” demands- such as extractive development (Gergen 1999). As Musolf (1992) argued, Pam constructed her meanings of sustainability in response to the “internalization of the powerful’s definitions of the situation,” while individuals like Ken constructed his meaning of sustainability in response to the “joint struggle against those definitions” (182).

Environmental justice, symbolic interactionism, and social constructionism are perspectives that are complementary, and through these three case studies, I have shown how they can be utilized together. Shifts in identity and meanings of sustainability and how victims of environmental injustice construct their experiences are understudied areas of EJ that warrant further research. Mineral rights ownership gives farmers a sense of control and procedural equity that farmers without mineral rights do not have. Farmers able to enjoy the economic benefits of mineral rights ownership also had a more fluid definition of sustainability; their definitions and meanings of sustainability are not only able to absorb O&G development, but allow them to operate under contexts and constraints that would be impossible without this flexibility. This flexibility also allows them not to construct O&G development as a social problem, but an economic opportunity. These fluid definitions of sustainability are also related to the local culture surrounding these farms; if the customers and community accept development alongside sustainable farming, the farmers reconstruct their identities around this. Individuals without

mineral rights experience little procedural equity regarding identity; this causes them to experience forced shifts in identity that are experienced as environmental injustices.

### ***Conclusion***

The research I conducted and cases examined only touch the surface of the debates around unconventional O&G development in northern Colorado. Small-scale sustainable farmers provide an interesting way to study the intersections between environmental justice and identity construction as they intersect with O&G development. Further research has the ability to explore these intersections more in depth as the push for more sustainable food systems and our hunger for domestic fossil fuels continue to collide.

There are limitations to this study that do not diminish from its importance, but illuminate what research can be done in the future. It would be beneficial to study more farmers, of both sustainable and conventional models, drawing more interesting comparisons and distinctions between the two groups. This is especially important not just when examining opinions about O&G development, but also when examining how different farmers construct and reconstruct their farming identities around their social, economic, and political contexts. Studying farmers in different areas of Colorado, with different historical contexts regarding natural resource development and views about sustainable agriculture, is also vital. This research demonstrated that different local cultures impact how individuals respond to O&G development and what EJ outcomes occur.

I was disappointed that I could not study the interactions between O&G development and organic certification in-depth. Although I did background research on organic certification and its interaction with O&G development, it was clear that I was a few years ahead of the curve regarding O&G development's impact on certification. None of the farmers I interviewed had

any information regarding hosting development alongside organically certified farmland, but the few that are interested in organic certification (along with the only farm that did have certification) are concerned. Contacting individuals at the USDA and inquiring about their thoughts about the two practices coinciding would be informative.

When starting this research, I thought I would find farmers using O&G lease money to subsidize their farms, as Malin (2011) did in her study of small scale farmers in the Marcellus Shale. Although there is not enough evidence within my case studies to make this claim, I think this connection is vital to study in further depth. My sample of farmers was unusual because most of them were financially stable and began sustainable farms as a more meaningful second career after “retiring” from their previous careers. A smaller segment of farmers or their spouses worked off the farm. Perhaps class privilege is an understudied characteristic of sustainable farmers. However, farmers expressed concerns about their financial futures because of the economic barriers faced by small-scale sustainable farmers. Although the Federal Farm Bill increased the amount of money available for cost sharing of organic certification for organic farmers to from 5 million to 11.5 million dollars in 2014, and has numerous programs to support marketing programs (USDA Know your Farmer, Know your Food), there are few traditional subsidies available for sustainable or organic farms (USDA 2014). This is because sustainable and organic farmers are less interested in growing commodity crops, instead focusing on higher profit specialty crops. Because of the nature of the farms, they are ineligible for the \$5,325,744,921 in funds the Farm Bill sets aside for commodity subsidies, the largest portion of the subsidy program aside from the Crop Insurance Program. Would financial pressures force these farms to lease their land for O&G development in a few years after their start up funds ran out? As O&G development continues to expand into areas with prevalent sustainable, local food

cultures, this connection is vital to study. Farmers like Rob and Pam may survive within this system of informal subsidization of agriculture through extractive development, while farmers like Ken and Sara would be less likely to exist within this environment. Could it be that O&G development actually enables us to have a viable small-scale, sustainable, food system? We must then contend with identity issues on an institutional and industrial scale – should sustainable agriculture (have to) depend on unconventional O&G development to be financially viable?

Lastly, it is important to study these connections in relation to other extractive industries such as coal and uranium. The American West, particularly rural communities and their experiences with various extractive industries, is an understudied bastion of EJ. As Kuletz (1998) argues, it is vital that we study histories of extraction in the west as dualities of extraction as a patriotic duty and the sacredness of the land. I would argue the land as sacred is also seen through the views of farmers, some whose families have farmed the same land for generations. As our rush for energy independence continues, pushing us towards more domestic development of our natural resources, it is important to examine how environmental justice and identity outcomes occur in other contexts. What other types of natural resource extraction and dependence might sustainable and organic farmers co-exist with? Studying the differences and similarities between different types of development and how they interact with sustainable agriculturalists will help us to prescribe solutions to some of the problems discussed in this thesis. These problems are not disappearing; as farmers and consumers continue to question the logic of our conventional agricultural system, sustainable farming will continue to interact with extractive industry in ways unique to this small-scale, often local form of agriculture.

## Works Cited Page

- Abramowitz, Michael, and Steven Mufson. 2007. Papers detail industry's role in Cheney's energy report. *Washington Post*, July, 18.
- "Act 13 of 2012." 2014. Environmental Protection Agency. August 30<sup>th</sup>, Accessed at [http://www.depweb.state.pa.us/portal/server.pt/community/act\\_13/20789](http://www.depweb.state.pa.us/portal/server.pt/community/act_13/20789).
- Adams, Elizabeth. 2012 "Environmental justice: where are the fracking sites?" *The Gettysburg Economic Review* 6:1-90. Available: <http://pop.gettysburgcollegebullets.biz/dotAsset/1a55eb92-bbe6-41bb-a6dd-c2902b48fa9f.pdf#page=6>. Accessed 14 June 2015.
- The 2012 Agricultural Census. 2012. "The 2012 Agricultural Census". Retrieved at 31 October 2014 (<http://www.agcensus.usda.gov/Publications/2012/>).
- Allen, Patricia, and Martin Kovach. 2000. "The capitalist composition of organic: The potential of markets in fulfilling the promise of organic agriculture." *Agriculture and human values* 17(3):221-232.
- Alvarez, Ramón A., Stephen W. Pacala, James J. Winebrake, William L. Chameides, and Steven P. Hamburg. 2012. Greater focus needed on methane leakage from natural gas infrastructure. *Proceedings of the National Academy of Sciences* 109(17):35-40.
- American Petroleum Institute. 2012. "Hydraulic Fracturing". Accessed August 2014. <http://www.api.org/hydraulicfracturing>.
- Anderson, Deborah. 2009. *Split Estate*. DVD: Red Rock Pictures.
- Anderson, Terry Lee, and Peter Jensen Hill. 1997. *Water marketing, the next generation* (No. 37). Rowman & Littlefield.

- Anderson, Brooklynn J., and Gene L. Theodori. 2009. "Local leaders' perceptions of energy development in the Barnett shale." *Southern rural sociology* 24(1):113-129.
- Anderton, Douglas L., Andy B. Anderson, John Michael Oakes, and Michael R. Fraser. 1994. "Environmental equity: the demographics of dumping." *Demography* 31(2): 229-248.
- Bamberger, Michelle, and Robert E. Oswald. 2012. "Impacts of gas drilling on human and animal health". *New solutions: a journal of environmental and occupational health policy* 22(1):51-77.
- Bauerle, Keith G. 2005. "Reaping the Whirlwind: Federal Oil and Gas Development on Private Lands in the Rocky Mountain West." *Denver Law Review* 83:1083.
- BBC Research and Consulting. 2008a. "Northwest Colorado Socioeconomic Analysis and Forecasts." Prepared for Associated Governments of Northwest Colorado. 179 pp.
- BBC Research and Consulting. 2008b. "City of Rifle: A Case Study of Community Renewal, Growth and Change in Northwest Colorado. Prepared for the City of Rifle." 51 pp.
- Best, Allen. 2014. "Colorado's Methane Rules a First." *Planning* 80(4):10-11.
- Becker, Howard S., and Blanche Geer.. 1957. Participant observation and interviewing: A Comparison. *Human Organization* 16(3):28-32.
- Becker, Howard S.1996. "The epistemology of qualitative research." *Ethnography and human development: Context and meaning in social inquiry*: 53-71.
- Beck-Gernsheim, Elisabeth. 2002. *Reinventing the family: In search of new lifestyles*. Polity.
- Been, Vicki. 1994. "Locally undesirable land uses in minority neighborhoods: Disproportionate siting or market dynamics?". *Yale Law Journal*:1383-1422.
- Berg, Bruce Lawrence, and Howard Lune. 2004. *Qualitative research methods for the social sciences* (Vol. 5). Boston: Pearson.

- Bem, Sandra Lipsitz. 1993. *The lenses of gender: Transforming the debate on sexual inequality*. Yale University Press.
- Best, Joel. 1989. *Images of issues: Typifying contemporary social problems*. Transaction Publishers.
- “Birth of an Industry- Florence and Boulder Oil Fields” Rocktalk Newsletter. April 2004: 7(2).
- Blumer, Herbert. 1986. *Symbolic interactionism: Perspective and method*. Univ of California Press.
- Blumer, Herbert. 1980. “Mead and Blumer: The convergent methodological perspectives of social behaviorism and symbolic interactionism.” *American Sociological Review* 45(3): 409-419.
- Bureau of Land Management. Accessed July- October 2014. Available at <http://www.blm.gov/wo/st/en.html>.
- Brasier, Kathryn J. et al. 2013. “Risk Perceptions of Natural Gas Development in the Marcellus Shale.” *Environmental Practice* 15(02):108–22.
- Braun, Joseph M. et al. 2014. “Gestational Exposure to Endocrine-Disrupting Chemicals and Reciprocal Social, Repetitive, and Stereotypic Behaviors in 4- and 5-Year-Old Children: The HOME Study.” *Environmental Health Perspectives*. Retrieved August 13, 2014 (<http://ehp.niehs.nih.gov/1307261>).
- Brown, David L., and Louis E. Swanson. 2010. *Challenges for Rural America in the Twenty-First Century*. Penn State Press.
- Brown, David L. and M.E. Warner. 1991. “Persistent low-income nonmetropolitan areas in the United States: some conceptual challenges for development policy.” *Policy Studies Journal* 19(2):22-41.

- Brown David L, Field D, Zuiches J, eds. 1993. *The Demography of Rural Life*. University Park, PA: NE Regional Center for Rural Development.
- Brown, Phil. 1992. Popular epidemiology and toxic waste contamination: lay and professional ways of knowing. *Journal of health and social behavior* 267-281.
- Brown, Phil and Mikkelsen, Edwin J. 1997. *No safe place: Toxic waste, leukemia, and community action*. University of California Press.
- Brown, Phil, Stephen Zvestoski, Sabrina McCormick, Brian Mayer, Rachel Morello- Frosch, and Rebecca Gasior Altman. 2004. "Embodied health movements: new approaches to social movements in health." *Sociology of Health & Illness* 26(1): 50-80.
- Brown, Phil. 2008. *Toxic exposures: contested illnesses and the environmental health movement*. Columbia University Press.
- Brown, Phil and Mikkelsen, E. J. (1997). *No safe place: Toxic waste, leukemia, and community action*. University of California Press.
- Brown, Ralph B. and H. Reed Geertse. 1989. "A Longitudinal Analysis." *Rural Sociology* 54(4): 568-586.
- Brown, Ralph B., Shawn F. Dorius, and Richard S. Krannich. 2005. "The Boom-Bust-Recovery Cycle: Dynamics of Change in Community Satisfaction and Social Integration in Delta, Utah." *Rural Sociology* 70(1):28-49.
- Brown, Valeria J. 2014. "Radionuclides in Fracking Wastewater: Managing a Toxic Blend." *Environmental Health Perspectives* 122(2):A50-A55.
- Buck, Daniel, Christina Getz, and Julie Guthman. 1997. "From farm to table: The organic vegetable commodity chain of Northern California." *Sociologia ruralis* 37(1): 3-20.

- Bryant, B. & Mohai, P., 1992. "Race and the incidence of environmental hazards: A time for discourse." Boulder, CO: Westview Press.
- Bullard, Robert, and Beverly Hendrix Wright. 1987. "Environmentalism and the politics of equity: emergent trends in the black community." *Mid-American Review of Sociology*: 21-37.
- Bullard, Robert, 1994. "A new chicken-or-egg debate: Which came first – the neighborhood, or the toxic dump?" *The Workbook* 19:60-62.
- Bullard, Robert. 2000. *Dumping in Dixie: Race, class, and environmental quality* (Vol. 3). Boulder, CO: Westview Press.
- Bullard, Robert D. and J. Lewis. 1996. *Environmental Justice and Communities of Color*. San Francisco, CA: Sierra Club Books.
- Bullard Robert, Paul Mohai, Robin Saha, Beverly Wright. 2007. *Toxic Wastes and Race at Twenty 1987–2007: Grassroots Struggles to Dismantle Environmental Racism in the United States*. Cleveland, OH: United Church Christ Justice Witness Ministry.
- Bunker, Stephen G. 1989. "Staples, links, and poles in the construction of regional development Theories." *Sociological Forum* 4:589-610.
- Brulle, Robert J., and David N. Pellow. 2006. Environmental justice: human health and environmental inequalities. *Annual Review of Public Health* 27:103–24.
- Burch Jr, William R. 1976. The peregrine falcon and the urban poor: some sociological interrelations. In *Human Ecology: An Environmental Approach*, ed. P Richerson, J McEvoy III, pp. 308–16. North Scituate, MA: Duxbury.
- Burns, Shirley Stewart. 2007. "Bringing Down the Mountains: The Impact of Mountaintop Removal on Southern West Virginia Communities". West Virginia University Press.

- Burawoy, Michael. 2005. "For public sociology." *American sociological review* 70(1): 4-28.
- Cable, Sherry and Cable, Charles. 1995. *Environmental Problems, Grassroots Solutions: The Politics of Grassroots Environmental Conflict*. St. Martin's Press, New York.
- Callero, Peter L. 2003. "The sociology of the self." *Annual review of sociology*: 115-133.
- Čapek, Stella M. 1993. "The 'environmental justice' frame: A conceptual discussion and an application." *Social problems*, 5-24.
- Cerulo, Karen. 1997. "Identity construction: New issues, new directions." *Annual review of Sociology*: 385-409.
- Charmaz, Kathy. 2011. *Grounded theory methods in social justice research*. Sage, Thousand Oak.
- Chiropolos, Mike. 2014. "Fracking Under Colorado's Gold Dome". *The Denver Post*, January 25. Accessed at [http://www.denverpost.com/opinion/ci\\_24985758/fracking-under-colorados-gold-dome](http://www.denverpost.com/opinion/ci_24985758/fracking-under-colorados-gold-dome).
- Clapp, Richard W., 2002. Popular epidemiology in three contaminated communities. *The ANNALS of the American Academy of Political and Social Science* 584 (1): 35-46.
- Clark, Corrie E., Andrew J. Burnham, Christopher B. Harto, and Robert M. Horner. 2012. "The Technology and Policy of Hydraulic Fracturing and Potential Environmental Impacts of Shale Gas Development." *Environmental Practice* 14(4):249-61.
- Clark, Corrie E, J. Han, Andrew Burnham, J.B. Dunn, and M. Wang. 2011. "Life-Cycle Analysis of Shale Gas and Natural Gas." ANL/ESD/11-11. Argonne National Laboratory, Argonne, IL, 38 pp.

- Cole, Luke W. and Sheila R. Foster. 2001. *From the Ground Up: Environmental Racism and the Rise of the Environmental Justice Movement*. New York, NY: New York University Press.
- Collins, Chiquita A., and David R. Williams. 1999. "Segregation and mortality: the deadly effects of racism?." In *Sociological Forum* 14(3): 495-523. Kluwer Academic Publishers-Plenum Publishers.
- Colorado Department of Public Health and Environment (CDPHE). 2012. *Colorado 2008 Air Pollutant Emissions Inventory*. CDPHE, Denver, CO.  
[http://www.colorado.gov/airquality/inv\\_maps\\_2008.aspx](http://www.colorado.gov/airquality/inv_maps_2008.aspx) (accessed October 10, 2014).
- Colborn, Theo, Carol Kwiatkowski, Kim Schultz, and Mary Bachran. 2011. "Natural gas operations from a public health perspective". *Human and Ecological Risk Assessment: An International Journal* 17 (5).
- Colborn, Theo, Kim Schultz, Lucille Herrick, and Carol Kwiatkowski. 2012. "An exploratory study of air quality near natural gas operations." *Human Ecological Risk Assessment*.
- Coleman, James William. 1970. "The Dynamics of Narcotic Abstinence: an Interactionist Theory." *The Sociological Quarterly* 19(4):555-564.
- Colorado Oil and Gas Association Accessed July-November 2014 at <http://www.coga.org/>.
- Colorado Oil and Gas Conservation Commission. Accessed July- November 2014 at <http://www.cogcc.gov>.
- Congress, U. S. 2005. Energy Policy Act of 2005. *Public Law 109(58):42*.
- Connell, Robert W. 1995. *Masculinities*. Cambridge, UK: Polity Press.
- Cook, Jeffrey J. 2014. "Who's Regulating Who? Analyzing Fracking Policy in Colorado, Wyoming, and Louisiana." *Environmental Practice* 16(2):102-12.

- Corburn, Jason. 2005. *Street science: Community knowledge and environmental health justice*. The MIT Press.
- Coser, Rose Laub. 1986. "Cognitive structure and the use of social space." *Sociological Forum* 1(1):1-26.
- Cutter, Susan L. 1995. "Race, class and environmental justice." *Progress in Human Geography* 19:111-122.
- Davenport, Joseph, and Judith Davenport. 1980. "The Boom Town: Problems and Promises in the Energy Vortex" (University of Wyoming, Laramie) Department of Social Work. Wyoming Human Services Project.
- Davis, Charles, and Jonathan M. Fisk. 2014. "Energy Abundance or Environmental Worries? Analyzing Public Support for Fracking in the United States." *Review of Policy Research* 31(1):1-16.
- Davis, James F. 2010. *Who is black?: one nation's definition*. Penn State Press.
- Day, Joe, Avery Garrett and Jean Wendt. 2009. *Split Estate*, Red Rock Pictures.
- Denzin, Norman K., and Yvonna S. Lincoln. 2011. *The SAGE handbook of qualitative research*. Sage.
- Devers KJ, Frankel RM. 2000. "Study Design in Qualitative Research—2: Sampling and Data Collection Strategies." *Education for Health* 13(2):263-71
- Diaz, Jessica. 2013. "A Forest Divided: Minard Run Oil Co. v. U.S. Forest Service and the Battle over Private Oil and Gas Rights on Public Lands." *Ecology Law Quarterly* 40(2):195-227.
- Downey, Liam. 1998. "*Environmental Injustice: Is Race Or Income a Better Predictor?*." National Emergency Training Center.

- Downey, Liam. 2006. "Environmental racial inequality in Detroit." *Social Forces* 85(2):771-796.
- Duggan, Kevin. 2013. "Fracking Moratorium Carries Uncertain Legal Consequences". *The Coloradoan*, October 24. Accessed at <http://archive.coloradoan.com/article/20131023/NEWS01/310230043/Fracking-moratorium-carries-uncertain-legal-consequences>.
- Dunn, Sharon. 2013. "Energy Pipeline: Banking on a future in the Wattenberg and Beyond". *The Greeley Tribune*, September 1. Accessed at <http://www.greeleytribune.com/news/feature2/7403922-113/oil-wattenberg-niobrara-production>.
- DuPuis, E. Melanie, and Sean Gillon. 2009. "Alternative modes of governance: Organic as civic engagement." *Agriculture and Human Values* 26(1-2):43-56.
- Easter, K. William, Mark W. Rosegrant, and Ariel Dinar. 1999. "Formal and informal markets for water: institutions, performance, and constraints." *The World Bank Research Observer* 14(1):99-116.
- Ecosystem Research Group. 2007. "Sublette County Socioeconomic Impact Study". *Draft Report*. Prepared for Sublette County Commissioners. Missoula, MT: Ecosystem Research Group.
- Ellsworth, W.L., Hickman, S.H., Lleons, A.L., McGarr, A., Michael, A.J., & Rubinstein, J.L., 2012. "Are Seismicity Rate Changes in the Midcontinent Natural or Manmade?" *Proceedings - Seismological Society of America*.
- Energy Information Administration., 2014. Natural gas data and projections. Accessed July-September 2014, at <http://www.eia.gov/naturalgas/>.

- England, J. Lynn, and Stan L. Albrecht. 1984. "Boomtowns and social disruption". *Rural Sociology* 49:230- 246
- England, Lynn and Ralph Brown. 2003. "Community and Resource Extraction in Rural America." Pp. 317-329 in *Challenges for America in the 21st Century* edited by DL Brown and LE Swanson.
- Entrekin, Sally, Michelle Evans-White, Brent Johnson, and Elisabeth Hagenbuch. 2011. "Rapid expansion of natural gas development poses a threat to surface waters." *Frontiers in Ecology and the Environment* 9(9):503-511.
- Environmental Working Group. 2014. "Farm Subsidy Database". Accessed on 31, August at [www. http://farm.ewg.org/](http://farm.ewg.org/).
- Epstein, Cynthia Fuchs 1988. *Deceptive Distinctions: Sex, Gender, and the Social Order*. New Haven, CT: Yale Univ. Press.
- Esswein, Eric, Max Kiefer, John Snawder, and Michael Breitenstein. 2012. "Worker exposure to crystalline silica during hydraulic fracturing". National Institute for Occupational Safety and Health. Retrieved from <http://blogs.cdc.gov/niosh-science-blog/2012/05/silica-fracking/>.
- Ferrar, Kyle J., Jill Kriesky, Charles L. Christen, Lynne P. Marshall, Samantha L. Malone, Ravi K. Sharma, Drew R. Michanowicz, and Bernard D. Goldstein. 2013a. "Assessment and longitudinal analysis of health impacts and stressors perceived to result from unconventional shale gas development in the Marcellus Shale region." *International Journal Occupational Environmental Health* 19:104-112.

- Ferrar, Kyle J., Drew R. Michanowicz, Charles L. Christen, Ned Mulcahy, Samantha L. Malone, and Ravi K. Sharma. 2013b. "Assessment of effluent contaminants from three facilities discharging Marcellus Shale wastewater to surface waters in Pennsylvania." *Environment Science and Technology* 47:3472-3481
- Finkel, Madelon L., and Jake Hays. 2013. "The implications of unconventional drilling for natural gas: A global public health concern." *Public health* 127(10): 889-893.
- Finkel, M.L., & Law, A. 2011. The rush to drill for natural gas: A public health cautionary tale. *American Journal of Public Health* 101 (5):784–785.
- Finewood, M.H. & Stroup, L.J. 2012. "Fracking and the neoliberalization of the hydro-social cycle in Pennsylvania's Marcellus Shale". *Journal of Contemporary Water Research & Education* 147 (1):72-79.
- Fleur, Nicholas. 2014. "The Alarming Research Behind New York's Fracking Ban". The Atlantic, December 14. Accessed at <http://www.theatlantic.com/national/archive/2014/12/the-alarming-research-behind-new-yorks-fracking-ban/383868/>.
- "Florence Chamber of Commerce". 2014. 19 January, Accessed at <http://florencecoloradochamber.com/community-history>.
- Foucault, Michel. 1979. *Discipline and punish: The birth of the prison*. Random House LLC.
- Foucault, Michel. 1984. *The foucault reader*. Pantheon.
- Forbis Jr., Robert. 2005. "A Handshake Deal Just Isn't What It Used To Be: Split-Estates and The Development of Oil and Gas in the West." P. N.PAG in *Conference Papers -- Midwestern Political Science Association*.

- Friedmann Harriett. 1978. "World market, state and family farm: social bases of household production in an era of wage labor." *Comparative Studies in Society and History* 20:545–86.
- Freudenburg, William. 1992. "Addictive economies: Extractive industries and vulnerable economies in a changing world order." *Rural Sociology* 57: 305-332.
- Freudenburg, William and Robert Gramling. 1998. "Linked to what? Economic linkages in an extractive economy." *Society and Natural Resources* 11: 569-586.
- Garkovich, Lorraine, Janet L. Bokemeier, and Barbara Foote. 1995. *Harvest of Hope: Family Farming/Farming Families*. Lexington: Univ. Kentucky.
- Gergen, Kenneth J. 1985. "The social constructionist movement in modern psychology." *American psychologist* 40(3): 266.
- Gibbs, Lois. 2002. "Citizen activism for environmental health: the growth of a powerful new grassroots health movement." *The Annals of the American Academy of Political and Social Science* 584(1): 97-109.
- Giddens, Anthony. 1991. *Modernity and self-identity: Self and society in the late modern age*. Stanford University Press.
- Glaser, Barney G., and Anselm L. Strauss. 1967. *The discovery of grounded theory*. 1967. *Weidenfield & Nicolson, London*.
- Gold, Russell and Tom McGinty. 2013. "Energy Boom Puts Wells in America's Backyards". *The Wall Street Journal*, October 25. Accessed at <http://www.wsj.com/articles/SB10001424052702303672404579149432365326304>.

- Goldsmith, Scott. 1992. "Economic Instability in Petroleum-based Economies". *Presented at OPEC/Alaska Conference on Energy Issues for the 1990s*. Anchorage, AK, July 23-24, 1992.
- Goldenberg, S. M., J. A. Shoveller, M. Koehoorn, and A. S. Ostry. 2010. "And They Call This Progress? Consequences for Young People of Living and Working in Resource-Extraction Communities." *Critical Public Health* 20(2):157–68.
- Goss, Kevin F., Richard D. Rodefeld, and Frederick H. Buttel. 1980. "The political economy of class structure in U.S. agriculture." *The Rural Sociology of Advanced Societies*: 83–132. Montclair, NJ: Allanheld Osmun
- Gould, George A. 1988. "Water Rights Transfers and Third-Party Effects." *Land and Water Law Review* 23:1.
- Gould, George A. 1989. "Transfer of water rights." *Natural Resources Journal* 29:457-477.
- Greene, Susan. 2013. "Drilling and the American Dream: Your Perfect Home in a Colorado Gas Patch". *The Colorado Independent*, November 2. Accessed at <http://www.coloradoindependent.com/144742/drilling-and-the-american-dream-your-perfect-home-in-a-colorado-gas-patch>.
- Gregory, Kelvin B., Radisav D. Vidic, and David A. Dzombak. 2011. "Water management challenges associated with the production of shale gas by hydraulic fracturing." *Elements* 7(3):181-186.
- Greider, Thomas, Krannich, Richard and E. Helen Berry. 1991. "Local Identity, Solidarity, and Trust in Changing Rural Communities. *Sociological Focus* 24 (1):253-282.
- Gulliford, Andrew. 1989. *Boomtown Blues: Colorado Oil Shale 1885-1985*. Niwot, CO: University Press of Colorado.

- Guthman, Julie. 2000. "Raising organic: an agro-ecological assessment of grower practices in California." *Agriculture and Human Values* 17 (3):257-66.
- Haefele, Michelle and Pete Morton. 2009. "The influence of the pace and scale of energy development on communities: Lessons from the natural gas drilling boom in the Rocky Mountains". *Western Economics Forum* 8 (2).
- Handy, Ryan. 2014. "Judge overturns Fort Collins fracking moratorium". *The Coloradoan*, August 7. Accessed at <http://www.coloradoan.com/story/news/local/2014/08/07/judge-overturns-fort-collins-fracking-moratorium/13743031/>.
- Hannigan, John. 1995. *Environmental Sociology: A Social Constructionist Perspective*. Routledge.
- Heath, G., J. Meldrum, N. Fisher, D. Arent, and M. Bazilian. 2014. "Life cycle greenhouse gas emissions from Barnett Shale gas used to generate electricity." *Journal of Unconventional Oil and Gas Resources*.
- Heikkila, Tanya et al. 2014. "Understanding a Period of Policy Change: The Case of Hydraulic Fracturing Disclosure Policy in Colorado." *Review of Policy Research* 31(2):65-87.
- Horton, David. 2003. "Green distinctions: the performance of identity among environmental activists." *The Sociological Review* 51(s2):63-77.
- Hochschild, Arlie R. 1983. *The Managed Heart: The Commercialisation of Human Feeling*. University of California Press.
- Hoschild, Arlie R. 1989. *The second shift*. Viking, New York.
- Hoschild, Arlie R. 1997. *The Time Bind*. Henry Holt.
- Howard, Philip H. 2009. "Consolidation in the North American Organic Food Processing Sector, 1997 to 2007." *International Journal of Sociology of Agriculture and Food* 16(1):13-30.

- Howarth, Robert W., Anthony Ingraffea, and Terry Engelder. 2011. "Natural Gas: Should Fracking Stop?" *Nature* 477(7364):271–75.
- Howarth, Robert W., Renee Santoro, and Anthony Ingraffea.. 2011. "Methane and the greenhouse gas footprint of natural gas from shale formations". *Climatic Change*. 106(4): 679-690.
- Howarth, Robert W. 2014. "A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas." *Energy Science & Engineering*.
- Howe, Charles W., and Christopher Goemans. 2003. "Water Transfers and Their Impacts: Lessons From Three Colorado Water Markets". 1055-1065
- Howe, Charles W., Dennis R. Schurmeier, and W. Douglas Shaw.1986. "Innovative approaches to water allocation: the potential for water markets." *Water resources research* 22(4): 439-445.
- Hou, D., Luo, J., & Al-Tabbaa, A. 2012. "Shale gas can be a double-edged sword for climate change." *Nature Climate Change* 2(6):385-387.
- Hughes, J. David. 2013. "A Reality Check on the Shale Revolution." *Nature* 494:307-308.
- Humphrey, Craig R., Gigi Berardi, Matthew S. Carroll, Sally Fairfax, Louise Fortmann, C. Geisler, T. G. Johnson et al. 1993. "Theories in the study of natural resource-dependent communities and persistent rural poverty in the United States." Pp. 136-172 in *Rural Sociological Society Task Force on Persistent Rural Poverty, Persistent Poverty in Rural America*. Boulder, CO: Westview Press.
- Hultman, Nathan, Dylan Rebois, Michael Scholten, and Christopher Ramig 2011. "The greenhouse impact of unconventional gas for electricity generation." *Environmental Research Letters* 6 (4):1055-1065.

- Humphrey, Craig R., Gigi Berardi, Matthew S. Carroll, Sally Fairfax, Louise Fortmann, C. Geisler, T. G. Johnson et al. 1993. "Theories in the study of natural resource- dependent communities and persistent rural poverty in the United States." Pp.142–84 in *Rural Sociological Task Force on Persistent Poverty*, eds. Persistent Poverty in Rural America. Boulder: Westview.
- Howe, Charles W., and Christopher Goemans. 2003. "Water Transfers and Their Impacts: Lessons from Three Colorado Water markets." *Journal of the American Water Resources Association* 39(5):1055–65.
- Irvine, Janice M. 1994. "Cultural differences and adolescent sexualities." *Sexual cultures and the construction of adolescent identities*: 3-28.
- Jackson, Robert B., Brooks Rainey Pearson, Stephen G. Osborn, Nathaniel R. Warner, and Avner Vengosh. 2011. "Research and policy recommendations for hydraulic fracturing and shale-gas extraction." *Center on Global Change, Duke University, Durham, NC*.
- Jackson, Robert B., Avner Vengosh, Thomas H. Darrah, Nathaniel R. Warner, Adrian Down, Robert J. Poreda, Stephen G. Osborn, Kaiguang Zhao, and Jonathan D. Karr. 2013. Increased stray gas abundance in a subset of drinking water wells near Marcellus shale gas extraction. *Proceedings of the National Academy of Sciences* 110(28):11250-11255.
- Jacoby, Henry D., Francis M. O'Sullivan, and Sergey Paltsev. 2011. *The influence of shale gas on US energy and environmental policy*. MIT Joint Program on the Science and Policy of Global Change.
- Jacquet, Jeffrey, and Richard C. Stedman. 2011. "Natural gas landowner coalitions in New York State: Emerging benefits of collective natural resource management". *Journal of Rural Social Sciences* 26(1):62-91.

- Jaffe, Mark. 2014A. "Hickenlooper: Land-use conflicts over drilling a key Colorado problem". *The Denver Post*, September 9<sup>th</sup>. Accessed at [http://www.denverpost.com/business/ci\\_26498630/hickenlooper-land-use-conflicts-over-drilling-key-colorado](http://www.denverpost.com/business/ci_26498630/hickenlooper-land-use-conflicts-over-drilling-key-colorado).
- Jaffe, Mark. 2014B. "Hickenlooper names task force to defuse drilling land-use conflicts". *The Denver Post*, September 8<sup>th</sup>. Accessed at [http://www.denverpost.com/business/ci\\_26493877/hickenlooper-names-task-force-defuse-drilling-land-use](http://www.denverpost.com/business/ci_26493877/hickenlooper-names-task-force-defuse-drilling-land-use).
- Jaffe, Mark. 2011. "Colorado property owners faced with possibility of being forced into drilling plans". *The Denver Post*, August 14. Accessed at [http://www.denverpost.com/ci\\_18678240](http://www.denverpost.com/ci_18678240).
- Jenner, Steffen, and Alberto J. Lamadrid. 2013. "Shale gas vs. coal: Policy implications from environmental impact comparisons of shale gas, conventional gas, and coal on air, water, and land in the United States." *Energy Policy* 53:442-453.
- Jiang M., Griffin W.M., Hendrickson C, Jaramillo P, VanBriesen J, Benkatesh A., 2011. "Life cycle greenhouse gas emissions of Marcellus shale gas". *Environmental Research Letters* 6(3): 034014.
- Joas, Hans. 2001. "The Emergence of the New: Mead's Theory." Pp. 89- 99 in *Handbook of social theory*. edited by Ritzer, George, and Barry Smart. New York: Sage.
- Johnson, Corey, and Tim Boersma. 2013." Energy (in)security in Poland the case of shale gas." *Energy Policy* 53 (0):389-399.
- Johnson, John Erich. 1997. "Gerrity Oil & Gas Corp. v. Magness: Colorado's Furtive Shift Toward Accommodation in the Surface-Use Debate". *Tulsa Law Journal* 33: 943.

- Jones, Kendor P, Welborn, John F, and Chelsea J. Russell. 2013. "Split Estates and Surface Access Issues," *Landman's Legal Handbook*. Rocky Mt. Min. L. Fdn., 5th ed.
- Jones, Kendor P. 2009. "Something Old, Something New: The Evolving Farmout Agreement". *Washburn Law Journal* 49:477.
- Kargbo, David M., Ron G. Wilhelm, and David J. Campbell. "Natural gas plays in the Marcellus shale: Challenges and potential opportunities." *Environmental Science & Technology* 44(15):5679-5684.
- Karion, Anna, Colm Sweeney, Gabrielle Pétron, Gregory Frost, R. Michael Hardesty, Jonathan Kofler, Ben R. Miller. 2013. Methane emissions estimate from airborne measurements over a western United States natural gas field. *Geophysical Research Letters* 40(16):4393-4397.
- Keranen, K. M., Weingarten, M., Abers, G. A., Bekins, B. A., & Ge, S. 2014. "Sharp increase in central Oklahoma seismicity since 2008 induced by massive wastewater injection". *Science* 345(6195):448-451.
- Kerr, Richard A. 2010. Natural Gas From Shale Bursts Onto the Scene. *Science* no. 328 (5986): 1624-1626. doi: 10.1126/science.328.5986.1624.
- Kerr, Richard A. 2012." Learning how to NOT make your own earthquakes". *Science* 335 (6075):1436-1437.
- Kinnaman, Thomas C. 2011. "The economic impact of shale gas extraction: A review of existing studies." *Ecological Economics* (70):1243-1249.
- Kittredge, William. 1987. "*Overthrust Dreams*". *Owning It All*. Saint Paul, MN: Graywolf Press.

- Kinnaman, Thomas C. 2011. "The Economic Impact of Shale Gas Extraction: A Review of Existing Studies." *Ecological Economics* 70(7):1243–49.
- Krause, Kenneth. 1987. "Corporate Farming 1969-1982." *Agricultural Economic Report no. 578*. Washington D.C.: USDA, ERS.
- Krannich, Richard and Al Luloff. 1991. "Problems of resource dependency in U.S. rural communities." *Progress in Rural Policy and Planning* 1:5-18.
- Kroll-Smith, Steve, and H. Hugh Floyd. 2000. *Bodies in protest: Environmental illness and the struggle over medical knowledge*. NYU Press.
- Krupp, Fred. 2014. "Don't Just Drill, Baby--Drill Carefully." *Foreign Affairs* 93(3):15–20.
- Kusel, Jonathan Paul. 1991. *It's just like baseball: a study of forest community well-being*. Doctoral dissertation, University of California, Berkeley.
- Lave LB, Seskin EP. 1970. "Air pollution and human health." *Science* 169:728.
- Lauver, Lori S. 2011. "Environmental health advocacy: An overview Of natural gas drilling in northeast Pennsylvania and implications for pediatric nursing" *Journal of Pediatric Nursing* 27(4):383–389.
- Litovitz, Aviva, Aimee Curtright, Shmuel Abramzon, Nicholas Burger, and Constantine Samaras. 2013. "Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania." *Environmental Research Letters* 8(1):14-17.
- Lobao Linda. 1990. "Locality and Inequality: Farm and Industry Structure and Socioeconomic Conditions". Albany: State University NY Press
- Lobao Linda. 1996. "A sociology of the periphery versus a peripheral sociology: rural sociology and the dimension of space". *Rural Sociology* 61:77–102.

- Lobao, Linda, Katherine Meyer, and Douglas Harper. 2004. "Farm Power Without Farmers." *Contexts* 3(4):12-21.
- Lobao Linda and K Meyer. 2000. "Institutional sources of marginality: Midwestern family farming in a period of economic decline". *Research in Sociology of Work. Work* 9:23–49.
- Lobao, Linda M., and Michael D. Schulman 1991. "Farming patterns, rural restructuring and poverty: a comparative regional analysis." *Rural Sociology* 56(4):565–602.
- Local Harvest. 2014. "Community Supported Agriculture". Accessed on 31 August, at <http://www.localharvest.org/csa/>.
- Lockie, Stewart. 2009. "Responsibility and agency within alternative food networks: assembling the 'citizen consumer'". *Agriculture and Human Values* 26(3):193-201.
- Lofland, John, & Lofland, Lyn H. 2006. *Analyzing social settings*. Belmont, CA: Wadsworth Publishing Company.
- Lofland, John, & Lofland, Lyn H. 1984. *Analyzing social settings: A guide to qualitative observation and analysis* (2nd ed.). Belmont, CA: Wadsworth.
- Lustgarten, Abrahm, and Nicholas Kusnetz. 2011. "Science Lags as Health Problems Emerge Near Gas Fields." *Propublica*.
- MacDonald, James. 2014. "Family Farming in the Unites States." *USDA*. Accessed at: [http://www.ers.usda.gov/amber-waves/2014-march/family-farming-in-the-united-states.aspx#.VX409\\_IVikp](http://www.ers.usda.gov/amber-waves/2014-march/family-farming-in-the-united-states.aspx#.VX409_IVikp) on 14 June, 2015.
- Maher, Jennifer. 2014. "Advocacy groups file motion to defend Fort Collins fracking moratorium". *The Reporter Herald*, February, 13. Accessed at [http://www.reporterherald.com/news/ci\\_25135172/advocacy-groups-file-motion-defend-fort-collins-fracking](http://www.reporterherald.com/news/ci_25135172/advocacy-groups-file-motion-defend-fort-collins-fracking).

- Maloney, Kelly O., and David A. Yoxtheimer. 2012. "Production and Disposal of Waste Materials from Gas and Oil Extraction from the Marcellus Shale Play in Pennsylvania." *Environmental Practice* 14(4):278–87.
- Malin, Stephanie. 2011. "There's no real choice but to sign: neoliberalization and normalization of hydraulic fracturing on Pennsylvania farmland." *Journal of Environmental Studies and Sciences* 4(1):17-27.
- Malin, Stephanie and Peggy Petrzela. 2010. "Left in the Dust: Uranium's Legacy and Victims of Mill Tailings Exposure in Monticello, Utah." *Society and Natural Resources* 23(12):1187-1220.
- Marshall, Nadine A., David M. Fenton, Paul A. Marshall, and S. G. Sutton. Marshall, N. A., Fenton, D. M., Marshall, P. 2007. "How Resource Dependency Can Influence Social Resilience within a Primary Resource Industry." *Rural Sociology* 72(3), 359-390.
- Marshall, Catherine, and Gretchen B. Rossman. 2011. *Designing Qualitative Research*. Sage.
- Martin, Douglas. 1982. "Exxon Abandons Shale Oil Project" *The New York Times*, May 3. Accessed at <http://www.nytimes.com/1982/05/03/business/exxon-abandons-shale-oil-project.html>.
- McCally, Michael. 2002. *Life support: the environment and human health*. MIT Press.
- Mccann, Elizabeth, Shannon Sullivan, Donna Erickson, and Raymond De Young. "Environmental awareness, economic orientation, and farming practices: a comparison of organic and conventional farmers." *Environmental Management* 21(5):747-758.
- McCracken, Grant. 1988. *The long interview* (Vol. 13). Sage.
- McGlade, Christophe, Jamie Speirs, and Steve Sorrell. 2013. "Methods of estimating shale gas resources – Comparison, evaluation and implications." *Energy* 59 (10): 116-125.

- McJeon, Haewon, Jae Edmonds, Nico Bauer, Leon Clarke, Brian Fisher, Brian P. Flannery, Jérôme Hilaire et al. 2014. "Limited impact on decadal-scale climate change from increased use of natural gas." *Nature* 514(7523):482-485.
- McKenzie, Lisa M., Ruixin Guo, Roxana Z. Witter, David A. Savitz, Lee S. Newman, and John L. Adgate. 2014. "Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado." *Environmental Health Perspectives* 122(4):412-17.
- McKenzie, Lisa M., Roxana Z. Witter, Lee S. Newman, and John L. Adgate. 2012. "Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources." *Science of The Total Environment* 424:79-87.
- Mead, George H. 1934. *Mind Self and Society*. Chicago: Univ. Chicago Press.
- Mead, George H. 1982. *The individual and the social self*. D. L. Miller (Ed.). Chicago: University of Chicago Press.
- Merrifield, John. 1984. "Impact Mitigation in Western Energy Boomtowns." *Growth and Change* 15(2):23-28.
- Milbank and Blum. 2005. "Document Says Oil Chiefs Met With Cheney Task Force". *The Washington Post*, November 16. Accessed at <http://www.washingtonpost.com/wp-dyn/content/article/2005/11/15/AR2005111501842.html>.
- MIT (Massachusetts Institute of Technology). 2011. *The Future of Natural Gas. An Interdisciplinary MIT Study*. Massachusetts Institute of Technology, Boston.
- Mohai, Paul, and Bunyan Bryant. 1992. "Environmental racism: reviewing the evidence." *Race and the incidence of environmental hazards: A time for discourse*:
- Mohai, Paul, David Pellow, and J. Timmons Roberts. 2009. "Environmental justice." *Annual Review of Environment and Resources* 34:405-435.

- Morton, Pete, Chris Weller, Janice Thomson, Michelle Haefele, and Nada Culver. 2004. "Drilling in the Rocky Mountains: How much and at what cost." *The Wilderness Society, Washington DC*.
- Mottura Giovanni, Pugliese, Enrico 1980. "Capitalism in agriculture and capitalist agriculture." pp. 171–199 in *The Rural Sociology of Advanced Societies*, edited F Buttel, H Newby,. Montclair, NJ: Allanheld Osmun.
- Muehlenbachs, Lucija, Elisheba Spiller, and Christopher Timmins. 2014. *The Housing Market Impacts of Shale Gas Development* (No. w19796). National Bureau of Economic Research.
- Musolf, Gil Richard.1992. "Structure, institutions, power, and ideology: New directions within symbolic interactionism." *The Sociological Quarterly* 33(2): 171-189.
- Myers, Tom. 2012. Potential contaminant pathways from hydraulically fractured shale to aquifers. *Groundwater* 50(6):872-882.
- Neuman, William Lawrence. 2003. *Social Research Methods*, 5th ed., Pearson Education, Boston, MA.
- Noel, Tom. "Oil Drilling In Colorado Isn't Likely To Go Away." *The Denver Post*. April 27, 2013. Retrieved from [http://www.denverpost.com/ci\\_23116194/noel-oil-drilling-colorado-isnt-likely-go-away](http://www.denverpost.com/ci_23116194/noel-oil-drilling-colorado-isnt-likely-go-away).
- Oldham, Jennifer. 2014. "Fracking Bans Enrage Coloradoans Sitting on Energy Riches". *Bloomberg Business Week*, September 17. Accessed at <http://www.businessweek.com/news/2014-09-17/fracking-bans-enrage-coloradans-sitting-on-energy-riches>.

- Opsal, Tara, & Shelley, Tara O'Connor. 2014. "Energy Crime, Harm, and Problematic State Response in Colorado: A Case of the Fox Guarding the Hen House?" *Critical Criminology* 22(4):561-577.
- Osborn, Stephen G., Avner Vengosh, Nathaniel R. Warner, and Robert B. Jackson. 2011. "Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing." *Proceedings of the National Academy of Sciences* 108(20):8172–76.
- O'Sullivan, Francis, and Sergey Paltsev. 2012. Shale gas production: potential versus actual greenhouse gas emissions. *Environmental Research Letters* 7(4): 30-44
- Pacala, Stephen, and Robert Socolow. 2004. "Stabilization wedges: solving the climate problem for the next 50 years with current technologies." *Science* 305:968–972.
- Pastor, Manuel, Jim Sadd, and John Hipp. 2001. "Which Came First? Toxic Facilities, Minority Move- in, and Environmental Justice." *Journal of Urban Affairs* 23(1):1-21.
- Penning, Trevor M., Patrick N. Breyse, Kathleen Gray, Marilyn Howarth, and Beizhan Yan. "Environmental health research recommendations from the inter-environmental health sciences core center working group on unconventional natural gas drilling operations." *Environmental Health Perspectives* 122 (11):1155.
- "Pennsylvania Public Utility Commission". 2014. Accessed at <http://www.puc.state.pa.us>.
- Peluso, Nancy, Craig Humphrey and Linda Fortmann. 1994. "The rock, the beach, and the tidal pool: People and poverty in natural resource-dependent areas." *Society and Natural Resources* 7:23-38.

- Penn State Extension. 2014. "Multi Well pads in the Marcellus Shale". 31 August, Accessed at <http://extension.psu.edu/natural-resources/natural-gas/news/2011/10/multi-well-pads-in-the-marcellus-shale>.
- Perry, Simona L. 2012. "Addressing the Societal Costs of Unconventional Oil and Gas Exploration and Production: A Framework for Evaluating Short-Term, Future, and Cumulative Risks and Uncertainties of Hydrofracking." *Environmental Practice* 14(4):352–65.
- Perry, Simona L. 2012. "Development, Land Use, and Collective Trauma: The Marcellus Shale Gas Boom in Rural Pennsylvania." *Culture, Agriculture, Food and Environment* 34(1):81-92.
- Peterson, Tarla Rai. 1991. "Telling the Farmers' Story: Competing Responses to Soil Conservation Rhetoric." *Quarterly Journal of Speech* 77:289-308.
- Pinedale Anticline Working Group. 2005. BLM Pinedale Anticline Working Group PAWG Task Groups' Report. 56 pp.
- Quinnipiac University Poll. 2014. Accessed at <http://www.quinnipiac.edu/news-and-events/quinnipiac-university-poll/colorado/release-detail?ReleaseID=1977>.
- Rabinow, Paul. 1991. *The foucault reader*. London: Penguin.
- Rahm, Dianne. 2011. "Regulating hydraulic fracturing in shale gas plays: The case of Texas." *Energy Policy* 39(5):2974-2981.
- Rinfret, Sara, Jeffrey J. Cook, and Michelle C. Pautz. 2014. Understanding State Rulemaking Processes: Developing Fracking Rules in Colorado, New York, and Ohio. *Review of Policy Research* 31(2):88-104.

- Ringquist, Evan J. 2003. "Environmental Justice: Normative Concerns, Empirical Evidence, and Government Action." In *Environmental Policy: New Directions for the Twenty-First Century*, edited by Norman J. Vig and Michael E. Kraft. Washington, DC: CQ Press.
- Robinson, Ramona, and Chery Smith. 2002. "Psychosocial and Demographic Variables Associated with Consumer Intention to Purchase Sustainably Produced Foods as Defined by the Midwest Food Alliance." *Journal of Nutrition Education and Behavior* 34(6):316–25.
- Roux, Ana V. Diez, Sharon Stein Merkin, Donna Arnett, Lloyd Chambless, Mark Massing, F. Javier Nieto, Paul Sorlie, Moyses Szklo, Herman A. Tyroler, and Robert L. Watson. 2001. "Neighborhood of residence and incidence of coronary heart disease." *New England Journal of Medicine* 345(2):99-106.
- Rowan, Elisabeth, Mark Engle, Carl Kirby, and Thomas Kraemer. 2011. Radium content of oil- and gas-field produced waters in the Northern Appalachian basin (USA)—Summary and discussion of data. *US Geological Survey Scientific Investigations Report* 5135:15.
- Rubin, Herbert J., and Irene S. Rubin. 2011 *Qualitative interviewing: The art of hearing data*. Sage Publications.
- Rubinstein, Justin L., William L. Ellsworth, Arthur McGarr, and Harley M. Benz. 2014. "The 2001–Present Induced Earthquake Sequence in the Raton Basin of Northern New Mexico and Southern Colorado." *Bulletin of the Seismological Society of America* 104(5).
- Rynes, Sara, and R. Gephart Jr.. 2004. From the editors. *Academy of Management Journal* 47(4):454-462.

- Schafft, Kai A., Yetkin Borlu, and Leland Glenna. 2013. "The relationship between Marcellus Shale gas development in Pennsylvania and local perceptions of risk and opportunity." *Rural Sociology* 78(2):143-166.
- Schmidt, Charles W. 2011. "Blind Rush? Shale Gas Boom Proceeds Amid Human Health Questions." *Environmental Health Perspectives* 119(8):a348–a353.
- Sealover, Ed and Cathy Proctor. 2014. "Bill to study health impacts of oil and gas dies in Colorado Legislature". *The Denver Business Journal*, April 29. Accessed at [http://www.bizjournals.com/denver/blog/earth\\_to\\_power/2014/04/bill-to-study-health-impacts-of-oil-and-gas-dies.html?iana=ind\\_energy&page=all](http://www.bizjournals.com/denver/blog/earth_to_power/2014/04/bill-to-study-health-impacts-of-oil-and-gas-dies.html?iana=ind_energy&page=all).
- Searle, John R. 1995. *The construction of social reality*. Simon and Schuster.
- Serpe, Richard T., and Sheldon Stryker. 1987. "The construction of self and reconstruction of social relationships." *Advances in group processes* 4:41-66.
- Shonkoff, Seth B., Jake Hays, and Madelon L. Finkel. 2014. "Environmental Public Health Dimensions of Shale and Tight Gas Development." *Environmental Health Perspectives* 122(8):787.
- Shrader-Frechette, K. 2005. *Environmental justice: creating equality, reclaiming democracy*. New York: Oxford.
- Smith, Edward J. 1986. *Boom and Bust in Energy Extraction*. Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, DC. Staff Report No. AGES860423.
- Smith, Michael D., Krannich, Richard and Lori M. Hunter. 2001. "Growth, Decline, Stability, and Disruption: A Longitudinal Analysis of Social Well-Being in Four Western Rural Communities." *Rural Sociology* 66(3):435-350.

- Snow, David A., E. Burke Rochford Jr, Steven K. Worden, and Robert D. Benford. 1986. "Frame alignment processes, micromobilization, and movement participation." *American sociological review*: 464-481.
- Sovacool, Benjamin K. 2014. "Cornucopia or curse? Reviewing the costs and benefits of shale gas hydraulic fracturing (fracking)." *Renewable and Sustainable Energy Reviews* 37:249-264.
- Spehar, Jim. 2010. "Remembering Colorado's Oil 'Boom'". *The Denver Post*, November 28. Accessed at [http://www.denverpost.com/ci\\_16711142](http://www.denverpost.com/ci_16711142).
- Stam, Jerome M., and Bruce L. Dixon. 2004. *Farmer Bankruptcies and Farm Exits in the United States, 1899-2002*. US Department of Agriculture, Economic Research Service.
- Stam, Jerome M., Steven Koenig, Susan E. Bentley, and H. Frederick Gale, Jr. "Farm Financial Stress, Farm Exits, and Public Sector Assistance to the Farm Sector in the 1980's." *Agr. Econ. Rept. No. 645*. U.S. Department of Agriculture Economic Research Service, Apr. 1991.
- Stedman, Richard C. et al. 2012. "Marcellus Shale Gas Development and New Boomtown Research: Views of New York and Pennsylvania Residents." *Environmental Practice* 14(4):382-93.
- Strauss, Anselm L. 1987. *Qualitative Analysis for Social Scientists*. Cambridge University Press, New York.
- Stryker, Sheldon, and Peter J. Burke. 2000. "The past, present, and future of an identity theory." *Social psychology quarterly*:284-297.

- Strochlic, Ron, and Luis Sierra. 2007. "Conventional, Mixed and Deregistered Organic Farmers: Entry Barriers and Reasons for Exiting Organic Production in California." *Davis, CA: California Institute for Rural Studies.*
- Suddaby, Roy. 2006. "From the editors: What grounded theory is not." *Academy of management journal* 49(4):633-642.
- Sumy, Danielle F., Elizabeth S. Cochran, Katie M. Keranen, Maya Wei, and Geoffrey A. Abers.. 2014. "Observations of static Coulomb stress triggering of the November 2011 M5. 7 Oklahoma earthquake sequence." *Journal of Geophysical Research: Solid Earth* 119(3):
- Szasz, Andrew, and Michael Meuser. 1997. "Environmental inequalities: Literature review and proposals for new directions in research and theory." *Current sociology* 45(3): 99-120.
- Sze, Julie, and Jonathan K. London. 2008. "Environmental justice at the crossroads." *Sociology Compass* 2(4):1331-1354.
- Taylor, D.T. and T. Foulke. 2008. Sublette County, Wyoming: A Socio-Economic Profile. Bridger-Teton Region, County Profile Series. Laramie, WY: University of Wyoming, Department of Agricultural and Applied Economics. 40 pp.
- Taylor, Verta, and Nancy Whittier. 1992. "Collective identity in social movement communities: Lesbian feminist mobilization." Pp. 349-365 in *Social perspectives in lesbian and Gay studies. New York: Routledge.*
- "The oil and gas law of the land: your guide to Act 13" 2014. National Public Radio. Accessed August 13th at <http://stateimpact.npr.org/pennsylvania/tag/impact-fee/.Thompson>,

- Jonathan. 2014. "Is Denver the Houston of the Rockies- again?" *High Energy News*, 29, September. Accessed at <http://www.hcn.org/articles/the-west-is-still-an-energy-colony>.
- Theodori, Gene L. 2009. "Paradoxical perceptions of problems associated with unconventional natural gas development." *Southern Rural Sociology* 24(3):97-117.
- UCC (United Church of Christ) Report. 1987. "Toxic wastes and race in the US: A national report on the racial and socioeconomic characteristics of communities with hazardous waste sites." Public Data Access, NY.
- Udell, Erin. 2014. "Judge denies stay in Fort Collins fracking lawsuit". *The Coloradoan*, November 10. Accessed at <http://www.coloradoan.com/story/news/local/2014/11/10/judge-denies-stay-citys-legal-fracking-battle/18805611/>.
- United States Department of Agriculture. 2014. "Organic Agriculture". Accessed on August 31 at <http://www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=organic-agriculture.html>.
- USDA NASS. 2014. "Census of Agriculture." *Ag Census Web Maps*. Available at: [www.agcensus.usda.gov/Publications/2012/Online\\_Resources/Ag\\_Census\\_Web\\_Maps/Overview/](http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Ag_Census_Web_Maps/Overview/).
- USDA. 1998. "A Time To Act: A Report of the USDA National Commission on Small Farms". Retrieved 20 September 2014 ([http://www.csrees.usda.gov/nea/ag\\_systems/pdfs/time\\_to\\_act\\_1998.pdf](http://www.csrees.usda.gov/nea/ag_systems/pdfs/time_to_act_1998.pdf)).

- US EPA. 2011. Investigation of groundwater contamination near Pavillion, Wyoming. Draft Report, Office of Research and Development.
- US GAO. 1983. Siting hazardous waste landfills and their correlation with racial and economic status of surrounding communities. *Washington, DC: US Government Printing Office.*
- Vidic, R. D., S. L. Brantley, J. M. Vandenbossche, D. Yoxtheimer, and J. D. Abad. 2013. "Impact of Shale Gas Development on Regional Water Quality." *Science* 340: 6134.
- Vogel, Stephan and Sarah Low. 2015. "The Size and Scope of Locally Marketed Food Production." *USDA*. Accessed on 14 June 2015.
- Wang, Qiang, Xi Chen, Awadhesh N. Jha, and Howard Rogers. 2014. "Natural gas from shale formation—The evolution, evidences and challenges of shale gas revolution in United States." *Renewable and Sustainable Energy Reviews* 30:1-28.
- Warner, Nathaniel R., Robert B. Jackson, Thomas H. Darrah, Stephen G. Osborn, Adrian Down, Kaiguang Zhao, Alissa White, and Avner Vengosh. 2012. "Geochemical evidence for possible natural migration of Marcellus Formation brine to shallow aquifers in Pennsylvania." *Proceedings of the National Academy of Sciences* 109(30): 11961-11966.
- Weber, Jeremy G. 2013. "A decade of natural gas development: The makings of a resource curse?" *Resource and Energy Economics*. 37:168-183.
- Weber, Christopher L., and Christopher Clavin. 2012. "Life cycle carbon footprint of shale gas: Review of evidence and implications." *Environmental science & technology* 46(11):5688-5695.
- Weinhold, Bob. 2012. "The Future of Fracking." *Environmental Health Perspectives* 120(7): A272–A279.
- "Weld County". 2014. August 31, Accessed at [www.co.weld.co.us](http://www.co.weld.co.us).

- Williams, David. 2010. "Ghosts of 'Black Sunday' hover over BLM's cautious oil shale move".  
The Colorado Independent, October 15. Accessed at  
<http://www.coloradoindependent.com/64303/ghosts-of-black-sunday-hover-over-blms-cautious-oil-shale-move>.
- Wines, Michael. 2013. "Colorado Cities' Rejection of Fracking Poses Political Test for Natural Gas Industry". The New York Times, November 7<sup>th</sup>. Accessed at  
<http://www.nytimes.com/2013/11/08/us/colorado-cities-rejection-of-fracking-poses-political-test-for-natural-gas-industry.html?r=0>.
- Wiseman, Hannah. 2009. "Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need for Revisit Regulation." *Fordham Environmental Law Review* 20:115.
- Witter, Roxana Z. et al. 2013. "The Use of Health Impact Assessment for a Community Undergoing Natural Gas Development." *American Journal of Public Health* 103(6):1002–1010.
- Wright, Peter R., Peter B. McMahon, David K. Mueller, and Melanie L. Clark. 2012. "Groundwater-quality and quality control data for two monitoring wells near Pavillion, Wyoming, April and May 2012." *United States Geological Survey (USGS) Summary Data Series 718*: 23p. Available at: [http://pubs.usgs.gov/ds/718/DS718\\_508.pdf](http://pubs.usgs.gov/ds/718/DS718_508.pdf)  
[Accessed October 13, 2014].
- Wynveen, Brooklynn J. 2011. "A thematic analysis of local respondents' perceptions of Barnett Shale energy development". *Journal of Rural Social Sciences* 26 (1):8-31.

Zadek, Simon, Sanjiv Lingayah, and Maya Forstater. 1998. "Social labels: Tools for Ethical Trade- Executive Summary." Luxemburg: Office for Official Publications of the European Communities.

Zoback, Mark, Kitasei, Saya, and Bradford Copithorne. 2010. Addressing the Environmental Risks from Shale Gas Development. Worldwatch Institute. Washington DC.

Zollinger, Brett and Richard Krannich. 2002. "Factors Influencing Farmers' Expectations to Sell Agricultural Land for Non-Agricultural Uses." *Rural Sociology* 67(3):442-463.

# Appendix A

## Dept. of Sociology, Colorado State University

### Interview Guide For Farmers:

1. Can you tell me a bit about your farm?
  1. Sustainable or organic? What do you grow?
  2. Do you participate in community supported agriculture or farmers' markets?
  3. Who are your consumers? History?
  4. A little bit about yourself and your farming background?
  
2. There has been a surge in unconventional oil and gas drilling in this area of northern Colorado  
—
  - a. what are your thoughts: on the practice?
  - b. on its pace and scale?
  - c. on industry regulations/moratoria?
  
3. What have the impacts of unconventional oil drilling been on your farm?
  - a. To your water rights/access? Costs of leasing water?
  - b. On the success/nature of your business (at markets, for eg)?
  - c. On your neighborhood/ community?
  - d. On local quality of life?
  - d. Have you noticed specific impacts on livestock? Dairy? Crops?
  - e. On your certification or status as 'sustainable'? Pesticide free?
  
4. Do you own your mineral rights? (If yes, go to Question #7)
  
5. Have you leased your mineral rights to an oil or gas company?
  - a. If yes, How long ago? Why did you decide to sign a lease?
  - b. What was your level of confidence when signing your lease?
  - c. Did you feel that the company you signed with adequately answered your questions?
  - d. If no, why not?
  
6. Do you have water rights? (If yes, go to Question #9)

7. How have you interacted with the O&G industry in relation to water?
  - a. Has your access to water/ nature of water rights changed?
  - b. Has the price of water changed (if you lease water)?
  - c. Has water quality changed?
  
8. Do you think that your community or the state of Colorado (or some other institution) should control where and how drilling is done?
  
9. (How) Has unconventional O&G development near your farm changed your identity as a sustainable or alternative agriculturalist? (pesticide free)
  
10. Do you feel that there has been adequate support for farmers – through the USDA, the extension agencies, and other state resources? (May need to probe further regarding each agency or institution by name.)
  
11. Do you have any other thoughts on unconventional oil drilling's impacts on your farm? On your community or northern Colorado?